ORIN PERCUS

CONSTRAINTS ON SOME OTHER VARIABLES IN SYNTAX*

In this paper I assume that syntactic structures contain items that function as variables over possible worlds (or things like possible worlds). I show that in certain syntactic positions we can use *some* variables but not *others*. I accordingly motivate a "binding theory" for the items that occupy these positions, and I discuss some consequences of this binding theory.

1. Overview

My starting point is this. There is a good way of modeling what we do when we judge a sentence to be true. It involves a procedure that takes as input a certain abstract representation for the sentence. When we look at the way the relevant representations interact with the interpretation procedure, we can say that some items in these representations function as variables. (More precisely: there is a close analogy between, on the one hand, the way that the procedure treats representations that contain these items and, on the other hand, the way that, in many logics, the interpretation function

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The basic point of the paper – that there are constraints on what world variables we use – is certainly not original with me. I know that when I started this research I had heard this point explicitly from other people, and there are some relevant remarks at the end of Musan (1995). It was Angelika Kratzer who made me realize the importance of establishing what the constraints are.

Closely related issues have come up in the study of tense. One position that is taken in the tense literature (see for example Musan 1995) is that syntactic structures contain "silent pronouns" of roughly the kind that I motivate here, though in that literature for various reasons the "silent pronouns" are considered to be variables over time intervals. This leads to the question of whether there are constraints on what time interval variables we use. On one rather free interpretation of the literature, Enç (1981) was the first to ask whether we need a "binding theory" for world and time pronouns; Enç thought not. Musan (1995) showed that there are constraints on the indexing of time pronouns, and suggested that there may be parallel constraints on the indexing of world pronouns. I stress that this is a free interpretation: these authors had different perspectives on the data.

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treats expressions that contain variables.) Moreover, we find that some items function as variables over possible worlds – or things like possible worlds.[1]

To put things the usual way: the syntactic structures that we interpret and the way we have of interpreting them are such that we can say that the structures contain variables over possible worlds.

What I will argue in this paper is that, once we say that world variables occupy positions in the structures that we interpret, we have to pay a price. Once we accept that there are positions for world variables, we have to recognize as well that in certain positions we can use *some* variables but not *others*. In other words, we have to recognize that there are additional principles that narrow down the available structures for natural language sentences by regulating which variables we can use in which positions. The situation is just like the situation that we find ourselves in when we assume that pronouns function as variables. On the usual assumptions about the way the interpretation procedure works, *merely* saying that pronouns are variables does not go far enough towards predicting when we judge sentences with pronouns to be true. It doesn't help us explain, for instance, why we don't judge (1) to be true when three prisoners killed themselves and their guards each testified to this effect afterwards. Rather, something else – a Binding Theory – has to tell us that, even if '*him*' is a variable, it cannot be a *locally bound* variable. The main point of this paper is that, just like pronouns on this view, world variables need a Binding Theory.

(1) Each guard testified that at least one of his prisoners had killed him.

I will structure my discussion as follows:

- First (section 2) I will motivate the view that in the structures that we interpret we find variables over possible worlds (or things like them). I will do so by arguing that this view conveniently accounts for certain readings of sentences that are properly described in terms of quantification over worlds. This starting point is in the spirit of Cresswell (1990): Cresswell was convinced on the basis of the range of interpretations that we find for natural language sentences that natural language has the expressive power of a language with "explicit quantification over worlds."[2]

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[1] That is to say: there is a close correspondence between these elements and the type *s* variables of sorted logics.

[2] However, Cresswell was concerned with sentences containing relative clauses, which I will ignore for most of this paper.

- Then (sections 3–4), relying on some assumptions about what the structures that we interpret look like and where world variables appear in these structures, I will motivate a Binding Theory for these variables. I will show that in certain structural positions we can use some variables but not others. I will conclude that there are constraints that govern what variables we can use, and I will argue that these constraints make reference to aspects of the structure in which the variable appears. (In my presentation here, the variables are indexed items of the form s_1, s_2, s_3, . . . , so another way of putting this is that there are structural constraints on what index an item of this kind can bear.) I will argue for two constraints in particular.
- I will then (section 5) demonstrate the predictions of a theory that incorporates these two constraints. I will show that recognizing these constraints helps us to understand some elaborate patterns in the interpretations that are available for sentences. I will briefly consider a puzzle involving indefinites, to suggest that, once we recognize that the constraints hold, we can see possible inroads to problems that looked unassailable before. I will conclude (section 6) with some questions about the proper formulation of the two constraints, and with some suggestions about where to look in order to discover why language exhibits constraints like these.

One remark before we begin. In a certain sense, representations with variables are notational variants of representations without variables – the literature contains many examples of systems *without* variables in the syntax that give rise to the same range of interpretations that systems *with* variables in the syntax give rise to, but that use different syntactic structures and/or different interpretation functions to arrive at these interpretations. (See Quine 1960, Cresswell 1990, Jacobson 1999.) In this paper, I am proposing to model natural language by using a system *with* variables in which additional constraints rule out certain representations, and in which these constraints make reference to the position of variables. These constraints have the effect of limiting the kinds of interpretations that sentences exhibit. I leave it open whether we could design a system *without* variables that could just as neatly account for the data. If you think we can't, you can take this paper as a strong argument for the existence of world variables in the structures that we interpret. I myself am happy with the modest thesis that, *if* we assume that there are world variables in the representation that we interpret (and that these variables occupy the positions that I assume they occupy), *then* we have to assume that there are constraints of the kind I shall describe.

2. Some Silent Pronouns

In this section, I will motivate the common view that the structures we interpret contain variables over possible worlds (or things like possible worlds). You might think of these items as unpronounced pronouns that can take possible worlds as their values. The idea is that on this view we can account for the ambiguities that certain sentences exhibit. This view allows us to say that the relevant sentences are ambiguous because we can assign to them a number of different structures, and the different structures give rise to different interpretations. Basically, the structures that give rise to different interpretations are structures that contain different binders for the variable occupying one particular position. More precisely, given my presentation here, the structures differ in that different items are coindexed with the silent pronoun occupying one particular position.

This section presupposes no background in semantics. You might wish to rush through it, glancing briefly at the discussion in section 2.1 and at example (12″). (At the same time, if you want to ask yourself how much motivation there is for the theory that I will assume in the rest of this paper, you might not.)

2.1. *An Ambiguity*

Let's say that I am quite convinced of (2). In judging (2) to be true, I am using the *if*-clause to determine a certain kind of scenario – one on which I am the owner of a villa – and I am confirming that this scenario has a certain property that I use the main clause to determine – it is a scenario on which I am not spending any time on semantics.

(2) If I owned a villa in Tuscany, I would not be a semanticist.

Apparently, we have different ways of using an *if*-clause like (3) to determine a scenario. Each way leads us to a scenario where every member of a certain (non-empty) class owns a villa, but the different ways pick out different classes as the relevant ones. On the one hand, we can use the *if*-clause to determine a scenario on which everyone who is a semanticist *as things stand now* is a villa owner (these people might not remain semanticists in the actual scenario that we choose). On the other hand, we can use the *if*-clause to determine a scenario with the property that everyone who does semantics *in the scenario* is a villa owner (in the actual scenario that we choose, these people might not include you, me, and all the others who do semantics as things stand now).

(3) if every semanticist owned a villa in Tuscany

Suppose for instance that I continue the dialogue that I started in (2) by telling you that other semanticists are undoubtedly just like me. If John and Mary owned villas in Tuscany, they would not be semanticists either. And, come to think of it, if *every* semanticist owned a villa in Tuscany, there would be no field at all. If I judge this last assertion ((4a)) to be true, then my judgment suggests that I am using the *if*-clause in the first way. I couldn't be using the *if*-clause in the second way, since any scenario that contains a non-empty class of semanticists is going to be a scenario in which there *is* a field of semantics. By contrast, my judgment that (4b) is true suggests that I am using the *if*-clause in the second way – at least if you think that the most natural reason for me to take (4b) to be true is that on the scenario that I determine I do not own a villa in Tuscany. Since I am a semanticist as things stand now, if I were using the *if*-clause in the first way I would be considering a scenario on which I *do* own a villa in Tuscany.

(4) a. **If *every* semanticist owned a villa in Tuscany**, there would be no field at all.
b. If I were a syntactician and **if every *semanticist* owned a villa in Tuscany**, I would be quite envious.

This paper starts from the view that these two ways of using an *if*-clause like (3) are in principle always available to us. For instance, on this view we have two ways of taking a sentence like (5): on the one hand, we can take it to cite a scenario on which you and I and all our colleagues are Tuscan villa owners; on the other hand, we can take it to cite a scenario on which the only people who do semantics are Tuscan villa owners. In a given situation there could of course be factors that direct us to one reading over the other.

(5) **If every semanticist owned a villa in Tuscany**, what a joy this world would be.

On a possible worlds analysis of conditionals (cf. Stalnaker 1968; Lewis 1973), conditionals express quantification over worlds. To say that a sentence of the form '*If every semanticist owned a villa in Tuscany, q*' is true is to say that some property holds of every world in a particular set. The two possible uses of the *if*-clause correspond to two different kinds of world sets that we can consider. On the one hand (simplifying a bit), we can consider a subset of (6a). This is what I do if I take (5) in the first way, and it is what I do when I say that (4a) is true. I judge (4a) to be true when I have sufficient grounds for believing that every world in a particular subset of (6a) is a world without semantics. On the other hand, we can consider a subset of (6b). This is what I do if I take (5) in the second

way, and it is what I do when I say that (4b) is true. I judge (4b) to be true when I have sufficient grounds for believing that every world in a particular subset of (6b) is a world where I am quite envious.[3]

(6) a. {w: every semanticist in **our world** owns a Tuscan villa in w}
b. {w: every semanticist in **w** owns a Tuscan villa in w}

I will adopt this common position: to say a sentence is true is to say that a certain function that takes possible worlds to truth values yields 1 when we apply it to the actual world. The two different ways of taking (5) then correspond to two different kinds of functions that we can determine on the basis of (5). One kind looks like (7a); the other looks like (7b).[4]

(7) Take any world *v*.
a. f^1(v) = 1 *as long as the following condition is met*:
For every world w such that
every semanticist in v owns a Tuscan villa in w (and . . .)
w is a real joy.
b. f^2(v) = 1 *as long as the following condition is met*:
For every world w such that
every semanticist in w owns a Tuscan villa in w (and . . .)
w is a real joy.

Here for future reference is some rough but useful terminology. In cases like (7a), where the condition that the world *v* has to meet makes reference *to people who are semanticists in v*, I will say that the description term *semanticist* has a **transparent** use. *Semanticist* has a transparent use in a sentence when we use the sentence to talk about semanticists in the actual world. In cases like (7b), where the condition makes reference to people who are semanticists in some other worlds that the sentence quantifies over, I will say that *semanticist* has an **opaque** use. *Semanticist* has an opaque use in a sentence when we use the sentence to talk about semanticists in worlds other than our own.

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[3] Here and throughout this paper, I assume an ontology under which a single individual may be located in more than one world. I believe that this is not crucial to the basic point of the paper, and that everything I have to say can be recast using Lewis-style counterparts. (See Percus 1998a for clues as to how to do so.)

[4] I will say some more about the suspicious parentheses in the next subsection.

2.2. *Accounting for the Ambiguity*

Why does (5) have these two different interpretations? One answer is that (5) admits a number of different structures. On our way of going from structures to functions of the kind in (7), some of the structures will yield the function in (7a) and some of them will yield the function in (7b). We can give an answer like this if we assume that the structures for (5) contain indexed items, that the different structures for (5) differ in that they contain different indexing patterns, and that as far as our interpretation procedure is concerned the indexed items function as variables over possible worlds and as abstractors over these variables.

In giving an answer of this kind, I am going to assume that we want a theory with the pieces below. I am going to assume that, apart from the innovations regarding indexed elements, the structures we interpret have those properties that independent work on the syntax of natural language has sought to motivate. The picture that results is essentially the picture endorsed by Heim and Kratzer (1998).

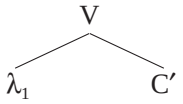
Piece number one: the idea that there is a recursive interpretation procedure that takes a syntactic constituent *together with an "assignment function"* and yields an object. (The assignment function is a function from numbers to various other objects: it might, for instance, map the number 1 to me.) If you give this interpretation procedure the full syntactic structure of a sentence together with an assignment function, it will give you a function that yields truth values for possible worlds – this is the function that we use when we judge whether a sentence is true. I will call the interpretation procedure ***J***, and will use $\langle c, g \rangle_J$ to mean the object that you get when you give ***J*** a pair of a constituent *c* and an assignment *g*. For instance, given some assignment g (abstracting away from some of the details of the syntactic constituent involved), $\langle$**[$_{\text{IP}}$ John owns a villa in Tuscany]**, g$\rangle_J$ could be a function that 'holds of' (i.e., yields 1 for) a world w as long as John owns a Tuscan villa in w.

Piece two: the syntax may contain indexed items. ***J*** is designed in such a way that, in cases where the syntactic constituent that we give to ***J*** contains an index, what ***J*** gives us back will often depend on what assignment we provided ***J*** with. For instance, if we assume that pronouns are indexed, ***J*** could be designed in the following way: if g(1) is *me*, $\langle$**[$_{\text{IP}}$ he$_1$ owns a villa in the Bronx]**, g$\rangle_J$ will be a function that holds of a world w as long as *I* own a Bronx villa in w; if g(1) is *you*, it will be a function that holds of a world w as long as *you* own a Bronx villa in w. In this way, the object that ***J*** provides given constituent c and assignment g may depend on g as well as on c. In the case of some indexed items, the object that ***J*** provides

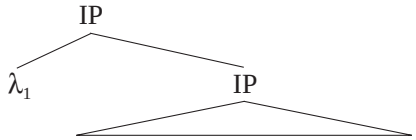
given an assignment function might simply be the object that the assignment function yields given the item's index. For instance, ***J*** might be designed in such a way that $\langle$**[$_{DP}$ he$_1$]**, g$\rangle_J$ = g(1). In the way in which they contribute to the interpretation of higher constituents, these indexed items will basically play the role that variables play in many extensions of predicate logic.

Piece three: the syntax contains a special kind of element that I will represent as an indexed λ. These indexed items basically play the role of variable abstractors. When ***J*** takes as input a constituent like C in (8a) together with an assignment g, it gives you a certain kind of function. The function it gives you is the function that, for any x, yields just what ***J*** would give you if ***J***'s input consisted of (i) C′ and (ii) an assignment g′ just like g except that g′(1) = x.[5] For instance, suppose we were to find a syntactic constituent that looked like (8b). Given what I have said thus far, $\langle$(8b), g$\rangle_J$ would be that function that, for any x, yields just what ***J*** would give you if ***J***'s input consisted of (i) **[$_{IP}$ he$_1$ owns a villa in the Bronx]** and (ii) an assignment g′ just like g except that g′ (1) = x. This is a function that, for any x, in turn yields a function that holds of a world w as long as x owns a Bronx villa in w.

(8) a.



b.



Another example. Suppose we again have a configuration of the kind in (8a). Suppose we know that, when we give ***J*** the constituent C′ together with an assignment g, ***J*** gives us the value 1 as long as g(1) is a world in which John owns a Tuscan villa. Then we can conclude that $\langle$(8a), g$\rangle_J$ is a function that, for any world w, will yield 1 just as long as w is a world in which John owns a villa. In this way, indexed λ's can create functions that take worlds as arguments and yield truth values.

Now here is how these pieces fit into an account for the ambiguity of (5) (repeated below as (9)). (I will give a slightly simplified version first.)

(9) If **every semanticist owned a villa in Tuscany**, what a joy this world would be.

One part of the account is that the conditional's antecedent contains a

[5] More precisely: For any x, x is in the function's domain only if $\langle$C′, g′$\rangle_J$ is defined. For any x in the function's domain, the function yields $\langle$C′, g′$\rangle_J$.

constituent with two indexed elements ((10a)). ***J*** is designed in such a way that when ***J*** is given this constituent together with an assignment *g*, the value that ***J*** yields will depend on the values that g yields for the two different indices. Specifically ((10b)), ***J*** will yield 1 as long as every semanticist in the world that g assigns to *i* owns a Tuscan villa in the world that g assigns to *j*. The first index here (i) determines the world in which semantics is being practiced; the second index (j) determines the world of villa ownership.

(10) a. $[_{IP3}$ . . . every semanticist . . . $_{i}$ . . . owned a villa in Tuscany . . . $_{j}$ . . .]
b. $\langle$IP3, g$\rangle_J$ = 1 as long as every semanticist in g(i) owns a Tuscan villa in g(j).

Another part of the account is that the structure of the sentence contains two indexed λ's. One λ belongs to the *if*-clause and is adjoined to the constituent that I have just discussed (the constituent that results is labelled *IP2* in (11)). The other λ is adjoined to the root.

(11) a. λ_m $[_{IP1}$ . . . if $[_{IP2}$ λ_n . . . every semanticist . . .] . . . what a joy . . .]
b. $\langle$IP1, g$\rangle_J$ = 1 as long as, for every world *w* such that $\langle$IP2, g$\rangle_J$ (*w*) = 1, *w* is a real joy.

The λ that belongs to the *if*-clause will produce the function that characterizes the worlds we are quantifying over. This is a function that, given a world *w*, yields the truth value 1 as long as every member of a certain class owns a Tuscan villa in w. For instance, if the two indices in the material below the λ are identical to the index of the λ, ***J*** will give us a function that for any world *w* yields 1 as long as every semanticist in w owns a Tuscan villa in w. As far as the λ adjoined to the root is concerned: ***J*** is designed in such a way that it will yield a truth value for the constituent that this λ attaches to (the constituent labelled *IP1*), and this λ will then make the sentence as a whole a function that takes worlds to truth values. ***J*** is specifically designed so that (for any g) $\langle$IP1, g$\rangle_J$ = 1 as long as every world that $\langle$IP2, g$\rangle_J$ yields the value 1 for happens to be a real joy.[6]

Given this, there are many different structures available for (9), all of

[6] In the next section, I will alter this assumption slightly: I will assume that the quantification that the *if*-clause contributes is not limited to worlds. I will not run through a second derivation of the ambiguity of (9) using the assumptions that I adopt in the next section (though the discussion at the end of section 4 should give some indication of how the derivation would work). While the details will not be identical, the general character of the account will stay the same.

which are interpretable and all of which yield a function that takes worlds to truth values. The structures differ in that they contain different indexing patterns. Here are two possible structures for (9):

(12) a. $\lambda_{\mathbf{0}}$ [$_{IP1}$ . . . if [$_{IP2}$ $\lambda_{\mathbf{1}}$ [$_{IP3}$ . . . every semanticist . . . $_{\mathbf{0}}$ . . . owned a villa in Tuscany . . . $_{\mathbf{1}}$ . . .] . . . what a joy . . .]
("transparent" use of *semanticist*)

b. $\lambda_{\mathbf{0}}$ [$_{IP1}$ . . . if [$_{IP2}$ $\lambda_{\mathbf{1}}$ [$_{IP3}$ . . . every semanticist . . . $_{\mathbf{1}}$ . . . owned a villa in Tuscany . . . $_{\mathbf{1}}$ . . .] . . . what a joy . . .]
("opaque" use of *semanticist*)

These structures differ only with respect to IP3's first index, the index that determines the world in which semantics is practiced. In (12a), it is the same as the index of the higher λ; in (12b), it is the same as the index of the lower λ. This difference is responsible for the difference between the two readings of (9): (12a) will give rise to the reading on which *semanticist* has a "transparent" use, while (12b) will give rise to the reading on which *semanticist* has an "opaque" use.

Look first at (12a). In (12a), (for any g) $\langle$IP3, g$\rangle_J$ = 1 as long as every semanticist in g(0) owns a Tuscan villa in g(1). This means that (for any g) $\langle$IP2, g$\rangle_J$ will be a function that yields 1 for any world *w* such that every semanticist in g(0) owns a Tuscan villa in w. This means that (for any g) $\langle$IP1, g$\rangle_J$ = 1 as long as, for every world w such that every semanticist in g(0) owns a Tuscan villa in w, w is a real joy. And this in turn will mean that (for any g) $\langle$(12a), g$\rangle_J$ will be a function that takes any world **v** to 1 as long as, for every world w such that every semanticist in **v** owns a Tuscan villa in w, w is a real joy. By contrast, in (12b), (for any g) $\langle$IP3, g$\rangle_J$ = 1 as long as every semanticist in g(**1**) owns a Tuscan villa in g(1). So by parallel reasoning, (for any g) $\langle$(12b), g$\rangle_J$ will be a function that takes any world **v** to 1 as long as, for every world w such that every semanticist in **w** owns a Tuscan villa in w, w is a real joy.

That in a nutshell is the account. There is just one small complication to add (it relates to the suspicious parentheses in (7)). I have thus far been glossing over the fact that, when we evaluate the truth of a counterfactual, our decision about what worlds we inspect always depends in some sense on what we know about the actual world (see Stalnaker 1968; Lewis 1973). A more accurate description of the two functions that we obtain for (9) would take this kind of form: *f*(*v*) = 1 *as long as every world in S is a real joy*, where you get S by taking all worlds *w* such that every semanticist in v (or w, depending on which case we are dealing with) owns a Tuscan villa in w, and selecting from those worlds only those that bear a certain relation to v. We could get this result here if the value of

⟨IP1, g⟩$_J$ were to depend not only on ⟨IP2, g⟩$_J$ but also on the value that g assigns to a certain index, an index that happens to be identical to the index on the highest λ. So the small complication is this. The structures for (9) should actually contain another index within IP1, an index identical to the index of the higher λ (as in (12′a, b)). (And the rule in (11b) for determining ⟨IP1, g⟩$_J$ should be modified so as to take into account the value that g assigns to this index.)

(12′) a. λ_0 [$_{IP1}$ . . . **0** . . . if [$_{IP2}$ λ_1 [$_{IP3}$ . . . every semanticist . . . $_0$ . . . owned a villa in Tuscany . . . $_1$ . . .] . . . what a joy . . .]

b. λ_0 [$_{IP1}$ . . . **0** . . . if [$_{IP2}$ λ_1 [$_{IP3}$ . . . every semanticist . . . $_1$ . . . owned a villa in Tuscany . . . $_1$ . . .] . . . what a joy . . .]

I have been assuming that the indexed λ's are adjoined to phrasal constituents. How do the other indices – the indices in IP3, for example – enter into the syntactic structure of the sentence? I will assume without argument that we find them on unpronounced elements that I will write as s_1, s_2, s_3, etc. I will assume that the value that ***J*** yields for an element of the form s_i given an assignment g is g(i), so these elements are like logical variables. I will also commit myself to some details about where we find these elements, and in the next section I will go through these details one by one. As far as IP3 is concerned, here are some assumptions that I am making. First, the element whose index determines the world in which semantics is practiced occurs inside the DP projected by *every*. (I will not take a position on whether it is selected by the determiner *every* or the noun *semanticist*.) Second, the element whose index determines the world of villa ownership is selected by the verb *own*, and it therefore combines with a constituent on this verb's projection line. I have pencilled in some of these details in the (still schematic) structures below:[7]

(12″) a. λ_0[$_{IP1}$ . . . $\mathbf{s}_0$ . . . if [$_{IP2}$ λ_1 [$_{IP3}$ . . . [$_{DP}$ every semanticist $\mathbf{s}_0$] . . . owned a villa in Tuscany . . . $\mathbf{s}_1$ . . .] . . . what a joy . . .]

b. λ_0[$_{IP1}$ . . . $\mathbf{s}_0$ . . . if [$_{IP2}$ λ_1 [$_{IP3}$ . . . [$_{DP}$ every semanticist $\mathbf{s}_1$] . . . owned a villa in Tuscany . . . $\mathbf{s}_1$ . . .] . . . what a joy . . .]

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[7] The actual structures that I assume for examples like (9) are structures in which [$_{DP}$ *every semanticist* s_i] has undergone QR. IP3 is made up of this DP and the constituent that is the remnant of QR, a constituent that contains the indexed element that determines villa ownership. In the case of (12″a), the rules of interpretation will tell us that ⟨DP, g⟩$_J$ is a function that, for any *F* (*F* a function from individuals to truth values), yields 1 whenever every individual x such that x is a semanticist in g(0) is such that F(x) = 1. For the constituent that the DP combines with, the rules of interpretation will yield a function that, for any individual *y*, yields 1 as long as y owns a villa in Tuscany in g(1). We get ⟨IP3, g⟩$_J$ by applying ⟨DP, g⟩$_J$ to this latter function.

The kind of account that I have just given is in the spirit of Cresswell 1990: Cresswell was convinced on the basis of the range of interpretations that we find for natural language sentences that language has the expressive power of a language with explicit quantification over worlds. With the goal of capturing the right range of interpretations for natural language sentences, Groenendijk and Stokhof (1984) specifically motivated representations with world variables; one can find related conclusions in Farkas (1993) and to a certain extent in Enç (1981). Can the pieces of the account be independently motivated? If we accept the popular view that pronouns function as variables over individuals, then there is independent motivation for the idea that the syntax contains indexed items that function as variables as far as the interpretation procedure is concerned. The only real difference between pronouns on the popular view and the world variables whose existence I have posited here is that the world variables are unpronounced. There is also independent motivation for the existence of unpronounced items that are interpreted in the same way that pronouns are: this is the common view of traces and of PRO. So you could take my account for the ambiguity of (9) as basically saying that (9) contains a few pronouns of the kind that we can't hear. With this in mind, I am going to speak of the elements s_1, s_2, s_3, etc. as "silent pronouns."

3. Assumptions

I have now motivated representations in which some positions are occupied by indexed items. The indexing pattern that we find in a given structure determines the interpretation that we get for that structure. With regard to (9)/(12), we specifically saw that when the silent pronoun in *every semanticist* is coindexed with the higher λ (when it is "non-locally bound") *semanticist* has a transparent use, while when it is coindexed with the lower λ (when it is "locally bound") *semanticist* has an opaque use. In principle, one configuration can admit a lot of different indexing patterns: once we accept that indexed items can appear in a certain position, we might expect that *any* indexed item can appear in that position. I will show in this paper that this expectation is wrong. You can't give a silent pronoun any index you like: just like normal pronouns, silent pronouns are subject to a binding theory.

I could show this with what we have developed already. However, to present the argument more easily, and also for the sake of completeness, I want to concentrate on sentences with attitude verbs and adverbial quantifiers. Since I am going to consider a range of different kinds of structures, I am going to have to introduce my assumptions about where

silent pronouns appear in these structures, and what they determine about the interpretation of these structures. The purpose of this section is to do that. When I go on to show that silent pronouns are subject to a binding theory, I will be making some simplifications in the structures for full sentences. Again, this is for ease of presentation. In this section, I will in passing indicate what simplifications I will make, and what other assumptions I will be modifying in order to use these simplified structures.

One important remark first about the kind of objects that ***J*** produces. I said earlier that to say that a sentence is true is to say that some function applies to the actual world and yields the value 1, and that this function is something that ***J*** yields given a syntactic structure for the sentence and an assignment. But I did not mean to imply that, whenever we give ***J*** a sentence and it gives us a function back, the domain of that function consists *only* of worlds. In fact, I assume that language works in such a way that sentences determine functions from *parts* of worlds (*situations*) to truth values (cf. Kratzer 1989). This means that no element of the domain will be bigger than a world, but that the elements of the domain are not necessarily limited to worlds. There is motivation for this view if you think that ***J*** yields the same kind of object for full sentences that it yields for those constituents that combine with adverbial quantifiers like *always*. Take the italicized sentence in (13), and assume that in the structure that we interpret (call it S) *always* combines with a constituent that includes the material *John was quite upset*. We take (13) to be true as long as John was upset at the end of every round of some game that was held. If we conclude from this that $\langle S, g\rangle_J$ applied to the actual world yields 1 iff all "ends of rounds" in the actual world are characterized by $\langle$**John was quite upset**, $g\rangle_J$, we want $\langle$**John was quite upset**, $g\rangle_J$ to be the kind of object that can characterize "ends of rounds," which are smaller than worlds.

(13) Mary won at least $10 in every round. *John was always quite upset*.

Once we say that ***J*** produces functions from *situations* to truth values, this has consequences for the silent pronouns that we have been considering. At least some of the constituents that are functions from situations to truth values have indexed λ's at the top. That means that these indexed λ's at the top must be responsible for creating functions from situations to truth values. For them to do that (on some assumptions that I will gloss over) the silent pronouns that they are coindexed with must be constrained to take situations as their values.[8] So the silent pronouns that we have

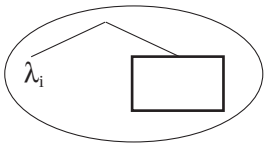
[8] The basic idea is this. To say that a pronoun s_i in a constituent C is "constrained to take

been talking about are *situation pronouns*. What forces these silent pronouns to take situations as their values? I will assume that this follows from the selectional requirements of other items in the sentence: the lexical items that syntactically select for these pronouns specify this small amount of semantic information about them as well.

This section, like the last one, does not presuppose much background. Some readers will be able to rush through it, and to deduce most of its content from a glance at the diagrams.

3.1. *The Structure Projected by Verbs*

One way of producing a function from situations to truth values (a "proposition," from now on) is to combine a constituent interpreted as a truth value with an indexed λ. To mentally process the structures that I will consider from here on in, it might help to imagine them as being made up of units of this sort. There will be constituents that are interpreted as propositions (we could diagram these as ellipses), and they will be made up of λ's and constituents that are interpreted as truth values (which we could diagram as boxes).



In general, on my assumptions below, the clausal structures that lexical items project will be interpreted as truth values. (They will be boxes.) By contrast, the clausal structures that lexical items select as arguments will be interpreted as propositions. (They will be ellipses.)

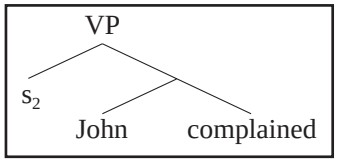
Verbs, I will assume, project a structure that includes a situation pronoun. Here are some (simplified) structures we could obtain that contain verbs. I assume that in these structures the verbs *complain*, *win*, and *own* have combined with all of the syntactic items that they select for, and I assume that the situation pronoun is the last item to combine in the structure that the verb projects. Likewise for *is Canadian*, which for the purposes of this paper I will treat as a simple verb.[9]

---

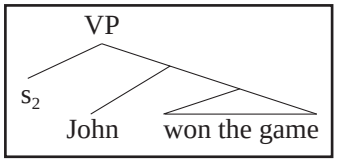
a situation as its value" is to say that, for any g, $\langle C, g \rangle_J$ is only defined if g(i) is a situation. This means that, if we then adjoin a λ_i to C, we will get a function whose domain consists only of situations. (See fn. 5.)

[9] A more realistic picture might be one where the adjective *Canadian* itself projects a structure of the kind that *is Canadian* projects here, and where the resulting structure combines with the verb *be*.

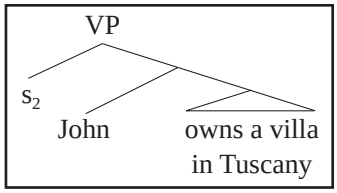
(14) a.



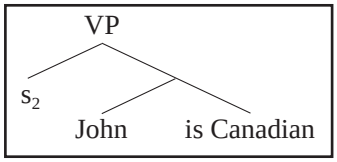
b.



c.



d.



For my purposes here, I will assume that these structures yield the (simplified) interpretations in (15); I will not detail how.

(15) a. $\langle$(14a), g$\rangle_J$ = 1 iff John is located in g(2) and John complained in g(2).

b. $\langle$(14b), g$\rangle_J$ = 1 iff John is located in g(2) and won the unique maximal game in g(2).[10, 11]

c. $\langle$(14c), g$\rangle_J$ = 1 iff in the world of g(2), and for the temporal duration of g(2), John owns a Tuscan villa.

d. $\langle$(14d), g$\rangle_J$ = 1 iff in the world of g(2), and for the temporal duration of g(2), John is Canadian.[12]

---

[10] Explication:

(i) A game may itself consist of other games: the rounds of a game may sometimes be spoken of as games in their own right.

(ii) Situations may contain games. I won't be specific about what this means, but the general idea is that the situation is one in which the players play out the entire course of the game. The temporal extent of the situation includes the temporal extent of the game.

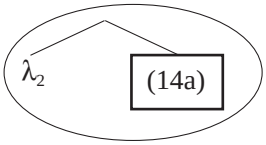
(iii) A game is a *maximal game in s* when s contains that game but no larger game that it is part of.

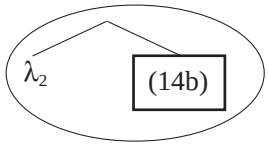
Basically, then, if g(2) contains a game that consists of several rounds (and no other game in addition), then $\langle$(14b), g$\rangle_J$ depends on whether John is the winner of that more inclusive game.

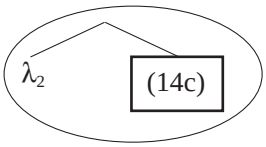
[11] The interpretation of $_{VP}[s_2$ John *lost* the game], I assume, is parallel: . . . and *lost* the unique maximal game in g(2).

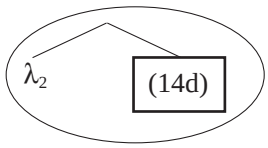
[12] That is, he has Canadian citizenship, or whatever characteristics one has to have in order to be Canadian.

If we adjoin a λ_2 to these structures, as in (16),

(16) a.


b.


c.


d.


we get the following functions from situations to truth values:

(17) a. $\langle$(16a), g$\rangle_J(s) = 1$ iff John is located in s and John complained in s.
b. $\langle$(16b), g$\rangle_J(s) = 1$ iff John is located in s and won the unique maximal game in s.
c. $\langle$(16c), g$\rangle_J(s) = 1$ iff in the world of s, and for the temporal duration of s, John owns a Tuscan villa.
d. $\langle$(16d), g$\rangle_J(s) = 1$ iff the world of s, and for the temporal duration of s, John is Canadian.

Through most of this paper, I will be assuming simplified structures in which little or no clausal material appears above the VP level. For instance, (16c) is the kind of structure that I might give for the sentence *John owns a villa in Tuscany*. These simplifications are justified to the extent that there is little or no material relevant to interpretation above the VP level. In fact, it could well be true that *some* nodes above VP are irrelevant: if most items that move in the overt syntax "reconstruct" at the level of structure that we interpret, then it is plausible that positions in the tree that serve as landing sites contain no material relevant to interpretation. But it is definitely false that *all* of the nodes that I will be omitting are irrelevant. For one thing, tense nodes, which I will eliminate in my simplified structures, certainly have something to contribute. For another, on my assumptions as they stand now, on which we judge a sentence with structure *S* to be true only when (for some assignment g) we take $\langle$S, g$\rangle_J$ to characterize the actual world, the structure of the sentence *John owns a villa in Tuscany* could not be limited to (16c): if it were, then we would judge the sentence to be true only when we take (17c) to characterize the actual world, and that will only happen when we think that John's ownership of a villa extends through the entire temporal history of the actual world. In what follows, I will try to correct for the interpretive differences

between my simplified syntactic structures and more realistic syntactic structures by imagining that the simplified structures affect our truth judgments differently from the way in which actual structures affect our truth judgments. Specifically, when dealing with a present tense sentence like *John owns a villa in Tuscany*, I will assume this. We judge the sentence to be true only when we can find a structure *S* for the sentence, and an assignment *g*,[13] with the following property: $\langle S, g \rangle_J$ characterizes a situation in the actual world *whose temporal extent includes the utterance time*. I will make a similar correction for past tense sentences: . . . *whose temporal extent precedes the utterance time*.[14]

3.2. *The Structure Projected by Attitude Verbs*

Some verbs, for example *think*, combine with constituents that are interpreted as propositions. They will project structures of the kind in (18a). In the structures that these verbs project, we will also find situation pronouns (e.g., $\mathbf{s}_1$) and items like the names of individuals (e.g., **Mary**), and as before the situation pronouns will be the last to combine. We can think of all of these items as satisfying the selectional requirements of the verb. Suppose the constituent in (16c) occupied the slot reserved for a proposition. We would then have the structure in (18b). (*NB*. In actual fact, the constituent in (16c) could not occupy this slot. *Think* combines with a CP and not with a VP. But in the simplified structures that I will assume in the discussion to come, I will assume that *think* combines with just such a constituent.)

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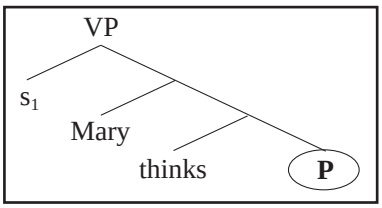
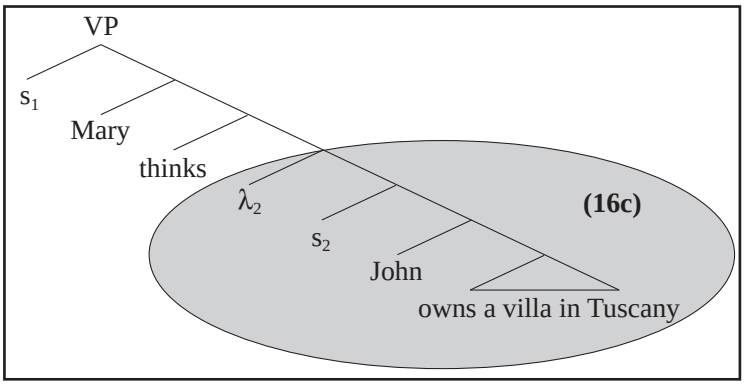
[13] More accurately: a *contextually suitable* assignment. (This will be clarified in section 3.3.)

[14] In practice, for most of the past tense sentences I will consider, this restriction to past situations will not be of any importance. This has to do with the fact that all of the past tense sentences I will consider contain adverbial quantifiers. In these cases, the proposition that provides the quantifier's domain narrows down the set of situations that we must pay attention to. The proposition is determined by the context, and in the past tense cases I will maintain that the context determines a proposition that characterizes only a small group of "past situations." See section 3.3 for relevant details.

(18) a.



b.



I will assume that, in the case of a structure like (18a), ***J*** yields the truth value 1 under the following conditions (when we provide ***J*** with an assignment g). For one thing, Mary is located in g(1); for another, while in g(1), Mary represents g(1) to herself as a situation that $\langle \mathbf{P}, g \rangle_J$ characterizes. Another way to express this second condition (cf. Hintikka 1969) is to say that all of the situations in a certain set C are situations that $\langle \mathbf{P}, g \rangle_J$ characterizes. Roughly speaking, this set C is the set of situations that, for all Mary knows while she is in the situation g(1), *could be* the situation g(1) – these situations will belong to different worlds if Mary (like the rest of us) does not know which world she is in. I will sometimes speak of the situations in this set as "Mary's candidates for g(1) while she is located in g(1)" or more simply as the situations "consistent with Mary's beliefs in g(1)." So $\langle$(18a), $g\rangle_J$ will be 1 on condition that Mary is in g(1) and that all of the situations *s** consistent with Mary's beliefs in g(1) are such that $\langle \mathbf{P}, g \rangle_J(s^*) = 1$.

(18) c. $\langle$(18a), $g\rangle_J = 1$ iff Mary is in g(1) and
all of the situations *s** consistent with Mary's beliefs in g(1) are such that $\langle \mathbf{P}, g \rangle_J(s^*) = 1$.

This means that $\langle$(18b), $g\rangle_J = 1$ iff Mary is in g(1) and all of the situations *s** consistent with Mary's beliefs in g(1) are such that in the world of s* John owns a Tuscan villa. And accordingly, if we adjoin a λ_1 to the constituent in (18b), then (with respect to any assignment g) ***J*** will yield

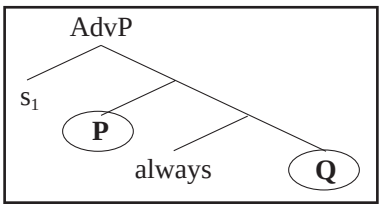
a function that takes a situation *s* to 1 when the following conditions are met: first, Mary is in s; second, all of the situations *s** consistent with Mary's beliefs in s are such that in the world of *s** John owns a Tuscan villa.

3.3. *Structures with Adverbial Quantifiers and Modals*

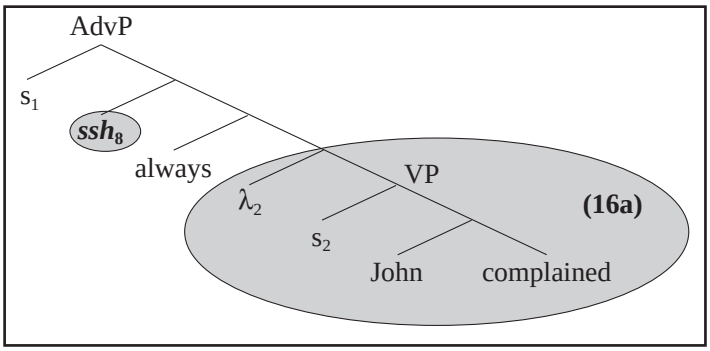
Like attitude verbs, adverbial quantifiers such as *always* appear together with situation pronouns and with items interpreted as propositions. As with attitude verbs, we can think of these items as satisfying the selectional requirements of the quantifier, and I will assume that they all appear within a structure that the adverb itself projects.

Unlike attitude verbs, *always* projects a structure that includes *two* constituents interpreted as propositions. (19a) gives the general schema.

(19) a.



b.



How are structures like (19a) interpreted? ***J*** (provided with an assignment g) will yield the truth value 1 for a structure for this kind on condition that $\langle \mathbf{Q}, g \rangle_J$ characterizes every situation in a certain class. This class is determined jointly by $\mathbf{s_1}$ and **P**. $\mathbf{s_1}$ narrows down the class by telling us a situation, and locating in the world of this situation all of the members of the class;[15] **P** narrows down the class by telling us another property that all of the situations in the class have to have. Specifically:

[15] I assume that no situation is part of two different worlds. Once we know that all the members of the class are worldmates of one particular situation, we know that all the members of the class belong to one particular world.

(20) $\langle$(19a), g$\rangle_J$ = 1 iff for every situation *s that belongs to the world of g(1)*,
if $\langle$**P**, g$\rangle_J$(s) = 1 then $\langle$**Q**, g$\rangle_J$(s) = 1.

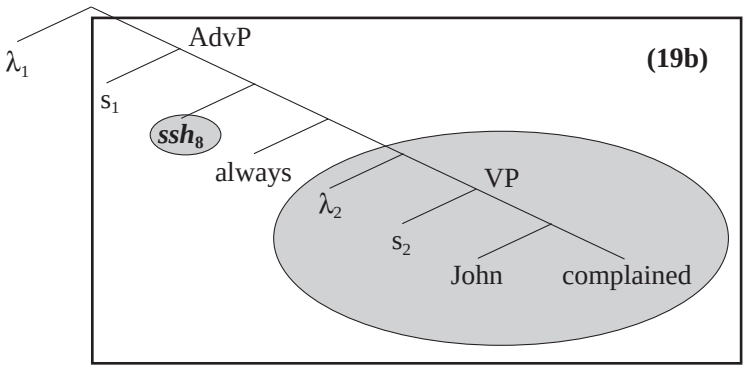
In practice, the **P** slot might not be filled by phonetically realized material, though the **Q** slot always will be. This is another difference with attitude verbs. (19b) gives an example of the kind of structure that we could find. In this structure, the **P** slot is occupied by a silent element which I have called *ssh*. I assume that *ssh* is like a demonstrative: the way in which it contributes to the interpretation of the structure around it depends at least in part on the context and on what the context makes salient. In particular, I assume that, when the context makes a set of situations salient, propositions that characterize these situations are possible values that we could obtain for *ssh* by applying **J** to *ssh* together with an assignment. In this way, by making a set of situations salient, the context will help to determine what situations *always* quantifies over. For concreteness, I assume that the silent element is indexed and interpreted in the same way that other indexed elements are – that is, $\langle$***ssh*$_8$**, g$\rangle_J$ = g(8) – and that its interpretation depends on the context to the extent that our choice of an assignment g depends on the context. In (19b), the **Q** slot is occupied by a VP to which a λ has been adjoined. Suppose that the context encourages us to evaluate (19b) with respect to a certain assignment *h*, and that h(8) is a proposition that characterizes certain segments of certain games. Then $\langle$(19b), g$\rangle_J$ will be 1 only if John complained in all of those game segments that are part of the world that h(1) is part of.

The structure in (19b) is part of the structure that we might generate for the second sentence in (21). I assume that there are a number of propositions that we can determine on the basis of the sentence in (21), but they are all functions that, when applied to a world (or part of one), yield 1 as long as John complained in a certain class of situations in that world. On one natural reading of the sentence, the situations are situations that temporally occur shortly after Mary's winnings for a particular game round have been announced. On my analysis here, in the structure that we interpret for this sentence, a λ appears adjoined to a constituent like the one in (19b). In line with my other simplifications, I will assume that nothing above this λ is relevant for interpretation: the resulting constituent ((22)) is the structure that we interpret. Take an assignment g; $\langle$(22), g$\rangle_J$ will be a function that takes any situation *s* to 1 as long as John complained in every situation in the world of s that is characterized by a certain proposition. What that proposition is depends on what the silent element's index is (8, in this case) and on what value g assigns to this index. Depending on

our choice of index and assignment, we will potentially be able to determine a number of different propositions. To the extent that the sentence has the natural reading that I mentioned, that is because somehow the context encourages an assignment g which, for the index on the silent element, yields a function that characterizes situations of the kind I mentioned. The idea is that this happens because in some manner the first sentence in (21) makes salient a bunch of situations of that kind.

(21) Mary won at least $10 in every round. John always complained bitterly.

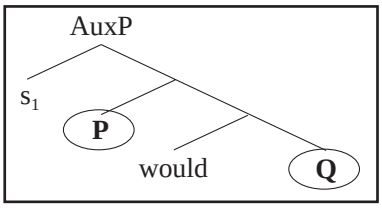
(22)



(Another adverbial quantifier that will appear in the examples to follow is *usually*. I assume that, just like *always*, *usually* combines with two propositions and a situation pronoun, so the general schema for structures with *usually* is just like (19a). **J** (together with assignment g) will give us 1 for these structures as long as $\langle \mathbf{Q}, g \rangle_J$ yields 1 for the majority of situations in the world of g(1) for which $\langle \mathbf{P}, g \rangle_J$ yields 1.)

The structures projected by modal auxiliaries like *would* – structures that we find in conditionals, for example – are for my purposes just like the structures projected by *always*. As with the structures projected by *always*, a VP (with adjoined λ) occupies the **Q** slot. In the case of counterfactual conditionals like the ones that we looked at in the last section, I will assume that the *if*-clause material is interpreted in the **P** slot. This may not be completely realistic, but it will do. I will not be more specific about the interpretation of structures like (23) than I was in the last section. $\langle (23), g \rangle_J = 1$ iff $\langle \mathbf{Q}, g \rangle_J$ yields 1 for every situation in a certain set S. In the case of a counterfactual, to get S, you take all the situations for which $\langle \mathbf{P}, g \rangle_J$ yields 1, and you select only those that bear a certain relation to g(1). One property that S will have, I assume, is that each situation in it will be part of a different world.

(23)



(I will also consider sentences with the modal auxiliary *might*. I assume that the structures are parallel. These structures yield 1 as long as $\langle$**Q**, g$\rangle_J$ yields 1 for *some* of the situations in a set S determined in just the same way.)

3.4. *Definite Descriptions*

Definite descriptions, I assume in what follows, contain a situation pronoun. I will not commit myself as to where exactly in the DP this pronoun appears. However, I will assume that the value that ***J*** yields for the DP is sensitive to the index on the pronoun:

(24) a. $\langle$**[$_{DP}$ the loser s_1]**, g$\rangle_J$ is the individual who lost the unique maximal game in g(1).[16]
(If there is none, $\langle$**[$_{DP}$ the loser s_1]**, g$\rangle_J$ is undefined)

b. $\langle$**[$_{DP}$ my brother s_1]**, g$\rangle_J$ is the unique individual in g(1) who is my brother in the world of g(1).
(If there is none, $\langle$**[$_{DP}$ my brother s_1]**, g$\rangle_J$ is undefined)

Recall the structure that we considered for *John always complained* ((22)). Structures for a sentence like *The loser always complained* will be similar. The difference is just that the DP *the loser* takes the place of the DP *John*. However, because the DP contains a situation pronoun, there are a variety of structures that are possible for this sentence that differ from each other only in the indexing of the situation pronoun.

In (25b) I have schematized one class of (simplified) structures that we could assign to the sentence. The structures differ with respect to what occupies the position that I have marked with an **S**. One possibility is that we find a silent pronoun s_1 coindexed with the higher λ; another possibility is that we find a silent pronoun s_2 coindexed with the lower λ. These two possibilities will yield two different interpretations that are analogous

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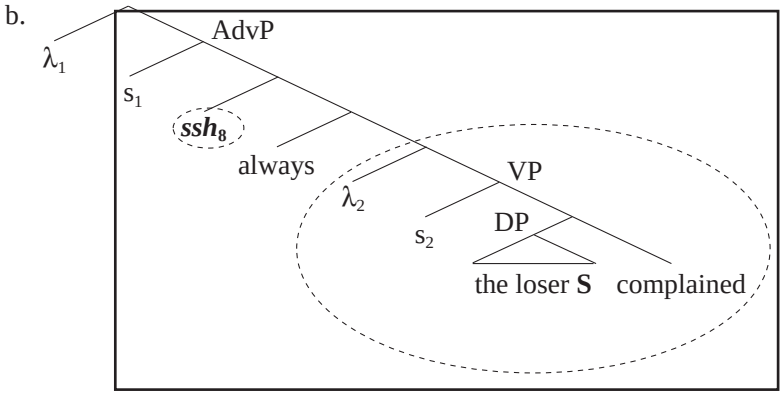
[16] In general, I assume that structures like $_{VP}$[s_i John won/lost the game] and structures likes $_{DP}$[the winner/loser s_i] are related in their interpretation. Roughly speaking, $\langle_{DP}$[the winner/loser s_i], g$\rangle_J$ = *x* as long as $\langle_{VP}$[s_i *N* won/lost the game], g$\rangle_J$ = 1, where *N* is the name of *x*.

to the two different interpretations that we found for the counterfactuals in section 2.

Suppose that the silent pronoun in the DP is s_1. Then, I assume, $\langle$(25b), g$\rangle_J$ will be a function that takes any situation *s* to 1 as long as, in every situation in the world of s characterized by the proposition g(8), the loser of the unique maximal game in s complained. Suppose on the other hand that the silent pronoun in the DP is s_2. Then $\langle$(25b), g$\rangle_J$ will be a function that takes any situation s to 1 as long as, in every situation in the world of s characterized by the proposition g(8), the loser of the maximal game in *that situation* complained. What consequences does this have? Let's say that the context makes salient a series of games – the kind of series (like a tournament) that can itself be regarded as one big game, with a winner and a loser. And let's suppose that accordingly we choose an assignment g that assigns to the index 8 a proposition characterizing games like those in the series. With this in mind, now take a situation in the actual world large enough to include the entire series of games. The first kind of function will characterize this situation as long as *the overall loser of the series* complained in every round, while the second kind of function will characterize this situation as long as *the loser of each round* complained. Imagine that the overall loser did not lose every round, and that in each round the only person who complained was the one who lost the round. In that case, if we judge the sentence to be true, we are making use of a structure that leads us to the second kind of function. Imagine instead that the overall loser did not lose every round but did complain in every round, and that in each round he was the *only* person who complained (all the other losers of rounds were good sports). In that case, if we judge the sentence to be true, we are making use of a structure that leads us to the first kind of function.

(25) a. The loser always complained.

b.



4. A "Binding Theory" for Situation Pronouns

We are now ready to discover a "binding theory."

In what follows, I will consider two sentences. For each sentence, I will consider several possible structures. These structures differ only with respect to the indexing of the situation pronouns in the structures. We will be forced to conclude that some of these structures are impossible, because they give rise to interpretations that apparently we don't get.

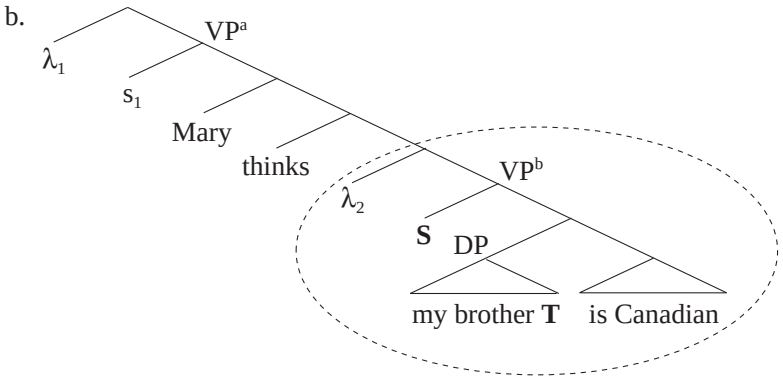
The argument is always the same. If structure S is available, we should take the sentence to be true under such-and-such conditions, because under such-and-such conditions we can find a situation *u* and a contextually suitable assignment *g* such that $\langle S, g\rangle_J(u) = 1$. The fact is that we take the sentence to be false. Therefore structure S is not available.

Since some of the structures are impossible, there must be constraints on what indexing situation pronouns can have in a given structure. On the basis of the two sentences, I will motivate two constraints – two "binding principles" for situation pronouns.

Look first at (26a). In (26b) I have schematized a class of (simplified) structures that we might in principle admit for (26a).

(26) a. Mary thinks that my brother is Canadian.

b.



In these structures, there are two indexed λ's. One (λ_1) is adjoined to the root: this λ makes the sentence into a proposition once it is coindexed with a situation pronoun below. The other (λ_2) is adjoined to the embedded clause: this λ, if it is coindexed with a situation pronoun below, will create the proposition that *think* has to combine with to satisfy its selectional requirements. Also, three situation pronouns are present. *Think* selects for one, *is Canadian* selects for another, and the DP *my brother* contains a third. The structures that I am considering are all alike in that the first of these situation pronouns is coindexed with the higher λ. They differ with respect

to what indices the other two situation pronouns have. In (26b), the labels **S** and **T** mark the places where these other two situation pronouns should be. In principle, either one of these pronouns could be coindexed with either one of the λ's. But are all of these indexings really possible?

No.

Here first are some indexings that (I claim) *are* possible. It *is* possible to give the pronoun in the DP the index of the higher λ (the index 1) and the other pronoun the index of the lower λ (the index 2) – that is, to have an embedded VP that looks like (27).

(27) $[_{VP}{}^{b}$ $\mathbf{s_2}$ $[_{DP}$ my brother $\mathbf{s_1}]$ is Canadian]

What evidence is there that this indexing is possible? I will go into more detail in the next paragraph, but the idea is this. Suppose we can always entertain a structure of this kind. Then we should take the sentence to be true if we think that there is a person who *in actuality* is my brother and who *Mary thinks* is Canadian (even if Mary does not know that this person is my brother or if this person is not in actuality Canadian). We do. My brother's name is Allon. Suppose Mary thinks Allon is not my brother but she also thinks that Allon is Canadian. Then (26a) is true.

In more detail now: The structure that we are considering yields the interpretation in (28b). Adopting the rough terminology from section 2, we could say that *my brother* has a "transparent" use (on this interpretation, we will use the sentence to talk about people who are brothers of mine in the actual world) and *is Canadian* has an "opaque" use (we will use the sentence to talk about Canadians in worlds other than our own).

(28) a. $\mathbf{S} = s_2$, $\mathbf{T} = s_1$

b. For any *s*, $\langle$(26b), g$\rangle_J(s) = 1$ as long as

i. Mary is in *s*; and

ii. all of the situations **s*** consistent with Mary's beliefs in *s* are such that

the unique individual in *s* who is a brother of mine in the world of *s*

is Canadian in the world of **s*** (and for the temporal duration of **s***).

Suppose then that we can find a situation *s* in the actual world – a situation that temporally surrounds the utterance time – with the following character. Here is Mary in s (along with someone who is my brother). And all of the situations that Mary is entertaining as candidates for s have this property: if you look at the one individual in s who is a brother of mine *in the actual world*, in the world of *the candidate situation* he has

all those characteristics that one has to have in order to be Canadian. Then, to the extent that we can generate the structure for (26a) that we are considering, we should take (26a) to be true. On the scenario that I just proposed, we can find such a situation: many situations containing Mary and Allon will do.

(To show how we wind up with the interpretation in (28b), I actually need to introduce another assumption. Let's start with the embedded VP, repeated below as (29a).

(29) a. $[_{VP}{}^{b}$ $\mathbf{s_2}$ $[_{DP}$ my brother $\mathbf{s_1}]$ is Canadian]
b. $[_{VP}$ s_2 John is Canadian]

Recall that in the case of a structure like (29b), $\langle$(29b), g$\rangle_J$ = 1 iff in the world of g(2), and for the temporal duration of g(2), John is Canadian – that is, he has Canadian citizenship, or whatever characteristics one has to have in order to be Canadian. I assume that, in the case of a structure with a different situation pronoun or a different expression that ***J*** yields an individual for, the conditions under which ***J*** will give us 1 are the analogous ones. So $\langle$(29a), g$\rangle_J$ = 1 iff in the world of g(2) – and for the temporal duration of g(2) (I will leave this out from here on in) – the individual that is $\langle[_{DP}$ my brother $\mathbf{s_1}]$, g$\rangle_J$ is Canadian.[17] Now recall how the situation pronoun in the DP *my brother* affects the value that ***J*** yields for that DP. In different worlds different people can be brothers of mine, and $\langle$**[$_{DP}$ my brother s_1]**, g$\rangle_J$ gives you the unique individual in the situation g(1) *who is a brother of mine in the world that g(1) is a part of*. This means that for the embedded VP, ***J*** is going to yield 1 under the conditions in (30b). Without going through all the steps, this in turn means that for the top VP, ***J*** is going to yield 1 under the conditions in (30c). And as a result the entire structure will yield a proposition of the kind that I gave above in (28b).)

(30) a. $\mathbf{S} = s_2$, $\mathbf{T} = s_1$
b. $\langle VP^{b}$, g$\rangle_J$ = 1 as long as
the unique individual in g(1) who is a brother of mine in the world of g(1) is Canadian in the world of g(2).

---

[17] In general, I assume the following about the way ***J*** works. Take a simple verb phrase *A* (for example (29b)) that contains a name for a certain individual *x* (like the individual John), and take a determiner phrase *B* (for example, $[_{DP}$ my brother $s_1]$) for which ***J*** yields an individual. Suppose $\langle$A, g$\rangle_J$ = 1 as long as x has some property P. Then, if we create a new expression *A** just like A except that *B* takes the place of the name, $\langle$A*, g$\rangle_J$ = 1 as long as $\langle$B, g$\rangle_J$ has property P. I will make use of this assumption throughout this paper.

c. $\langle VP^a, g\rangle_J = 1$ as long as
Mary is in g(1) and
all of the situations *s** consistent with Mary's beliefs in g(1) are such that
the unique individual in g(1) who is a brother of mine in the world of g(1) is Canadian in the world of **s***.

Another indexing that *is* possible: we can give both pronouns the index of the lower λ (the index 2), as in (31):

(31) $[_{VP}{}^b$ $\mathbf{s_2}$ $[_{DP}$ my brother $\mathbf{s_2}]$ is Canadian]

On this indexing, both *my brother* and *is Canadian* have "opaque" uses. Given this indexing, we should take the sentence to be true whenever Mary thinks that I have a Canadian brother (even when the person who Mary thinks is my brother is in actuality neither my brother nor Canadian, or for that matter even when I don't have a brother at all). And we do: for instance, if we know that Mary mistakenly thinks that Pierre is my brother but that she correctly takes him to be Canadian, we judge the sentence to be true. To be more precise about what is going on here: the structure that we are considering yields the interpretation in (32b).

(32) a. $\mathbf{S} = s_2$, $\mathbf{T} = s_2$

b. For any *s*, $\langle$(26b), $g\rangle_J(s) = 1$ as long as
i. Mary is in *s*; and
ii. all of the situations **s*** consistent with Mary's beliefs in *s* are such that
the unique individual in **s*** who is a brother of mine in the world of **s*** is Canadian in the world of **s*** (and for the temporal duration of **s***).

Suppose that we can find a situation *s* in the actual world – a situation that temporally surrounds the utterance time – with the following character. Here is Mary in s. And all of the situations that Mary is entertaining as candidates for s have this property: there is a unique individual *in the candidate situation* who is a brother of mine *in the world of the candidate situation*, and in the world of the candidate situation he has all those characteristics that one has to have in order to be Canadian. In the case where Mary wrongly takes Pierre to be my brother but correctly takes him to be Canadian, we can find such a situation. I assume that there will be a lot of situations containing Mary and Pierre (and no one else who Mary takes to be my brother) that Mary represents to herself as a situation containing Pierre (and no one else who she takes to be my brother). Many of these situations should do the trick.

What we are *not* able to do, however, is to take the pronoun that *is Canadian* selects for and to give it the index of the *higher* λ (the index 1). If we could, we would allow the indexing in (33).[18]

(33) $[_{VP}{}^{b}$ $\mathbf{s_1}$ $[_{DP}$ my brother $\mathbf{s_2}]$ is Canadian]

On this indexing, *my brother* has an "opaque" use and *is Canadian* a "transparent" use. If the sentence permitted a structure with this indexing, we would take the sentence to be true whenever there is some *actual* Canadian who *Mary thinks* is my brother – even when this person is not my brother in actuality, and *even when Mary mistakenly thinks that he is not Canadian*. For instance, we would take the sentence to be true when Mary thinks that Pierre (the Canadian) is my brother and naturally concludes – since she knows that *I* am American – that Pierre too is American. But in fact we judge the sentence to be *false* on this scenario, and so there must be something that makes the indexing in (33) impossible. Why exactly do we expect the sentence to be true on this scenario? (34b) gives the interpretation of a structure with the (33) indexing:

(34) a. $\mathbf{S} = s_1$, $\mathbf{T} = s_2$

b. For any *s*, $\langle$(26b), g$\rangle_J(s) = 1$ as long as

i. Mary is in *s*; and

ii. all of the situations **s*** consistent with Mary's beliefs in *s* are such that

the unique individual in **s*** who is a brother of mine in the world of **s*** is Canadian in the world of *s* (and for the temporal duration of *s*).

This means that we should take the sentence to be true when we can find an actual situation *s* with the following character. Here is Mary in s. All of the situations that Mary is entertaining as candidates for s have this property: there is a unique individual *in the candidate situation* who is a brother of mine *in the world of the candidate situation*, but this individual is one who *in the actual world* has all those characteristics that one has to have in order to be Canadian. So imagine that we allow the indexing in (33), and consider the scenario again. If we can find a situation with Mary

[18] I am not going to consider in the text the option of coindexing *both* pronouns with the higher λ. I assume that this possibility is independently ruled out. For the sister of *think*, we would wind up with a function whose output is defined for objects other than situations; I assume that this would violate the selectional requirements of *think*, which requires that its sister be a proposition. Incidentally, ***J*** would also give us a strange proposition at the top: whether this function yields 1 for a given situation is independent of what Mary thinks.

in it that Mary represents to herself as a situation containing Pierre (and no one else who she takes to be my brother), then this situation should make the sentence true. Many situations containing Mary and Pierre should work.

We have now found motivation for a binding principle:[19, 20]

(34) **Generalization X:** The situation pronoun that a verb selects for must be coindexed with the nearest λ above it.[21]

The next sentence that I want to consider is (35a). Structures for this sentence contain one more situation pronoun than our previous structures did, because *always* projects a structure that includes a situation pronoun. (35b) abbreviates a class of structures that we could assign to the sentence. In structures of this kind, the situation pronoun in *my brother* is coindexed with the λ below *thinks* (so *my brother* will have an "opaque" use). Also, the situation pronoun that *won* selects for is coindexed with the λ below *always*, so Generalization X is satisfied. What I am interested in is this. Once these indexings are established, what indexings are available for the situation pronoun that *always* introduces (the situation pronoun in the position marked **S**)? In principle, it could be coindexed with λ_1 or λ_2. Are both of these indexings really possible?

(35) a. Mary thinks that my brother always won the game.

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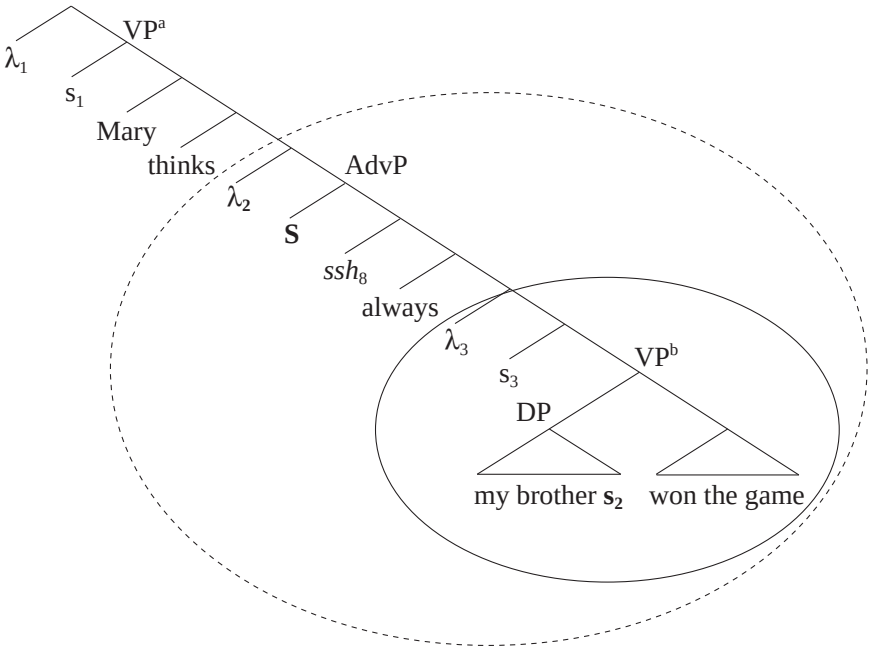
[19] By "nearest" in (34), I mean the lowest λ that c-commands the pronoun – that is, the λ that c-commands the pronoun without c-commanding any other λ that c-commands the pronoun.

[20] This stab at the generalization behind (33)'s impossibility ignores among other things the presence of certain λ's that I have not focused on in the text. What I said above established (without much explanation) that, in order for a structure to be grammatical and interpretable, some positions must be occupied by constituents that ***J*** yields a proposition for – the complement of *think*, for example. The λ's we have seen in the text all occur at the top of constituents that occupy these kinds of positions. However, λ's might appear elsewhere as well – for example, at the top of the constituents that raised quantifiers combine with and that are interpreted as predicates of individuals (cf. Heim and Kratzer 1998). I only mean the generalization in (34) to refer to the first kind of λ.

[21] On one view of how semantic composition works in VPs, the situation pronoun semantically composes with its sister by functional application. On this view, (34) means that, in cases where we find λ's adjoined to VPs containing a single situation pronoun, ***J*** will yield the same value for this adjunction structure that it yields for the sister of the situation pronoun alone. But it would be wrong to think that the additional structure that the λ and the pronoun provide is always interpretively redundant: it isn't in cases where the VP contains a second situation pronoun coindexed with the λ.

b.



I will approach this question in the usual way, asking first what value ***J*** yields given each of these indexings and then seeing whether these values correctly predict our truth judgments. To do this, however, I need to consider the sentence in context. This is because the value ***J*** yields for the entire structure (on an assignment g) depends on the value ***J*** yields for the silent element ssh_8 that determines the situations that *always* ranges over, and what value ***J*** yields for ssh_8 depends in turn on the context. I am going to imagine in what follows that I am talking about a game that lasted several rounds and that I utter the sentence in (35a) in that context. In this case, I will assume, the context makes available one single value for ssh_8, and it is a proposition that holds of situations in this and other worlds that constitute the rounds of a game.[22] What evidence is there for this? Suppose that I am talking about a game that lasted several rounds and you hear me say (36a). You would judge (36a) to be true if John won every round of the game that I have been talking about and false otherwise. (Glossing over the reasoning) I take this to mean that, in a context

[22] I won't be more specific about what this means than I have been up till now. Basically, the idea is that each situation is one where the players are playing, and the temporal extent of each situation is the temporal extent of a single round.

in which I am talking about a game that lasted several rounds, ***J*** can yield for the silent element a proposition that characterizes rounds of that game and no other situations in our world. If the silent element can have this kind of value when I utter (36a), then when I utter (35a) in the same context, the same value should be available for ssh_8. Similarly, suppose you hear me say (36b) in the same context. You would judge (36b) to be true if Mary too was under the impression that a game took place and if she represented the world to herself as one in which John won every round. By similar reasoning, I take this to mean that in this context ***J*** can yield a proposition that, for each world that Mary entertains as a candidate for the actual one, characterizes the rounds of a game in that world and no other situations in that world. Again, the same value should be available for ssh_8 in (35a).

(36) a. John always won (the game).
b. Mary thinks that John always won (the game).

Now back to the question: are both indexings possible for the situation pronoun that *always* introduces? No. What we can *not* do is give this pronoun the index of the *higher* λ (the index 1). If we could, then given the context that I have just described, we would take the sentence to allude to rounds of a game held in the *actual* world, and we would take it to be true whenever someone who Mary *thinks* is my brother won each of the *actual* game rounds. Why? On this indexing, and in this context, (35b) yields the interpretation in (37b):

(37) a. $\mathbf{S} = s_1$
b. For any *s*, $\langle$(35b), g$\rangle_J(s) = 1$ as long as
i. Mary is in *s*; and
ii. all of the situations **s*** consistent with Mary's beliefs in *s* are such that
for every s′ <u>in the world of *s*</u>,
if s′ is one of the relevant game rounds,
then the unique individual in **s*** who is a brother of mine in the world of **s*** (is located in s′ and) won the (maximal) game in s′.

So suppose we can find an actual situation *s* with Mary in it. And suppose that the situations that Mary is entertaining as candidates for s have this character: there is a unique individual *in the candidate situation* who is my brother *in the world of the candidate situation*, and this individual won the unique game played in each of the relevant *actual* game-playing situations (that is, he won each round of the *actual* game I have been talking

about). Then we should take the sentence to be true. If we can find someone who Mary thinks is my brother and who in actual fact won each round of the game, we can find a situation like this: we just need a situation that Mary represents to herself as a situation containing *him*, and many situations containing both Mary and him should do the trick. But the fact is that we do *not* always take the sentence to be true on this kind of scenario. Imagine that Mary wrongly takes Pierre to be my brother, imagine moreover that she is unaware of the fact that Pierre and I played the series of games that I have been talking about, and imagine that Pierre won all of those games. If we could coindex the quantifier's situation pronoun with the higher λ, we should take the sentence to be true. But we don't.

What we *can* do is give the pronoun the index of the *lower* λ (the index 2). In this case, we take the sentence to allude to games held in worlds *that Mary takes to be candidates for the actual world*. On this indexing (see (38)), we should take the sentence to be true if we can find the following kind of situation *s*. Here is Mary in s. And all the situations that she is entertaining as candidates for s have this character: there is a unique individual in the candidate situation who is my brother in the world of the candidate situation, and this individual *won every game round in the world of the candidate situation*. Take a scenario that is slightly different from the one I gave above. On the new scenario, Mary is aware of the fact that Pierre and I played a series of games but is under the delusion that Pierre won every one, when in fact Pierre's performance was hopeless. On this new scenario, we should be able to find a situation of the sort that I just described. And the fact is that on this new scenario we judge the sentence to be true.

(38) a. $\mathbf{S} = s_2$

b. For any *s*, $\langle$(35b), g$\rangle_J(s) = 1$ as long as
   i. Mary is in *s*; and
   ii. all of the situations **s*** consistent with Mary's beliefs in *s* are such that
      for every s′ <u>in the world of **s***</u>,
         if s′ is one of the relevant game rounds,
            then the unique individual in **s*** who is a brother of mine in the world of **s*** (is located in s′ and) won the (maximal) game in s′.

The conclusion:

(39) **Generalization Y:** The situation pronoun that an adverbial quantifier selects for must be coindexed with the nearest λ above it.

(Generalization Y looks a lot like Generalization X.)

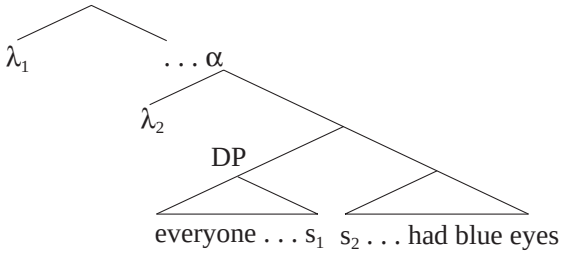
I have now motivated two "binding principles." I did this by considering sentences with attitude verbs and definite descriptions, but I stress that this was just to keep the argument simple. To conclude this section, I will sketch how to motivate Generalization X by considering counterfactuals with universal quantifiers.

First, here is a fact: I have hazel eyes. Once we know this, do we take the sentence in (40) to be true? No. That is another fact.

(40) If everyone with hazel eyes had blue eyes, then I might have dark brown eyes.[23]

Now, there are a number of different classes of structures that we can generate for (40), and this *No* is just the judgment that we expect if we are limited to a particular one of these classes. In (41), I have given an abbreviated example of the kind of structure I am talking about. I have included only the λ that is adjoined to the root, and the interpreted material in the *if*-clause (which I have labelled α). What is important is that the situation pronoun in the DP is coindexed with the λ adjoined to the root – this will give-*one with hazel eyes* a "transparent" use – and the situation pronoun in the structure that the verb projects is coindexed with the λ at the top of the *if*-clause – this will give *had blue eyes* an "opaque" use. (In (41), s_2 is the situation pronoun that appears within the structure that the verb projects. The reason why it appears below the DP rather than above it is that I assume that QR has extracted the DP from the structure the verb projects.)

(41)

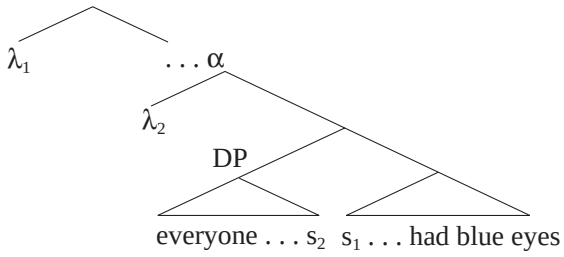


[23] For speakers like myself, *might* frequently sounds odd in counterfactual conditionals: my impression is that, for me, when a counterfactual *if*-clause is around, *would* is the only auxiliary that conveys the required modal force and nothing extra. If you are a speaker who finds *might* odd here, you might want to modify this example and the later ones to read *. . . then perhaps I would have dark brown eyes*. Since I am not certain how to analyze the semantics of this latter construction, I am not certain that the argument in the text will be apposite. However, I hope that as a first approximation we can treat this construction as having the semantics that I assume for the analogous *might* construction.

Without going into all the details, when we apply ***J*** to this structure, we will get a function that takes a situation *u* to 1 as long as some of the situations in a certain set Σ_u are part of a world where my eyes are dark brown. What Σ_u looks like depends on the situation u that we started out with and on what ***J*** yields for α. More specifically, we will be selecting the situations in Σ_u from among the situations that satisfy this proposition: the proposition you get by evaluating α with respect to an assignment that yields u given the index 1. That means that we will be selecting them from {s: every individual with hazel eyes in the world of u has blue eyes in the world of s}. But now take a situation u in our world. I have hazel eyes in our world. Will *any* member of {s: every individual with hazel eyes in the world of u has blue eyes in the world of s} be part of a world where my eyes are dark brown? Obviously not: they will all be parts of worlds where my eyes are blue. No matter how we select the situations in Σ_u, we are not going to get any parts of worlds where my eyes are dark brown. So if the *only* structures we have for (40) are structures like (41), we have the result we want. We won't be able to find a situation u in our world and a structure for (40) such that u satisfies the proposition that ***J*** yields for the structure. So we won't say that (40) is true.

But there is also another class of structures that we generate for (40). These structures differ from the kind exemplified in (41) in that their *if*-clauses show a different indexing pattern. (42) is an abbreviated example. In *this* structure, it's the situation pronoun *that the verb projects* that is coindexed with the λ adjoined to the root (so *had blue eyes* will get a "transparent" reading) and it's the situation pronoun *in the DP* that is coindexed with the λ at the top of the *if*-clause (so-*one with hazel eyes* will get an "opaque" reading).

(42)



Once again, when we apply ***J*** to this structure, we will get a function that takes a situation *u* to 1 as long as all the situations in a certain set Σ_u are part of a world where my eyes are dark brown. But this time, we will be selecting the situations in Σ_u from a different set. We will be selecting them from {s: every individual with hazel eyes in the world of s has blue

eyes in the world of u}. That is, rather than choosing them from worlds where every individual whose eyes are hazel in the world of u has blue eyes, we will be choosing them from worlds where *only* individuals whose eyes are *blue* in the world of u have *hazel* eyes. Now take a situation u in the actual world, where I have hazel eyes. Imagine that when we choose the situations in Σ_u, we choose one from a world in which certain blue-eyed people in our world have hazel eyes, in which those people are the *only* people who have hazel eyes, and in which I have dark brown eyes. In that case, there will be a situation in Σ_u that is part of a world where my eyes are dark brown, and so the function that we get by applying ***J*** to (42) will take the situation u to 1. That means that we will be able to find a situation u in our world and a structure for (40) such that u satisfies the proposition that ***J*** yields for the structure. And that means that contrary to fact we should take (40) to be true!

There are two ways out of the problem that the structure in (42) seems to pose. One option is to say that our procedure for selecting the situations in Σ_u is simply not going to give us any situation from a world where my eyes are dark brown. For those who take this view, the semantics of counterfactuals works in such a way that the value ***J*** gives for (42) is a lot like the value ***J*** gives for (41) – it too would fail to take any situation in the actual world to 1 – but I just haven't spelled out the semantics of counterfactuals in enough detail to bring this out. However, this looks unlikely (I will elaborate below). The second option is simply to say that something prevents us from using the structure in (42). That is what Generalization X does. There, in a nutshell, is the motivation for Generalization X.

Why was that first option unpromising? I think there are at least two reasons. I can only present the arguments in vague outline here, but I believe they can be fleshed out. The first reason is that if we take a sentence that is just like (40) but replace the *if*-clause with an expression that has a semantics just like (42)'s *if*-clause, we no longer get an easy *No* judgment. This is a big surprise if our *No* judgment follows from something about the semantics of (42), since ***J*** should give us the same value for this minimally differing sentence. I offer the sentences in (43) and (44) as candidates for sentences that minimally differ from (40) in the way I just suggested, though I cannot back up their candidacy with what I have presented so far:

(43) If any number of these people – John, Bill, Mary, Vladimir . . . (*and so forth, enumerating the people who have blue eyes in our world*) – had hazel eyes, but no one else did, then I might have dark brown eyes.

(44) If only people who have blue eyes (as things stand now) had hazel eyes, I might have dark brown eyes.

The second reason is that, given what is accepted about the semantics of counterfactuals, it is unlikely that, when we spell out the semantics of (42) in more detail, we will find that ***J*** gives us the kind of value for (42) that guarantees a *No* judgment. If we follow the intuition behind a number of accounts of the semantics of counterfactuals (see, e.g., Lewis 1973), we would have to make the following claim in order to predict a *No* judgment for (42). Take all those worlds in the set from which we choose Σ_u – that is, those worlds where the only people who have hazel eyes are people whose eyes are blue in the actual world. If we look at the worlds in this set that are most similar to the actual world, we will not find worlds where my eyes are dark brown. I think it can be argued that this claim is wrong.[24]

5. Some Consequences of the Binding Theory

Once we say that structures of the kind I outlined in section 3 are constrained by the indexing conditions that I outlined in section 4, we make a lot of predictions about what interpretations we will and will not find for sentences of natural language. In this section, I will point out some other cases where I think we can detect the binding conditions at work. I will concentrate on sentences with adverbial quantifiers and definite descriptions like *the loser* or *the winner*, and I will be concerned mostly with the effects of Generalization X. The section essentially contains two parts, and each part constitutes an argument: in each part, I present a set of facts and argue that they provide further evidence for the binding conditions. I will close the section by pointing out that recognizing the binding conditions gives us a new vantage point on a range of linguistic phenomena, and opens up possible avenues to their explanation. To give an example of the kind of possibility that it opens up, I will briefly consider a puzzle involving indefinites.

The first argument is a straightforward argument for Generalization X. In arguing that the facts that I consider below confirm Generalization X,

[24] Still, arguing this will not be a simple task. The argument might be organized as follows: First, one shows that the claim is wrong when the actual world is a world in which eye color has no effect whatsoever – that is, when there is a minimally differing world in which an individual's eye color differs, but all other aspects of the world remain the same. Then, one verifies that departures from this basic case will not change matters. The second part will clearly be the tricky part.

I will be relying on the following idea. Suppose we have two sentences Φ and Ψ. Let's call the set of structures that Φ admits Str_Φ and the set of structures that Ψ admits Str_Ψ. Suppose that for every structure S in Str_Φ, there is a structure S′ in Str_Ψ that has exactly the same interpretation – that is, for all g, $\langle S, g\rangle_J = \langle S', g\rangle_J$. Then if we take Φ to be true in a given context, we will also take Ψ to be true in that context.

The form of the argument is basically this. I will consider two sentences Φ and Ψ. Without Generalization X, Φ and Ψ would be related in the way I just mentioned. But with Generalization X, the two sentences would admit different sets of structures, and they would not be related that way. I will consider the two sentences in a particular context, and claim that we take the first sentence to be true but the second sentence to be false. This is plausible if Generalization X constrains the structures available for the two sentences, but a complete surprise if it doesn't.

The two sentences in question are (46a, b), and you should imagine that they are preceded by the discourse in (45).[25, 26]

(45) *Context:* Generally, the winner of this game loses a few rounds, and often enough the loser wins a few rounds. Last week's game was surprising: I won the game, and all the rounds were mine as well. This week's game was more typical . . .

(46) a. . . . the winner sometimes lost.
b. . . . the loser sometimes won.

Without Generalization X, each of these sentences admits three structures.[27] With Generalization X, each one admits only two. Imagine for a minute what structures we would get without Generalization X. (The general schemata are given in (47).) The two sets of structures that we would get are related in the way I outlined earlier: for each structure that one sentence admits, there is a structure for the other sentence that yields just the same proposition. In the case where **S** and **T** are both s_2, ***J*** will yield for both (47a) and (47b) a flat-out contradiction: a function that takes no situation to 1. In the case where **S** is s_2 and **T** is s_1, ***J*** will yield for (47a) the fol-

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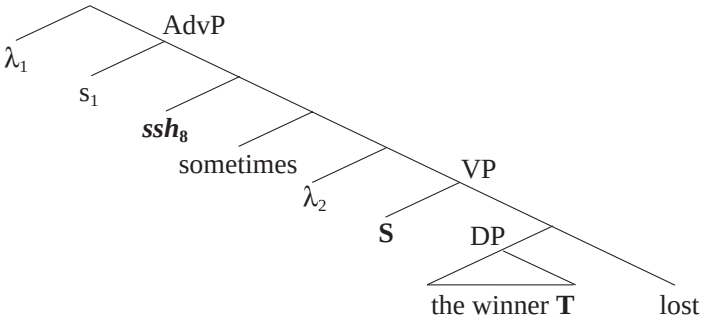
[25] In what follows, I assume that structures like [s_i John won/lost] are interpreted in the way that I claimed for structures like [s_i John won/lost the game]. I also assume that *sometimes* projects the same kind of structure that *always* and *usually* project, and that the structure is interpreted in a parallel way.

[26] Given this context, I think the most natural intonation for (46a) is one where pitch accent falls on *lost*. I think the most natural intonation for (46b) is one where pitch accent falls on *loser*.

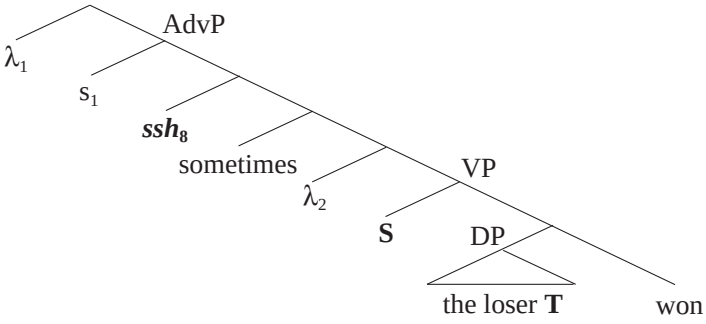
[27] Again, I am not considering structures that leave some λ's without coindexed situation pronouns. See fn. 18.

lowing kind of proposition: one that holds of a situation as long as the winner of the maximal game held in *that* situation lost some of the games held in *other* relevant parts of the same world. But this proposition happens to be just the one that ***J*** yields for (47b) under a different indexing, where **S** is s_1 and **T** is s_2. And the proposition that we get for (47b) under that original indexing **S** = s_2/**T** = s_1 – one that holds of a situation as long as the *loser* of the maximal game held in that situation *won* some of the games held in other relevant parts of the same world – is the proposition that we get for (47a) under the different indexing **S** = s_1/**T** = s_2. So there is a sense in which, without Generalization X, these sentences admit exactly the same interpretations. Once we impose Generalization X, however, the sentences no longer have this property. Imposing Generalization X eliminates one structure for each sentence: the structures for (47a) and (47b) under which **S** is s_1. But, in ruling out a structure for one sentence, Generalization X does *not* rule out the counterpart structure for the other sentence that yields the same proposition.

(47) a. The winner sometimes lost.



b. The loser sometimes won.



Now here is the important fact. Say that in this week's game no one did as well as he would have liked. John, who won it, nonetheless lost a

few of the rounds, and Mary, who got the lowest score, didn't manage to win a single round. If we think that that is how things are, then we take (46a) to be true and (46b) to be false. Without Generalization X, there is no reason why this should be: for every structure that (46a) has, (46b) has a structure that yields the same proposition. But, if Generalization X constrains the structures that are available for the two sentences, this is no longer true: there is no structure for (46b) that corresponds to the structure for (46a) under which **S** is s_2 and **T** is s_1. So if it is this structure for (46a) that licenses our truth judgment, the fact is explained. Support for Generalization X.

This argument relied on the idea that if we take Φ to be true in a given context, we will also take to be true any sentence Ψ whose structures yield the same propositions that Φ's structures yield. There is nothing wrong with this idea. What I want to point out is that it is compatible with many different kinds of assumptions about when we judge a sentence to be true, and in particular with assumptions other than the ones I have been making. That is good because, once we consider examples with adverbial quantifiers and descriptions like *the loser*, the assumptions that I have been making might turn out not to be on the mark. Thus far, I have been assuming that the only way in which the context constrains our truth judgments is by narrowing down our choice of assignment – the context constrains what assignment we can choose, but within these limits we will take a sentence Φ to be true as long as we find a structure S for Φ, an assignment g, and a situation u in our world such that we think that $\langle S, g\rangle_J(u) = 1$. But of course it could be otherwise: for instance, the context could also narrow down our choice of situation. In fact, once we look at examples like the ones I considered here, if we want to maintain the assumptions that I went through in section 3, we are probably forced to say that the context constrains more than just our choice of assignment. One indication of this is that as things stand now we do not generally predict (46b) to be false in the scenario that I just went through. Suppose we know – along with the facts I mentioned above – that Bill was another player in this week's game, and that he lost some of the rounds and won some of the rounds. In that case, we wrongly predict (46b) to be true. I won't go through the reasoning, but the basic point is that if we take a situation that consists of a round that Bill lost, and we evaluate the non-contradictory structure that (46b) admits in that situation, we will get 1. One way of getting out of this prediction would be to say that the context determines the choice of situation as well as our choice of assignment, and in this case it prevents us from evaluating a structure for (46b) in any situation that consists of a game round that Bill lost.

I am aware that if I revise my assumptions about when we judge a sentence to be true, I am also going to have to revise my original arguments for Generalization X and Generalization Y. For instance, suppose that indeed the context does constrain our choice of evaluation situation. In that case, to show that a sentence Φ lacks structure S, it is not enough first to locate a scenario where we take the sentence to be false and then to show that we can find a situation u in our world and a contextually suitable assignment g such that $\langle S, g\rangle_J(u) = 1$. We need to guarantee as well that the situation u is contextually suitable. Still, I am pretty sure that, whatever revisions have to be made in what I have presented so far, we will come to the same conclusions. So I will not try to modify my original arguments now. Instead, I will argue that, once we supplement the system here with conditions of the kind that enable us to correctly predict truth judgments for (46b), we will be able to see further consequences of Generalizations X and Y. (More accurately, I will sketch an argument: I can't justify all the steps with what I have said thus far.)

In what follows I will imagine that the adjustment we need to make is indeed one on which the context narrows down our choice of evaluation situation. To explain how the context's winnowing of possible u's will figure in the argument, I need to introduce some further assumptions. These assumptions have to do with when it is appropriate for a speaker to utter a sentence.[28]

Thus far, I have committed myself to this idea: to judge a sentence Φ to be true is to claim that for some structure S for the sentence, and for some situation u and assignment g that the context helps to determine, $\langle S, g\rangle_J(u) = 1$. Similarly, a speaker who utters a sentence Φ in order to communicate that he judges it to be true is claiming of some structure S, and of some contextually suitable u and g, that $\langle S, g\rangle_J(u) = 1$. But, when a speaker utter a sentence in order to convey its truth, there are also certain rules that he must obey. It is part of our linguistic knowledge that some sentences – by virtue of their lexical items and the way these items are put together – impose conditions on their own use. In particular: Suppose a speaker wants to utter a sentence in order to communicate that it is true – or in other words, suppose a speaker wants to utter a sentence in order to claim of some S, and of some suitable u and g, that $\langle S, g\rangle_J(u) = 1$. Sometimes, he can only do so if u has a certain property whose identity depends on S and g. For instance, suppose a speaker wants to convey the

[28] I won't spend time here justifying the assumptions, but I will note that they have ample precedent in the literature on "presuppositions" (see, e.g., Karttunen 1974; Stalnaker 1974).

truth of (48a), whose only structure is (48b).[29] He can only do so if u has *this* property: the parties to the conversation accept that it contains a single student. What this means is that, in a context that does not make available any such u, the speaker is not permitted to use the sentence. An example of such a context is the one in (49). When uttered in the context of (49), (48a) sounds odd. This (I claim) traces back to the fact that, in a conversation that begins with (49), there are no u's in the running that are understood to contain a single student.

(48) a. The student was Canadian.
b. λ_1 [$_{VP}$ s_1 [$_{DP}$ the student s_1] was Canadian]

(49) *Context:* John gave a visiting lecture here last year. It was a nightmare for him. Every five minutes, a different student interrupted him with a hard question . . .

To summarize: When we claim that a sentence is true, we have in mind a situation, an assignment, and a structure for the sentence. Our choice of situation sometimes limits our choice of structures.[30] The context, since it rules out certain situations, rules out certain structures as well. Sometimes, as in the case we just saw, it rules out all possible structures for the sentence (in the case we just saw, it ruled out the only one), and it thus effectively prevents us from claiming that the sentence is true.

Now, here is the way the argument will work. I will consider a sentence that in principle admits a number of different structures, and I will consider a context in which the sentence is uttered. The fact is that the sentence sounds odd in the context: specifically, once we hear the context for the sentence, our reaction to the sentence is that the speaker is making a very unlikely claim. With Generalization X and Generalization Y, there is a clear explanation for this fact. When we hear the sentence, first of all we reason that a speaker who is asserting its truth cannot have certain structures for the sentence in mind – this is because all the situations that the context makes available are incompatible with those structures. But once we get rid of the structures that the context rules out, the binding generalizations leave us with only one other structure S, and it turns out that (for any u and g) to say that $\langle S, g\rangle_J(u) = 1$ is to make a very odd claim. On the other hand, without the binding generalizations, this explanation disappears. Without the binding generalizations, there are additional struc-

[29] Remember that we are ignoring tense nodes. I am also assuming here that every situation pronoun must be coindexed with some λ.
[30] Or structure-assignment pairs.

tures that remain once we get rid of those that the context rules out, and some of these admit quite reasonable claims.[31]

The context I want to consider is the one from before (repeated in (50)). The continuation is the sentence in (51a). I think that (51a) forces us to do a double-take. At least on our first attempt to understand the sentence, we do *not* read it as reporting, for instance, that John mistakenly imagined that his interrogators were professors. If anything, we read it as attributing to John an unlikely thought, according to which certain individuals are simultaneously students and professors. (51a) contrasts with the alternative continuation in (51b): a speaker who utters (51b) in the context of (50) seems to be giving a quite plausible account of John's experience.[32] I will now argue that our reaction to (51a) is in part a result of the binding conditions.

(50) *Context:* John gave a visiting lecture here last year. It was a nightmare for him. Every five minutes, a different student interrupted him with a hard question . . .

(51) a. . . . He thinks that the student usually was a professor.
b. . . . He thinks that the student usually was a syntactician.

(51a) allows structures that conform to the template in (52). (We have seen structures of this kind already – in the discussion of example (35).)

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[31] As usual, my decision to ignore some interpreted syntactic material – like tense nodes – may turn out to play a role in the specific argument that I am giving. But as usual, I think that even on more realistic assumptions about syntactic structures, it will be possible to construct an argument of the same form. The argument is also simplistic in some other ways which I don't want to go into here.

[32] For me, (51b) is most natural when *usually* is accented slightly. Perhaps it is still a little awkward. If you find (51b) *quite* awkward, you are probably not going to be impressed by an account that predicts (51a) to be odd but has nothing to say about (51b). Here are some other pairs of sentences that I think exhibit the same kind of contrast. One can construct a similar argument on the basis of the contrast between the (a) and (b) continuations in these examples.

(i) a. . . . # He thinks that the student usually had a faculty job.
b. . . . He thinks that the student usually had blue eyes.

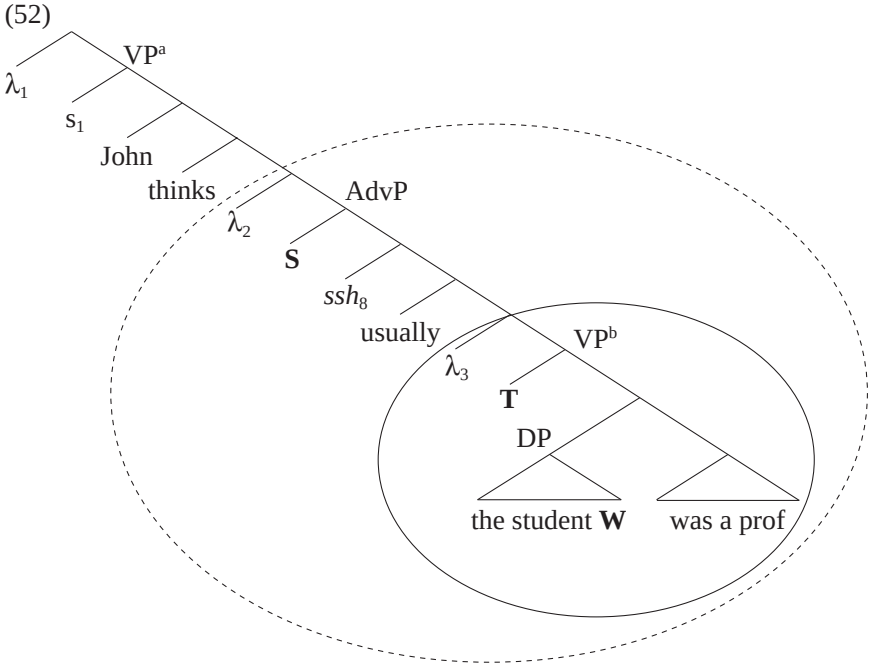
(ii) a. . . . # If the student had always been a professor, John would have burst into tears by the end.
b. . . . If the student had always been a syntactician, John would have burst into tears by the end.

I believe that our reaction to (51a) contrasts not only with our reaction to (51b) but also with our reaction to (iii) (a sentence I will discuss later on). To appreciate that there is something bizarre about (51a), it might help to consider all three of the sentences – (51a), (51b), and (iii).

(iii) He usually thought that the student was a professor.

These structures contain four situation pronouns: one that *think* projects, one that the adverbial expression *usually* projects, one that (simplifying) *be a professor* projects, and one that the description *the student* contains. The structures also contain three λ's. I will continue to assume that every situation pronoun must be coindexed with some higher λ, with the consequence that the highest situation pronoun (the one that *think* projects) must be coindexed with the λ adjoined to the root. But various indexings are possible for the remaining situation pronouns.

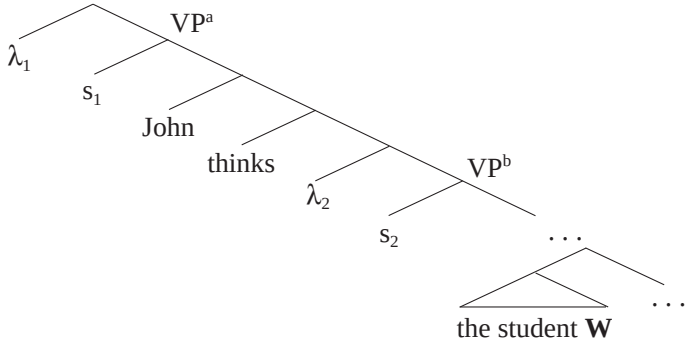
(52)



This said, a speaker who asserts (51a) in the context of (50) cannot have some of these structures in mind. In particular, *he cannot have in mind structures in which* the student's *situation pronoun is coindexed with* λ_1 *or* λ_2. Why is this? Recall the idea: a speaker who asserts (51a) must have an S, g, and u in mind such that $\langle S, g\rangle_J(u) = 1$; the context allows the speaker to choose some situations u but not others; some structures S for the sentence are only compatible with situations u that the context prevents the speaker from choosing. Here (I claim) is how the idea applies to (51a). First, as far as the way situations limit the speaker's choice of structures, I assume the following generalization. Take structures of the kind schematized in (53). Suppose the situation pronoun in *the student* is coindexed with the higher λ (i.e., **W** is s_1). Then a speaker who wants to

assert the truth of the sentence on the basis of this structure has to choose a situation with the following property: the parties to the conversation accept that the situation contains a single student. Suppose instead that the situation pronoun in *the student* is coindexed with the lower λ (i.e., **W** is s_2). Then the speaker has to choose a situation with the following property: the parties to the conversation accept that John represents the situation to himself as one containing a single student. (That is, they accept that, in each of John's candidates for the situation in question, there is a unique individual who, in the world of that situation, for the duration of that situation, is a student.) In addition to all this, however, I assume that the context in (50) does not allow the speaker to choose situations with either of these two properties. The upshot is that the context effectively rules out structures for (51a) in which *the student*'s situation pronoun is either s_1 or s_2.

(53)



(Aside. *Why* does the speaker's choice of situation limit his choice of structures in the way I claimed, and why does the context limit the choice of situations in the way I claimed? I won't explain any of this here, but I will note that there is independent evidence that these things work the way I claimed. Here is one piece of evidence. (54) sounds incoherent in the same context (50) that we have been considering all along. My assumptions explain why this is. The structures for (54) again conform to the format in (53), but in the structures for (54) – as opposed to the structures for (51a) – there is no λ other than λ_1 and λ_2. This means that the only possible structures for (54) are structures where **W** is s_1 or s_2. But on my assumptions, the context in (50) rules out all situations that are compatible with these structures, and this means that in the context of (50) the sentence is unassertable.)

(54) #He thought that the student was a syntactician.

So, given that the speaker is claiming of some structure S, assignment g, and situation u that $\langle S, g\rangle_J(u) = 1$, we can conclude that the structure is

one where **W** is neither s_1 nor s_2. What structures does this leave? If the binding generalizations apply, there is only one: a structure in which **W** is s_3, **S** is s_2, and **T** is s_3. In this case, for the lower VP, ***J*** (provided with an assignment g) will yield 1 only if the situation g(3) contains an individual who is simultaneously a student and a professor;[33] accordingly, for the entire structure, ***J*** will give us a function that takes a situation to 1 only if John, in that situation, envisions the world as containing individuals who are simultaneously students and professors. (The details are in (55).) If indeed this structure is the only structure left, then we have to conclude that the speaker who claims that the sentence is true is claiming something rather odd – namely, that John imagines a single individual to be a student and a professor at the same time. On the other hand, if the binding generalizations do *not* apply, there are some other possible structures, and these do not necessarily lead to odd claims. Take the structure in which **W** is again s_3, but **S** is s_1 and **T** is s_2 ((56)). In this case, it is possible for the lower VP to yield 1 even when g(3) does not contain a student-professor hybrid. What ***J*** yields for the entire structure will depend on what assignment we provide it with. But, arguably, on one assignment that the context admits, we will get a function that takes a situation in the actual world to 1 as long as the students who asked questions are by and large among the people who John, in that situation, imagines to be professors.[34] So, if the binding generalizations do *not* apply, then the speaker might be reporting something more plausible: that John mistook the students for professors. Now, the fact is that we take the speaker to have made a bizarre claim. So we can take this fact as more evidence that the binding generalizations are at work. End of argument.

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[33] Specifically, what I am assuming about VP^b in (52) is: $\langle VP^b, g\rangle_J = 1$ as long as the unique individual in the situation $\langle \mathbf{W}, g\rangle_J$ who is a student in the world of $\langle \mathbf{W}, g\rangle_J$ (for the temporal duration of $\langle \mathbf{W}, g\rangle_J$) is a professor in the world of $\langle \mathbf{T}, g\rangle_J$ (for the temporal duration of $\langle \mathbf{T}, g\rangle_J$). On the basis of this, it should be clear what ***J*** yields for the constituents dominating VP^b.

[34] This is because, arguably, on one assignment g that the context admits, g(8) is a proposition that holds of situations – in this and other worlds – where an obnoxious individual is asking John a question. In the case of the actual situations that the proposition characterizes, the obnoxious individual is a student. There is some independent evidence that the context admits assignments like this. I won't go through the details here, but some evidence comes from the way we interpret sentences like *The student was usually Canadian* in the same context.

(55) a. **S** = s_2, **T** = s_3, **W** = s_3.

b. For any *s*, ⟨(52), g⟩$_J$(*s*) = 1 as long as

i. John is in *s*; and

ii. for each of the situations **s*** consistent with John's beliefs in *s*,

the majority of situations s** that are in the world of **s*** and that g(8) takes to 1 are such that

the unique individual in s** who is a student in the world of s** (for the temporal duration of s**)

is a professor in the world of s** (for the temporal duration of s**).

(56) a. **S** = s_1, **T** = s_2, **W** = s_3.

b. For any *s*, ⟨(52), g⟩$_J$(*s*) = 1 as long as

i. John is in *s*; and

ii. for each of the situations **s*** consistent with John's beliefs in *s*,

the majority of situations s′ that are in the world of s and that g(8) takes to 1 are such that

the unique individual in s′ who is a student in the world of s′ (for the temporal duration of s′)

is a professor in the world of **s*** (for the temporal duration of s*).

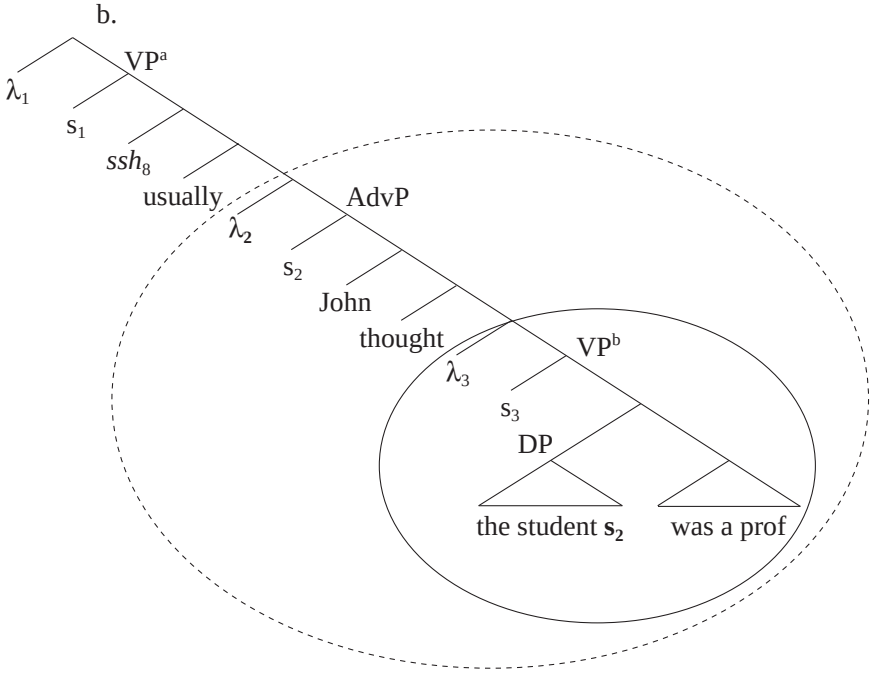
On the explanation that I just gave, the oddness of (51a) basically traces back to the fact that anyone who utters it has to have chosen a structure where the lower VP gives rise to a very strange proposition – a function that holds of a situation only if it contains an individual who is simultaneously a student and a professor. The lower VP gives rise to this kind of proposition because the situation pronoun that *the student* contains and the situation pronoun that *be a professor* projects have exactly the same index. There are two factors that force the utterer to a structure of this type: first, independent considerations force him to choose a structure in which *the student*'s situation pronoun is coindexed with the λ below *usually*; then, the "binding conditions" force the structure to be one where the situation pronoun that *be a professor* projects is coindexed with the same λ. Now, the reason *why* the "binding conditions" (and specifically Generalization X) force the verb's situation pronoun to be coindexed with the λ in question is that that λ is the closest λ to the pronoun. So, if indeed the "binding conditions" are responsible for the oddness of (51a), here is the kind of prediction we make. Suppose we minimally change the sentence

in such a way that the λ below *usually* is no longer the closest λ to the verb's situation pronoun. (And suppose the same independent considerations force the speaker to choose a structure in which *the student*'s situation pronoun is coindexed with the λ below *usually*.) Then we might not expect the sentence to seem so odd.

It looks as though this prediction is met. If we switch the order of *usually* and *think* so that *usually* is above *think* rather than below it, that makes a big difference. The sentence (57a) does not make a bizarre claim in the context of (50). It expresses the kind of claim that (51a) could not: that John mistook most of the students for professors. And – given my assumptions about what the context admits (see the most recent footnote) – this is what we expect if the sentence can have the structure in (57b), which does not violate the binding generalizations. (I will leave it to the reader to work out the details and verify this.) So here we have some support for the idea that the "binding conditions" (specifically Generalization X) play a role in the explanation of (51a)'s oddness.

(57) a. He usually thought that the student was a professor.

b.



I have now sketched a few ways in which the "binding theory" affects our interpretations of sentences. I would like to close this section with a

different kind of point. Once we recognize that principles like Generalizations X and Y regulate the structures we interpret, this knowledge can open the way to analyses of a variety of linguistic phenomena.

Take for instance the following well-known phenomenon. Often, if you have a sentence that contains an adverbial quantifier and an indefinite, you can use it to express what would be expressed by a parallel sentence with a determiner quantifier and no indefinite. An example is in (58). (58b), which contains the adverbial quantifier *always* and the indefinite *a good semanticist*, seems pretty much to convey what (58a) conveys. (58a) doesn't contain an indefinite, but instead contains the determiner quantifier *every good semanticist*.

(58) a. Every good semanticist is a good syntactician too.
b. A good semanticist is always a good syntactician too.

A not so well known fact is that this pattern breaks down when clauses like those in (58) are embedded. Consider for example the pair of sentences in (59).[35] The two sentences in (59) differ only with respect to what is in the antecedent of the counterfactual, and the two antecedents differ in just the way the clauses in (58) differ. But (59b) certainly does not succeed in conveying what (59a) does. A speaker who utters (59a) is making a sensible if disputable claim. He is asking us to consider a scenario in which those people who are semanticists as things stand now are not seman-

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[35] Other examples of the same breakdown are the (a, b) pairs in (i) and (ii). If John knows that visiting assistant professors are not tenured, for instance, then it is quite reasonable to claim (ii.a) but quite unreasonable to claim (ii.b).

(i) a. Imagine that the field of physics vanished last century and that every physicist we know got his degree in linguistics instead. Probably, *every solid state physicist would have gotten his degree in semantics*.
b. Imagine that the field of physics vanished last century and that every physicist we know got this degree in linguistics instead. ??Probably, *a solid state physicist would have always gotten his degree in semantics*.
(Cf. c. Imagine that every physicist we know got a degree in linguistics before he pursued physics. Probably, a solid state physicist would have always gotten his first degree in semantics.)

(ii) a. John is mistaken about the rank of some of our instructors. In particular, he has concluded that *every visiting assistant professor here is tenured*.
b. John is mistaken about the rank of some of our instructors. #In particular, he has concluded that *a visiting assistant professor here is always tenured*.
(Cf. c. John is mistaken about the household status of some of our instructors. In particular, he has concluded that a visiting assistant professor here is always married.)

The embedding contexts in (59), (i), and (ii) are of course contexts of the kind we have been concerned with throughout this paper – attitude contexts and counterfactuals.

ticists but rather syntacticians, and he is claiming that the scenario has a certain nice property. (59b), on the other hand, sounds downright odd. When we try to imagine what kind of scenario the speaker might have in mind, we have the bizarre impression that the scenario must be an impossible one – a scenario where some people are simultaneously semanticists and not semanticists. (The acceptability of the minimally differing sentence in (60) confirms that the oddness of (59b) is due to the way we interpret the sentence rather than to some independent problem with the sentence's form.)

(59) a. If *every semanticist was a syntactician instead*, a lot more would get done in our field.
b.??If *a semanticist was always a syntactician instead*, a lot more would get done in our field.

(60) If a semanticist was always a syntactician as well, a lot more would get done in our field.

Whatever the right explanation is for why a sentence like (58b) succeeds in paraphrasing (58a), it should also account for why sentences like these do *not* contribute in the same way to complex sentences in which they are embedded. A reasonable interpretation of the data in (58)–(59) is the following. We allow (58b) a paraphrase with a determiner quantifier because we can assign to (58b) a structure for which ***J*** yields the same kind of proposition that ***J*** yields for (58a). But if we assign the parallel structure to the embedded clause in (59b), we wind up with an "impossible" proposition, one that could never hold of any situation. So the right explanation will have two parts: it will explain why given one structure for (58b), ***J*** yields the same kind of proposition that it yields for (58a); and it will explain why the parallel structure for the embedded clause in (59b) gives rise to an "impossible" proposition.

The binding generalizations make available one direction for solution. In many ways, aspects of this solution parallel the explanation for why (61) (=(51a)) – the contextually situated example we considered earlier – was odd.

(61) (*Context:* John gave a visiting lecture here last year. It was a nightmare for him. Every five minutes, a different student interrupted him with a hard question.) ??He thinks that *the student usually was a professor*.

As a starting point, imagine that in the structures for the sentences with adverbial quantifiers – just as in the structure for (61) – the VP below *always*

has a situation pronoun in it over and above the one that the verb projects. (Let's again call this VP VP^b, the situation pronoun that the verb projects ***T***, and the additional situation pronoun ***W***.) And imagine that in (59b) specifically – in analogy to (61) – ***J*** works in such a way that $\langle(VP^b), g\rangle_J$ yields 1 only if some individual who is a semanticist in g(**W**) is a syntactician and not a semanticist in g(**T**). Now recall the idea: in all those cases where a clause with an adverbial quantifier has a paraphrase with a determiner quantifier, that is because we can assign to this clause a structure for which ***J*** yields the same kind of proposition that it yields for a clause with a determiner quantifier. Here, then, is the direction for solution that suggests itself: *in all those cases, the relevant structure is one where the second situation pronoun in the VP* – the **W** pronoun – *is coindexed with the* λ *below the adverbial quantifier*. On this kind of solution, the binding generalizations will straightforwardly explain what goes wrong in (59b). Suppose we try to assign to (59b) the structure that we generally use to obtain the determiner paraphrases. That will mean coindexing the **W** pronoun with the λ below *always*. But we already know that Generalization X requires the verb's situation pronoun **T** to be coindexed with the same λ. So if we try to assign this structure to (59b), what will ***J*** give us for the constituent directly below *always* (the constituent that includes the λ)? An "impossible" proposition – a function that takes a situation to 1 only if some individual who *is* a semanticist in that situation is a syntactician and *not* a semanticist in that same situation. And this means – though I won't go into the details – that ***J*** will yield an impossible proposition for the entire *if*-clause as well.

This is of course just a direction for solution. How promising is it? In part, that depends on whether the "starting point" here was the right one. It definitely depends on whether there is a convincing explanation for why, in cases like (58b), when we coindex the **W** pronoun with the λ below *always*, we wind up with a proposition of the kind we get from (58a). (Among other things, this explanation would involve specifying more precisely the semantics of the VP below *always*.) At least one line of explanation has been sketched in the literature – by Percus (1998b), who proposes among other things that the indefinite itself contains the **W** pronoun. I won't evaluate that proposal here. The purpose of this discussion was just to show how, once we recognize the presence of the binding generalizations, we reveal perspectives that were concealed before.

6. Remaining Issues

One issue that remains is purely descriptive. Did I formulate the binding principles in the right way? There were many conditions that I could have chosen in order to rule out the structures that I argued to be unavailable. Was I right to choose Generalization X and Generalization Y? Here for instance is another condition that would have done the job in the cases I considered: Every λ must be coindexed with the situation pronoun directly below it. This condition is phrased quite differently from Generalization X and Generalization Y. Instead of dictating the index of a situation pronoun on the basis of indices in its vicinity, it dictates the index of a λ on the basis of indices in its vicinity. It also potentially makes different predictions from Generalization X and Generalization Y. Suppose, for example, that we could find a situation pronoun that was selected for by a verb but that was not *directly* below its closest c-commanding λ. Generalization X would require this situation pronoun to be coindexed with its closest c-commanding λ, but the new condition would not.

It will require more research to decide just what the right generalization is. Some information might come from relative clauses, which I have not examined here. To see the idea, consider a sentence like (62a). When we judge (62a) to be true, we are confirming something about a scenario in which people who are semanticists *as things stand now* are doing syntax. One way of explaining this might contain ingredients of the following kind. First, the antecedent clause has three indices, call them i, j, and k, and ***J*** yields 1 for the antecedent IP as long as every individual who is a linguist in the world of g(i) and a semanticist in the world of g(j) works on syntax in the world of g(k). Second, we assign a structure on which the j index is the same as the index of the λ adjoined to the root (λ_1 in (62b)). Plausibly, this kind of structure will give rise to a claim about people who are semanticists in the actual world. Now, suppose we assume this additional detail about the structure of the sentence: there is just one place in the antecedent IP where the j index appears, and it is inside the relative clause, on the situation pronoun that the verb *is a semanticist* selects for. In that case, the indexing of this situation pronoun will violate Generalization X. So sentences of this kind might provide potential evidence against Generalization X and for some alternative generalization. Naturally, the argument would be more convincing if the additional detail could be defended.[36]

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[36] Quer (1998) investigates the interpretation of indicative and subjunctive relative clauses. Perhaps facts of the kind Quer considers are relevant to this issue.

(62) a. If [$_{IP}$ every linguist who is a semanticist worked on syntax], there would be fewer misunderstandings.
b. λ_1[. . . [λ_2[$_{IP}$ . . .]] . . .]

Even if Generalizations X and Y turn out to be correct, one might ask whether there is a more insightful way of expressing them. As they stand, each condition says that a situation pronoun of one kind or another must be coindexed with the nearest λ. If there were independent reasons for thinking that these different kinds of situation pronouns formed a natural class, it might be more insightful to state a single condition: a situation pronoun in the relevant class must be coindexed with the nearest λ. Are there independent reasons for thinking that they form a natural class? In fact, the way I have drawn my trees, there *is* something in common to situation pronouns that verbs select for and situation pronouns that adverbial quantifiers select for: they are the last items in the projection of a lexical element. But the truth is that I had no independent justification for drawing my trees this way. Maybe one way of taking the material in this paper is as an argument that – since they appear to be subject to the same constraints – these different kinds of situation pronouns *do* appear together in a natural class. (And perhaps more specifically as an argument that these different kinds of situation pronouns have parallel locations in the projection of a lexical element.)

Future work has a more fundamental question to address as well: Why are there these constraints, and why do they look the way they do? In trying to answer this question, we might look for other places in language where constraints like these seem to operate. My feeling is that we don't have to look very far. Recall that we started out here by trying to account for an ambiguity. The use of indices allowed us to account for the ambiguity, but we were then forced to conclude that there were constraints on the indexing patterns that structures could have. There are quite a few other places in language where we find an ambiguity similar to the one we started out with here, where the use of indices allows us to account for this ambiguity, and where once we allow indices we are forced to conclude that there are indexing constraints. Take for example (63). One can read (63) as claiming that each politician's praise went to the class of people who loved *that politician's* country; or one can read it as claiming that each politician's praise went to the class of people who loved *their own* country (that is, the class of patriots). One way of accounting for this ambiguity assumes that structures for the sentence contain indexed λ's and that there are two further indexed items in the constituent that *every* combines with – the overt pronoun and an additional silent element. (Heim

and Kratzer (1998) endorse assumptions of this kind, for independent reasons.) I will not go into the details,[37] but the idea is that a structure where the overt pronoun is coindexed with one λ yields one of the readings, and a structure where the overt pronoun is coindexed with another λ yields the other. More specifically, a structure of the kind in (64a) yields the first reading, and a structure of the kind in (64b) yields the second reading. The point is that, on one way of specifying the details, we have to conclude that there are constraints on what λ the *silent* pronoun can be coindexed with. Specifically, it must be coindexed with the nearest λ. Given the details that I have in mind, we need a constraint like this to prevent us from reading (63) as claiming that each politician's praise went to the class of people whose country the politician loved. This is the reading that we would get from a structure like (64c).

(63) Each politician started off his speech with praise for every lover of his country.

(64) a. . . . [Each politician] [λ_1 . . . every [λ_2 $_{NP}$[. . . e_2 lover of his_1 country . . .]] . . .]

b. . . . [Each politician] [λ_1 . . . every [λ_2 $_{NP}$[. . . e_2 lover of his_2 country . . .]] . . .]

c.*. . . [Each politician] [λ_1 . . . every [λ_2 $_{NP}$[. . . e_1 lover of his_2 country . . .]] . . .]

Some other relevant examples, just to mention them in passing, are (65) and (67). Again, I won't go into the details, but the idea is the same. Both examples are ambiguous and one approach to the ambiguity involves positing two λ's and two additional indexed elements – the overt pronoun and a silent item. In each case, to rule out unavailable interpretations, we

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[37] Neglecting situation pronouns in the NP for the moment, the basic idea is that, when we give ***J*** an assignment g together with an NP of the form [. . . e_i lover of his_j country . . .], ***J*** will give us 1 as long as the individual g(i) loves g(j)'s country. So for example, in (64a), ***J*** will yield 1 for the NP as long as g(2) loves g(1)'s country. This means that, for the constituent including λ_2, ***J*** will yield a function that takes any x to 1 as long as x loves g(1)'s country. And this, roughly speaking, will be the function that characterizes the class of individuals that *every* quantifies over.

To be more accurate, an NP of this kind will contain indexed situation pronouns as well and what ***J*** gives us for it will depend on what g yields for the index of these situation pronouns. For instance, ***J*** might give us 1 as long as the individual g(i) loves *in g(k)* the country that g(j) is a citizen of *in the world of g(m)*, where k and m are the indices of situation pronouns in the NP.

have to specify that the silent item must be coindexed with the nearest λ.[38]

(65) Every girl's mother wants PRO to clean her room.

(66) a. . . . [Every girl] [λ_1 . . . wants [λ_2 [. . . e_2 to clean her$_1$ room . . .]] . . .]
b. . . . [Every girl] [λ_1 . . . wants [λ_2 [. . . e_2 to clean her$_2$ room . . .]] . . .]
c.*. . . [Every girl] [λ_1 . . . wants [λ_2 [. . . e_1 to clean her$_2$ room . . .]] . . .]

(67) Each girl thinks that only she likes her mother.

(68) a. . . . [Each girl] [λ_1 . . . only she$_1$ [λ_2 [. . . e_2 likes her$_1$ mother . . .]] . . .]
b. . . . [Each girl] [λ_1 . . . only she$_1$ [λ_2 [. . . e_2 likes her$_2$ mother . . .]] . . .]
c.*. . . [Each girl] [λ_1 . . . only she$_1$ [λ_2 [. . . e_1 likes her$_2$ mother . . .]] . . .]

There seems to be a pattern here. In many cases where positing a silent indexed element allows us to account for an ambiguity, we have to accept that there are strict "locality" constraints on the element's index. One possibility, of course, is that it is wrong to begin with to posit the silent indexed element, that there is a better way of accounting for the ambiguity, and that this pattern is an artifact of a mistaken theoretical decision.[39] But another possibility is that the element is there, that the indexing constraint is real, and that the constraint follows from independent principles of grammar.

There are many places where one might look in order to discover why language exhibits constraints of the kind we saw here. Let me close by mentioning one possible way of looking at the pattern. (This remark is inspired by a discussion of examples like (63) in Heim and Kratzer 1998.)

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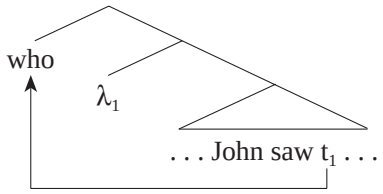
[38] These are the ambiguities, expressed somewhat awkwardly. In (65), the mother's desire can be that she cleans the girl's room or that she cleans her own room. In (67), the girl's opinion can be "No one else likes my mother," or "No one else likes her own mother" (that is, that no one else is a faithful daughter). On the approach I have in mind (see Chierchia 1990 for the general idea), the (a) structures would yield the former interpretations and the (b) structures would yield the latter interpretations. By contrast, the (c) structure for (65) would express that the mother's desire is that the girl cleans the mother's room, and the (c) structure for (67) would express that the girl's opinion is "I don't like anyone else's mother."

[39] If one wants to pursue an alternative approach that would do without the silent elements we are forced to assume indexing constraints for, one might look to the Derived VP Rule (Partee 1973; Williams 1977) for inspiration.

It has been independently proposed (see Heim and Kratzer 1998 specifically) that in constructions where syntactic movement has taken place, an indexed λ appears below the moved item and a silent coindexed element appears in the base position of the moved item. For instance, a relative clause like *who John saw* would have a structure of the general form of (69b).[40] On this way of looking at relative clauses, the relative pronoun itself is not interpreted, and ***J*** yields for the whole relative clause the function it yields for the constituent below the relative pronoun – the constituent that has the λ as a daughter.

(69) a. The assassin *who John saw* giggled.

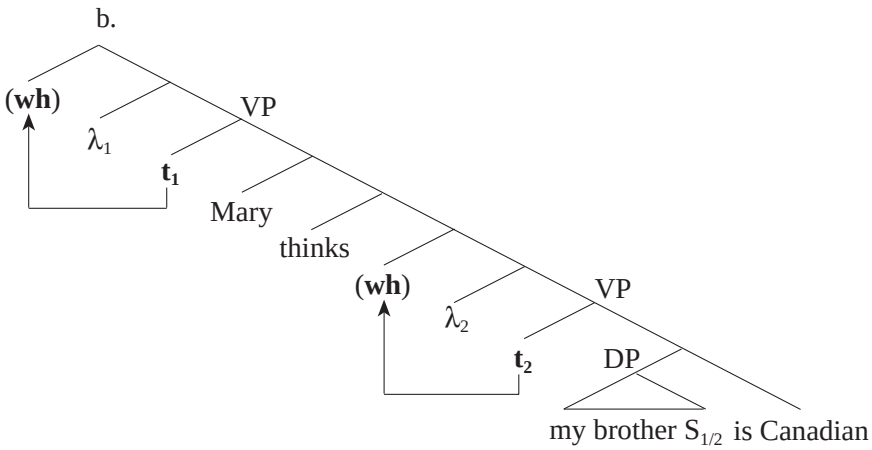
b.



Now, suppose we assume that the *only* way of introducing λ's into the syntax is by movement. This means that structures for sentences like (70a) will have to involve movement. Why? Because, for one thing, *thinks* selects for a proposition, and the only way of getting a proposition out of the VP below *thinks* is by putting a λ above it. What we are forced to say is that, in the structures for (70a), something like a silent relative pronoun moves from a position in the material below *thinks* (the situation position in the structure that *is Canadian* projects), and attaches itself above the VP. More specifically, the available structures for (70a) will be as in (70b).

(70) a. Mary thinks that my brother is Canadian.

[40] This particular example departs in letter but not in spirit from the Heim and Kratzer proposal.



This now gives us another way of construing Generalization X. On this way of looking at things, to say that the structures for (70a) obey Generalization X is to say that the relative pronoun whose movement makes the VP into a proposition must move from the situation position in the structure the verb projects. It cannot move, say, from the situation position inside the DP. One might now ask why *that* is. The hope is that some independently motivated account of conditions on movement will yield this result.

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Cattedra di Filosofia del Linguaggio
Dipartimento di Filosofia
Università degli Studi di Milano
via Festa del Perdono 7
20122 Milano
Italy
E-mail: Orin.Percus@unimi.it