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From the Selected Works of Angelika Kratzer

1991

The Representation of Focus

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voidable. Nevertheless, Löbner's treatment of free focus still might be on the right track.

I wish to thank Joachim Jacobs and Manfred Krifka for helpful comments and Bruce Mayo for checking my English.

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**The Representation
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1. Introduction

1.1 The Plot

In this article, I will start out by examining two current approaches to the representation and interpretation of sentences containing focused constituents.

A Movement Theories of Focus: e.g. Chomsky 1976

At the level of Logical Form, a focused constituent moves from its base position, leaving behind a variable.

B In Situ Theories of Focus: Rooth 1985

Focused constituents can be interpreted in situ.

Chomsky and Rooth both assume three transformationally related levels of syntactic representation: Deep Structure, Surface Structure, and Logical Form. The level of Logical Form is the input for the semantic interpretation component. For Rooth, the semantic interpretation component consists in a translation procedure, mapping Logical Form representations into expressions of an intensional logic. Each intensional logic expression receives two denotations. One denotation is its usual denotation. The second denotation is meant to capture the specific contribution of focusing to the meaning of an expression. We have then:

B1 Denotational In Situ Theories (Rooth's "official proposal")

Focusing is accounted for by assigning two denotations to each intensional logic expression.

Reviewing the advantages and disadvantages of movement and in situ theories, I will argue for the following slightly different version of an in situ theory briefly mentioned in Rooth (1985).

B2 Representational In Situ Theories

Each Logical Form representation receives two intensional logic translations. One translation is its usual translation. The second translation is its "presupposition skeleton" (this is Rooth's term. Presupposition skeletons correspond to the "Presupps" of Jackendoff 1972.)

1.2 Some Theoretical Assumptions

a. Syntax

I am assuming the model of grammar of the Extended Standard Theory (Chomsky and Lasnik 1977). On this proposal, Deep Structure, Surface Structure, and Logical Form are related by movement operations obeying the usual constraints. At the level of Logical Form, noun phrases may have been raised from their base positions, resulting in structures of the following kind:

- (1) Jane₁ fed_{NP}[every cat]₂
 (1') s_{[NP[every cat]₂} s_{[Jane fed_N[e]₂]]}

b. Semantics

Logical Form representations are compositionally translated into expressions of an intensional λ -categorical language of the sort given in the Appendix. (1'), for example, is translated as (1'').

- (1'') every'(cat')($\lambda v_{e,2}$ [fed' ($v_{e,2}$)(Jane')])

Concrete proposals for the translation procedure can be found e.g. in Rooth (1985). In (1), the trace of the moved NP is translated as a variable of type e bearing the same index as the trace. And the index of the moved NP matches the index of the variable bound by the λ -operator of the λ -abstract that is the translation of the NP's sister node.

c. Focus

At Surface Structure, focused constituents are marked with the focus feature F (Jackendoff 1972, Selkirk 1984).

- (2) F [Jane] laughed

2. A Version of the Movement Theory of Focus

As presented above, a movement theory of focus is any theory where focused constituents have to move leaving a trace behind (the trace is then translated as a variable). At this point, we may wonder where a focused phrase is supposed to move. This question has been most clearly addressed in connection with focus sensitive particles like *only* or *even*. It is usually proposed that at the level of representation relevant for semantic interpretation, focus sensitive particles and the focused constituents they associate with have to be adjacent, and that this is what triggers focus movement. This is the version of the Movement Theory that Rooth 1985 addresses, and I am going to review his main points here.

2.1 Examples (Rooth 1985)

Surface Structure

- (3) a. John₁ $_{VP}$ [only $_{VP}$ [introduced F [Bill]₂ to Sue₃]]
 b. John₁ $_{VP}$ [only $_{VP}$ [introduced Bill₂ to F [Sue]₃]]

Logical Form

The focused phrases are adjoined as sisters of the focusing operator *only*.

- (3') a. s_{[John₁ $_{VP}$ [only F [Bill]₂ $_{VP}$ [introduced e_2 to Sue₃]]]}
 b. s_{[John₁ $_{VP}$ [only F [Sue]₃ $_{VP}$ [introduced Bill₂ to e_3}]]]

Semantic Interpretation

Logical forms (3'a) and (3'b) are translated into expressions of the intensional language assumed.

- (3'') a. $\lambda v_{e,1}$ [only'(Bill')($\lambda v_{e,2}$ [introduce' ($v_{e,2}$)(Sue') ($v_{e,1}$)])] (John')
 b. $\lambda v_{e,1}$ [only'(Sue')($\lambda v_{e,3}$ [introduce' (Bill') ($v_{e,3}$) ($v_{e,1}$)])] (John')

In the translations above, "*only*" is an expression of type $\langle e, \langle \langle e, t \rangle, t \rangle \rangle$, that is, an expression that forms a quantifier phrase when combined with a proper name. The quantifier phrase is then quantified into the VP. (3''a) is true iff Bill is the only person which has the property of being introduced to Sue by John. (3''b) is true if Sue is the only person which has the property that John introduced Bill to her.

Eventually, we want to have a more general semantics for *only*, of course, allowing us to focus constituents of other categories and several constituents at a time. For concrete proposals see Rooth (1985), von Stechow (1981b, 1982a, 1989), and Jacobs (1983). The above way of interpreting focus sensitive operators like *only* can be seen as a realization of the **structured meaning** approach of von Stechow.

2.2 Crossover Arguments

The crossover argument is used in Chomsky (1976) to show that focused noun phrases behave like quantifier phrases and *wh*-phrases in certain respects, suggesting that all of those phrases are moved from their base positions at some level of representation. The argument has since been discussed by various scholars, in particular in Horvath (1981, 1986) and Rooth (1985). The following variations of the crossover examples are from Rooth (1985).

- (4) a. We only expect F [him]₁ to be betrayed by the woman he₁ loves

- b. We only expect the woman he_i loves to betray ${}_F[him]_i$

The important observation is that (4a) is ambiguous, while (4b) is not. Suppose the pronoun *he* in the above sentences refers to John.

Then we have:

- (4a) Bound variable reading (possible):
We expect nobody but John to have the property
' $\lambda v_{e,1} [v_{e,1}$ is betrayed by the woman $v_{e,1}$ loves]'.
Referential reading (possible):
We expect nobody but John to have the property
' $\lambda v_{e,1} [v_{e,1}$ is betrayed by the woman John loves]'.
(4b) Bound variable reading (impossible):
We expect nobody but John to have the property
' $\lambda v_{e,1} [the\ woman\ v_{e,1}\ loves\ betrays\ v_{e,1}]$ '.
Referential reading (possible):
We expect nobody but John to have the property
' $\lambda v_{e,1} [the\ woman\ John\ loves\ betrays\ v_{e,1}]$ '.

On the movement theory of focus, we can explain these data given the logical forms (4'a) and (4'b) and an independently needed principle for bound variable interpretations applying at the level of Logical Form. (Various principles have been proposed here. I propose principle (5) since it seems to apply to at least as broad a range of cases as the principles usually invoked.)

- (4') a. We ${}_{VP}[only\ {}_F[him]_i\ {}_{VP}[expect\ e_i\ to\ be\ betrayed\ by\ the\ woman\ he_i\ loves]]$
b. We ${}_{VP}[only\ {}_F[him]_i\ {}_{VP}[expect\ the\ woman\ he_i\ loves\ to\ betray\ e_i]]$

- (5) Bound Variable Principle (Logical Form):
The phonological content of a pronoun may optionally be deleted if it is c-commanded by a co-indexed empty pronoun.

The Bound Variable Principle now tells us that there is a second Logical Form Representation for (4a), but not for (4b).

Second logical form for (4a):

We ${}_{VP}[only\ {}_F[him]_i\ {}_{VP}[expect\ e_i\ to\ be\ betrayed\ by\ the\ woman\ e_i\ loves]]$

Suppose that pronouns without phonological content are translated as variables of the intensional λ -categorical language, whereas pronouns with phonological content are translated as constants (keeping their original in-

dices). This means that the second logical form for (4a) corresponds to the bound variable reading, whereas the two logical forms (4'a) and (4'b) correspond to the referential readings of (4a) and (4b) respectively. We now correctly predict that (4a), but not (4b) has a bound variable reading.

The force of the crossover argument comes from the fact that on the movement theory, the distribution of readings for (4a) and (4b) can be explained in exactly the same way as the distribution of readings for the following sentences, all involving moved NPs at some level of representation.

Surface Structure:

- (6) a. [Every man]_i was betrayed by the woman he_i loved
b. The woman he_i loved betrayed [every man]_i

Logical Form:

- (6') a. $s[[Every\ man]_i\ s[e_i\ was\ betrayed\ by\ the\ woman\ he_i\ loved]]$
 $s[[Every\ man]_i\ s[e_i\ was\ betrayed\ by\ the\ woman\ e_i\ loved]]$
b. $s[[every\ man]_i\ s[the\ woman\ he_i\ loved\ betrayed\ e_i]]$

Surface Structure:

- (7) a. Who_i [e_i was betrayed by the woman he_i loved]?
b. Who_i did [the woman he_i loved betray e_i]?

Logical Form:

- (7') a. Who_i [e_i was betrayed by the woman he_i loved]?
Who_i [e_i was betrayed by the woman e_i loved]?
b. Who_i did [the woman he_i loved betray e_i]?

Given principle 5, we correctly predict that the pronouns in the (a) sentences do, and the pronouns in the (b)-sentences don't have a bound variable interpretation. Note that on the present proposal, empty and non-empty pronouns are interpreted independently, even if they are co-indexed. The reason is that empty pronouns are translated as variables and non-empty pronouns as constants of the intensional language, and (as usual) variables and constants are assigned values by independent interpretation functions.

2.3 Problems

As pointed out in Rooth 1985, the movement theory of focus (in the strong version presented above) is undesirable since Focus

Movement would have to be a transformation with rather idiosyncratic properties. In particular, it would have to be a transformation that doesn't obey the island constraints holding for other transformations.

Island Constraints:

- (8) They only investigated the question whether you know the woman who chaired $_F$ [the Zoning Board] $_i$.
They $_{VP}$ [only $_F$ [the Zoning Board] $_i$, $_{VP}$ [investigated the question whether you know the woman who chaired e_i]]
- (9) * [Which board] $_i$ did they investigate the question whether you know the woman who chaired e_i ?
- (10) They investigated the question whether you know the woman who chaired [every board in town] $_i$.
* $_s$ [[Every board in town] $_i$, $_s$ [they investigated the question whether you know the woman who chaired e_i]]

While Focus Movement (if it exists) behaves like wh-movement and quantifier movement with respect to crossover phenomena, it differs from both kinds of transformation with respect to the usual island constraints.

3. Rooth's In Situ Theory of Focus

3.1 Examples

Rooth's theory of focus allows focused constituents to associate with a focus sensitive operator while staying in situ. On his proposal, F-features are assigned to constituents at Surface Structure and are passed on to the expressions of the intensional language via the level of Logical Form. That is, Rooth's version of intensional logic allows meaningful expressions of the form $_F[\alpha]$, where α is any expression of some type τ . The expressions of the intensional logic are then recursively assigned two denotations. The first denotation is the usual intension (neglecting a complication concerning variable assignments). It is computed without paying attention to the F-feature. The second denotation is computed by means of rules sensitive to the F-feature. It determines a **p-set**, a set of intensions of type τ for every meaningful expression of type τ . P-sets are meant to capture the alternatives created by focusing. These alternatives are interpreted as providing the quantification domains for focus sensitive operators like *only*. Here is an example illustrating Rooth's approach.

- (11) John $_1$ $_{VP}$ [only $_{VP}$ [introduced $_F$ [Bill] $_2$ to $_F$ [Sue] $_3$]]

Since (11) doesn't contain any quantified NPs, (11) is a well-formed Surface Structure or Logical Form representation (Rooth also allows proper names like *Bill* or *Sue* to move at the level of Logical Form. But since proper names can be interpreted in situ, movement isn't required.) The scope of the focus sensitive operator *only* is the VP here, so we are interested in the double interpretation of the VP part of (11).

- (12) $_{VP}$ [introduced $_F$ [Bill] $_2$ to $_F$ [Sue] $_3$]

(12') is the translation of (12):

- (12') introduced'($_F$ [Bill'])($_F$ [Sue'])

Computation of intension of (12') (variable assignments neglected):

1. $\|_F$ [Bill'] $\| = \|$ Bill' $\| =$ Bill
2. $\|_F$ [Sue'] $\| = \|$ Sue' $\| =$ Sue
3. $\|$ introduced' $\| =$ that function $f \in D_{\langle e, \langle e, \langle e, t \rangle \rangle \rangle}$ such that for any $a, b, c \in D_e$, $f(a)(b)(c) = \{w \in W: c \text{ introduced } a \text{ to } b \text{ in } w\}$
4. $\|12'\| = \|$ introduced' $\| (\|_F$ [Bill'] $\|) (\|_F$ [Sue'] $\|) =$ that function $g \in D_{\langle e, t \rangle}$ such that for any $a \in D_e$, $g(a) = \{w \in W: a \text{ introduced Bill to Sue in } w\}$.

Computation of the p-set for (12') (variable assignments neglected):

1. $\| \|_F$ [Bill'] $\| \| = D_e$
2. $\| \|_F$ [Sue'] $\| \| = D_e$
3. $\| \|$ introduced' $\| \| = \{\|$ introduced' $\| \}$
4. $\| \|12'\| \| = \{f \in D_{\langle e, t \rangle}: \exists a \in \|_F$ [Bill'] $\| \|, \exists b \in \|_F$ [Sue'] $\| \|, \exists g \in \| \|$ introduced' $\| \| [f = g(a)(b)]\} = \{f \in D_{\langle e, t \rangle}: \exists a, b \in D_e [f = \|$ introduced' $\| (a)(b)]\}$

Intuitive characterization of the p-set for (12'):

Suppose John, Bill, Sue, and Ann are the only entities in the domain D_e . The p-set for (12'), then, is the following set of properties:

'introducing John to Bill'	'introducing Bill to Ann'
'introducing John to Sue'	'introducing Bill to John'
'introducing John to Ann'	'introducing Bill to Sue'
'introducing John to John'	'introducing Bill to Bill'
'introducing Sue to Ann'	'introducing Ann to Sue'
'introducing Sue to John'	'introducing Ann to Bill'

'introducing Sue to Bill'	'introducing Ann to John'
'introducing Sue to Sue'	'introducing Ann to Ann'

According to Rooth's semantics, the counterpart of (11) in the intensional language will now be true in a world w iff, out of all the (contextually relevant) properties in the p-set of (12'), the property of introducing Bill to Sue is the only property John has in w .

3.2 Island Constraints and Crossover

Rooth's approach doesn't require focused phrases to move in order to associate with a focus sensitive operator. Take sentence (8) from above.

- (8) They only $_{VP}$ [investigated the question whether you know the woman who chaired $_{F}$ [the Zoning Board] $_{I_1}$].

Suppose the relevant committees in the domain of entities are the Zoning Board, the Planning Board, the Rent Control Board, and the Conservation Commission. The p-set of the main VP (the scope of *only*) is then the following set of properties:

- P-set of the main VP of (8):
 'investigating the question whether you know the woman who chaired the Zoning Board'
 'investigating the question whether you know the woman who chaired the Planning Board'
 'investigating the question whether you know the woman who chaired the Rent Control Board'
 'investigating the question whether you know the woman who chaired the Conservation Commission'

Rooth's semantics says that (8) is true iff, out of all the properties in the above p-set, the first property (the intension of the VP) is the only property they had. Rooth's semantics, then, can interpret (8) without moving the focused phrase. Hence no island violations have to be assumed.

What about the crossover facts, one of the main motivations for the Movement Theory of focus? Consider the following crossover sentences:

- (13) a. We only wonder whether $s_{[F[he]_I}$ was betrayed by the woman he_1 loves]
 b. We only wonder whether $s_{[the woman he_1 loves betrayed F[him]_I]$

Recall that we want to explain why a bound variable reading is possible with (13a), but

not with (13b). Rooth points out that his theory is compatible with these facts, since it allows NPs to be raised at the level of Logical Form. But his NP raising operation is independent of focusing and obeys the usual constraints for movement. In the case of (13a) and (b), the focused NPs may optionally be adjoined to their closest dominating S-node. We have then:

- (13') a. We only wonder whether $s_{[F[he]_I}$ $s[e_1$ was betrayed by the woman he_1 loves]]
 b. We only wonder whether $s_{[F[him]_I}$ $s[the woman he_1 loves betrayed $e_1]$]]$

A condition like our Principle for Bound Variables (or any of the usual principles invoked for weak crossover) will now allow the unmoved non-empty pronoun in (13'a), but not in (13'b) to be interpreted as a bound variable.

Second logical form for (13a):

We only wonder whether $s_{[F[he]_I}$ $s[e_1$ was betrayed by the woman e_1 loves]]

Rooth shows that, in each case, his semantics in terms of p-sets assigns the right interpretations without having to move the focused phrase all the way up to be adjoined as a sister of *only*. The crucial point is that the lower S-nodes indicated in the logical forms above will be assigned λ -abstracts of the form $\lambda v_{e_1} [\dots]$ by the translation procedure. Depending on which pronouns are allowed to be interpreted as bound variables, the λ -abstracts determine different properties, and we get the following kind of p-sets for the next higher S-constituents.

(a) P-set for:

$s_{[F[he]_I}$ $s[e_1$ was betrayed by the woman he_1 loves]]

Assume that he_1 refers to John, and that John, Fred, and Harry are the only members of D_e . This means that the p-set of $_{F[he]_I}$ consists of John, Fred, and Harry, and we have the following p-set for the whole sentence:

'John was betrayed by the woman John loves'
 'Fred was betrayed by the woman John loves'
 'Harry was betrayed by the woman John loves'

(b) P-set for:

$s_{[F[he]_I}$ $s[e_1$ was betrayed by the woman e_1 loves]]

Assuming again that he_1 refers to John,

and that the domain D_e is as above, we have:

'John was betrayed by the woman John loves'

'Fred was betrayed by the woman Fred loves'

'Harry was betrayed by the woman Harry loves'

(c) P-set for:

$s[\text{F}[\text{him}]_i] s[\text{the woman he}_i \text{ loves betrayed } e_i]$

Assuming again that he_i refers to John, and that the domain D_e is as above, we have:

'The woman John loves betrayed John'

'The woman John loves betrayed Fred'

'The woman John loves betrayed Harry'

The p-sets for the next higher constituents, and the general strategy for the computation of the truth-conditions of (13a) and (13b) are now straightforward.

If the focused pronoun is not raised in (13a) and (13b) (also an option), we get the p-sets (a) and (c) respectively for the relevant S-constituents, hence no new readings.

This means that Rooth predicts exactly the correct range of readings for (13a) and (b).

3.3 Problems

Consider the following sentence:

(14) $I_{VP}[\text{laughed}] \text{ because you did }_{VP}[e]$

(14) is a case of VP deletion. This construction is discussed in Sag (1976) and Williams (1977). VP deletion is assumed to involve a reconstruction process copying the missing VP from an appropriate antecedent VP at the level of Logical Form. The result is (14').

(14') $I_{VP}[\text{-ed }_{VP}[VP[\text{laugh}]] \text{ because you did }_{VP}[\text{laugh}]]$

Imagine now you are angry at me and start voicing the following accusations. "What a copy cat you are! You went to Block Island because I did. You went to Elk Lake Lodge because I did. And you went to Tanglewood because I did." I feel you exaggerate and reply:

(15) $I \text{ only }_{VP}[\text{went to }_{F}[\text{Tanglewood}]] \text{ because you did }_{VP}[e]$

On Rooth's approach, we always have at least the option to interpret a focused proper name like *Tanglewood* in situ. So let us explore this option here. After reconstruction, (15') should then be a possible logical form associated with (15).

(15') $I_{VP}[\text{past }_{VP}[\text{only }_{VP}[\text{go to }_{F}[\text{Tanglewood}]] \text{ because you did }_{VP}[\text{go to }_{F}[\text{Tanglewood}]]]]]$

Given the mechanism of focus interpretation as proposed by Rooth, (15') doesn't represent a possible meaning for (15), however. Assuming that the domain D_e contains just Block Island, Elk Lake Lodge, and Tanglewood, we get the following p-set for the VP that constitutes the scope of *only* in (15').

P-set for

$_{VP}[_{VP}[\text{go to }_{F}[\text{Tanglewood}]] \text{ because you did }_{VP}[\text{go to }_{F}[\text{Tanglewood}]]]]]$:

'go to Tanglewood because you went to Tanglewood'

'go to Tanglewood because you went to Block Island'

'go to Tanglewood because you went to Elk Lake Lodge'

'go to Block Island because you went to Block Island'

'go to Block Island because you went to Elk Lake Lodge'

'go to Block Island because you went to Tanglewood'

'go to Elk Lake Lodge because you went to Block Island'

'go to Elk Lake Lodge because you went to Elk Lake Lodge'

'go to Elk Lake Lodge because you went to Tanglewood'

(15') is predicted to be true iff, out of all the properties in the above p-set, the property 'go to Tanglewood because you went to Tanglewood' is the only property I had. But that's not a reading (15) has. What we want to say is that, out of all the properties in the p-set given below, the property 'go to Tanglewood because you went to Tanglewood' is the only property I had.

Desired p-set:

'go to Block Island because you went to Block Island'

'go to Elk Lake Lodge because you went to Elk Lake Lodge'

'go to Tanglewood because you went to Tanglewood'

We can get this p-set for the VP constituting the scope of *only* in (15), if we raise the NP *Tanglewood* at the level of Logical Form and adjoin it to one of the dominating VPs before reconstruction takes place. The result is shown in (15'').

(15'') $I_{VP}[\text{past }_{VP}[\text{only }_{F}[\text{Tanglewood}]_i]_{VP}[_{VP}[\text{go to } e_i]] \text{ because you did }_{VP}[\text{go to } e_i]]]$

Given that the meaning determined by (15") is the only meaning (15) has, we must now conclude that focused phrases are obligatorily moved in these cases. If we have to concede that focused phrases are obligatorily moved in some cases, can we at least assume that this kind of movement has the usual properties? I think the answer is negative, as shown by the following examples.

- (16) Context: "You always see more Edsels than I do."
No, I only saw more _F[pink] Edsels than you did.

- (17) Context: "You always contact every responsible person before me."
No, I only contacted the person who chairs _F[the Zoning Board] before you did.

In (16), an adjective phrase would have to be moved out of a noun phrase to get the correct reading, not the sort of movement that is possible otherwise.

- (16) *It was pink that I saw Edsels

In (17), a noun phrase would have to be moved out of a wh-island and a noun phrase, again a serious violation.

- (17) *It was the Zoning Board that I contacted the person who chairs.

We have to conclude, then, that Rooth's in situ interpretation mechanism for focused phrases doesn't help us avoid unusual kinds of movement operations for such phrases.

4. A Presupposition Skeleton Version of the In Situ Theory

In this section, I want to argue that the more representational version of Rooth's theory that he briefly mentions at the beginning of his dissertation (p. 12) allows us to define p-sets in a slightly different way, thereby avoiding the difficulties that we saw arise in the previous section.

4.1 Two Translations

As before, let us assume that focused constituents are F-marked at Surface Structure and that F-marking is passed on to Logical Form.

Let us assume furthermore that all F-marked constituents bear an F-index. F-indices are assigned at Surface Structure in such a way that no two constituents bear the same F-index in a given tree (the 'novelty' condition for F-indexing). Every Logical Form expres-

sion is assigned two intensional logic translations. For any Logical Form phrase α , α' is its usual translation and α'' is its presupposition skeleton. The **presupposition skeleton** for a given phrase is computed like the ordinary translation, using the same rules, except that F-marked constituents are translated as designated variables (see Rooth 1985, p. 12 for a sketch of a recursive definition). Whenever α is an F-marked constituent bearing the F-index n , and α' is of type τ , then α'' is the n th designated variable of type τ .

4.2 Changes in the Intensional Logic

The intensional language assumed here has to be changed as to accommodate designated variables.

Adding designated variables:

For every natural number n and type τ , $V_{n,\tau}$ is a designated variable of type τ .

Two variable assignments:

We distinguish two variable assignments. Ordinary assignments assign values of the appropriate type to ordinary variables. Distinguished assignments assign appropriate values to distinguished variables. All meaningful expressions are assigned intensions relative to an ordinary and a distinguished assignment. Here are some examples:

For all natural numbers n , all types τ , and all ordinary assignments g and distinguished assignments h we have:

Denotations for the ordinary variables

$$\|v_{\tau,n}\|^{g,h} = g(v_{\tau,n})$$

Denotations for the designated variables

$$\|V_{\tau,n}\|^{g,h} = h(V_{\tau,n})$$

Denotations for the constants

$$\|\text{Ann}\|^{g,h} = \text{Ann}$$

.....

Denotations for complex expressions

If $\alpha \in \text{ME}_\tau$ and u is an ordinary variable of type σ , then $\|\lambda u[\alpha]\|^{g,h} =$ that function $f \in D_{\langle \sigma, \tau \rangle}$ such that for any $a \in D_\sigma$, $f(a) = \|\alpha\|^{g^a/u, h}$.

4.3 P-Sets

The addition of designated variables to the intensional language allows us to give the following very simple definition of p-sets.

Where α is any meaningful expression of some type τ , and g any ordinary variable assignment we define $\|\alpha\|^g$, the p-set of α with respect to g , as follows:

$\|\alpha\|^g = \{a \in D_e : \exists h [h \text{ is a designated assignment and } a = \|\alpha\|^{g,h}]\}$

In the above definition, p-sets are defined with the help of the designated variable assignments. This feature is the crucial difference between the current proposal and Rooth's proposal. Variable assignments assign the same values to different occurrences of the same variable. This is what will be responsible for a correct account of the VP-deletion cases as we will see shortly.

4.4 The Semantics of *only* (as VP-Modifier)

We are now ready to spell out the semantics for focus sensitive quantifiers like *only*.

- (i) Translation of logical forms into the intensional language:

Whenever β is a Logical Form expression of the form $_{VP}[only \text{ } _{VP}[\alpha]]$, then $\beta' = \text{only}'(\alpha')(\alpha'')$.

(Recall that α' is the ordinary translation of α , and α'' is its presupposition skeleton).

- (ii) *Only* in the Intensional Language:

In the intensional language assumed here, *only'* = **only** is treated syncategorematically, that is, it is not assigned a type.

Syntax of **only**

If α and $\beta \in ME_{\langle e,t \rangle}$, then **only**(α)(β) $\in ME_{\langle e,t \rangle}$.

Semantics of **only**

If α and $\beta \in ME_{\langle e,t \rangle}$, then $\|\text{only}(\alpha)(\beta)\|^{g,h}$ = that function $f_1 \in D_{\langle e,t \rangle}$ such that for any $a \in D_e$ and any $w \in W$, $w \in f_1(a)$ iff $w \in \|\alpha\|^{g,h}(a)$ and for all $f_2 \in \|\beta\|^g$, if $w \in f_2(a)$, then $f_2 = \|\alpha\|^{g,h}$.

4.5 Examples

Consider the following sentences:

- (18) I $_{VP}$ [said that $_{F2}[Sue_1]$ thinks she_1 is funny].

(Who thinks she is funny?)

- (19) I $_{VP}$ [said that $_{F2}[Sue_1]$ thinks $_{F3}[she_1]$ is funny].

(Who thinks who is funny?)

The semantics sketched above determines the same p-sets for sentences (18) and (19) as Rooth's semantics. Assuming that the domain D_e contains just Sue, Ann, and Maria, and that she_1 refers to Sue, we get the following logical forms, intensional logic translations, and p-sets for the sentential complements of *say*.

- (a) Logical Form:

$_{F2}[Sue_1]$ thinks she_1 is funny]

Presupp. Skeleton:

think'(funny')(she_1 ')) ($V_{e,1}$)

P-Set: 'Sue thinks Sue is funny'

'Ann thinks Sue is funny'

'Maria thinks Sue is funny'

- (b) Logical form:

$s_{[F2[Sue_1]]} s_{[e_1 \text{ thinks } she_1 \text{ is funny}]}$

Presupp. Skeleton:

$\lambda v_{e,1} [\text{think}'(\text{funny}'(she_1')) (v_{e,1})] (V_{e,1})$

P-set: As for (a)

- (c) Logical Form:

$s_{[F2[Sue_1]]} s_{[e_1 \text{ thinks } e_1 \text{ is funny}]}$

Presupp. Skeleton:

$\lambda v_{e,1} [\text{think}'(\text{funny}'(v_{e,1})) (v_{e,1})] (V_{e,1})$

P-set: 'Sue thinks Sue is funny'

'Ann thinks Ann is funny'

'Maria thinks Maria is funny'

- (d) Logical Form:

$_{F2}[Sue_1]$ thinks $_{F3}[she_1]$ is funny

Presupp. Skeleton:

think'(funny')($V_{e,3}$)) ($V_{e,2}$)

P-set: 'Sue thinks Sue is funny'

'Sue thinks Ann is funny'

'Sue thinks Maria is funny'

'Ann thinks Ann is funny'

'Ann thinks Maria is funny'

'Ann thinks Sue is funny'

'Maria thinks Maria is funny'

'Maria thinks Ann is funny'

'Maria thinks Sue is funny'

- (e) Logical Form:

$s_{[F2[Sue_1]]} s_{[e_1 \text{ thinks } _{F3}[she_1] \text{ is funny}]}$

Presupp. Skeleton:

$\lambda v_{e,1} [\text{think}'(\text{funny}'(V_{e,3})) (v_{e,1})] (V_{e,2})$

P-set: As for D

Sentence (18) allows possibilities (a), (b), and (c). Sentence (19) allows possibilities (d) and (e). (18) is the kind of example we discussed before. (19) is interesting since it illustrates that F-indexing must assign different F-indices to different focused phrases even if they bear the same referential index.

4.6 VP-Deletion

Let us finally examine how the Presupposition Skeleton Theory deals with the VP-deletion cases that were troublesome for Rooth's "official proposal". Take (15) from above.

- (15) I $_{F1}$ [past $_{VP}$ [only $_{VP}$ [$_{VP}$ [go to $_{F2}$ [Tanglewood]] because you did $_{VP}$ [e]]]]]

I want to show that we can derive the correct meaning of (15) without having to move the focused NP. In this particular case, the focused NP could move, of course. But this movement should only be optional. And as we saw above, there are more complicated VP-deletion cases where we don't want to assume the possibility of movement at all. Hence it is important to be able to capture even benign VP-deletion cases like (15) without having to assume that the focused constituent has to move.

Assume (as usual) that the missing VP of (15) is reconstructed at the level of Logical Form. The result is (15').

- (15') I _F[past _{VP}[only _{VP}[_{VP}[go to _{F2}[Tanglewood]] because you did _{VP}[go to _{F2}[Tanglewood]]]]]

The normal translation, the presupposition skeleton, and the p-set for the VP that constitutes the scope of *only* are then as given below (leaving out tense).

Logical Form

_{VP}[go to _{F2}[Tanglewood]] because you do _{VP}[go to _{F2}[Tanglewood]]]

Normal Translation

$\lambda v_{e,1}$ [because'(go'(Tanglewood')(v_{e,1})) (go'(Tanglewood')(you'))]

Presupposition skeleton

$\lambda v_{e,1}$ [because'(go' (V_{e,2})(v_{e,1})) (go'(V_{e,2})(you'))]

P-set, assuming that D_e = {Tanglewood, Elk Lake Lodge, Block Island}

'go to Tanglewood because you go to Tanglewood'

'go to Elk Lake Lodge because you go to Elk Lake Lodge'

'go to Block Island because you go to Block Island'

Note that a presupposition skeleton as the one above can only arise through copying operations beyond Surface Structure. The 'novelty' constraint for F-indexing wouldn't (and shouldn't, see sentence (19)) allow the appearance of two occurrences of the same designated variable otherwise.

Von Stechow (1989) reports an observation of Thomas Ede Zimmermann also intended to show that it is a structural defect of Rooth's "official" theory that focusing doesn't involve variables. Here is a version of Zimmermann's example:

- (20) Situation: We are looking at a group of children about to leave for summer camp. There are quite a number of siblings in the group. Bill is the older brother of Mary.

Question: Are there many girls in the group that are taller than their older brothers?

Answer: No, I don't think so.
I can only see that _F[Mary] is taller than _F[Bill]

Zimmermann's point is that on Rooth's "official" approach, it is hard to see how we can explicitly restrict the p-set determined by the sentential complement of the verb *see* in (20) to propositions of the kind 'b is an older sibling of a and a is a girl and b is a boy and a is taller than b'. The example might not yet be absolutely convincing since it seems to assume that all contextual restrictions have to be spelled out in the translation procedure. This objection might be eliminated, however, by considering answers of the following kind:

- (21) As for girls and their older brothers, I can only see that _F[Mary] is taller than _F[Bill]

In (21), the restriction for the domain of quantification is explicit and should be allowed to play a systematic role in determining the p-set associated with the sentential complement of *see*. This is a problem for Rooth. The Presupposition Skeleton Theory seems to be in a better position here, since it allows distinguished variables to be explicitly related to each other.

I conclude that, all in all, in situ theories of focus are to be preferred over movement theories. And that among the in situ theories, representational theories seem to be more adequate than denotational theories. In drawing this conclusion, I want to emphasize, however, that the representational in situ theory argued for here is only a slightly different version of Rooth's "official" proposal. In particular, it allows us to keep all the essential features of his analysis of focus. These features include a very elegant semantic analysis of focus sensitive quantifiers, a convincing account of the crossover facts, and a highly constrained theory of movement.

5. Appendix : An Example of a λ -Categorical Intensional Language

0. The language L is an intensional λ -categorical language as used in Cresswell (1973), except that it admits the syncategorematic

treatment of logical constants. To facilitate communication, it is given the looks of Montague's intensional logic. Unlike Montague's intensional logic, it has no "up"s and "down"s. All expressions (except the logical constants) are assigned intensions with respect to a variable assignment.

1. The definition of types

The types of L are recursively defined as follows:

- (1) e is a type.
- (2) t is a type.
- (3) if σ and τ are types, then $\langle \sigma, \tau \rangle$ is a type.

2. Assignment of constants to types

- (1) **Jan, Jacob, Ann, Maria** are constants of type e .
- (2) **laugh, weep** are constants of type $\langle e, t \rangle$.
- (3) **spot, greet** are constants of type $\langle e, \langle e, t \rangle \rangle$.
- (4) **girl, boy, rabbit, mayor** are constants of type $\langle e, t \rangle$.
- (5) **a(n), every, the, no** are constants of type $\langle \langle e, t \rangle, \langle \langle e, t \rangle, t \rangle \rangle$.

3. The variables of L

For any type τ , and any natural number n , $v_{n,\tau}$ is a variable of type τ .

4. Syntactic Rules

For any type τ , the set of meaningful expressions of type τ , denoted by " ME_τ ", is recursively defined as follows:

- (1) Every constant or variable of type τ is a member of ME_τ .
- (2) For any types σ and τ , if $\alpha \in ME_{\langle \sigma, \tau \rangle}$, and $\beta \in ME_\sigma$, then $\alpha(\beta) \in ME_\tau$.
- (3) If ϕ is in ME_t , so is **not** ϕ .
- (4) If ϕ and ψ are in ME_t , so is **[ϕ and ψ]**.
- (5) If ϕ and ψ are in ME_t , so is **[ϕ or ψ]**.
- (6) If α and $\beta \in ME_e$, then **[$\alpha = \beta$]** $\in ME_t$.
- (7) If $\alpha \in ME_\tau$ and u is a variable of type σ , then $\lambda u [\alpha] \in ME_{\langle \sigma, \tau \rangle}$.
- (8) If $\phi \in ME_t$, then **necessarily** $\phi \in ME_t$.
- (9) If $\phi \in ME_t$, then **possibly** $\phi \in ME_t$.

5. Semantic domains

Let D be the set of all possible individuals, and W the set of all possible worlds. We can then define the set D_τ (the set of possible denotations of type τ) for any type τ as follows:

- (1) $D_e = D$.
- (2) D_t = the power set of W
- (3) For any types σ and τ , $D_{\langle \sigma, \tau \rangle} = D_\tau^{D_\sigma}$, that is, the set of functions from D_σ to D_τ .

6. Denotations

For any expression α , $\|\alpha\|^g$ is the denotation of α with respect to a variable assignment g . A variable assignment is a function that assigns to each variable of type τ a member of D_τ , for all types τ .

7. Denotations for the constants

- (1) $\|\mathbf{Jan}\|^g = \text{Jan} \dots \text{etc.} \dots$
- (2) $\|\mathbf{weep}\|^g$ is that function $f \in D_{\langle e, t \rangle}$ such that for any $a \in D_e$ and any $w \in W$, $w \in f(a)$ iff a weeps in w .
..... etc.
- (5) $\|\mathbf{the}\|^g$ is that function $\in D_{\langle \langle e, t \rangle, \langle \langle e, t \rangle, t \rangle \rangle}$ such that for any $h_1, h_2 \in D_{\langle e, t \rangle}$ and any $w \in W$, $w \in f(h_1)(h_2)$ iff there is an $a \in D_e$ such that $w \in h_1(a)$ and $w \in h_2(a)$, and for all $b \in D_e$, if $w \in h_1(b)$, then $b = a$.
..... etc.

8. Denotations for the variables

$\|v_{n,\tau}\|^g = g(v_{n,\tau})$ for all natural numbers n and types τ .

9. Denotations for the complex expressions

- (2) For any types σ and τ , if $\alpha \in ME_{\langle \sigma, \tau \rangle}$, and $\beta \in ME_\sigma$, then $\|\alpha(\beta)\|^g = \|\alpha\|^g(\|\beta\|^g)$.
- (3) If ϕ is in ME_t then $\|\mathbf{not} \phi\|^g = W - \|\phi\|^g$.
- (4) If ϕ and $\psi \in ME_t$ then $\|\phi \mathbf{and} \psi\|^g = \|\phi\|^g \cap \|\psi\|^g$.
- (5) If ϕ and $\psi \in ME_t$ then $\|\phi \mathbf{or} \psi\|^g = \|\phi\|^g \cup \|\psi\|^g$.
- (6) If α and $\beta \in ME_e$, and $w \in W$, then $w \in \|\alpha = \beta\|^g$ iff $\|\alpha\|^g = \|\beta\|^g$.
- (7) If $\alpha \in ME_\tau$ and u is a variable of type σ , then $\|\lambda u [\alpha]\|^g =$ that function $f \in D_{\langle \sigma, \tau \rangle}$ such that for any $h \in D_\sigma$, $f(h) = \|\alpha\|^g_{h/u}$.
- (8) If $\phi \in ME_t$ and $w \in W$, then $w \in \|\mathbf{necessarily} \phi\|^g$ iff for all $w' \in W$, $w' \in \|\phi\|^g$.
- (9) If $\phi \in ME_t$ and $w \in W$ then $w \in \|\mathbf{possibly} \phi\|^g$ iff there is a $w' \in W$ such that $w' \in \|\phi\|^g$.

6. Short Bibliography

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