A Theory of Focus Interpretation

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Abstract

According to the *alternative semantics* for focus, the semantic reflex of intonational focus is a second semantic value, which in the case of a sentence is a set of propositions. We examine a range of semantic and pragmatic applications of the theory, and extract a unitary principle specifying how the focus semantic value interacts with semantic and pragmatic processes. A strong version of the theory has the effect of making lexical or construction-specific stipulation of a focus-related effect in *association with focus* constructions impossible. Furthermore, while focus has a uniform import, the sources of meaning differences in association with focus are various.

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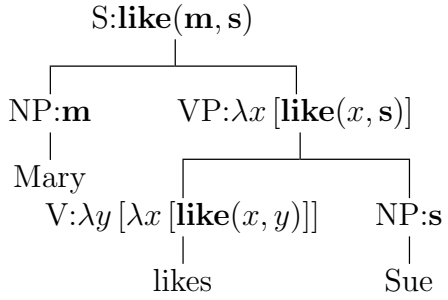
1 Alternative Semantics for Focus

The semantic component of a grammar associates abstract objects, model theoretic *semantic values*, with the phrases of a syntactic description. Let us assume that the semantic value of a sentence is a proposition (for instance as constructed in possible world semantics) and that the semantic value of a proper name is an element of a domain of individuals E. In the tree (1), where each phrase is annotated with a semantic value, $\mathbf{like}(\mathbf{m}, \mathbf{s})$ is a proposition, and $\mathbf{m}$ and $\mathbf{s}$ are individuals. We derive the semantic values of the non-terminal nodes compositionally by assuming that **like** is a two-place function from individuals to propositions, and stipulating a semantic rule of function application for the VP and S nodes.

(1)



I use the notation $[\![.]\!]^{\mathrm{o}}$ for semantic values, so that for instance $[\![\text{Mary}]\!]^{\mathrm{o}}$ is $\mathbf{m}$.

The idea of alternative semantics is to take semantic account of focus by adding an additional semantic value.[1] Informally, the focus semantic value for a phrase of category S is the set of propositions obtainable from the ordinary semantic value by making a substitution in the position corresponding to the focused phrase. For instance, the focus semantic value for the sentence $[_{\mathrm{S}}\,[\text{Mary}]_{\mathrm{F}}\text{likes Sue}]$ is the set of propositions of the form 'x likes Sue', while the focus semantic value for $[_{\mathrm{S}}\,\text{Mary likes }[\text{Sue}]_{\mathrm{F}}]$ is the set of propositions of the form 'Mary likes y'. This is stated in a more precise way using set abstraction notation:

(2) a. $[\![\ [_{\mathrm{S}}\,[\text{Mary}]_{\mathrm{F}}\text{likes Sue}]\ ]\!]^{\mathrm{f}} = \{\mathbf{like}(x, \mathbf{s}) | x \epsilon E\}$, where E is the domain of individuals.

b. $[\![\ [_{\mathrm{S}}\,\text{Mary likes }[\text{Sue}]_{\mathrm{F}}]\ ]\!]^{\mathrm{f}} = \{\mathbf{like}(\mathbf{m}, y) | y \epsilon E\}$

In general, $[\![\alpha]\!]^{\mathrm{f}}$ is the focus semantic value for the phrase α, in contrast to the ordinary semantic value $[\![\alpha]\!]^{\mathrm{o}}$. At an intuitive level, we think of the focus semantic value of a sentence as a set of alternatives from which the ordinary semantic value is drawn, or a set of propositions which potentially contrast with the ordinary semantic value. As I define things, the ordinary semantic value is always an element of the focus semantic value.

[1] The semantic theory is introduced in (Rooth, 1985); (von Stechow, 1989) is the source of the term "alternative semantics", which is pronounced with compound stress.

There are several proposals on how to derive $[\![.]\!]^f$. (Rooth, 1985) gives a recursive definition using the notion of the image of a semantic function operating on a subset of its domain, while (Kratzer, 1991) introduces a distinguished set of focus variables in terms of which substitution instances are defined. Something which is relevant here is that the definitions give focus semantic values for phrases other than S. Again, it is perhaps simplest to think of these as sets of substitution instances. If we give the N' $[_{N'}\text{American}_F\text{farmer}]$ an intersective semantics, so that its ordinary semantic value is

$$\lambda x\,[\mathbf{American}(x) \wedge \mathbf{farmer}(x)]$$

(the function which maps an individual x to the proposition that x is both American and a farmer), then its focus semantic value is the set of properties of the form 'P farmer', where P is an intersective modifier:

$$\{\lambda x\,[P(x) \wedge \mathbf{farmer}(x)]\,|P : E \rightarrow \text{propositions}\}$$

The example also illustrates what happens when something other than an individual-denoting phrase is focused. Since an intersective adjective denotes a property (a function from individuals to propositions) rather than an individual, it is a property rather than an individual which is substituted for.

2 Focus-related effects

In this section, we survey some pragmatic and semantic effects of focus, and say, sometimes in a programmatic way, how they are analyzed in alternative semantics. In each case, the story will be that a semantic or pragmatic rule somehow uses the focus semantic value.

This section has a motivational purpose and does not include a review of previous work. See (von Stechow, 1991) for a discussion of approaches to focus in model-theoretic semantics, and an exposition of alternative approaches to the phenomena discussed below.

2.1 Focusing adverbs

Focus has a truth-conditional effect in the context of *only*, and a non-truth-conditional semantic effect on conventional implicature in the context of *even* and certain other adverbs in English and other languages. In a story related in (Rooth, 1985), Mary introduced Bill and Tom to Sue, and there were are no other introductions. As a description of this situation, (3a) is false and (3b) is true. Note that the two sentences differ only in the location of focus.

(3) a. Mary only introduced $[\text{Bill}]_F$to Sue
    b. Mary only introduced Bill to $[\text{Sue}]_F$

The second chapter of (Rooth, 1985) analyzes this phenomenon by assigning *only* in auxiliary position a lexical semantic value which quantifies properties. The quantification obtained in the configuration (4a) is (4b), which says that if P is a property in a certain set of properties C, and if Mary has the property P, then P is identical to the property expressed by VP.[2]

(4) a. $[_{\mathrm{S}}$ Mary only VP]
b. $\forall P\,[[P \epsilon C \wedge P(\mathbf{m}) \rightarrow P = VP']]$

The role of focus is to identify the set C serving as a domain of quantification: the variable is set equal to the focus semantic value of VP. Let us see how this works out in the examples (3). (5) gives the focus semantic values for the VPs in (3), and (6) is what results when the pattern of interpretation (4) is applied to either of the examples in (3).[3]

(5) a. $[\![[_{\mathrm{VP}}\text{introduced } [\text{Bill}]_{\mathrm{F}}\text{to Sue}]]\!]^{\mathrm{f}} = \{\lambda x\,[\mathbf{introduce}(x, y, \mathbf{s})]\,|y \epsilon E\}$
b. $[\![[_{\mathrm{VP}}\text{introduced Bill to } [\text{Sue}]_{\mathrm{F}}]]\!]^{\mathrm{f}} = \{\lambda x\,[\mathbf{introduce}(x, \mathbf{b}, z)]\,|z \epsilon E\}$

(6) $\forall P\,[[P \epsilon C \wedge P(\mathbf{m}) \rightarrow P = \lambda x\,[\mathbf{introduce}(x, \mathbf{b}, \mathbf{s})]]]$

With (5a), the set of properties of the form 'introducing y to Sue', as the value for C, (6) can be rendered: if Mary has a property of the form 'introducing y to Sue', it is the property 'introducing Bill to Sue'. This is arguably the right truth-conditional meaning: it excludes the possibility of Mary having the property 'introducing Tom to Sue', since this is a property of the form 'introducing y to Sue' distinct from 'introducing Bill to Sue'. Thus we are capturing the fact that (3a) is false in the scenario described earlier.

The analysis of the second example runs in a similar way. With (5b) as the value of C, (6) amounts to: if Mary has a property of the form 'introducing Bill to z', it is the property 'introducing Bill to Sue'. One can easily convince oneself that the condition is satisfied in a model for the introduction scenario.

When one looks at a broader range of data, it becomes clear that the notion of always setting C to the full focus semantic value for the VP which is next to *only* is unsustainable. This is obvious in case of a focused transitive verb:

(7) Mary only $[\text{read}]_{\mathrm{F}}$ The Recognitions.

[2] A number of questions about the detailed lexical semantics of focusing adverbs are orthogonal to the present discussion. $P(\mathbf{m})$ should perhaps be added as a presupposition or assertion. For certain cases, it might be better to require merely that P be the strongest property in C that Mary has: consider *Mary only introduced [Bill and Tom]*$_{\mathrm{F}}$*to Sue.*

[3] In the interest of the appearance of simplicity, I am using a notation which hides intensionality, with the intent of introducing it in the way described in (Cresswell, 1973), and applied to alternative semantics in (von Stechow, 1989). In (4), it is important to be careful about intensions: "=" has to be interpreted as expressing identity in intension. That is, $P = Q$, where P and Q are properties, corresponds to the IL expression $\hat{}[P = Q]$, not $\hat{}[[\check{} P] = [\check{} Q]]$.

Assuming the individual c is the semantic value of the object NP, the focus semantic value for $[_{\text{VP}}\ [\text{read}]_{\text{F}}\text{The Recognitions }]$ is:

(8) $\{\lambda x\,[R(x,c)]\,|R : E \times E \rightarrow \text{propositions}\}$

Since (7) has a focused transitive verb, what varies in (8) is a relation between individuals: (8) is the set of *all* properties of the form 'R-ing The Recognitions'. This includes properties based on all sorts of choices for R, such as the relation which hold between x and y exactly if x was born in the same millennium as the author of y, and even trivial relations such as the one which holds between any x and any y. The consequent problem is that an application of (4) gives a unsatisfiable truth-conditions. In any reasonably complex model, Mary has many properties of the form 'R-ing The Recognitions', so that the condition

> if Mary has a property of the form 'R-ing The Recognitions', then
> it is the property 'reading The Recognitions'

is not satisfied. However, in intuition, (7) can be true, and for an obvious reason. Part of what is involved in understanding (7) is recovering from context (or constructing) a set of relevant properties which are to be considered substitutes for 'reading The Recoginitions'. In particular uses, this might be quite a small set.

The problem just discussed, which was not treated in (Rooth, 1985), can be addressed formally in the way just hinted at. Instead of fixing the value of C, one should simply use the focus semantic value to constrain C, leaving room for a pragmatic process of constructing a domain of quantification to add further information. Specifically, we want to require that C be a subset of the focus semantic value of the VP in (4). Below, I repeat (4), adding the focus-determined constraint.

(9) a. $[_{\text{S}}$ Mary only VP]
b. $\forall P\,[[P \epsilon C \wedge P(m) \rightarrow P = \text{VP}']]$
c. Focus-determined constraint: $C \subseteq [\![\text{VP}]\!]^{\text{f}}$

In (7) this would allow, for instance, taking C to be the set with just the two elements 'reading The Recognitions' and 'understanding The Recognitions'.

2.2 Contrast

Focusing adverbs are of particular interest because they show that one has to pay attention to focus in doing recursive semantics oriented toward deriving truth conditions. Much more common, and also of interest, are a variety of pragmatic uses of focus, prominent among which is the use of focus to express contrast. For instance, focus in the stereotypical initial adverbial phrases (10) would appear to be motivated by suggested contrasts, for instance between the old days and the new or current days.

(10) in $[\text{my}]_F$opinion, in the $[\text{old}]_F$days, in $[\text{this}]_F$country

A configuration which has received some attention is one of symmetric contrast. In (11), which is to be thought of as the beginning of a joke, there is a focus in each of the two noun phrases, apparently motivated by contrast with the other.

(11) An $[\text{American}]_F$farmer was talking to a $[\text{Canadian}]_F$farmer ...

(12)a. John is neither éager to please, nor éasy to please, nor cértain to please...
b. Jóhn hit Bíll and then hé hit hím.

(Chomsky, 1971), who discusses (12a), states that "contrastive intonation" is necessary in such "parallel constructions." (Ladd, 1980, p78) picks up the argumentation, citing (12b) and suggesting a special reciprocal interpretation for focus. (Rochemont, 1986, Ch.2) comes to what I believe to be the heart of the matter in proposing that such examples involve a dual and symmetric contrastive interpretation for focus. The symmetric configuration is significant because, in many examples, theoretical accounts based on a semantics of contrast are in competition with ones based on a semantics of anaphora. One might say that the prosody on the second noun phrase in (11) is the result of anaphoric de-accenting of *farmer*, with resulting default prominence on *Canadian*, in line with the proposal in chapter 4 of (Ladd, 1980). The point now is that the first noun phrase in (11) has the same status as the second. In pressing an account based on anaphoricity, we would be led to say that each occurrence of *farmer* in (11) is de-accented by virtue of being anaphoric to the other. This is an odd position from the standpoint of our understanding of anaphora in general, comparable to an analysis of (13) which claimed that each pronoun was anaphoric to the other, with no requirement for an external antecedent.

(13) Her father likes her husband.

So, symmetric configurations motivate an analysis based on contrast. How is this realized in alternative semantics? In line with an assumption that pragmatics is semantically based (that semantics provides the objects manipulated by pragmatic rules or processes), what we have to work with in (11) are the ordinary and focus semantic values of the component phrases. It is possible to

state a simple interpretation rule referring to these objects:[4] [5]

(14) **Contrasting phrases.** Construe a phrase α as contrasting with a phrase β, if $[\![\beta]\!]^{o} \epsilon [\![\alpha]\!]^{f}$.

It turns out that (11) can be analyzed with (14) operating either at the NP or the N' levels. Consider the second case, which involves simpler semantic values. In the analysis of the first focus, α is $[_{N'}[\text{American}]_F\text{farmer}]$ and the contrasting phrase β is $[_{N'}[\text{Canadian}]_F\text{farmer}]$. The relevant semantic values are:

(15) $[\![[_{N'}[\text{American}]_F\text{farmer}]]\!]^{f}$
$= \{\lambda x\,[P(x) \wedge \mathbf{farmer}(x)]\,|P : E \rightarrow \text{propositions}\}$ $(= [\![\alpha]\!]^{f})$
$[\![[_{N'}[\text{Canadian}]_F\text{farmer}]]\!]^{o} = \lambda x\,[\mathbf{Canadian}(x) \wedge \mathbf{farmer}(x)]$ $(= [\![\beta]\!]^{o})$

As required in the interpretation rule, $[\![\beta]\!]^{o}$ is an element of $[\![\alpha]\!]^{f}$, that is 'Canadian farmer' is a property of the form 'P farmer'. The contribution of the focus semantic value of $[_{N'}[\text{American}]_F\text{farmer}]$, then, is to constrain the choice of the contrasting phrase.

The analysis of focus in the second NP of (11) is entirely symmetric. α is $[_{N'}\text{Canadian farmer}]$, β is $[_{N'}\text{American farmer}]$, and the constraint is satisfied by virtue of the fact that $\lambda x\,[\mathbf{American}(x) \wedge \mathbf{farmer}(x)]$ is a property of the form $\lambda x\,[\mathbf{P}(x) \wedge \mathbf{farmer}(x)]$.

The rule (14) is incomplete, in that it refers to an undefined notion of contrast. In applying it, we would have to know exactly what it is to construe two phrases as contrasting. Possibly there is a lot to say about this, and the semanticist might modestly say that his aim is to specify the interface between semantics and a pragmatics of contrast which is not being explicated in his present project. While this sounds unexceptionable, my strategy in this paper will be a different, more formalist one which will eventually strip away any reference to contrast.

[4] The final formulation of focus interpretation will in addition entail that $[\![\beta]\!]^{o} \neq [\![\alpha]\!]^{o}$; this could be added to (14). (14) really represents a sufficient rather than a necessary condition for contrastive focus. It is known that an entailment relationship can mediate contrastive focus, as in the example *he*$_1$ *called her*$_2$ *a Republican, and then she*$_{2,F}$ *insulted him*$_{1,F}$. For this case, one would require that $[\![\beta]\!]^{o}$ entail some element of $[\![\alpha]\!]^{f}$. In the example, making the entailment go through requires a presupposed axiom that to call someone a Republican is to insult him, which mirrors our intuitions about the example. Manfred Bierwisch has pointed out to me that the situation is even more complicated in examples such as *he*$_{1,F}$ *bit her*$_{2,F}$*, and then she*$_{2,F}$ *punched him*$_{1,F}$.

[5] (Carlson, 1983), (Carlson, 1984) and (Rochemont, 1986) propose a contrastive semantics for focus in discourse. (14) and the individual clause of my final formulation (40) are closely related to Carlson's dialogue rule interpreting emphasis (Carlson, 1984, p308), and to Rochemont's interpretation rule for contrastive focus (Rochemont, 1986, p65).

2.3 Scalar implicature

My roommates Steve and Paul and I took a quiz in our self-paced calculus class, which was graded right away by the TA. Afterwards, George asked me how it went. My answer was:

(16) Well, I $[\text{passed}]_{\text{F}}$.

With this focus marking (perhaps together with a particular type of accent, which I will not be talking about[6]) the answer tends to suggest that I did no better than passing, that I did not, for instance, ace the exam.

Suppose I had instead said:

(17) Well, $[\text{I}]_{\text{F}}$passed.

This would have suggested that my roommates did not pass. In contrast, (16) seems to suggest nothing about whether or not my roommates passed.

George's reasoning with regard to (16) might run as follows: Mats said that he passed. If he had not only passed but aced, he would have said so. Therefore he must not have aced. This pattern of reasoning, which is an example of Gricean quantity implicature, can be generalized using the notion a scale of alternative assertions (see (Horn, 1972) or (Gazdar, 1979)). Since my acing implies my passing, but not conversely, we can set up a partially ordered set of two propositions ordered by entailment:

(18)
'Mats aced'
↓
'Mats passed'

A partially ordered set is an underlying set C together with a partial order $\geq_C$ on C. In this case, C is the set of propositions:

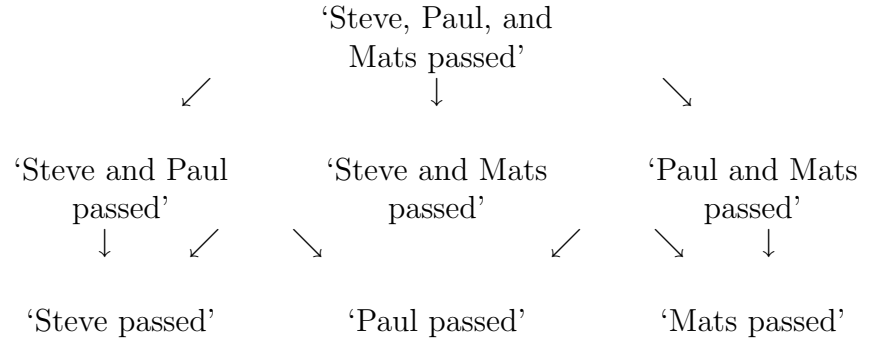
(19) $\{\mathbf{ace}(m), \mathbf{pass}(m)\}$

The ordering relation $\geq_C$ is entailment. The pattern of scalar implicature is then that asserting an element ϕ of C implicates the negation of any higher element of the scale, that is any ψ such that $\psi \geq_C \phi$ and $\psi \neq \phi$. So in this case asserting 'Mats passed' implicates the negation of 'Mats aced'.

The partially ordered set for (17) might be:

[6]For a proposal on the semantics of accent choice, see (Pierrehumbert and Hirschberg, 1990).

(20)



If we include groups in our domain of individuals (together with a group sum operation $\oplus$), and assume that the property **pass** is true of a group g exactly if **pass** is true of the atomic parts of g, we can write C for this case as:

(21) $\left\{ \begin{array}{l} \mathbf{pass}(s), \mathbf{pass}(m), \mathbf{pass}(p), \\ \mathbf{pass}(s{\oplus}p), \mathbf{pass}(s{\oplus}m), \mathbf{pass}(m{\oplus}p), \\ \mathbf{pass}(s{\oplus}p{\oplus}m) \end{array} \right\}$

Asserting $\mathbf{pass}(m)$ will implicate, for instance, the negation of $\mathbf{pass}(m{\oplus}p)$. $\mathbf{pass}(m{\oplus}p)$ is false exactly if $\mathbf{pass}(m)$ is false or $\mathbf{pass}(p)$ or is false. Thus if $\mathbf{pass}(m)$ is true and $\mathbf{pass}(m{\oplus}p)$ is false, $\mathbf{pass}(p)$ must be false. So, asserting that Mats passed implicates that Paul did not pass. We could reason in the same way about Steve.

Since (16) and (17) differ only in the location of focus, we want to use focus semantic values to explain the difference in scalar implicatures between the two. The general idea is that focus provides information about the underlying set. Since C in the example just discussed does not include all propositions of the form 'x passed', just a certain small set of propositions of this form, it would be a mistake to identify C with the focus semantic value of the asserted sentence. Instead, we say that C should be some subset of this focus semantic value:

(22) **Constraint on scales.** In constructing a scale of alternative assertions determining the scalar implicatures of a sentence α, choose an underlying set C such that $C \subseteq [\![\alpha]\!]^{\mathrm{f}}$.

(19) is indeed a subset of $[\![\text{I } [\text{passed}]_{\mathrm{F}}]\!]^{\mathrm{f}}$, and (21) is a subset of $[\![[\text{I}]_{\mathrm{F}}\text{passed}]\!]^{\mathrm{f}}$.

2.4 Questions and answers

There is a correlation between questions and the position of focus in answers. In (23), the solid lines link appropriate question-answer pairs, and the dotted lines link inappropriate ones. (23Aa) might be an answer to (23Qa), but probably not to (23Qb). Conversely, (23Ab) might be an answer to (23Qb), but probably not to (23Qa).

(23) Qa: Who cut Bill down to size? Qb: Who did Mary cut down to size?

Aa: Mary_{F}cut Bill down to size. Ab: Mary cut Bill_{F}down to size.

Work on the semantics and pragmatics of questions emphasizes the that a question determines a set of potential answers. Potential answers to the question Qa include the sentences in the left column below.

(24) Monique cut Bill down to size.	Mary cut Björn down to size.
Michiko cut Bill down to size.	Mary cut Boris down to size.
...	...

None of these are direct answers to Qb, however. Conversely, the sentences in the right column are potential answers to Qb but not to Qa. Note that in each column, the propositions expressed by the alternative answers are members of the focus semantic value for the actual answer in the corresponding column of (23). That is, the propositions expressed by the sentences in the left column of (24) are of the form 'x cut Bill down to size', while those expressed by sentences in the right column are of the form 'Mary cut y down to size'. We might say that the function of focus in an answer is to signal other propositions which are potential answers in the context of the question. Or if we wanted to speak in terms of contrast, we could say that focus in an answer expresses contrast between the asserted answer and other potential answers.

A particularly direct formulation of a constraint relating questions to focus in answers can be given in terms of the semantics for questions of (Hamblin, 1973).[7] Hamblin constructs a theory in which a question determines a set of potential answers by actually identifying the semantic value of a question with a set of potential answers, including both true and false answers. For instance, the (ordinary) semantic values for Qa and Qb are:

(25)a. $\{\textbf{cut-down-to-size}(x, \textbf{b}) | x \epsilon E \wedge \textbf{person}(x)\}$
b. $\{\textbf{cut-down-to-size}(\textbf{m}, y) | y \epsilon E \wedge \textbf{person}(x)\}$

The requirement that x (or y) be a person is contributed by the interrogative pronoun *who*. Notice the similarity between (25a) and the focus semantic value of the answer Aa: both are sets of propositions of the form 'x cut Bill down to size'. As I have defined focus semantic values, the focus semantic value of Aa is a proper superset of (25a), since it includes propositions based on choices for x which are not people. So the right thing to do is to insist that the ordinary semantic value of a question be an subset of the focus semantic value of a

[7]Dietmar Zaefferer pointed out the connection between Hamblin's question semantics and the (Rooth, 1985) semantics for focus to me. The connection extends to the form of the recursive definitions of focus semantic values and question semantics.

corresponding answer. Through the intermediary of the two kinds of semantic values, this has the effect of constraining the question-answer relation. Since (25a) is a subset of $[\![\text{Aa}]\!]^{\text{f}}$, the set of propositions of the form 'x cut Bill down to size', Aa is an appropriate answer to Qa. Since (25a) is not a subset of $[\![\text{Ab}]\!]^{\text{f}}$, the set of all propositions of the form 'Mary cut y down to size', Ab is not an appropriate answer to Qa.

The question-answer constraint just stated completes our survey of applications of alternative semantics. The balance of the paper has the following concerns. Section 3 states a unitary principle governing focus interpretation, a principle which is modified and partially formalized in section 4. Sections 5 and 6 claim that the principle provides a highly constrained theory of focus, and outline a reconstruction of the general hypothesis about interactions between focus and recursive (in particular truth conditional) semantics proposed in (Rooth, 1985). Sections 7 and 8 show that what is descriptively an association with focus effect in certain elliptical constructions receives an explanation which falls outside this reconstructed hypothesis, but within the theory of section 4. Section 9 poses the question whether focus effects are always theorems, or are sometimes stipulated in lexical or constructional grammatical information.

3 Focus Interpretation Principle

Here are the generalizations governing four applications of alternative semantics:

(26)a. **Focusing adverb constraint.** If C is the domain of quantification of a focusing adverb with argument α, then $C \subseteq [\![\alpha]\!]^{\text{f}}$.

b. **Contrasting phrase constraint.** If a phrase α is construed as in contrast with a phrase β, then $[\![\beta]\!]^{\text{o}} \epsilon [\![\alpha]\!]^{\text{f}}$.

c. **Constraint on scales.** If C is the underlying set of a scale used in computing the implicatures of a sentence α, then $C \subseteq [\![\alpha]\!]^{\text{f}}$.

d. **Question-answer constraint.** In a question-answer pair $\langle \psi, \alpha \rangle$, $[\![\psi]\!]^{\text{o}} \subseteq [\![\alpha]\!]^{\text{f}}$.

In each case, a constraint requires that some semantic object is either a subset or an element of a focus semantic value. In fact, the difference between the different constraints lies just in the description of this semantic object. This suggests that the characterization of a contrasting object (e.g. as the semantic value of a question, or the underlying set of a scale) is not really part of the theory of focus. If we remove these characterizations, what remains is the following schematic principle:

(27) **Focus interpretation principle**, first version. In interpreting focus at the level of a phrase α, add a constraint that:

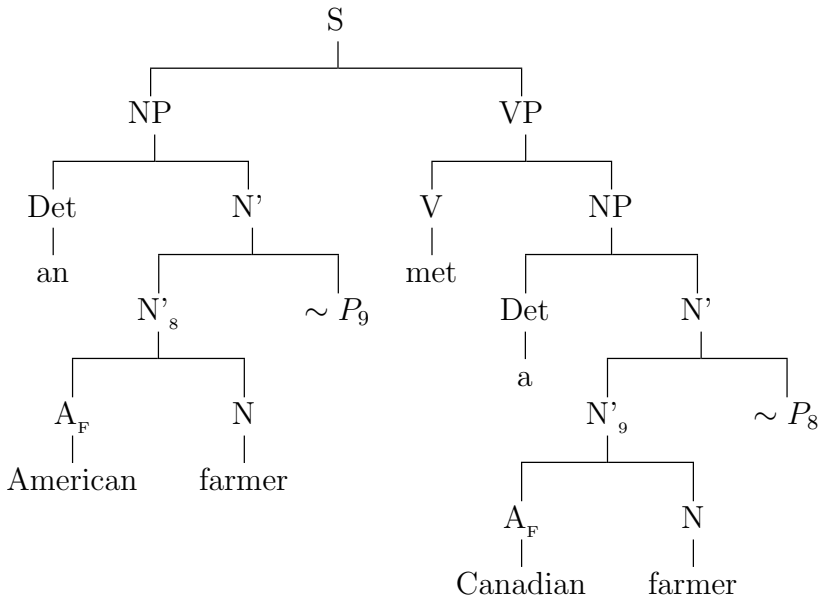
(contrasting set) $\Gamma \subseteq [\![\alpha]\!]^{f}$, or
(contrasting individual) $\gamma \epsilon [\![\alpha]\!]^{f}$

Γ is a variable with the type of a set of objects matching α in type, and γ is a variable matching α in type.

In a particular representation, Γ (or γ) will be identified with a particular semantic object, in some cases the semantic value of a phrase, in some cases an implicit semantic object such as a domain of quantification, and in some cases a pragmatically constructed object.

In the following section, I will define an operator $\sim$ which introduces the constraints described in (27). Here this symbol will be used to annotate the level at which focus is interpreted. This can be illustrated with the farmer example:

(28)



Focus is interpreted at the N'level, and there are two independent instances of focus interpretation. Consider the first focus. The focused phrase is the adjective $[_{A}$ American], and this focus is interpreted at the level of $[_{N'}[_{A}$ American$]_{F}$ farmer]. We use the second clause of (27). Since the ordinary semantic value of $[_{N'}[_{A}$ American$]_{F}$ farmer] is a property of individuals, γ is a particular property variable P_9, which is written as a second argument of $\sim$. The grammatical representation (28) indicates coindexing between the variable P_9 and the second N', a relation understood as expressing identity of properties. That is, γ in (27) as applied to (28) is identified with the ordinary semantic value of $[_{N'}$Canadian farmer].[8] Since 'Canadian farmer' is a property of the form 'P

[8]In the framework of (Kamp, 1981), we would say that the notation $[_{N'}$Canadian farmer$]_{9}$ is spelled out at the level of discourse representation as an equation $P_9 = \lambda x\,[\mathbf{Canadian}(x) \wedge \mathbf{farmer}(x)]$, where P_9 is a discourse referent of property type. Such discourse referents, like ones for proper names, would have to be given the privilege of

farmer' the constraint in the second clause of (27) is satisfied.

Note that interpreting focus at a certain level is, conceptually, separated from the process of identifying the antecedent for the variable introduced by focus interpretation. This is what will allow a variety of focus phenomena to fall under a single principle.

In my original discussion, the farmer example was analyzed in terms of the contrastive phrase constraint (26b). Since I have just analyzed the example directly in terms of the Focus Interpretation Principle (FIP), (26b) has no primary role in the theory of focus. If it is descriptively valid, however, it should be possible to derive it from the FIP and other primitives. The derivation of a counterpart of the constraint runs as follows:

1. Focus interpretation at the level of α introduces a free variable Γ, restricted by the formula $\Gamma \epsilon [\![\alpha]\!]^{f}$

2. The semantic value of any phrase β is a discourse object, available as an antecedent for free variables.

3. Therefore, if $[\![\beta]\!]^{o} \epsilon [\![\alpha]\!]^{f}$, the semantic value of a phrase β can serve as the antecedent for the variable introduced by focus interpretation at the level of the phrase α.

The derived statement differs from the original constraint in that reference to contrast is eliminated. This is welcome, since I did not give any content to the notion. Notice also that the source of the reference to the syntactic phrase β is the general axiom 2, rather than anything having to do specifically with focus.

In the remainder of this section, I review the application of FIP to the other three problems from section 2. The desired pattern of explanation is now that

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floating to higher levels of discourse representation, since semantic embedding does not affect the possibility of contrast expressed by focus: consider for instance *The fact that* $[_{\text{NP}}$*American*$_{\text{F}}$*farmers] are rich has never bothered* $[_{\text{NP}}$*a* $[_{\text{N'}}$*Canadian*$_{\text{F}}$*farmer]]*.

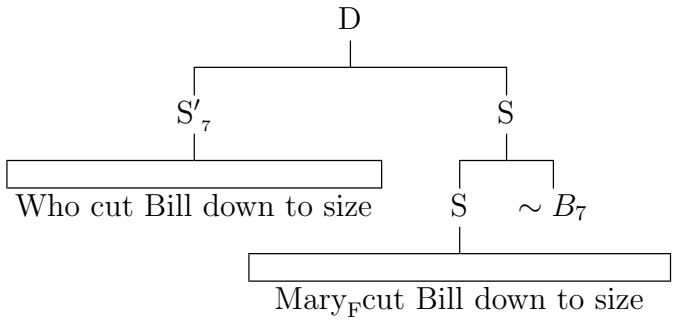
If representations such as (28) are taken literally as syntactic representations, it is of interest to ask whether binding theory constrains the distribution of indices. Superficially, however, no binding theoretic effects are predicted. The c-command domain of P_9 is just the operator $\sim$, or at most the N'to which $\sim P_9$ is adjoined. Thus the antecedent for P_9 is not included in the c-command domain of P_9, and there are no potential condition B or condition C violations. I conjecture that this conclusion generalizes to all relevant cases. Further, if the suggestion just made regarding the status of the index 8 in (28) as essentially the index of the proper name of a property is correct, the issue of weak crossover, which is relevant only for quantified variables, does not arise.

It would follow from such a negative conclusion regarding syntactic constraints on the distribution of the variable introduced by focus interpretation that it would be possible to say that this variable is present only at a level such as discourse representation, not at a syntactic level in the strict sense. Since this would be consistent with the substance of the proposal made here, I am using (28) as an expository device, without commitment about the presence of the variables at a strictly syntactic level.

in a particular kind of configuration containing a phrase α, a semantic object which can serve as the antecedent for focus interpretation at the level of α is characteristically available.

In the question-answer paradigm, we assume that in a question-answer pair $\langle \phi, \alpha \rangle$ focus is interpreted at the level of α using the first clause of (27). This introduces a free variable with the type of a set of propositions. As we saw before, we can assume that $[\![\phi]\!]^o$, the ordinary semantic value of the question, is a set of propositions. Thus in terms of semantic type, the semantic value of the question is an appropriate antecedent for the variable introduced in interpreting focus at the level of the answer. The representation for (23a) is:

(29)



The question and answer are the constituents of a discourse note D. Focus is interpreted at the level of the answer. The variable introduced by focus interpretation is B_7; as indicated by the indexing, this is identified with the ordinary semantic value of the question. As we saw (by example) in section 2.4, because of a similarity between the semantics of questions and focus semantics, in a pair consisting of a question of the form $[_{S'}[_{XP}$ wh-phrase$]_i[_S$ A e_i B$]]$ $(= \phi)$ and an answer of the form $[_S$ A XP_FB$]$ $(= \alpha)$, the semantic value of the question is a subset of the focus semantic value of the answer. So, if focus in the answer is placed in a position corresponding to the trace in the question, the constraint $\Gamma \subseteq [\![\alpha]\!]^o$ will be satisfied. In other words, placing focus in the right place in the answer will result in focus semantics which validates taking the semantic value of the question as the antecedent for the variable introduced by focus interpretation.

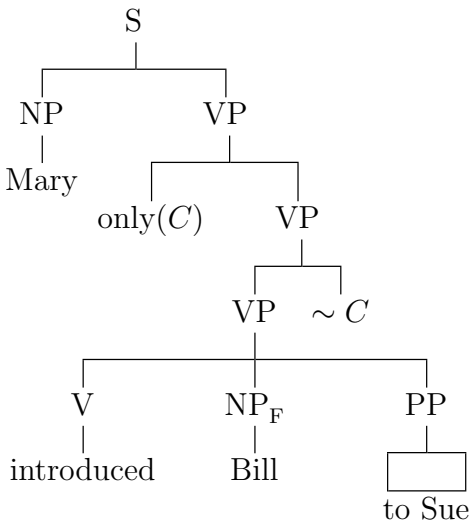
Consider next focusing adverbs. Given the lexical semantics for *only* which was introduced earlier, any use of *only* in auxiliary position introduces a free variable with the type of a set of properties:

(30)a. configuration: [only VP]
b. interpretation: $\lambda x\,[\forall P\,[[P \epsilon C \wedge P(m) \rightarrow P = VP']]]$

Here VP is the phrase where focus is being interpreted, that is α in the FIP. If we again use the first clause of the FIP, a variable with the type of a set of properties is introduced. We identify this with the domain of quantification variable introduced by the lexical semantics of *only*, which as required

is a set of properties. In the representation of the introduction example below, C in the notation *only(C)* is an overt representation of the domain of quantification.

(31)



Since C is a variable, there need not be any independent information about its reference. The effect is that the constraint introduced by focus interpretation may give information about C. In this case, the requirement is that C be a set of properties of the form 'introducing y to Sue'. Focus need not be the only source of information about C, though. At a formal level, C remains a free variable, which is viewed as an indication that its value is to be fixed pragmatically.

Finally, in the scalar implicature example, focus is interpreted at the level of a sentence such as $[_{\mathrm{S}}\, \mathrm{I}_{\mathrm{F}}$passed], using the first clause of (27). This gives a free variable with the type of a set of propositions. The antecedent is in this case not contributed by the semantics, but by the pragmatic process of constructing a scale of alternative assertions. We simply have to assume that pragmatically constructed entities, in addition to entities contributed by the semantics proper, are possible antecedents for variables introduced by focus interpretation.

4 Revisions

The constraint in the first (contrasting set) clause of the focus interpretation was $\Gamma \subseteq [\![\alpha]\!]^{\mathrm{f}}$. It is possible to say a bit more about Γ, though. In each of the applications of the first clause, $[\![\alpha]\!]^{\mathrm{o}}$ was an element of Γ. For instance, in the question-answer paradigm, the proposition expressed by the actual answer was an element of the semantic value of the question, and in the scalar implicature example, the assertion was a member of the scale of alternative assertions. Moreover, there was always an element of Γ distinct from $[\![\alpha]\!]^{\mathrm{o}}$. So

the characteristic configuration seems to be:

(32) $\begin{array}{lll} [\![\alpha]\!]^{o} & \epsilon & \\ \neq & & \Gamma \subseteq [\![\alpha]\!]^{f} \\ \gamma & \epsilon & \end{array}$

That is: $[\![\alpha]\!]^{o} \epsilon \Gamma \wedge \gamma \epsilon \Gamma \wedge [\![\alpha]\!]^{o} \neq \gamma \wedge \Gamma \subseteq [\![\alpha]\!]^{f}$

Since it seems advisable to constrain Γ as much as possible while retaining generality, I will add the additional two restrictions to the first clause. Similarly, in the second clause we can require $[\![\alpha]\!]^{o} \neq \gamma$. A second question is is whether it is necessary to retain a disjunctive formulation of focus interpretation. The constraint in the second clause was $\gamma \epsilon [\![\alpha]\!]^{f}$. As already suggested by the notation, the γ of (27) corresponds to the γ of (32), and the second clause might arise as a specialization of the first where Γ is the pair $\{[\![\alpha]\!]^{o}, \gamma\}$.[9] In the farmer example, Γ would be the pair:

(33) $\{\lambda x\,[\mathbf{American}(x) \wedge \mathbf{farmer}(x)]\,, \lambda x\,[\mathbf{Canadian}(x) \wedge \mathbf{farmer}(x)]\}$

Given the notion that the ultimate value for Γ is a discourse entity to which the variable Γ is anaphoric, we have to explain how (33) arises as a discourse entity. Note that this pair, unlike $\lambda x\,[\mathbf{Canadian}(x) \wedge \mathbf{farmer}(x)]$, is not the semantic value of a syntactic phrase. We would have to say that it is a derived discourse entity, created by set-forming operation acting on the ordinary semantic values of $[_{N'}$American farmer] and $[_{N'}$Canadian farmer]. This would be analogous to the process of group formation which, according to one account, forms the semantic underpinning for split antecedent anaphora:

(34) An American farmer was talking to a Canadian farmer. They got into an argument about canola.

In this example, the surface syntax provides two separate discourse referents for farmers. To create a discourse entity for the pair of two farmers, a free process of group formation is required.

The appeal to set formation is something which the analysis using the second clause of the original FIP does not require, and so Occam's razor does not tell us which account to prefer. I will leave the question open, but continue, for reasons of expository simplicity, to use a disjunctive formulation.

Formalization in terms of presupposition

What is the status of the constraints introduced by focus interpretation? They are constraints on interpretation which do not enter content. The important

[9] We can also contemplate a reduction in the other direction. At least in the focusing adverb and scalar implicature cases, there was a quantified variable ranging over Γ. This could be identified with γ.

point is that they constrain the choice of antecedent for the variable introduced by focus interpretation. Based on an analogy with a similar result in a presuppositional/anaphoric theory of definite descriptions, I will tentatively identify the constraints introduced by focus interpretation as presuppositions.

In an anaphoric theory of definite descriptions, one says that the content of a common noun is a presupposed constraint on the index of the definite description. In (35), the presupposed constraint would be that x_i be an American. On the reading where i is 1, though not on the reading where i is 2, the presupposition is satisfied. Thus we obtain a disambiguating effect.

(35) $[_{\text{NP}}$ an American farmer$]_1$ was talking to $[_{\text{NP}}$ a Canadian farmer$]_2$.
$[_{\text{NP}}$ the American$]_{\text{i}}$ ...

At a slightly more technical level, the constraint that x_1 be an American is encoded as a presupposition in the semantics of a version of the second sentence where i is 1. (For a specific proposal, see (Heim, 1982), (Heim, 1983).) The first sentence entails this presupposed information, and when the two sentences are semantically combined, the presupposition is satisfied; in the technical terminology of the compositional semantics of presupposition, it is filtered out, so that it is not a presupposition of the discourse as a whole.

Treating the focus-derived constraints in exactly the same way gives a satisfactory account of the symmetric contrast example. As we saw, focus interpretation at the level of one N-bar introduces a free variable, subject to a constraint which happens to be satisfied by the ordinary semantic value of the other N-bar. If we say that the constraint is a presupposition, we obtain the disambiguating effect observed with definite descriptions. This would explain, for example, why the semantic value of the verb could not be taken as the contrasting element for either of the N-bars.

In the focusing adverb example, the situation at first appears different. In the analysis of (Rooth, 1985), the focus semantic value of the VP in (36a) was actually used to fix the value of C in (36b). This certainly seems to be a matter of contributing to the assertion rather than the presupposition.

(36)a. $[_{\text{S}}$ Mary only $[_{\text{VP}}$introduced Bill$_{\text{F}}$to Sue]]
b. $\forall P\,[[P \epsilon C \wedge P(m) \rightarrow P = \lambda x\,[\mathbf{introduce}(x, b, s)]]]$

We have already seen, though, that the (Rooth, 1985) story misrepresents the contribution of focus to fixing the value of C: focus constrains C rather than fixing it uniquely. Let us return to an example which motivated this. In (37b) a possible value for C is (37c), which is a proper subset of $[\![[_{\text{VP}}$ [read]$_{\text{F}}$ The Recognitions $]]\!]^{\text{f}}$.

(37)a. Mary only [read]$_{\text{F}}$The Recognitions.
b. $\forall P\,[[P \epsilon C \wedge P(m) \rightarrow P = \mathbf{read}(c)]]$
c. $\{\mathbf{read}(c), \mathbf{understand}(c)\}$

If we wanted to modify (37b) so that C is no longer free, but rather has the value (37c), how should we do it? One way of setting the value of a variable C in a formula ϕ to a term τ is to equate the two, and to existentially quantify C to obtain a formula where C is not free:

(38) $\exists C[[C = \tau] \wedge \phi]$

The operation would have to be applied at the level of some formula in (37b) which contains C, with (37c) serving as τ. It turns out that the various possibilities produce equivalent results. What makes most sense, though, is fixing the value of C at the maximal level in (37b): since we think of C as a domain of quantification, we would expect C to be fixed external to the quantification it serves as domain for. Accordingly, let us suppose that (38) applies at the maximal level in (37b), yielding:

(39) $\exists C\,[C = \{\mathbf{read}(c), \mathbf{understand}(c)\} \wedge \forall P\,[[P \epsilon C \wedge P(m) \rightarrow P = \mathbf{read}(c)]]]$

This operation is not part of the compositional semantics of (37a). Rather, we think of it as (the final step in) a pragmatic process of fixing domains of quantification. What is the contribution of focus interpretation to this? There is the appearance of a non-compositional process, since focus is interpreted at the embedded VP level, but should somehow make a contribution to determining the specific value for C which is fixed at the top level of (39). Note that a certain kind of non-locality is characteristic of presupposition: the information which satisfies a presupposition is non-local relative to the phrase where a presupposition is introduced. For instance, in a version of (35) with 1 as the choice for i, the presupposition $\mathbf{American}(x_1)$ arises in the second sentence, but is satisfied by information contributed in the first sentence. This suggests that the constraint introduced by focus interpretation is a presupposition which enters the semantics in the same place as the ordinary semantic value of the VP, while the specification

$$C = \{\mathbf{read}(c), \mathbf{understand}(c)\}$$

is a piece of information which satisfies the presupposition. In the terminology introduced above, the presupposition that C be a set of properties of the form 'R-ing The Recognitions' is introduced at an embedded level, and filtered out at the level of the maximal conjunction in (39). In this case, the presupposition is that C is a set of properties of the form 'R-ing The Recognitions'. The filtering is a result of the fact that the conjunct $C = \{\mathbf{read}(c), \mathbf{understand}(c)\}$ entails the presupposition.

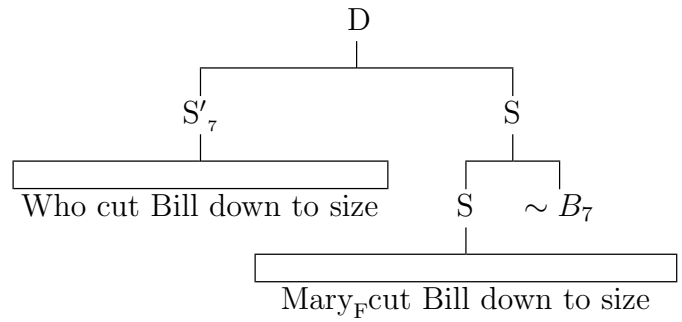
Let us take a step towards making these ideas concrete by introducing an operator $\sim$ which introduces the following presuppositions:[10]

[10](Rooth, 1985, p59) defined a three-place operator R which can be considered an ancestor of $\sim$. In $R(C, a, b)$, the value of C in b was set to (the characteristic function of) focus semantic value of a.

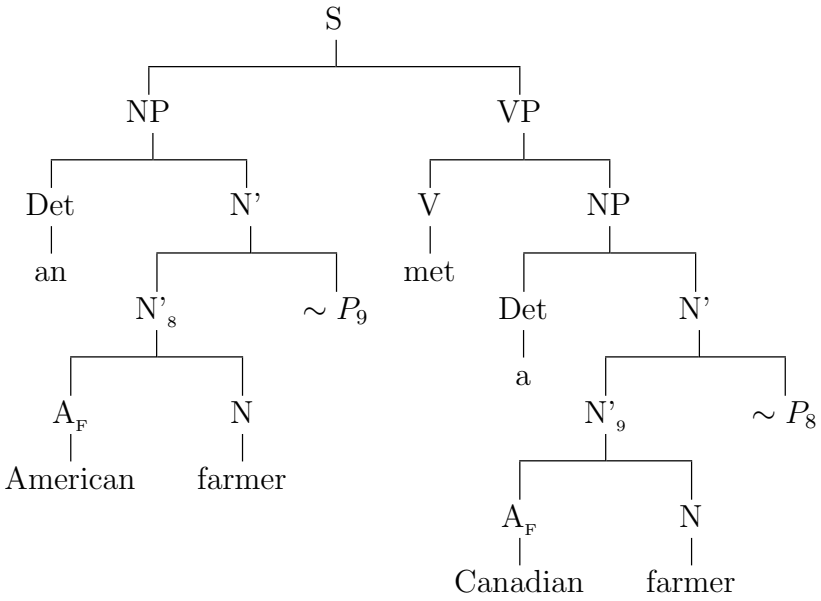
(40)	set case	$\phi \sim \Gamma$	presupposes that Γ is a subset of the focus semantic value for ϕ and contains both the ordinary semantic value of ϕ and an element distinct from the ordinary semantic value of ϕ
	individual case	$\phi \sim \gamma$	presupposes that γ is an element of the focus semantic value for ϕ distinct from the ordinary semantic value of ϕ

The statement of presuppositional semantics incorporates the revisions discussed above. The operator can be introduced either in the logical language ILF (intensional logic with focus) presented in (Rooth, 1985), or at the LF level of syntax. Here again are some examples of the logical forms which are contemplated under the second alternative:

(41)a.



b.



Where focus is interpreted, we see an adjoined operator $\sim v$. The choice of antecedent for the variable v is free, but is guided by the presuppositional constraint introduced by $\sim$. We have already seen that the constraint is satisfied in the representations above,

We have to say a few more things about the semantics of the focus interpre-

tation operator. First, it is a purely presuppositional operator: the assertion of $\phi \sim v$ is the assertion of ϕ. Second, in the expression $\phi \sim v$, focus has been interpreted, so we want to neutralize the semantic effect of the foci in ϕ. In alternative semantics, the focus semantic value of a phrase containing no foci is the unit set of its ordinary semantic value, so the way to say state this closure clause is:

(42) $[\![\phi \sim v]\!]^{f} = \{[\![\phi]\!]^{o}\}$

With this semantic characterization of the operator $\sim$, we can restate the focus interpretation principle as simply: adjoin an operator $\sim v$ to a phrase α in LF, where v is a variable with either the same type as α (individual case), or the type of a set of objects with the same type as α (set case).

5 Constraints on Focus Interpretation

Many stories about the grammar of focus include rules specifying the phonological interpretation of a syntactic focus feature. (Rooth, 1985) added to this the two-dimensional alternative semantics for focus, which defines a semantic interpretation of the focus feature. In this paper, we have adopted these ideas, and proposed a unitary principle specifying how focus semantic values are used. In outline, then, the theory of focus consists of:

(43)a. Rules describing the phonological interpretation of the feature F.
b. Two-dimensional alternative semantics, defining focus semantic values with reference to F and ordinary semantic values.
c. The semantic clauses for $\sim$.
d. The rule introducing $\sim$ in LF.

I maintain that, in gross terms, this is all there is to say about intonational focus in English. This is made more concrete in two negative constraints:

(44)a. **Negative syntactic constraint:** no rules other than (43a) and (43b) refer to the focus feature.
b. **Negative semantic constraint:** no rules other than (43b) and (43c) refer to the focus semantic value.

In essence, the constraints say that (43a) and (43b) fully specify the interpretation of the focus feature, while (43c) fully specifies the interpretation of the focus semantic value.

As an example of what is excluded, consider an analysis of focusing adverbs discussed in (Rooth, 1985). What I called a scope theory postulates a logical form where the focusing adverb forms a phrase with the focused phrase:

(45) $[_{VP}[_{XP}\,\text{only XP}_{F}]_{i}\,[_{VP}\,\ldots\,\text{e}_{i}\,\ldots\,]]$

As shown in (Rooth, 1985), this logical form is a satisfactory basis for semantic interpretation. The question is, what enforces the logical form (45)? Apparently, something of a syntactic nature is required to specify that *only* is the sister of a focused phrase in LF. (Rooth, 1985, p40) considers a syntactic co-occurrence restriction (46) which says just that:

(46) In LF, *only* must be the sister of a phrase bearing the focus feature F.

Such a syntactic filter is in conflict with (44a), since it refers to the focus feature.

Any of the interpretation principles discussed in section 2 (e.g. the question-answer constraint) are excluded by the negative semantic constraint, since they refer to the focus semantic value. These examples are somewhat uninteresting, since they involve interpretation principles of which the FIP is a generalization. We will see a better example in section 7.

(44) is a strong hypothesis, and the syntactic constraint (44a) immediately leads us to ask what to make of the array of syntactic interactions with focus described in the literature, particularly syntactic constructions which are said to mark focus. Probably the only interesting answer would be an analysis of particular cases. But this obviously cuts both ways: a given descriptive correlation is not, in the absence of analysis (which must include semantic analysis) a counterexample, just an empirical problem. Several notes of caution about what the constraints mean are also in order, particularly at the point where we start to talk about languages significantly different from English. The constraints refer to the focus feature and focus semantic values, in the technical senses employed here, not to the descriptive label "focus". In some cases, what is called "focus" will turn out to have something to do with the subject matter of this paper, in other cases not. In particular, a semantics of existential presupposition or exhaustive listing is distinct from the semantics of intonational focus in English, although constructions with a semantics of this kind might trigger association with focus; see the brief discussion of the English cleft construction in (Rooth, 1985). A separate point is that (44) would allow for syntactic focusing realized by movement with the same external semantics as $\sim$: given such a syntactic configuration, the desired semantics can be stated in a standard compositional semantic rule, without reference to either a focus feature or focus semantic values. [11] Finally, in a language with morphological focus marking which (let us suppose) should fall under the present theory according to other criteria, the morphological marking would replace (43a), so that there would be no real conflict with (44a).

[11] In this case, the counterpart of (44) would be the claim that this compositional interpretation was, uniformly, the interpretation of the syntactic focusing construction. The abstract possibility of surface focus movement with the semantics of intonational focus in English shows that the semantic approach proposed here is not in principle incompatible with an LF movement theory of focus.

6 The Free Parameter Theory of Association with Focus

As I use the term, an association with focus effect is one in which focus makes some contribution to recursive (e.g. truth-conditional) semantics. (Rooth, 1985) considers a "strong theory" which attributes all such effects to a contribution of focus to fixing a domain of quantification. That is, the general theory of association with focus proceeds on the model of the analysis of focusing adverbs: some lexical or constructional meaning introduces a free domain of quantification variable, and focus semantics contributes to fixing its value.

In the present theory, the reference to the notion of domain of quantification is illegitimate: given the negative semantic constraint, it is not possible to say something along the lines of "use focus semantic values to fix free domain of quantification variables". However, we can retain the idea that the source of an association with focus effect is a free variable contributed by some lexical or constructional meaning. As we have seen, it is a consequence of the focus interpretation principle that focus can have the effect of constraining such variables. Let us call this the free parameter hypothesis about association with focus. It can be considered a hypothesis about the source of the meaning variation observed in association with focus. Meaning variation in association with focus is not a result of differing compositional possibilities, along the lines of ambiguities of surface structure (e.g. (47a)) or scope (e.g. as (47b)).

(47)a. I saw the man with the telescope.
b. Every man loves some woman.

In a compositional ambiguity, different readings are obtained by putting things together in different ways. In association with focus, according to the free parameter hypothesis, things (the semantic values of phrases in LF or in an analysis tree) are put together in just one way, resulting in a meaning with a free parameter which can be constrained using focus.

In the following sections, I exhibit an apparent counterexample to the free parameter hypothesis, and show that it can be given a different and equally explanatory analysis.

7 Bare Remnant Ellipsis

The sentences below illustrate a focus-sensitive ambiguity in *bare remnant* ellipsis ((Hankamer, 1971), (Sag, 1975), (Napoli, 1983), (Reinhart, 1983), (Heim, 1985)).

(48)a. she beats $[\text{me}]_{\text{F}}$more often than Sue (= than she beats Sue)
b. $[\text{she}]_{\text{F}}$beats me more often than Sue (= than Sue beats me)

(49)a. she likes [me]$_F$well enough, but not Sue (= she does not like Sue)
b. [she]$_F$likes me well enough, but not Sue (= Sue does not like me)

(50)a. she visited [me]$_F$before Sue (= before she visited Sue)
b. [she]$_F$visited me before Sue (= before Sue visited me)

(51)a. Mom$_F$wants her to choose me$_F$, and Dad Sue (= Dad wants her to choose Sue)
b. Mom$_F$wants her$_F$to choose me, and Dad Sue (= Dad wants Sue to choose me)

The examples illustrate comparative ellipsis comparatives, stripping, temporal comparatives, and gapping, respectively. One way of viewing the ambiguity is that the noun phrase [$_{NP}$Sue] can correspond either to the object noun phrase [$_{NP}$me], or to the subject [$_{NP}$she] ([$_{NP}$her] in (51)). This also forms the basis for an approach to the ambiguity in which a property (or relation) is recovered from the main clause, and used as a predicate for [$_{NP}$Sue] (or the pair [$_{NP}$Dad], [$_{NP}$Sue]). (52) introduces some terminology.

(52)a. John will do it or Bill (will do it)
correlate antecedent property remnant
λx[x will do it]

b. she got John to do it or (she got) Bill (to do it)
antecedent property correlate remnant
λx[she got x to do it]

The *remnant* is the phrase which is (conceived as being) left over after ellipsis. The *antecedent property* is obtained by abstracting the position of the *correlate*[12] in the main clause. Using the antecedent property as a predicate for the remnant gives us the desired meaning.

Scoping and a precluded syntactic analysis

(Sag, 1975) suggested that scoping the correlate is implicated in recovering the antecedent property (see also (Pesetsky, 1982), (Reinhart, 1983), (Heim, 1985)). Sag's theory is a deletion theory, where each ellipsis sentence is related to a non-ellipsis variant, and ellipsis is licensed by the redundancy of a phrase in a representation which we can identify with logical form. (53) is a schematic logical form for (52b). Both the correlate and the remnant are scoped in their clauses.

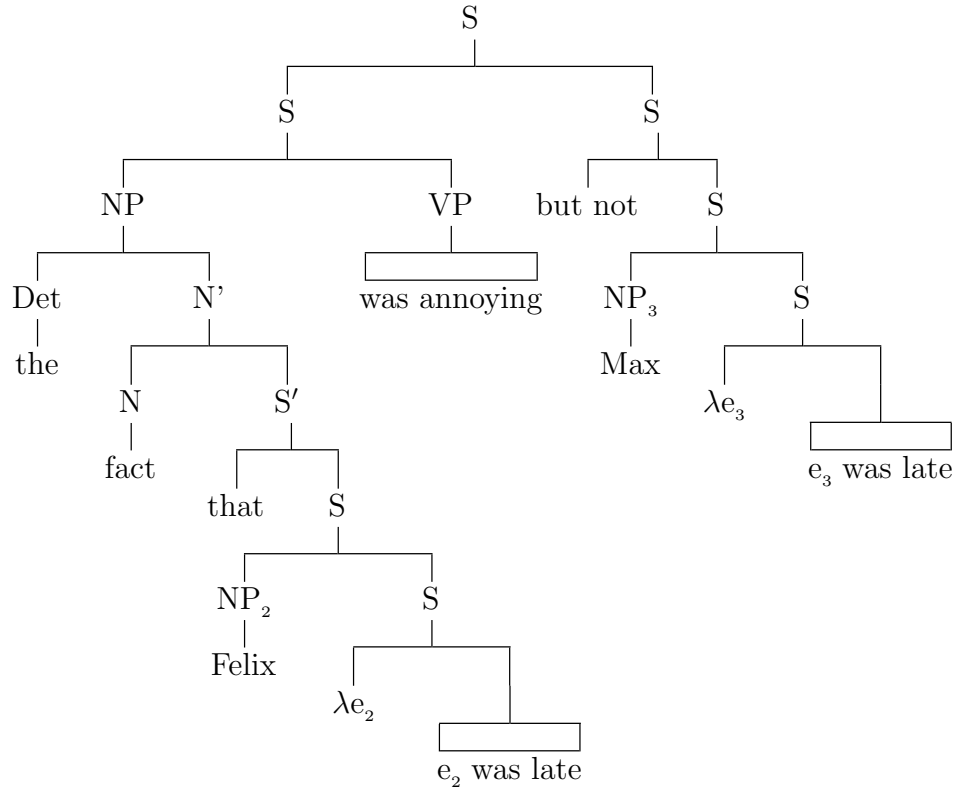
(53) [John $\underline{\lambda e_2[\text{she got } e_2 \text{ to do it}]}$] or [Bill $\underline{\lambda e_3[\text{she got } e_3 \text{ to do it}]}$]

[12]Pesetsky calls this the *correspondent*. My term is adopted from (Heim, 1985). Reinhart's label for the general kind of ellipsis under discussion here is *bare argument ellipsis*.

If it is assumed that the scoping operation inserts a λ operator (or the equivalent), we obtain a logical form in which the phrase λe_3[she got e_3 to do it] is redundant, since it is equivalent to the phrase λe_2[she got e_2 to do it]. For Sag, the redundancy is what licenses phonological deletion of the material [she got — to do it].

This analysis is attractive, in that it is integrated with a general account of ellipsis, and in addition, (Pesetsky, 1982) has presented evidence for scoping based on weak crossover. I will end up assuming that the scoping approach is correct. The problem, in the present context, is to account for the focus effect. Sag and Pesetsky propose that the movement is motivated by focus, referring to (Chomsky, 1976)'s analysis, in which focused phrases are scoped in logical form. What is being suggested, then, is that the correlate and remnant in (53) are scoped because they bear the focus feature F. This is not quite sufficient, though. (Reinhart and Rooth, ms), following (Hankamer, 1971), discuss a locality effect in bare remnant ellipsis which does not follow from the LF redundancy theory. As they put it, in LF the correlate-antecedent complex must be a conjunct with the complex consisting of the remnant and the deleted phrase (or, in a base generated treatment where there is no deleted material, the remnant). This rules out, for instance, a logical form where the correlate-antecedent complex is embedded relative to the remnant:

(54)



In (54), the circled phrase is redundant, and so should be deletable. However, (55a) does not have the predicted reading (55b).

(55)a. The fact that Felix was late was annoying, but not Max.
b. ... Max was not late.
c. The fact that Felix was late was annoying, but (at least) Max wasn't.

This is in contrast to the verb phrase ellipsis example (55c); verb phrase ellipsis does not exhibit the locality effect. Reinhart and Rooth conclude that something in the grammar must enforce the configuration (56a), or (56b) in a base theory.

(56)a. [[correlate antecedent] conjunction [remnant deleted-phrase]]
b. [[correlate antecedent] conjunction remnant]

Since we are contemplating using focus to identify the correlate, this means that something must enforce the configuration (57).

(57)a. [[correlate$_{\mathrm{F}}$antecedent] conjunction [remnant deleted-phrase]]
b. [[correlate$_{\mathrm{F}}$antecedent] conjunction remnant]

An analogous case might be (Huang, 1982, p258)'s proposal that interrogative verbs check a [+wh] feature in the COMP of their complement, at LF. We could entertain the hypothesis that a similar constraint enforced the [+F] feature in (57). The constraint might be associated with the conjunction, in the way that Huang's constraint is associated with an interrogative verb, or with the particular syntactic position that the correlate is in.[13] The point now is that the negative constraints on reference to focus are a bar to any approach along these lines, since they preclude syntactic reference to the focus feature.[14]

A precluded semantic analysis

Suppose there were a function Δ which decoded the antecedent property from the focus semantic value, so that for instance:

$$\Delta(\llbracket[_{\mathrm{s}}\,\text{she got [John]}_{\mathrm{F}}\text{to do it}]\rrbracket^{\mathrm{f}}) = \llbracket\lambda \mathrm{e}_{\mathrm{i}}\,[[_{\mathrm{s}}\,\text{she got e}_{\mathrm{i}}\text{ to do it}]]\rrbracket^{\mathrm{o}}$$

Then we could state a semantic interpretation rule for bare remnant ellipsis:

[13] According to Pesetsky, the correlate is in COMP.

[14] Orthogonal to the present question is the argument in (Rooth, 1985) that focused phrases are not necessarily scoped, based on the observation that association with focus is not constrained by quantifier scope islands. This is not relevant to (57), since the conclusion that some focused phrases are not scoped is perfectly consistent with the idea that certain scoped phrases are necessarily focused. Note however that if we adopt the scoping theory of bare remnant ellipsis along with an in situ theory of association with focusing adverbs, there is a potential for differential sensitivity to scope islands. (Heim, 1985) gives data indicating subjacency-like effects on the scope of the correlate in bare remnant comparatives, while (Rooth, 1985) claims that association of focus with focusing adverbs is insensitive to subjacency (or generally to scope islands).

(58) $[\![[\phi$ conjunction remnant$]]\!]^{o} =$
$[\![\text{conjunction}]\!]^{o}([\![\phi]\!]^{o}, \Delta([\![\phi]\!]^{f})([\![\text{remnant}]\!]^{o}))$

The rule decodes the antecedent property from the focus semantic value of the left conjunct, and uses it as a predicate for the remnant. We have:

$[\![[_{S}$ she got $[\text{John}]_{F}$to do it], or Bill$]]\!]^{o} =$

$[\![\text{or}]\!]^{o}([\![[_{S}$ she got $[\text{John}]_{F}$to do it$]]\!]^{o}, \Delta([\![[_{S}$ she got $[\text{John}]_{F}$to do it$]]\!]^{f})([\![\text{Bill}]\!]^{o})) =$

$[\![\text{or}]\!]^{o}([\![[_{S}$ she got $[\text{John}]_{F}$to do it$]]\!]^{o}, [\![\lambda e_{i}\,[[_{S}$ she got e_{i} to do it$]]\,]\!]^{o}([\![\text{Bill}]\!]^{o}))$

In the final formula, the desired predicate, namely the antecedent property, is applied to $[\![[_{NP}\text{Bill}]]\!]^{o}$. The derivation is generalizable, assuming the following specification for Δ:

$\Delta([\![[_{S}\,X\ \alpha_{F}Y]]\!]^{f}) = [\![\lambda e_{i}\,[[_{S}\,X\ e_{i}\ Y]]\,]\!]^{o}$

Whether or not the required decoding function Δ exists,[15] this analysis is impermissible in the theory of focus being developed here, since the interpretation rule (58) refers to focus semantic values, in violation of the second negative constraint on reference to focus.

8 An Analysis of the Focus Effect

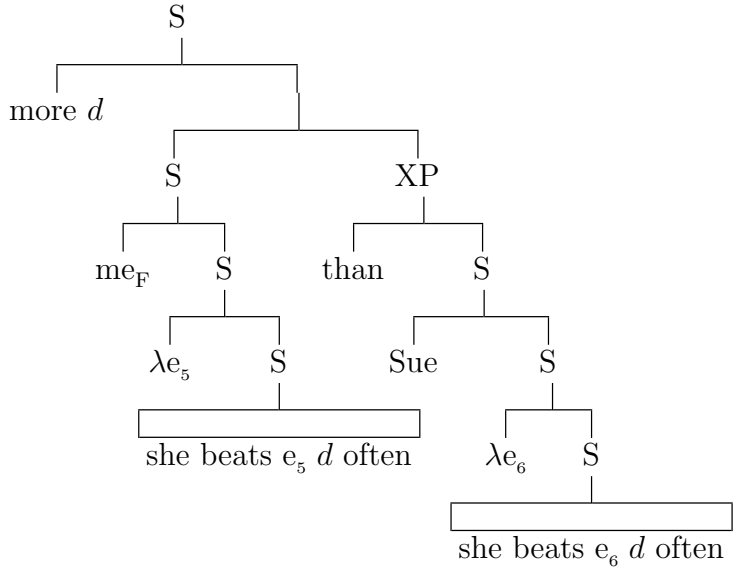
At this point we are faced with a dilemma. The focus effect in bare remnant ellipsis is compelling, particularly in examples where the potential correlates are pronouns, such as those repeated below.

(59)a. she beats $[\text{me}]_{F}$more often than Sue (= than she beats Sue)
b. $[\text{she}]_{F}$beats me more often than Sue (= than Sue beats me)

On the other hand, the previous section suggests that it is not possible to link the grammar of bare remnant ellipsis with focus in any direct way. Let us see what happens if we accept the conclusion that the grammar of this construction does not refer to focus. Specifically, suppose we adopt the scoping analysis, stripped of any reference to focus. That is, we say that any scopable phrase can serve as correlate, irrespective of whether it bears the focus feature. For instance, the object in (59) could serve as a correlate, whether or not it is focused. Let us look at the relevant logical form:

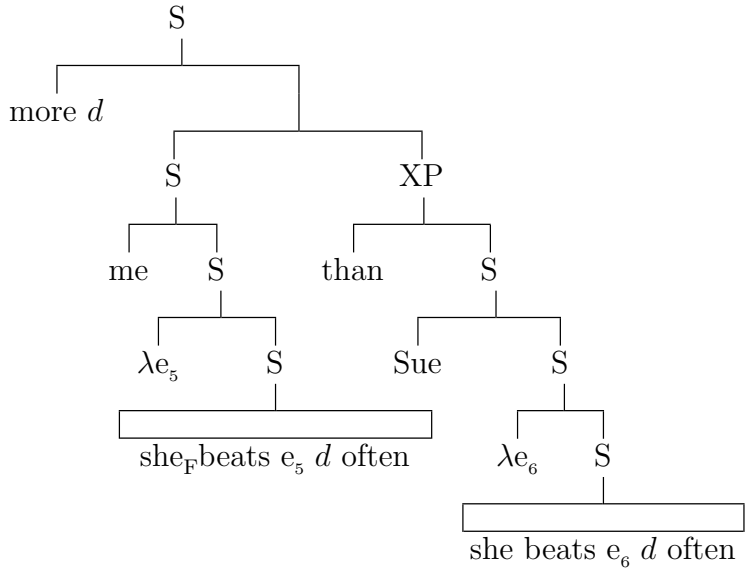
[15]Ede Zimmermann has proposed an argument to me: Suppose f is a bijective function on the set of individuals E, and P and Q are distinct properties such that for any individual x, $P(x)$ and $Q(f(x))$ are the same proposition. Then the sets $\{P(x)|x\epsilon E\}$ and $\{Q(f(x))|x\epsilon E\}$ are the same sets of propositions. Since f is a bijection, the latter equals $\{Q(x)|x\epsilon E\}$. Then since $\{P(x)|x\epsilon E\} = \{Q(x)|x\epsilon E\}$, any putative decoding function would fail on either P or Q. For instance, take P to be λt['it rains in Stuttgart at t'], Q to be λt['it rains in Stuttgart an hour before t'], and f to be the function which maps a time t to an hour after t, and anything else to itself.

(60)



Above, the correlate does in fact bear the focus feature. However, a counterpart in which the correlate was not focused would also be a possible logical form, as far as the theory of ellipsis goes:

(61)



We need not be concerned with the motivation for this logical form for comparatives, which is taken from (Reinhart and Rooth, ms). It is sufficient to keep in mind an informal gloss along the lines of "the degree d such that she beats me d often is greater than the degree d such that she beats Sue d often", and to assume that this is obtained through a standard compositional interpretation of (60) or (61).[16] If both of the logical forms are possible logical forms as far as

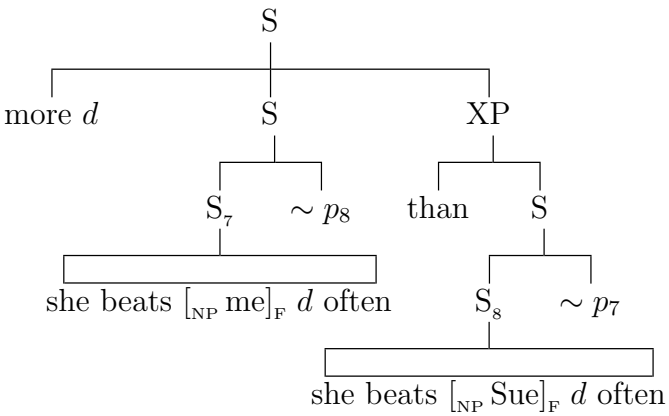
[16]The gloss is convenient, but does not represent the best interpretation for comparatives: see (von Stechow, 198x) for a survey. Reinhart and Rooth offer several motivations for the logical form. In order to capture semantic generalizations, it is desirable to give *than* the

the grammar of ellipsis goes, we have to look for an explanation for the focus effect which is independent of ellipsis. In fact, focus is likely to fall the same place in the non-ellipsis variants:

(62)a. she beats $[\text{me}]_{\text{F}}$more often than she beats $[\text{Sue}]_{\text{F}}$
b. $[\text{she}]_{\text{F}}$beats me more often than $[\text{Sue}]_{\text{F}}$beats me

Since there is no ellipsis, the story about focus in these examples could not have anything to do with ellipsis.[17] Instead, they are instances of something we already understand, the symmetric contrast configuration: focus in each minimal S is motivated by contrast with the other. In the notation of section 4, the logical form for (62a) is:

(63)



The focus on $[_{\text{NP}}\text{me}]_{\text{F}}$is interpreted at the level of $[_{\text{S}}$ she beats $[\text{me}]_{\text{F}}d$ often], using the individual clause of focus interpretation. This gives a variable p_8

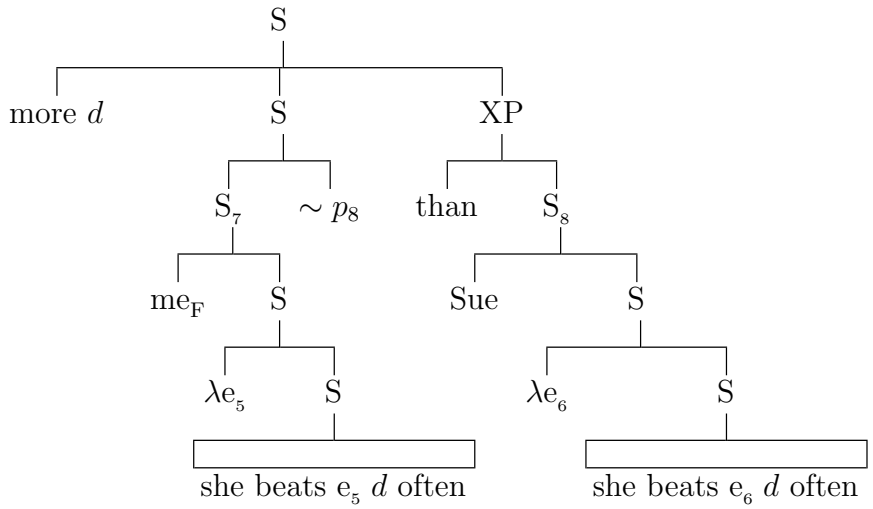
combinatory syntax of a conjunction. Second, in order to satisfy the "single token binder" clause of the alphabetic variance condition on ellipsis (Sag, 1975), it is necessary to employ a logical form with a single degree binder, instead of two. The informal gloss, which uses two degree binders, is deceptive in this respect.

[17]Except in the sense that there might be an overlap between the theories of ellipsis and contrastive focus. I believe that the theory of ellipsis has something to do with the theory of contrastive focus, or more generally with a theory of redundancy expressed by prosodic reduction, but this does not to affect the conclusion reached here, it turns out. In (Rooth, 1992) I claimed that although the redundancy constraint governing contrastive focus is more permissive than the one governing ellipsis (reduction redundancy can be implicationally bridged, as noted in footnote 4, and reduction allows for sloppy readings for pronouns in the reduced phrase which correlate with proper names rather than pronouns in the antecedent), ellipsis is in part semantically licensed. I suggested enforcing the semantic licensing of ellipsis by means of a $\sim$ operator with scope over the elided material. For the logical form (64) to license ellipsis, there would have to be an additional $\sim$ operator with scope over the *than*-clause. This operator would in addition license a contrastive focus on the remnant, something which we want to account for anyway. However, what we are concerned with explaining in the text is the disambiguating function of focus on the correlate, and it remains true in the theory just sketched that the story about this focus is independent of ellipsis in the *than*-clause: the story makes reference just to the semantics of the *than*-clause, not to its syntactic form.

with propositional type. Taking the antecedent for p_8 to be the *than*-clause satisfies the presuppositional constraint, since the ordinary semantic value of $[_S$ she beats Sue d often] is a proposition of the form 'she beats y d often'.[18] The story about focus in the *than*-clause is symmetric.

Since in Sag's theory (and also in the interpretive theory of (Williams, 1977)) ellipsis sentences have standard logical forms (i.e. the logical forms of non-ellipsis sentences), it should be possible to explain focus in the ellipsis sentences in the same way. The appropriate logical form for (59a) is:

(64)

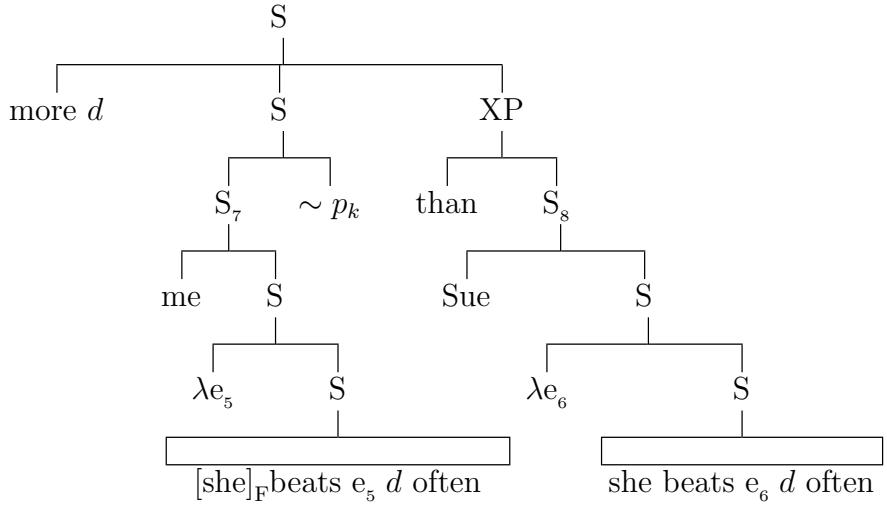


The story vis-a-vis focus interpretation is exactly the same as before. Focus is interpreted at the level of S_7, resulting in the introduction of a variable anaphoric to S_8. The presuppositional constraint on γ_8 is exactly the same as in the non-ellipsis variant, since it turns out that scoping $[_{NP}$me$]_F$does not affect the focus or ordinary semantic values of S_7. The focus semantic value of S_7 in (64) is the set of propositions of the form 'she beats y d often', just as in (63). If there is also a focus on the remnant, it would be interpreted at the level of the *than*-clause, that is by a focus interpretation operator adjoined to the sister of *than*.

To see what happens if focus is in the wrong place, we add focus interpretation to (61), continuing to assume that we have a possible logical form, as far as the grammar of ellipsis goes.

[18] At this point, this locution has become ambiguous. The (open) propositions vary in the y slot, not the d slot.

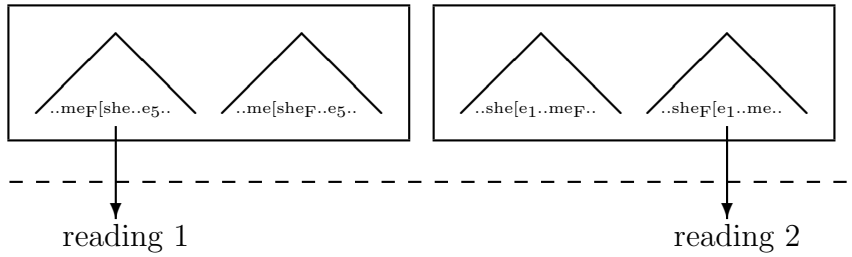
(65)



The problem with this LF is that there is no antecedent for p_k. The index k can not be 8, since the presuppositional constraint on p_8 requires that it be a proposition of the form 'x beats me d often'. The semantic value of S_8, the proposition 'she beats Sue d often', is definitely not of the required form.

The structure of this explanation is diagrammed in (66). The two boxes represent two structurally determined readings, differing in the choice of correlate. Within each box, the LFs differ only in the location of the focus feature. The transition to the area below the dotted line represents the contribution of focus. It has a filtering effect: only one of the LFs in each box is compatible with the information contributed by focus.[19]

(66)

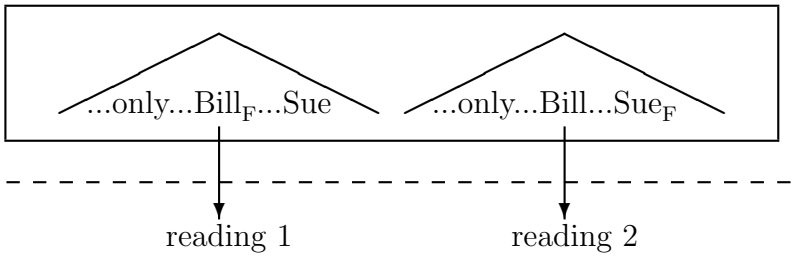


This story is not an instance of the free parameter theory of association with focus. The two readings in (66) correspond to differences of logical form: they result from a difference in the way things are put together compositionally. Furthermore, there is no level at which we see a single parameterized reading.

For comparison, here is a schematization of the analysis of focusing adverbs:

(67)

[19]This description is modified below, where I point out that focus on a non-correlate can be motivated by contrast with something other than the *than*-clause.



In this case, there is a single family of LFs, differing in the location of focus, and corresponding to a single parameterized meaning. There is no difference in how things are put together compositionally. Below the dotted line, focus adds information about the free parameter, resulting in distinct readings.

9 Strong, Weak, and Intermediate

At this point, focus effects in five empirical domains have been examined: questions and answers, focusing adverbs, scalar implicatures, contrastive configurations, and bare remnant ellipsis. These disparate phenomena have been brought under a unitary theory of focus interpretation. The theory is unitary in that focus has a uniform semantic import, a presupposition defined in terms of focus and ordinary semantic values. This unitary semantic import is introduced in a uniform way, by the semantic clauses for the focus interpretation operator $\sim$.

This theory can be contrasted with one which merely supplies focus-sensitive semantic objects and leaves it to particular lexical items or semantic interpretive rules to say how focus is used semantically. For instance, we might use focus semantic values as defined in alternative semantics, and include construction-specific rules such as those from section 2 in the grammar and pragmatics. According to this view, the specification of focus semantic values is all that there is to say in general about the semantics and pragmatics of focus. Focus semantic values are semantic objects which, like other semantic objects (i.e. ordinary semantic values) are manipulated by semantic and pragmatic rules. When we encounter a new focus-sensitive phenomenon, our task as theorists is to state a rule using focus semantic values which deals with the facts.

From several points of view, this is a weak position. As a component of a theory, a list of construction-specific rules makes limited predictions, predictions limited at best to a few specific empirical domains. The list does not say anything about how focus might be used in another empirical domain. In fact, the only general consequence derivable from a theory of this form is that focus is used in ways which can be characterized by rules stated in terms of focus semantic values. Although this is perhaps not a trivial consequence, the theory remains radically unrestricted. In the usual way, a reflex of theoretical

weakness is a burdensome task for a language learner. In learning how focus works in English, one would have to learn a lot of separate things, keyed to specific constructions, lexical items, and discourse configurations.

We might call the theory just outlined the *weak theory* of alternative semantics. It can hardly be considered an explanatory theory of focus. It does not go far enough beyond correspondence with linguistic fact.

Within the proposal I am advocating, I would like to distinguish two positions, a strong and an intermediate one. The difference revolves around the question whether a focus interaction is ever stipulated in lexical or constructional syntax and semantics. Plainly, a theory which does not contemplate construction-specific stipulation of focus effects is maximally explanatory. If there is no construction-specific reference to focus, there is little to learn about focus, at most phonology and the semantics of the operator $\sim$. This *strong theory* of alternative semantics is what I have been aspiring to throughout this paper. We will see, however, that there is a coherent and only somewhat less attractive intermediate position.

A prediction of the strong theory is that focus effects should always be optional. Optionality can be traced to two sources. Focus interpretation introduces a free variable, which we assume is free to find an antecedent by a process which, from the point of view of a competence theory, is non-deterministic. Second, interpreting focus at the level of a given phrase — that is, adjoining an operator $\sim v_i$ to the phrase — must be considered an optional process. In logical forms for bare remnant ellipsis, there is nothing which forces focus interpretation at the level of the main clause (i.e. the clause that the correlate has scope over). And given that focus is interpreted at this level, there is nothing which forces the antecedent for the variable introduced by focus interpretation to be the *than*-clause. In fact, there are other possibilities. In the gapping example below, alongside the retort with focused correlates (68b), we have one with a focused transitive verb (68c).

(68)a. A: I guess she hates him.
b. B: Not really. $[\text{She}]_{\text{F}}$likes $[\text{him}]_{\text{F}}$, and he her.
c. B: Not really. She $[\text{likes}]_{\text{F}}$him, and he her.

We can say that in both cases focus is interpreted at the level of $[_{\text{S}}$ she likes him], the difference being in the choice of the contrasting element. In (68b) the contrast is with the right conjunct. In (68c) the contrasting element (i.e. the antecedent for the variable introduced by focus interpretation) is the phrase $[_{\text{S}}$ she hates him] of (68a). Here is a similar example:

(69)a. A: I guess she beats you pretty often.
b. B: Not really. But she $[\text{ties}]_{\text{F}}$me just as often as you.

The correlate is understood as being $[_{\text{NP}}$she]. That is, the equative clause is understood as "... as often as you tie me." However, the transitive verb, rather

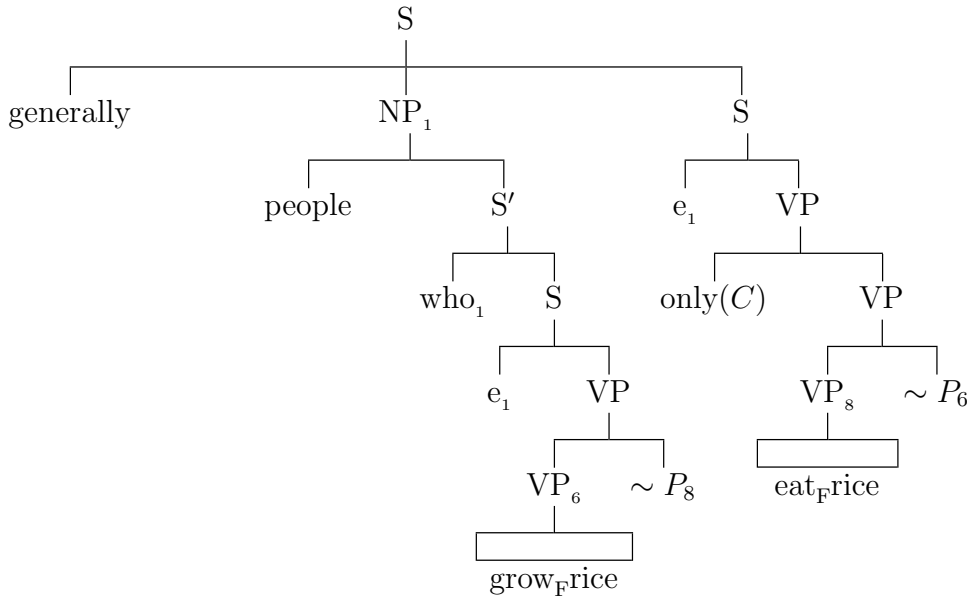
than the correlate, is focused. Again, this is motivated by contrast with part of A's statement.

(70) is a similar example involving *only*. There is a focus on the verb *eat*, but this need not be understood as associated with *only*. This would imply a domain of quantification for *only* consisting of properties of the form 'R-ing rice'. On one interpretation, though, what is excluded is eating staples other than rice, i.e. having certain properties of the form 'eating y'.

(70) People who $[\text{grow}]_{\text{F}}$rice generally only $[\text{eat}]_{\text{F}}$rice.

Plainly, the focus on the verb is motivated not by the semantics of the focusing adverb, but by contrast with the other verb phrase. (70) is a symmetric contrast configuration, with a logical form something like:

(71)



P_6 is the variable introduced by focus interpretation at the level of the argument of *only*. It is anaphoric to the verb phrase $[_{\text{VP}}$grow rice]; since $[\![[_{\text{VP}}$grow rice$]\!]^{\text{o}}$ is a property of the form 'R-ing rice', the presuppositional constraint is satisfied. In this grammatical description, focus contributes no restriction on the domain of quantification variable introduced by *only*. The consequence is simply that the domain of quantification is fixed pragmatically, without reference to grammatically determined information. This is a satisfactory result. It is non-controversial that pragmatic information is a contributor to fixing the domain of quantification for *only*, and it is probably implicated to some extent in most examples. So, it is not particularly surprising that it can be called on to do all the work, without a helping hand from focus.

Finally, consider the contrastive example. Above, it was analyzed in terms of a logical form where focus was interpreted at the level of each N'. However, the contrastive foci are optional, particularly the first, anticipatory one. In

(72a), there is no contrastively motivated focus within the first NP. In the corresponding logical form, there is no focus interpretation operator at the level of the first N'.

(72)a. An American farmer was talking to a $[\text{Canadian}]_{\text{F}}$farmer ...

That this variant is possible shows that the grammar should not enforce focus interpretation at the level of the first N'.

The above examples tend to support the idea that focus effects are optional. Except for the one just discussed, however, they rely on the presence of some competing motivation for focus. Especially with focusing adverbs, it seems that if no competing motivation for focus within the VP argument of the adverb is present, association with focus is practically obligatory. Within my theory as it presently stands, one would be led to seek a non-grammatical explanation for this: perhaps since the domain of quantification for *only* is a free variable, it is simply very useful to use focus to contribute information about it, whenever possible. Furthermore, the domain of quantification variable is always a good candidate antecedent for a variable introduced by focus interpretation. If the quantification is to be non-trivial, the domain C must include both the property denoted by the argument of the adverb, and some other property. This means that two of the constraints in the characteristic configuration (32) are automatically satisfied, by virtue of the lexical semantics of *only*.

Still, I think the opposite possibility, that association of focus with *only* is grammatically obligatory, has to be taken seriously. In developing this approach, we would have to find a different analysis of (70). Possibly, we would be led to postulate an additional focus on $[_{\text{NP}}\text{rice}]$, associated with the focusing adverb *only*. This initially appears unattractive, since $[_{\text{NP}}\text{rice}]$ is pronounced in the post-nuclear tail of the sentence. If this phonological position precludes a pitch accent (perhaps by definition of "nuclear accent") and if focus entails a pitch accent (as maintained in (Selkirk, 1984)), this would preclude a focus on $[_{\text{NP}}\text{rice}]$. However, there is some indication that there can be semantically significant prominence in the post-nuclear tail. Consider (73), another example where there are two motivations for focus.

(73)a. It isn't Anna_{F}who only likes big_{F}cars
b. It isn't Anna_{F}who only likes_{F}big cars

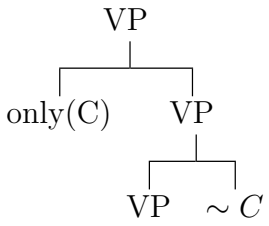
The first focus is motivated by the cleft, the second by the focusing adverb. One way of pronouncing each of the examples in (73) uses only one intonational phrase, with nuclear accent (i.e. final pitch prominence) on $[_{\text{NP}}\text{Anna}]$. Still, there is a perceptible marking of the truth-functionally significant difference in the focus associated with *only*.[20] Motivated by data such as this,

[20](73a), where *big* is focused, might exclude Anna's liking small cars; (73b), with *likes* focused, might exclude her loving big cars.

(Jacobs, 1988) develops a metrical theory of post-nuclear focus marking. If such marking is in general possible, (70) might just be a degenerate example in which there is not enough space in the tail to mark prominence in whatever way prominence is marked in the tail (e.g. rhythmically). In this theoretical context, a grammatical analysis of (70) in which the object bears the focus feature would be more palatable.

This line of inquiry is leading us in the direction of a discussion of the phonology and phonetics of focus. This is a different topic from the subject matter of this paper, as well as being a complex one. The question which we can try to answer here is whether it would be possible to make association of focus with focusing adverbs obligatory withing the present theory, should we decide that this is advisable. We do not want to retreat to a theory in which focus semantic values can be used in arbitrary ways, since this would rob the theory of its explanatory power. Fortunately, this is not quite what is called for. In the theory as it presently stands, focus semantic values are interpreted by the operator $\sim$, and nothing else. Since we have given semantically adequate grammatical descriptions of examples with focusing adverbs using this operator, there is no need to modify this part of the theory. Rather, in order to make association with focusing adverbs obligatory, what is required is to enforce LFs of the form (74).

(74)



We could think of (74) as a complex subcategorization frame, which in addition to the syntactic category of the argument, stipulates focus interpretation at the level of the argument, and a certain indexing, one which was allowed but not required in the earlier treatment. Indirectly, this logical form entails the presence of a focus within the argument. It follows from the semantics for $\sim$ that the focus semantic value for its left argument contains an element distinct from the ordinary semantic value of that argument (see the characteristic configuration (32)). Since the focus semantic value of a focus-free phrase is the unit set of its ordinary semantic value, the argument must contain a focus.

What would be the impact of such lexical representations on the general theory? In section 5, I proposed that the theory of focus consists of:

1. Rules describing the phonological interpretating of the feature F.
2. Two-dimensional alternative semantics, defining focus semantic values, with reference to F and ordinary semantic values.
3. Semantic clauses for the operator $\sim$.

4. A rule freely adjoining operators $\sim v_i$ to phrases in LF.

What is being contemplated is allowing additional, lexical sources for $\sim v_i$. This would not affect the generalizations expressed by the second and third items, or the analysis of other constructions discussed in this paper. But it would constitute a weakening of the theory, since a language learner would have the opportunity of learning lexical specifications along the lines of (74) for individual words.

In summary, I feel that the prediction that focus effects should be optional is largely confirmed. However, partially depending on the resolution of the question whether certain overtly non-prominent phrases can be considered grammatically focused, it might be preferable to treat association with focus as obligatory in certain constructions. This can be achieved by lexically stipulating a $\sim$ operator, and a certain indexing of its second argument.

While the intermediate theory just sketched allows for lexical stipulation of focus effects, this does not affect the derivation of focus effects as theorems, i.e. automatic products of the interaction of independently motivated lexical or constructional meanings with focus interpretation. In particular, once a lexical or constructional meaning is fixed, there is no way of blocking the derivation of a focus effect, if one is possible at all. In contrast, a weak theory of focus would allow for a language just like English, where *only* had exactly the lexical semantics I have claimed, but does not associate with focus. The reason is that given a weak theory, the grammar of a language stipulates lexical item by lexical item whether focus-determined information influences interpretation. To turn to a concrete example, Kanerva suggests in his study of focus in Chichewa (which is expressed by phrasing differences which in turn influence phonology) that focus in this language has the same semantic/pragmatic significance as focus in English. (Kanerva, 1989) specifically discusses association with focusing adverbs and the question-answer paradigm. If it is correct that the family of focus effects discussed in section 2 can be demonstrated for Chichewa, the intermediate (as well as the strong) theory can attribute this to the same focus interpretation principle being in force. A weak theory of focus, I believe, could offer no genuine explanation for cross-linguistic clustering of focus effects, assuming that this is a significant generalization. In this sense, the intermediate theory retains a substantial degree of explanatory force.

10 Conclusion

I have argued that intonational focus in English has a uniform semantic import, which can be related to the intuitive notion of contrast withing a set of alternative elements. The key to a uniform interpretation for focus is an interpretation principle which introduces a variable, thought of as a contrasting element or set of contrasting elements. This variable can be anaphoric to a va-

riety of pragmatic and semantic objects, resulting in a variety of focus-sensitive effects, including both discourse effects and sentence-internal association with focus effects. The strong version of the theory of association with focus fulfills the program of (Rooth, 1985, p82): "Ideally, one would like to regard association with focus as a kind of theorem." More precisely, what has the status of a theorem in the strong theory is that focus *can* interact with focusing adverbs such as *only*, with an effect on recursive (in the case of *only*, truth-conditional) semantics. The axioms on which the derivation depends are those which comprise the general theory of focus, together with the lexical semantics of the focusing adverb.

The counterpart of the general hypothesis about association with focus of (Rooth, 1985) is the free parameter theory: association with focus arises when focus has the opportunity of restricting a free variable contributed by some lexical or constructional meaning. We found that association with focus can work this way, but that it can also be the result of a focus-determined filtering of the products of a compositional ambiguity.

The theory brings together the (Rooth, 1985) theory of focus semantics and of association with focus with proposals advocating a contrastive interpretation for focus in discourse, such as (Carlson, 1984) and (Rochemont, 1986). We have also in part justified the term "alternative semantics", since in two of the applications discussed, focus-conditioned scalar implicatures and question/answer paradigm, the contrasting elements were alternative assertions.[21]

[21]In this connection, I would like to point out a connection between alternative semantics and the theory of accent interpretation proposed in (Vardul', 1967), (Vardul', 1977), as summarized in (Keijsper, 1985, p107-108):

> Vardul' proposes (in my terms) that the last accent of a sentence defines a set of projections from among which the projection conveyed by uttering the sentence is chosen. For example, by uttering *The man was smôking* the speaker conveys that he has chosen the projection "The man was smoking" from a set of projections, each member of which pictures the man while he is engaged in something: "The man was working", "The man was sleeping", "The man was reading a book", etc.
>
> By uttering *The mân was smoking* the speaker conveys (in the narrow scope interpretation) that he has chosen the projection "The man was smoking" from a set of projections, each member of which pictures somebody who was smoking: "John was smoking", "The woman was smoking", and so forth.
>
> In this approach, the functioning of accentuation is an example of the principle that the information contained in a message depends on the messages that could have occurred instead of the message that does occur: by accentuation, so it is proposed, the speaker conveys which projections could have occurred at the moment of speaking instead of the one that does occur.

Projections are what I would call semantic vales, in this case propositions. In saying "narrow scope", Keijsper refers to a grammatical description in which the [$_{\text{NP}}$the man] is focused. The passage suggests both the nature of the focus semantic value of a sentence (a set of

Perhaps in contrast to an earlier version, the present theory brings out the fact that there is a significant notion of the scope of a focus, even in a theory where focused phrases are interpreted in situ. Throughout the analysis, the level at which focus was interpreted (in the LF theory, the level at which the $\sim$ operator was adjoined) was a significant dimension of variation. It is convenient to use the term "scope" for this dimension, in agreement with those who actually contemplate scoping focused phrases as a prerequisite to interpretation ((Chomsky, 1976), (von Stechow, 1982)). To the extent that there is a correlation between the scope of the $\sim$ operator and the phonological domain of prominence for a focus, as there surely is to some extent, a theory of focus realization should enforce the correlation. If the $\sim$ operator is present only in LF, it could not serve the purpose of delimiting a phonological domain of prominence. Perhaps the solution is simply that it is present at other levels also, including the input to phonological interpretation.

One thing which has been left out of this paper is an investigation of how alternative semantics is to be put together with a semantics of anaphora and presupposition. We would like to know, since presupposition and anaphora are used in the interpretation of focus. (Rooth, 1991) proposes an integration of two-dimensional alternative semantics with a model-theoretic version of discourse representation theory. Presuppositions could be accommodated, along the lines of Heim's treatment of presupposition in file change semantics ((Heim, 1983)). This might prove to be too mechanical a solution, though. The motivation for alternative semantics as originally conceived has to be rethought in light of the results of the present investigation, and of (Kratzer, 1991). The theory proposed here has the effect of putting the definition of the focus semantic value as a set of alternatives into a subsidiary role; explanatory force resides in the semantics for the focus interpretation operator. Since the semantics for $\sim$ is the only place where focus semantic values are used, and since $\sim$ can introduce reference to a set of alternatives, the motivation for taking $[\![.]\!]^f$ to be a set of alternatives (rather than say an open proposition) is lost. Independently, Kratzer has argued using ellipsis data for a semantic level in which variables are substituted for focused phrases. While she then defines alternative sets, one could consider skipping this step, and defining $\sim$ as an operator which binds focus variables. [22]

propositions), and an important class of applications of focus interpretation, those where the contrasting elements can be viewed as alternative assertions.

[22] In simple examples this would be equivalent to the approach presupposed here, but variables might allow for more complex interactions in examples involving multiple foci. (Krifka, 1991) considers such cases, in a different framework.

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