Association with Focus and Choice Functions

— A Binding Approach *

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Abstract. In a discussion of the scopal properties of focus, Rooth (1996) notes that association with focus, indefinites and in situ *wh*-phrases appear to form a class of island-insensitive phenomena, and suggests that this is the natural consequence of a common semantic property. In this paper, I analyse the hypothesis that this lowest common denominator is an analysis based on choice functions. Generalizing Reinhart's (1994) binding analysis to association with focus, I propose that — similar to the case of indefinites and *wh*-phrases — focus introduces a choice function variable that operates on a contextually given set of alternatives, and gets bound by a coindexed focus-sensitive operator like, for example, the particle *only*. Having shown that this approach accounts for a wide range of data, it is compared to a similar one made in Wold (1996), and, in the light of the discussion of 'association with focus phrase, a possible extension of the analysis is taken into consideration.

Keywords: choice functions, association with focus, island insensitivity

1. Introduction

It is a well-known fact that particles like *only*, *also* or *even* are sensitive to the focus background structure of their syntactic scope in that a difference in the placement of focus results in a difference in truth-conditions, cf. for example (1) vs. (2).

- (1) John only introduced [BILL]_F to Sue.
(= Bill is the only person *x* s.t. John introduced *x* to Sue)
- (2) John only introduced Bill to [SUE]_F.
(= Sue is the only person *y* s.t. John introduced Bill to *y*)

In the relevant literature, this phenomenon is usually referred to as 'association with focus.' Since *only* (being a VP-adjunct) is not adjacent to the focus it is associated with, the obvious challenge is to derive this truth-conditional effect in a compositional way.

* I am grateful to Klaus von Heusinger, Ruth Kempson, Jürgen Pafel, Arnim von Stechow, and an anonymous reviewer for valuable comments on earlier versions of this paper. I'd also like to thank audiences at the conference "Sinn und Bedeutung V", the ESSLI 2001 workshop on "Choice Functions and Natural Language Semantics", and the Tübinger Kolloquium.

In this paper, I want to propose and investigate a binding analysis of association with focus based on choice functions: Focus introduces a choice function variable that operates on a contextually given set of alternatives, and gets bound by a coindexed focus-sensitive operator. It turns out that this way of approaching the syntax and semantics of association with focus not only accounts for a wide range of the relevant data, but also captures the fact that association with focus, indefinites and in situ *wh*-phrases are interrelated in various ways, in especially and probably most importantly that they appear to form a natural class of island-insensitive phenomena (cf. Rooth, 1996).

Before laying down the details of my own proposal in section 3, I will first discuss two prominent previous approaches to the syntax and semantics of association with focus, the movement approach and so-called alternative semantics. Since the main purpose of section 2 is to show that an adequate treatment of association with focus calls for a selective binding approach, I will focus on questions related to the island-insensitivity of association with focus.^{1,2} In section 4, then, the proposed choice function approach is compared to a similar approach developed by Wold (1996), followed by a short discussion of so-called ‘association with focus phrase’ in section 5.

2. Two Approaches to Association with Focus

2.1. FOCUS MOVEMENT

The first approach to association with focus I want to discuss goes back to a proposal made by Chomsky (1976) for contrastive focus and assumes covert focus movement: The focused constituent is covertly moved to the focus-sensitive expression it is associated with. Given binary branching, there are two ways to implement this idea, cf (3): Either the focus *Bill* adjoins to *only* and forms a constituent with it, cf. (3a), or it adjoins to its sister, cf. (3b).

- (3) John only introduced [BILL]_F to Sue.
- a. John [[only [BILL]_F] λ_t₁ [_{VP} introduced *t*₁ to Sue]]
 - b. John only [_{VP} [BILL]_F] λ_t₁ [_{VP} introduced *t*₁ to Sue]]

¹ Cf. von Stechow (1991) and Rooth (1996) for a more comprehensive comparison.

² I also refrain from a discussion of more indirect approaches like ‘association with presupposition’ (but cf. Rooth, 1999, and Fox et al., 2001) or Schwarzschild’s (1997) approach based on ‘felicity conditions’ for utterances. If Beaver and Clark (2000) are right in claiming that a ‘mixed’ approach to association with focus phenomena is called for, this presentational decision is, to a certain extent, justified by restricting the following discussion to focus particles like *only* or *also*.

In the case of (3a), it is immediately clear that the focus particle *only* now has direct access to the focus it is associated with.

This does not hold for (3b), however: Without further assumptions, the moved constituent is simply semantically reconstructed to its base position within VP. For this reason, von Stechow (1981) proposes to interpret the F-Index carried by the moved constituent as triggering the construction of a structured property, i.e., an ordered pair $\langle \alpha, \beta \rangle$ consisting of a focus α and a background β (where $\beta(\alpha)$ is well-formed and denotes the corresponding unstructured property); (3b), then, is represented along the following lines:

$$(4) \quad \textit{only}(\langle \textit{Bill}, \lambda x. \textit{introduced } x \textit{ to Sue} \rangle)(\textit{John})$$

Since *only* now operates on a structured property rather than an unstructured one, it has immediate access to both of its parts, the focus *Bill* as well as the background *being introduced to Sue*. Ignoring its presupposition, the semantics of *only* thus can be defined as follows: If, for any given individual b and any contextually given alternative x to the focus a , $P(x)(b)$ is true, then x must be identical to the focus a .

$$(5) \quad \textit{only}(\langle a, P \rangle)(b) = 1 \text{ iff } \forall x \in \mathbf{alt}(a)(P(x)(b) = 1 \rightarrow x = a).$$

Because of its relatedness to the categorial semantics of *wh*-questions, I'd like to call this variant of the movement approach the 'categorial approach' to association with focus.

Unfortunately, the movement approach seems to face a serious problem. As has already been observed by Anderson (1972) and Jackendoff (1972), association with focus appears not to be subject to well-established constraints on overt as well as covert operator movement like, e.g., the Complex Noun Phrase Constraint (CNPC):

- (6) Dr. Jones only rejected [the proposal that [BILL]_F submitted]
- (7) *[Which student]₁ did Dr. Jones reject [the proposal that t₁ submitted]
- (8) #Dr. Jones rejected [the proposal that most students submitted]
(For most students x : Dr. Jones rejected the proposal that x submitted)

Proponents of the movement approach thus have to conclude that there are at least two kinds of covert movement operations, one obeying so-called island constraints (*wh*-movement and quantifier raising in (7) and (8), respectively) and one that doesn't (focus movement in (6)).

2.2. ALTERNATIVE SEMANTICS

Mainly to avoid this conclusion, Rooth (1985) developed an ‘in situ’ semantics for association with focus that has been labeled ‘alternative semantics’ in von Stechow (1991). The basic idea is roughly as follows: A focused constituent introduces a set of alternatives that, modulo semantic composition, percolates (upward) to the sister node of the focus particle, which in turn is able to retrieve the relevant information.

To implement this idea, Rooth (1985, 1992) postulates the existence of a second dimension of interpretation that computes for any expression α the set of its alternatives. In addition to the usual interpretation function $\llbracket \cdot \rrbracket$ he therefore introduces a recursive focus-sensitive evaluation function $\llbracket \cdot \rrbracket_F$ defined as follows:

- $$(9) \quad \begin{array}{ll} \text{a.} & \llbracket \alpha \rrbracket_F = \{ \llbracket \alpha \rrbracket \} \\ \text{b.} & \llbracket [\alpha]_F \rrbracket_F = \{ u \in D_\tau; \tau = \mathbf{type}(\alpha) \} \\ \text{c.} & \llbracket [\alpha \beta] \rrbracket_F = \{ u; \exists a \in \llbracket \alpha \rrbracket_F, \exists b \in \llbracket \beta \rrbracket_F: u = a(b) \text{ or } u = b(a) \} \end{array}$$

If α is not focused, α does not introduce any alternatives, and therefore its alternative set is simply the singleton set whose only element is α itself, cf. (9a). But if α is focused, it intuitively does introduce alternatives, and therefore its alternative set is identical to the whole domain corresponding to α ’s logical type, cf. (9b), or, alternatively, to a contextually restricted subset. Finally, the interpretation of binary branching: The alternative set corresponding to the mother node is identical to the set of all well-formed function-argument combinations with elements of the alternative sets of the daughter nodes, cf. (9c).

If, for example, the domain of individuals is restricted to Bill, John, and Paul, and the mechanics in (9) are applied to example (3), we get the set of alternatives given in (10).

- $$(10) \quad \llbracket \text{introduced } [\text{Bill}]_F \text{ to Mary} \rrbracket_F = \{ \text{introduced Bill to Mary,} \\ \text{introduced John to Mary, introduced Paul to Mary} \}$$

Having defined for each LF-constituent α the set of its alternatives, the next step is to make these alternatives available to the focus particle *only*. To this effect, Rooth (1992) assumes that an operator $\sim$ together with a context variable Γ_i adjoins to the sister node of *only*, cf. (11b), and Γ_i is taken to be anaphorically related to the context variable C_i which is, by assumption, implicit in the semantics of *only*.

- $$(11) \quad \begin{array}{ll} \text{a.} & \text{John only introduced } [\text{BILL}]_F \text{ to Sue.} \\ \text{b.} & \text{John } [\text{only}(C_i) \llbracket \text{introduced } [\text{Bill}]_F \text{ to Sue} \rrbracket \sim \Gamma_i] \end{array}$$

The interpretation of the ‘squiggle’ operator $\sim$ then has two important effects: Focus is bound by stipulation, cf. (12b), and the interpretation of the contextual restriction C_i is restricted via coindexation with Γ_i to a subset of the set of alternatives of the sister node of *only*, cf. (12c).

- (12) a. $\llbracket [\alpha [\sim \Gamma]] \rrbracket = \llbracket \alpha \rrbracket$
 b. $\llbracket [\alpha [\sim \Gamma]] \rrbracket_F = \{ \llbracket \alpha \rrbracket \}$
 c. Presupposition of $[\alpha [\sim \Gamma]] : \llbracket \Gamma \rrbracket \subseteq \llbracket \alpha \rrbracket_F$

If, finally, *only* is given a semantics along the following lines,

- (13) $\forall x, w: \text{only}_w(C)(\alpha)(x) = 1$ iff $\forall P \in C(P_w(x) = 1 \rightarrow P = \alpha)$.

the correct truth-conditions are derived. Since these mechanics do not refer to movement, no constraints on movement can be violated. As a consequence, so it seems, the assumption that there is only one kind of movement, namely island-sensitive movement, can be maintained.

But, as Kratzer (1991) points out, this impression is in fact wrong. To see this, consider the discourse sequence in (14a), followed by the elliptical construction in (14b). (14b) is a case of VP-ellipsis, and it is commonly assumed that on LF both the antecedent VP and the elided VP are in some sense ‘identical’ (cf., e.g., Sag, 1976); i.e., the LF-representation of (14b) can be considered to be the one in (14c).

- (14) a. What a copycat you are! You went to Block Island because I did. You went to Elk Lake Lodge because I did. And you went to Tanglewood because I did.
 b. I only [went to Tanglewood_F] because you did [e]
 c. I only [went to Tanglewood_F] b. you [went to Tanglewood_F]

If (14c) is interpreted according to the mechanics developed in Rooth (1985, 1992), this results in a set of alternatives containing alternatives which are excluded by the preceding discourse, cf. (15b).

- (15) a. I only [went to Tanglewood_F] b. you [went to Tanglewood_F]
 b. $\llbracket (15a) \rrbracket_F = \{ \text{I went to } x \text{ because you went to } y; \\ x, y \in \{ \text{Block Island, Elk Lake Lodge, Tanglewood} \} \}$

To be more concrete: The proposition that *I went to Tanglewood because you went to Block Island* is clearly not a salient alternative in the context of (14a). In fact, the correct set of alternatives is the one given in (16b), where the instantiations of the F-marked constituents are always parallel. To derive this set of alternatives the F-marked constituent needs to be QRed out of VP, cf. (16a).

- (16) a. I only [Tanglewood_F λt_1 [[went to t_1] b. you [went to t_1]]]

- b. $\llbracket (16a) \rrbracket_F = \{I \text{ went to } x \text{ because you went to } x;$
 $x \in \{\text{Block Island, Elk Lake Lodge, Tanglewood}\}\}$

In general, however, this results in exactly the same violations of island constraints that motivated the development of an in situ semantics for association with focus, cf. (17).

- (17) a. You always contacted every responsible person before me.
 b. I only contacted [the person who chairs [the zoning board]_F] before you did.

Kratzer (1991) therefore proposes to pursue a different, representational variant of alternative semantics, one that was already mentioned in Rooth (1985) and goes back to Jackendoff (1972). This proposal crucially relies on the following two assumptions about F-marking:

- (18) a. All F-marked constituents bear an F-index i , $i \in \mathbb{N}$.
 b. No two constituents bear the same F-index in a given tree.

Substituting F-indices for F-markers is in fact all that is necessary to deal with the problematic cases of VP-ellipsis. Let us suppose that the F-marked expression in the antecedent VP carries an F-index, say F1. In this case, because of the identity condition on VP-ellipsis, the F-marked constituent in the elided VP carries exactly the same F-index F1, cf. (19b). If it is assumed — as Kratzer does — that a focused constituent α_{Fi} is represented by a corresponding focus variable v_i , both occurrences of the focused constituent are represented by exactly the same variable, and, consequently, the correct set of alternatives can be derived without moving the focus out of VP, cf. (19c).

- (19) a. I only [went to Tanglewood_{F1}] because you did [e]
 b. I only [went to Tanglewood_{F1}] b. y. [went to Tanglewood_{F1}]
 c. $\llbracket (19b) \rrbracket_F = \{p; \exists h: p = \llbracket I \text{ [went to } v_1] \text{ b. y. [went to } v_1] \rrbracket^h\}$

This, however, is not yet the end of the story. As Krifka (1991) points out, there are cases of multiple focus in which association with focus behaves selectively, cf. (20).

- (20) a. John only introduced BILL_{F1} to Mary.
 b. John also_(F2) only_(F1) introduced BILL_{F1} to SUE_{F2}.

In the context of (20a), (20b) is understood as ‘it is also true for Sue that Bill is the only person which John introduced to her.’ Thus, the additive particle *also* appears to associate with the prominent focus

on *Sue* whereas the exclusive particle *only* associates with the second occurrence focus on *Bill*.^{3,4}

It is not difficult to see that neither the denotational variant nor the representational variant of alternative semantics is able to cope with examples like (20) without moving the focus *Sue* out of the scope of *only*, the reason simply being that alternative semantics is unselective in nature. However, if the focus is moved out of the scope of the focus particle *only*, this again — as Rooth (1996, 288) showed himself — results in the violation of island constraints, cf. (21).

- (21) a. We only_(F1) recovered [the diary entries [that MARYLIN_{F1} made about John]]
 b. We also_(F2) only_(F1) recovered [the diary entries [that MARYLIN_{F1} made about BOBBY_{F2}]]

This suggests that, in general, neither the denotational nor the representational variant of alternative semantics is able to avoid reference to the kind of movement that motivated its development in the first place: island-insensitive focus movement.

3. A Binding Approach based on Choice Functions

As far as I can see, the previous discussion shows two different things: First, to avoid island-insensitive movement, some kind of in situ analysis is called for. Second, to deal with examples like (21), this analysis needs to be selective by nature. In this section, I propose a selective binding analysis based on choice functions, and I argue that an analysis along these lines is a good starting point to capture the fact that — as the following discussion is intended to show — focus, indefinites, and (in situ) *wh*-phrases are closely related phenomena.

3.1. INDEFINITES, *wh*-PHRASES AND FOCUS

Consider, for example, word order in German. As Lenerz (1977) observes, focused constituents and indefinites are subject to the same

³ *Bill*, being a second occurrence of the focused constituent *Bill* in (20a), apparently lacks a pitch accent. However, as is argued in Krifka (1997), Beaver and Clark (2000) and references therein, there is good evidence from weak pronouns that nevertheless second occurrence expressions (SOEs) are syntactically focused and that this syntactic focus is realized by features other than pitch, e.g. duration or amplitude. Here, and in the following, SOEs are indicated by small caps.

⁴ For a thorough investigation of the syntax and semantics of German focused and unfocused *auch* ('also') as well as a proposal for a unified treatment of both uses, cf. Reis and Rosengren (1997).

or at least similar restrictions: Given the basic word order ‘indirect object (IO) before direct object (DO)’, a focused direct object mustn’t scramble over a non-focused indirect object, cf. (22), and an indefinite direct object mustn’t scramble over a definite indirect object, cf. (23).

- (22) a. ?(weil) er [das BUCH]_{F,DO} [dem Hans]_{IO} gab
 (because) he [the BOOK]_{F,DO} [the Hans]_{IO} gave
 ‘(Because) he gave the book to Hans’
 b. (weil) er [dem Hans]_{IO} [das BUCH]_{F,DO} gab
 (because) he [the Hans]_{IO} [the BOOK]_{F,DO} gave
 ‘(Because) he gave the book to Hans’
- (23) a. ?(weil) er [ein Buch]_{DO} [dem Hans]_{IO} gab
 (because) he [a book]_{DO} [the Hans]_{IO} gave
 ‘(Because) he gave a book to Hans’
 b. (weil) er [dem Hans]_{IO} [ein Buch]_{DO} gab
 (because) he [the Hans]_{IO} [a book]_{DO} gave
 ‘(Because) he gave a book to Hans’

Secondly, it is well known that the property of being island-insensitive is not restricted to association with focus, but can be observed with respect to indefinites, too (cf. already Ross, 1967). In (24), for example, the indefinite *a student* allows for an intermediate reading, where *usually* has wider scope than *a student* and *a student* outscopes the definite complex noun phrase [*the first three proposals that ...*].

- (24) Dr. Svenson usually rejects [the first three proposals [that a student submits]]. (= Usually: if there is a student *x*, then Dr. Svenson rejects the first three proposals that *x* submits.)

In Reinhart (1994, 1997) and Rooth (1996) a similar claim is also made with respect to in situ *wh*-phrases in English, cf. (25a). Surprisingly enough, however, its German counterpart is ungrammatical, cf. (25b).

- (25) a. Tell me who rejected [the proposal [that who submitted]].
 (Tell me about all pairs $\langle x, y \rangle$ such that *x* rejected the proposal that *y* submitted.)
 b. *Sag mir, wer das Papier ablehnte, das wer einreichte.

But, like many other languages, German exhibits a different close connection between *wh*-phrases and indefinites: Most pronominal *wh*-phrases in German — e.g. *wer* (‘who’), *was* (‘what’), *wo* (‘where’) — have a homonymous indefinite counterpart, cf. (26) vs. (27).

- (26) Wen / Was hat Peter empfohlen?
 Who / What has Peter recommended

‘Who/what did Peter recommend?’

- (27) Peter hat wen / was empfohlen.
 Peter has someone / something recommended
 ‘Peter recommended someone/something’

And last but not least, *wh*-phrases, indefinites and focus all relate to the notion of ‘new’ information in one way or another: Whereas indefinites typically (though not exclusively) introduce new discourse referents and *wh*-phrases typically ask for ‘new’ information, it is the focus of a sentence that typically supplies the ‘new’ information asked for.

All these similarities suggest that indefinites, *wh*-phrases, and focus form some sort of natural class of ‘indefinite’ or ‘weak’ phenomena. If this is correct, it should be reflected by a common core in their analysis.

3.2. INDEFINITES, *wh*-PHRASES AND CHOICE FUNCTIONS

Actually, Reinhart (1994, 1997) already made a proposal that goes a good way towards a unified analysis of indefinites, *wh*-phrases, and focus. To account for the island-insensitivity of indefinites and in situ *wh*-phrases (within a minimalist framework) without referring to any kind of island-insensitive movement, Reinhart (1994, 1997) proposes a binding analysis based on choice functions: Both indefinites and *wh*-phrases introduce a choice function variable that (i) operates on the restriction supplied by their complement, cf. (28),

and (ii) gets bound by some c-commanding operator — existential closure in the case of indefinites, a Q-morpheme in the case of in situ *wh*-phrases.⁵ Technically, a choice function is any function whose domain

⁵ The introduction of choice functions into the analysis of indefinites and in situ *wh*-phrases raises a lot of important questions concerning their exact definition in case the complement’s extension is empty (cf. e.g. Winter, 1997, von Stechow, 2000) as well as in intensional contexts (the so-called ‘Donald Duck’ problem; cf. i.a. Reinhart, 1994, von Stechow, 2000, Dekker, this volume), questions concerning the applicability to overtly moved *wh*-phrases (cf. von Stechow, 2000) or definites (cf. von Heusinger, 1997b), and finally questions concerning the binding process (cf. e.g. Reinhart, 1997 vs. Kratzer, 1998). Although, of course, some of these problems

consists of a set of non-empty sets mapping each of these sets to one of its elements, cf. (29).

$$(29) \text{ choice}(f) = 1 \text{ iff } \emptyset \notin \text{Dom}(f) \text{ and } \forall X \in \text{Dom}(f): f(X) \in X.$$

As regards content, a choice function simply chooses an element from a given set. The observed island-insensitivity, then, apparently follows from the assumption that the choice function variable is bound by existential closure or by a Q-morpheme:

(30) Usually, $\exists_f$ Dr. Svenson rejects [the first three proposals [that $f(\text{student})$ submits]]

(31) Tell me who Q_f rejected [the proposal [that $f(\text{person})$ submitted]]

The basic idea therefore is quite parallel to that of alternative semantics: no movement, no violation of movement constraints.

3.3. CHOOSING FROM ALTERNATIVES

Having argued that indefinites, (in situ) *wh*-phrases and (association with) focus form a natural class of ‘weak’ phenomena, and having presented a uniform semantic analysis of indefinites and (in situ) *wh*-phrases based on choice functions, it seems reasonable to consider choice functions as the common core of this class of phenomena, and to try to extend this approach to association with focus.⁶ In the following, I will first give an informal sketch of the basic idea of such an analysis, and then specify its precise semantics.

Following Rooth (1985) and many others, I take it that the notion of introducing alternatives is the basic notion when it comes to focus: Focusing a constituent evokes (the construction of) a set of contextually salient alternatives to this constituent.⁷ In (32), for example, focusing the constituent *Bill* highlights the set of all the people, including Bill, who have or could have been introduced to Mary by John.

carry over to the choice function approach to association with focus proposed in this paper, I can’t enter into a discussion of these matters here for obvious reasons (but cf. e.g. Farkas, 2002, and references therein, for recent discussion).

⁶ This, of course, raises the question why (in situ) *wh*-phrases in German behave island-sensitively, while indefinites and association with focus do not. In Reich (2002b, 2003) it is argued (i) that in German *wh*-phrases should be analysed as functional expressions with an indefinite core, and (ii) that the functional part of *wh*-phrases is subject to movement operations and thus triggers island effects. In a nutshell, the answer is that *wh*-phrases contain an additional island-sensitive component that the semantics of indefinites and association with focus lack.

⁷ For a somewhat different position cf. e.g. Schwarzschild (1997).

(32) John only introduced $[\text{BILL}]_F$ to Mary.

Let me introduce the notation $\text{alt}(\text{Bill})$ as a shorthand for the set of alternatives to Bill (in the relevant context). In Rooth's (1985, 1992) system, this set is made available on a level of interpretation different from the level of interpretation that calculates truth-conditions. In the following, I want to pursue the obvious alternative, namely the hypothesis that the set of alternatives is, in fact, part of the level that calculates truth-conditions. Taking the phrase 'focus introduces a set of alternatives' quite literally, let us assume that the minimal focus on the constituent Bill substitutes the set of alternatives $\text{alt}(\text{Bill})$ for the individual Bill, cf. (33).

(33) John only introduced $\text{alt}(\text{Bill})$ to Mary.

Apparently, this assumption leads to two problems. First, the resulting representation isn't interpretable, since the set $\text{alt}(\text{Bill})$ of alternatives to Bill is not a suitable argument for the predicate *introduce*. Second, we lose the information about Bill.

The solution to both of these problems is rather obvious. In an example like (33) there are, intuitively, at least two things going on: (i) Focus introduces a set of alternatives to Bill, *and* (ii) Bill is chosen from this set and enters into the predication. Since choosing from a given set is exactly what choice functions do, it would seem advisable to model this intuition by making use of exactly this kind of functions. So let us assume that, in fact, a choice function f operates on $\text{alt}(\text{Bill})$, selecting Bill from this set. Let us furthermore assume for reasons that will be clear in a moment that the set $\text{alt}(\text{Bill})$ of alternatives to Bill is the only element within the domain of f , i.e., f is a partial choice function with $\text{Dom}(f) = \{\text{alt}(\text{Bill})\}$ and $f(\text{alt}(\text{Bill})) = \text{Bill}$. If we call this function f_{Bill} , the resulting representation is (34).

(34) John only introduced $f_{\text{Bill}}(\text{alt}(\text{Bill}))$ to Mary.

The problem with the resulting representation is, of course, that the focus particle *only* still has no access to the information triggered by the focus on Bill. Let us therefore assume — just for the moment — along the lines of the categorial approach that the choice function f is moved to the sister of *only*, and a structured proposition consisting of the choice function f_{Bill} and a property of choice functions is generated:

(35) *only*($\langle f_{\text{Bill}}, \lambda f_i. \text{John introduced } f_i(\text{alt}(\text{Bill})) \text{ to Mary} \rangle$)

Given the representation in (35), it is rather straightforward to give a precise semantics for *only* that results in the desired truth-conditions,

cf. (36): If there is a choice function f' with the same domain as f and if $\alpha(f')$ is true, then this choice function is identical to f .

$$(36) \quad \text{only}(\langle f, \alpha \rangle) = 1 \text{ iff } \forall f' (\text{Dom}(f') = \text{Dom}(f) \wedge \alpha(f') \rightarrow f = f').$$

In the case of (35) this is equivalent to saying that if there is a choice function f' that selects an element u from the set of alternatives to Bill so that *John introduced u to Mary* is true, then f' selects Bill.⁸

As long as movement of the focused constituent is assumed to get from (34) to (35), the sketched analysis is, of course, more or less equivalent to the categorial approach as presented in section 2.1. The central claim of this section thus is that the introduction of choice functions into the semantics of association with focus enables us to develop a variant of the categorial approach that does completely without focus movement. The analysis I want to propose is a binding analysis parallel to Reinhart's (1994) analysis of indefinites and in situ *wh*-phrases: Focus introduces a choice function variable (operating on a set of alternatives) that is selectively bound by a coindexed binder like, e.g., the focus particle *only*, cf. (37a).

- (37) a. John only_{F_1} introduced $[\text{BILL}]_{F_1}$ to Mary.
 b. $\text{only}(\langle f_{\text{Bill}}, \lambda f_1. \text{John introduced } f_1(\text{alt}(\text{Bill})) \text{ to Mary} \rangle)$

What needs to be shown, then, is that there is in fact a binding mechanism that gets us from an LF like (37a) to the representation in (37b), and that this mechanism can be defined in a compositional way. This is the task of the following subsection.

3.4. A SELECTIVE BINDING ANALYSIS

The following analysis rests on three sets of assumptions: assumptions about coindexation, assumptions about the interpretation of foci, and finally assumptions about the binding mechanism. Let us start with the assumptions about coindexation.

3.4.1. Coindexation

Following Kratzer (1991), I assume that a focused constituent carries an F-index F_i rather than a simple F-marker F and that no two expressions in a tree bear the same (kind of) F-index. Contrary to her

⁸ Here it is absolutely crucial that the domain of f is in fact minimal in the sense that it only contains the set of alternatives to Bill. If, for example, the domain of f contains another set, say X , then any choice function f' with $f'(\text{alt}(\text{Bill})) = \text{Bill}$, but $f'(X) \neq f(X)$ will falsify the condition in (36). The minimality requirement thus captures the fact that other arguments than $\text{alt}(\text{Bill})$ are simply not relevant for calculating the truth-conditions of (32).

analysis, I further assume that a focus particle carries a binder index Fi ($= \langle Fi, -p \rangle$) which has to be distinguished from the bound index Fi ($= \langle Fi, +p \rangle$) carried by the focus, for only the latter is subject to phonological interpretation (indicated by the feature $[+p]$).

(38) *Assumptions about F-indexing*

- a. There are bound indices Fi as well as binder indices Fi .
- b. No two constituents bear the same (kind of) F-index in a given tree.

A binder index Fi and a bound index Fj are coindexed iff $i = j$. In case of (32) this results in a representation like the one given in (39).

(39) John only_{F1} introduced [BILL]_{F1} to Mary.

3.4.2. *The Interpretation of Focus*

Syntactically, (minimally) focusing a constituent can be conceived of as adjunction of an F-index, cf. (40a). Semantically, the focus Fi is interpreted as a kind of complex generalized skolem function, cf. (40b).⁹

(40) *Interpretation of F-indexed foci*

- a.

$$\begin{array}{c}
 \text{NP} \\
 \swarrow \quad \searrow \\
 \text{F1} \quad \text{NP} \\
 | \quad \triangle \\
 \lambda x.f_1(\mathbf{alt}(x)) \quad \text{Bill}
 \end{array}$$
- b. Let α be a branching node with daughters β and γ , where β dominates only an F-index $Fi = \langle Fi, +p \rangle$, then

$$\llbracket \alpha \rrbracket^w = (\lambda x.f_i(\mathbf{alt}_c(x)))(\llbracket \gamma \rrbracket^w),$$
 where $\mathbf{alt}_c(x) =$ the unique $X \in \{Y; x \in Y\}$ s.t. all and only the elements of X are salient alternatives to x in c .

The focus is interpreted as a generalized skolem function, since it maps an object of type σ to another object of type σ , and it is complex, since the mapping involves two steps: First, the alternative function $\mathbf{alt}_c$ maps the focused constituent x — *Bill* in (40a) — to the set of (in c) salient alternatives to x (an object of type $\langle \sigma, t \rangle$). Then, a choice function (variable) f_i chooses exactly one (arbitrary) element from this set (an object of type σ). In the case of (39) this results in the following, only partly interpreted representation:

⁹ For reasons of readability, I omit in the following the variable assignment g .

(41) John only_{F1} introduced $f_1(\text{alt}_c(\text{Bill}))$ to Mary.

Here it is important to note that the representation of the F-index F_i involves a choice function *variable* f_i rather than a *constant* choice function (like, e.g., f_{Bill}). In this way, the denotation of $f_1(\text{alt}_c(\text{Bill}))$ in (41) depends on the local variable assignment g , and the focus can be bound by a coindexed focus-sensitive operator.

3.4.3. The Binding Mechanism

The central element of the binding analysis is, of course, the binding mechanism itself. Following Heim and Kratzer (1998), I assume that binder indices adjoin to their sister node at LF, i.e., the (partly interpreted) representation in (41) is mapped to (42).¹⁰

(42) only [F1 [John introduced $f_1(\text{alt}_c(\text{Bill}))$ to Mary]]

The crucial question then is: How can we interpret adjoined binder indices of the sort in (42)? Whatever the exact definition looks like, we know from the previous subsection that we want to end up with something like (37b), repeated here as (43), i.e., the binder index F1 maps its complement to the structured proposition consisting of the ‘focus’ f_{Bill} and the ‘background’ $\lambda f_1. \text{John introduced } f_1(\text{alt}_c(\text{Bill})) \text{ to Mary}$.

(43) only($\langle f_{\text{Bill}}, \lambda f_1. \text{John introduced } f_1(\text{alt}_c(\text{Bill})) \text{ to Mary} \rangle$)

The ‘background’ of this structured proposition is simply derived by λ -abstracting over the choice function variable f_1 . The compositional derivation of the ‘focus’ f_{Bill} , however, is somewhat more complicated: To characterize the function f_{Bill} , it is necessary to know its domain (i.e., $\{\text{alt}_c(\text{Bill})\}$), its range (i.e., $\{\text{Bill}\}$), and which argument is mapped to which element in its range (i.e., $f_{\text{Bill}}(\text{alt}_c(\text{Bill})) = \text{Bill}$). But even though the focused constituent is not locally accessible, this information can in fact be locally reconstructed: Suppose f is a choice function such that $(\lambda f_1. \text{John introduced } f_1(\text{alt}_c(\text{Bill})) \text{ to Mary})(f)$ is defined. This is equivalent to saying that the set $\text{alt}_c(\text{Bill})$ is an element of the domain of f . The following definition moreover ensures that the set $\text{alt}_c(\text{Bill})$ is the only element in the domain of f :

(44) $\text{min-ch}(f, P) = 1$ iff $\text{choice}(f) \wedge f \in \text{Dom}(P) \wedge \forall g(\text{choice}(g) \wedge g \in \text{Dom}(P) \rightarrow \text{Dom}(f) \subseteq \text{Dom}(g))$

Given the minimality condition (44), f is one of the $|\text{alt}_c(\text{Bill})|$ -many choice functions mapping the set $\text{alt}_c(\text{Bill})$ (and only this set) to one

¹⁰ To keep things simple, I will also assume, here and in the following, that the subject *John* is syntactically reconstructed to its base position within VP.

of its elements. The next question we are faced with then is: How can we guarantee on the basis of the locally available information that f chooses Bill from $\text{alt}_c(\text{Bill})$ and not, say, Paul or John? What we know for certain is the following: If the background $(\lambda f_1. \text{John introduced } f_1(\text{alt}_c(\text{Bill})) \text{ to Mary})$ is applied to f , then the resulting proposition $(\text{John introduced } f(\text{alt}_c(\text{Bill})) \text{ to Mary})$ is identical to the proposition that $(\text{John introduced Paul to Mary})$, if f chooses Paul; it is identical to the proposition that $(\text{John introduced John to Mary})$, if f chooses John; and it is identical to the proposition that $(\text{John introduced Bill to Mary})$, if f chooses Bill. If we make the reasonable assumption that all these propositions are pairwise distinct,¹¹ then there is a one-to-one mapping between those propositions and the relevant choice functions f_{Bill} , f_{John} , and f_{Paul} . Thus, to guarantee that f is in fact identical to f_{Bill} , it is sufficient to somehow state the following condition on f : The proposition in (45a) — which results from applying the ‘background $(\lambda f_1. \text{John introduced } f_1(\text{alt}_c(\text{Bill})) \text{ to Mary})$ to f — has to be identical to the proposition in (45b).

- (45) a. *John introduced $f(\text{alt}_c(\text{Bill}))$ to Mary*
 b. *John introduced Bill to Mary*

- (46) only [F1 [John introduced [Bill]_{F1} to Mary]]

It is clear, however, that not only the proposition in (45a), but also the proposition in (45b) can be derived on the basis of the sister node γ of the binder index F1 (indicated by bold square brackets in (46)) — we just have to ignore the (bound) F-index F1 on *Bill*. Technically, this can be done by ‘telling a given interpretation function $\llbracket \cdot \rrbracket$ to ignore every (bound) F-index F1 — and only this F-index — within its scope:

- (47) ‘Modifying’ a given interpretation function $\llbracket \cdot \rrbracket$
 Let $\llbracket \cdot \rrbracket$ be any arbitrary function from the set $\mathcal{F}$ of all possible LF-structures into the set $\mathcal{D}$ of all possible denotations. Then $\llbracket \cdot \rrbracket_{Fi}$ is the unique function from $\mathcal{F}$ into $\mathcal{D}$ such that:
 i. $\llbracket \alpha_{Fi} \rrbracket_{Fi} = \llbracket \alpha \rrbracket$, and
 ii. $\llbracket \mu \rrbracket_{Fi} = \llbracket \mu \rrbracket$ for all $\mu \in \mathcal{F}$ that carry no index Fi .

Putting everything together, the choice function f_{Bill} can now be locally reconstructed as a definite description restricted by two conditions: f_{Bill} is the unique choice function f such that (i) f is minimally defined with respect to $\lambda f_1. \llbracket \gamma \rrbracket$, and that (ii) applying $\lambda f_1. \llbracket \gamma \rrbracket$ to f results in the

¹¹ Without further assumptions, this analysis apparently cannot cope with examples involving hyperintensionality. Since this is a general problem of the model this analysis is couched in, I won’t enter into a discussion of this issue here.

same proposition that we get, if we simply ignore the (bound) F-index F_1 when we interpret γ (i.e., $(\lambda f_1. \llbracket \gamma \rrbracket)(f) = \llbracket \gamma \rrbracket_{F_1}$), cf. definition (48).

(48) *Interpretation of adjoined binder indices F_i*

Let α be a branching node with daughters β and γ , where β dominates only an F-index $F_i = \langle F_i, -p \rangle$, then

$$\llbracket \alpha \rrbracket^w = \langle \iota f [\mathbf{min-ch}(f, \lambda f_i. \llbracket \gamma \rrbracket) \wedge (\lambda f_i. \llbracket \gamma \rrbracket)(f) = \llbracket \gamma \rrbracket_{F_i}], \lambda f_i. \llbracket \gamma \rrbracket \rangle.$$

According to (48), the logical form in (37a) is now in fact mapped to (37b) without making reference to any kind of focus movement, cf. (49), and is finally interpreted along the lines of (36).¹²

- (49) a. John only_{F_1} introduced $[\mathbf{BILL}]_{F_1}$ to Mary.
 b. *only*($\langle f_{\mathbf{Bill}}, \lambda f_1. \text{John introduced } f_1(\mathbf{alt}_c(\mathbf{Bill})) \text{ to Mary} \rangle$)

To keep things simple, I made the assumption that the sister node of the focus particle *only* is of type t . However, since *only* is a VP-adjunct, this is not necessarily the case.¹³ Moreover, in examples like (50) there are good reasons to assume that *only* adjoins to the DP *Peter*.¹⁴

- (50) $[\text{Nur}_{F_1} \text{PEter}_{F_1}]$ hat ein Buch gekauft.
 $[\text{only}_{F_1} \text{PEter}_{F_1}]$ did a book buy
 ‘Only PEter bought a book’

So the question emerges whether the mechanics developed so far for sisters of type t can be generalized to sisters of arbitrary conjoinable type. By using well-known techniques, this can of course be easily done: Suppose *only* adjoins to an expression γ of type $\langle \sigma, t \rangle$ and P is a variable of type σ , then simply replace every occurrence of $\lambda f_i. \llbracket \gamma \rrbracket$ in definition (48) with $\lambda f_i. \llbracket \gamma \rrbracket(P)$, and $\llbracket \gamma \rrbracket_{F_i}$ with $\llbracket \gamma \rrbracket_{F_i}(P)$; finally λ -abstract over the variable P (resulting in $\lambda P. \langle \dots \lambda f_i. \llbracket \gamma \rrbracket(P) \dots, \lambda f_i. \llbracket \gamma \rrbracket(P) \rangle$).

3.5. SOME CENTRAL PROPERTIES

Having presented the technical details of the choice function analysis proposed here, I now want to outline some of its most central properties.

First of all, and not very surprisingly, the proposed semantics predicts island-insensitivity of association with focus. The reason for that is exactly the same as it is in the case of indefinites and *wh*-phrases

¹² It should be noted here that the structured proposition constructed via definition (48) is always immediately destroyed by the focus-sensitive particle to which the binder index originally belongs. In this way, complicating projection principles for structured objects, as stipulated in Krifka (1991), are avoided.

¹³ In fact this is only possible under the VP-internal subject hypothesis.

¹⁴ But cf. also the discussion in Jacobs (1983), Buring and Hartmann (2001).

in Reinhart’s approach: Since the analysis makes no use of movement operations, no constraints on movement can be violated.

The second issue I’d like to discuss here concerns the analysis of so-called ‘free focus, i.e., constructions in which no possible binder seems to be present, cf. for example (51a). If we apply the mechanics developed so far, the translation of (51a) results in something like (51b). But since the choice function f_1 is not bound, the truth-conditions of (51b) depend on the context (i.e., the local variable assignment g), and this is certainly not true for (51a).

- (51) a. John introduced $[BILL]_{F_1}$ to Mary.
 b. *John introduced $f_1(alt_c(Bill))$ to Mary.*

To derive the correct truth-conditions, even so-called ‘free foci’ need to be bound by some covert operator. Actually, this has already been argued for in Jacobs (1984) and is known under the label ‘the relational approach to association with focus.’ To be specific, Jacobs proposes that ‘free foci’ are bound by focus-sensitive operators like **assert** or **ask** that indicate the mood of the sentence, cf. (52).¹⁵

- (52) a. **assert** F_1 [John introduced $f_1(alt_c(Bill))$ to Mary]
 b. **assert**($\langle f_{Bill}, \lambda f_1. John\ introd. f_1(alt_c(Bill))\ to\ Mary \rangle$)

Strictly speaking, it is a bit sloppy to say that ‘free foci’ are *bound* by covert operators in Jacobs’ proposal, for he assumes a categorial movement approach, and this kind of approach allows, at least in principle, an arbitrary number of focus-sensitive expressions to access one and the same focus. This may be welcome with respect to examples like (53a),¹⁶ but in general this property seems to lead to too many non-existent readings.

- (53) a. John even $_{F_1}$ only $_{F_1}$ introduced $[BILL]_{F_1}$ to Sue.
 b. *John even [F_1 [only [F_1 [introduced $[BILL]_{F_1}$ to Sue]]]]
 c. John [even only] F_1 [introduced $[BILL]_{F_1}$ to Sue]

In alternative semantics this consequence is avoided by stipulating that retrieving alternatives binds focus. Within the semantics proposed here, on the other hand, a bound focus is not available for further interpretation without further stipulations. This is simply because the interpretation of adjoined binder indices involves λ -abstraction over the choice-function variable introduced by the focus, and another attempt to bind the same variable necessarily leads to vacuous binding. Conse-

¹⁵ In Reich (2002b, 2003) it is argued that this notion needs to be generalized to other rhetorical relations like, e.g., **contrast** and **answer**.

¹⁶ Cf. also Schwarzschild (1997) for another interesting case.

quently it is predicted that *even* and *only* in an example like (53a) do not ‘share’ their focus, but that *even* is in some sense parasitic on *only*, cf. (53c), as proposed e.g. in von Stechow (1991).

3.6. TWO PROBLEMS RECONSIDERED

Having illustrated the details of the choice function analysis and its most basic properties, it remains to be shown that this approach is able to deal with the problems outlined in section 2.2.

3.6.1. *VP-Ellipsis*

Since the assumptions about F-indexing are an extension of those assumed in Kratzer’s approach, it comes as no surprise that Kratzer’s Tanglewood example is handled correctly. Since both instances of the focused expression *Tanglewood* (TW) carry the same F-index after copying, identical choice-function variables are introduced which finally results in a binding effect, cf. (54).

- (54) a. only [F1 [I [went to TW_{F1}] because you did [e]]]
 b. only [F1 [I [went to TW_{F1}] because you [went to TW_{F1}]]]
 c. *only*($\langle f_{TW}, \lambda f_1. \text{I went to } f_1(\mathbf{alt}_c(TW)) \text{ because you went to } f_1(\mathbf{alt}_c(TW)) \rangle$)

3.6.2. *Selective Association with Focus*

Since the proposed analysis has a mechanism for coindexation at its disposal, it is also to be expected that instances of selective binding as in (56) (in the context of (55)) are treated correctly.

- (55) John only introduced BILL_{F1} to Mary.
 (56) John also_{F2} only_{F1} introduced BILL_{F1} to SUE_{F2}.

But it needs some calculation to see this. To avoid unnecessary complications, let us again assume the VP-internal subject hypothesis, and start with the logical form given in (57).

- (57) also [F2 [only [F1 [John introduced Bill_{F1} to Sue_{F2}]]]]

According to (48) (57) is interpreted as indicated in (58).

- (58) *also*($\langle \iota f[\mathbf{min}\text{-ch}(f, \lambda f_2. \llbracket \alpha \rrbracket) \wedge ((\lambda f_2. \llbracket \alpha \rrbracket)(f) = \llbracket \alpha \rrbracket_{F2}), \lambda f_2. \llbracket \alpha \rrbracket] \rangle$),
 where $\alpha = \text{only [F1 [John introduced Bill}_{F1} \text{ to Sue}_{F2}]]$.

To figure out what exactly (58) means, we need a semantics for *also* and we need to calculate $\llbracket \alpha \rrbracket$ and $\llbracket \alpha \rrbracket_{F2}$. Let’s start with $\llbracket \alpha \rrbracket$. According to (48) $\llbracket \alpha \rrbracket$ is mapped to (59).

$$(59) \text{ only}(\langle \iota g[\mathbf{min-ch}(g, \lambda f_1. \llbracket \gamma \rrbracket) \wedge ((\lambda f_1. \llbracket \gamma \rrbracket)(g) = \llbracket \gamma \rrbracket_{F_1}), \lambda f_1. \llbracket \gamma \rrbracket) \rangle, \\ \text{where } \gamma = \text{John introduced Bill}_{F_1} \text{ to Sue}_{F_2}.$$

Since $\llbracket \gamma \rrbracket = \text{John introduced } f_1(\mathbf{alt}_c(\text{Bill})) \text{ to } f_2(\mathbf{alt}_c(\text{Sue}))$ and $\llbracket \gamma \rrbracket_{F_1} = \text{John introduced Bill to } f_2(\mathbf{alt}_c(\text{Sue}))$, we know that the definite description in (59) is identical to f_{Bill} and (59) is thus reduced to (60).

$$(60) \text{ only}(\langle f_{\text{Bill}}, \lambda f_1. \text{John intr. } f_1(\mathbf{alt}_c(\text{Bill})) \text{ to } f_2(\mathbf{alt}_c(\text{Sue})) \rangle)$$

Similarly, $\llbracket \alpha \rrbracket_{F_2}$ is interpreted as indicated in (61):

$$(61) \text{ only}(\langle \iota g[\mathbf{min-ch}(g, \lambda f_1. \llbracket \gamma \rrbracket_{F_2}) \wedge ((\lambda f_1. \llbracket \gamma \rrbracket_{F_2})(g) = \llbracket \gamma \rrbracket_{F_2, F_1}), \\ \lambda f_1. \llbracket \gamma \rrbracket_{F_2}) \rangle, \text{ where } \gamma = \text{John introduced Bill}_{F_1} \text{ to Sue}_{F_2}.$$

Again, since $\llbracket \gamma \rrbracket_{F_2} = \text{John introduced } f_1(\mathbf{alt}_c(\text{Bill})) \text{ to Sue}$ and $\llbracket \gamma \rrbracket_{F_2, F_1} = \text{John introduced Bill to Sue}$, we know that the definite description in (61) is likewise identical to f_{Bill} , and that (61) is reduced to (62).

$$(62) \text{ only}(\langle f_{\text{Bill}}, \lambda f_1. \text{John introduced } f_1(\mathbf{alt}_c(\text{Bill})) \text{ to Sue} \rangle)$$

Because of (60) and (62) we now know that the definite description in (58) is identical to f_{Sue} , and that (58) is equivalent to (63).

$$(63) \text{ also}(\langle f_{\text{Sue}}, \lambda f_2. \text{only}(\langle f_{\text{Bill}}, \lambda f_1. \text{John introduced } \\ f_1(\mathbf{alt}_c(\text{Bill})) \text{ to } f_2(\mathbf{alt}_c(\text{Sue})) \rangle) \rangle)$$

Given a ‘standard’ semantics for *also*, (63) derives the correct truth-conditions. This concludes the discussion of the central properties of the proposed choice function approach to association with focus.

4. A Comparison to Wold (1996)

Manfred Krifka and an anonymous reviewer called my attention to a proposal of Wold (1996) that bears some resemblance to the analysis proposed in section 3: Both analyses are motivated by the same set of data, and both are selective binding approaches. They differ however in the way the binding analysis is implemented: Whereas the proposal in the previous section is based on choice functions, the one in Wold (1996) is based on partial variable assignments. Consider (64).

$$(64) \text{ John only}_1 \text{ introduced BILL}_{F_1} \text{ to Sue.}$$

As in the previous proposal the focus-sensitive particle *only* and the focused constituent *Bill* are coindexed. In contrast to the previous proposal, however, the focused constituent neither introduces a set of alternatives nor a choice function or skolem function, but is interpreted

like a pronoun, if the F-index is ‘old’ (i.e., is an element of the domain of the local variable assignment g), and as if it were not focused, if the F-index is ‘new’, cf. (65).

$$(65) \quad \llbracket Bill_{F1} \rrbracket^g = \begin{cases} g(1) & \text{if } 1 \in \text{Dom}(g), \\ Bill & \text{if } 1 \notin \text{Dom}(g). \end{cases}$$

Apparently, the new/old condition on variable assignments is the counterpart to the modification of an interpretation function defined in section 3. To avoid a pronominal interpretation of the focused constituent, the F-index F1 needs to be bound by a focus-sensitive particle like *only* (or a covert operator in case of so-called ‘free’ focus). As regards content, Wold (1996) basically adopts the semantics for *only* proposed in Rooth (1985, 1992), cf. (66b), but gives a different derivation.

$$(66) \quad \begin{array}{ll} \text{a.} & \llbracket only_1 \phi \rrbracket^g \text{ defined only if } 1 \notin \text{Dom}(g); \text{ if defined:} \\ \text{b.} & \llbracket only_1 \phi \rrbracket^g(w) = 1 \text{ iff } \forall p \in C(p(w) = 1 \rightarrow p = \llbracket \phi \rrbracket^g), \\ & \text{where } C = \{\llbracket \phi \rrbracket^{g \cup \{1, x\}}; x \in D\}. \end{array}$$

Suppose we interpret (64), and start with the empty variable assignment $g = \emptyset$. Ignoring *only*₁ for the moment, $\llbracket \cdot \rrbracket^\emptyset$ interprets the focused constituent $Bill_{F1}$ as if it were not focused, since the index 1 is not an element of the domain of $\emptyset$. If, however, the domain of $\emptyset$ is extended to include the index 1, and 1 is mapped to u , then $Bill_{F1}$ is interpreted as u and the proposition *John introduced u to Sue* is derived. By quantifying over all possible ‘index 1 extensions’ of the given variable assignment g , it is thus possible to derive the set C consisting of all and only the propositions of the form *John introduced u to Sue*, where u is some individual of type e . The interpretation of *only* then states that the only ‘index 1 extension’ in C which is true is the same proposition that we get if we ignore the F-index F1 (i.e., if we don’t extend g by 1).

Despite apparent similarities — both proposals are binding analyses based on coindexation and a mechanism that makes it possible to ignore particular foci —, there are also important differences with both theoretical and empirical consequences. As Krifka (1996) points out, Wold’s (1996) analysis, even though it is somewhat stronger, is still a variant of Rooth’s alternative semantics, for the information about the focused constituent is not accessible at the level of the focus binder *only*. As a consequence, this analysis makes it impossible to express non-existent verbs like *tolfed* (cf. the discussion in Rooth, 1996), but, on the other hand, makes it also impossible to express certain necessary restrictions on the set of alternatives (cf. the discussion of the Zimmermann example in von Stechow, 1991). Exactly the opposite is the case for the choice function approach proposed in this paper.

It is also quite informative to have a somewhat closer look at the derivation of alternative sets in Wold's analysis. As I have already mentioned above, the interpretation of the focused constituent makes no reference to the notion of alternatives at all, but the relevant set of propositions is — modulo pronominal interpretation of the focus — exclusively derived at the level of *only* (or, more precisely, its index 1): $C = \{\llbracket \phi \rrbracket^{g \cup \{ \langle 1, x \rangle \}}; x \in D\}$, where ϕ is the sister of *only* at LF. But since in general only a real subset C' of C — in (64) by assumption the set $\{John\ introduced\ x\ to\ Sue; x \in \{John, Bill, Paul\}\}$ — is contextually relevant, the question arises of how to restrict the set C to the relevant alternatives. The easiest way to do this is, I think, to restrict D to some contextually given set $A \subset D$, and to stipulate that $\llbracket \phi \rrbracket^g \in C_A = \{\llbracket \phi \rrbracket^{g \cup \{ \langle 1, x \rangle \}}; x \in A\}$ (just to ensure that Bill is in fact one of the relevant alternatives). Technically, this seems to work. The important question to be asked now is the following: Is A given independently by some pragmatic mechanism, or is it determined 'online' as a set of *alternatives to* the focused constituent Bill? To put it somewhat differently: Is A based on an asymmetric relational notion or not? If it is, then it is necessary to refer to the focused constituent at some level during the interpretational process. This, however, is impossible within Wold's (1996) approach (even though it is part of Rooth's system). As is clear from my own analysis, I intuitively tend towards an asymmetric relational conception of alternative sets, but this matter certainly deserves more serious empirical investigation.

To conclude the comparison, I want to hint at a possible problem in Wold's approach that concerns the treatment of second occurrence expressions. As Wold (1996) shows in great detail, it is essentially no problem to deal with structures like (68) that show selective binding.

(67) John $only_1$ introduced $BILL_{F1}$ to Mary.

(68) John $also_2$ $only_1$ introduced $BILL_{F1}$ to SUE_{F2} .

But the analysis rests on one crucial assumption: The indices 1 and 2 have to be 'unknown' to the variable assignment g relative to which (68) is interpreted — otherwise the interpretation results in a presupposition failure, cf. (66a).¹⁷ In the context of (67), then, the F-index on *Bill* needs to be changed to an index different from 1 (and 2). Again, this is no problem technically. But what does it mean for a focused constituent to be a second occurrence expression? And how is phonology to know that it is to interpret the F-index on a second occurrence expression differently than an F-index on first occurrence expressions? Within a

¹⁷ The presupposition in (66a) ensures that there is a way to interpret the focused constituent as being unfocused.

selective binding approach the most straightforward answer to these questions is, I think, that (i) a second occurrence expression is simply a complete copy of its first occurrence, including its F-index, and that (ii) old indices are mapped to a different representation than new ones. This, however, is not a possible answer within Wold's (1996) analysis.

5. 'Association with Focus Phrase'

In the last part of this paper, I want to outline a possible extension of the choice function analysis presented in section 3 that deals with a problem that is known under the label 'association with focus phrase'. Building on work done by Steedman (1991) and Drubig (1994), Krifka (1996) presents a semantic argument that suggests that in an example like (69) *only* in fact associates with the complex noun phrase *the woman who introduced Bill to John* rather than with the focused constituent embedded within this island for operator movement. In Drubig (1994) complex noun phrases (and other comparable islands) in such a configuration are called 'focus phrase' (FP).

(69) Sam only talked to [the woman who introd. BILL_F to John]_{FP}

Krifka (1996) illustrates his argument with the movement approach to association with focus. Suppose that Mary introduced Bill to John and Tim to John, and that Sam only talked to Mary. In this context (69) is intuitively true, but it is predicted to be false relative to the semantics of *only* proposed in section 2.1, cf. (70) with $\text{alt}(Bill) = \{Bill, Tim\}$.

(70) $\llbracket \text{only} \rrbracket^w(\langle Bill, \lambda x. \text{Sam talked to the woman who introduced } x \text{ to John} \rangle) = 1$ iff $\forall y \in \text{alt}(Bill)((\text{Sam talked to the woman who introduced } y \text{ to John})(w) = 1 \rightarrow y = Bill)$

Although alternative semantics uses a different semantics for *only* (a semantics that compares intensions rather than extensions, cf. section 2.2), it is nevertheless subject to exactly the same objection, cf. (71), since there is a one-to-one mapping from the set of alternatives introduced by the focus *Bill* to the restrictor *C* of *only*.

(71) $\llbracket \text{only} \rrbracket^w(C)(\text{Sam talked to the woman who introduced Bill to John}) = 1$ iff $\forall p \in C(p(w) = 1 \rightarrow p = \text{Sam talked to the woman who introduced Bill to John})$, where $C = \{\text{Sam talked to the woman who introduced Bill to John}, \text{Sam talked to the woman who introduced Tim to John}\}$

5.1. KRIFKA (1996): ASSOCIATION WITH FOCUS PHRASE

Krifka (1996) concludes from this discussion that there is something real to Drubig’s distinction between ‘focus phrase’ and ‘focus’, and that the focus phrase *the woman who introduced Bill_F to John* associates with *only* by island-sensitive covert operator movement, cf. (72).¹⁸

$$(72) \text{ only [the w. who intr. Bill}_F \text{ to John]}_{FP} \lambda t_1 [\text{Sam talked to } t_1]$$

On the other hand, Krifka also observes that — first — the focus *Bill* can occur arbitrarily deep within FP, cf. (73),

$$(73) \text{ Sam only talked to [the man who mentioned [the woman who introduced Bill}_F \text{ to John]}]_{FP}$$

and — second — that the set of alternatives corresponding to FP is determined by its internal linguistic structure: In (72), for example, it is the set $\{\text{the woman who introduced } x \text{ to Bill}; x \in \text{alt}(\text{Bill})\}$. This suggests that the focus *Bill* associates with the focus phrase FP by some island-insensitive mechanism, and that it is linked to the focus particle *only* only in an indirect way. Krifka (1996) assumes that the mechanism in question is alternative semantics. Within alternative semantics the simplest way to interpret (72) is via the condition in (74a).

$$(74) \begin{aligned} & \llbracket \text{only [FP } \phi] \rrbracket^w = 1 \text{ iff} \\ & \text{a. } \forall y \in \llbracket \text{FP} \rrbracket_F (\llbracket \phi \rrbracket^w(y(w)) = 1 \rightarrow y = \llbracket \text{FP} \rrbracket) \\ & \text{b. } \forall y \in \llbracket \text{FP} \rrbracket_F (\llbracket \phi \rrbracket^w(y(w)) = 1 \rightarrow y(w) = \llbracket \text{FP} \rrbracket^w) \\ & \text{where } \llbracket \phi \rrbracket = \lambda w \lambda x. \text{Sam talked to } x \text{ in } w, \llbracket \text{FP} \rrbracket_F = \{\lambda w. \text{the woman who introduced Bill to John in } w, \lambda w. \text{the woman who introduced Tim to John in } w\}, \text{ and } \llbracket \text{FP} \rrbracket = \lambda w. \text{the woman who introduced Bill to John in } w. \end{aligned}$$

Since the meaning rule for *only* in Krifka (1996) somewhat blurs the distinction between extensions and intensions, it is at first glance not quite clear whether it has to be interpreted as the condition in (74a) comparing the intensions y and $\llbracket \text{FP} \rrbracket$, or as the condition in (74b) comparing their extensions. But if one has a closer look at it, it becomes evident that *only* must be interpreted along the lines of (74b): Since there is a one-to-one mapping from the set of alternatives introduced by the focus *Bill* to the set $\llbracket \text{FP} \rrbracket_F$, only the condition in (74b) predicts the correct truth-conditions. This is somewhat unexpected, because in general *only* quantifies over intensions rather than extensions (cf. for

¹⁸ The LF in (72) is, again, simplified by assuming that the subject is syntactically reconstructed to a position within VP.

example the discussion in Rooth, 1985), and may suggest that the observation made in Krifka (1996) is an epiphenomenon of the semantics of determiners as proposed in von Stechow (1997a, 1998).

5.2. AN ALTERNATIVE: ASSOCIATION WITH FOCUS

Krifka's (1996) analysis of (69) is apparently hybrid in that it assumes two different concepts related to focus — 'focus' and 'focus phrase' — each of which corresponds to a different association type: Whereas association with focus phrase is a purely syntactic notion and involves island-sensitive FP-movement, association (of focus phrase) with focus is primarily a semantic concept and is island-insensitive.

As an alternative to Krifka's proposal, I finally want to outline a possible extension of the choice function approach presented in section 3 that does without the notion of 'focus phrase'. Suppose that in (69) the complex noun phrase *the woman who introduced Bill_F to John* is focused and associates with *only*, cf. (75).¹⁹

(75) Sam only_{F1} talked to [the woman who introd. BILL_{F2} to John]_{F1}

In this case, the embedded focus *Bill_{F2}* cannot associate with *only*. But — as we saw in section 3.5 — every focus needs to be bound. Since the alternatives to the complex noun phrase depend on its internal focus structure, and since the (bound) focus F1 introduces an alternative function *alt*, it seems reasonable to assume that it is in fact the bound focus F1 that binds the noun phrase internal focus F2 (cf. also Rooth, 1996, for a similar proposal). Given this assumption, (75) is assigned an LF along the lines of (76).

(76) only [F1 [Sam talked to [F2 [the woman ... BILL_{F2} to John]]_{F1}]]

Since until now the alternative function *alt_c* is not sensitive to linguistic context, it is clear that this function needs to be generalized. To give a concrete example of such a generalization, let us first interpret the internal structure of the complex noun phrase. According to (48), this results in a structured individual concept as indicated in (77).

(77) $\llbracket \text{F2 [the woman that introduced BILL}_{\text{F2}} \text{ to John}] \rrbracket^w =$
 $\langle f_{\text{Bill}}, \lambda f_2 \lambda w. \text{the woman}_w \text{ that introd.}_w f_2(\text{alt}_c(\text{Bill})) \text{ to John} \rangle.$

An alternative to this structured individual concept is, of course, every structured individual concept that is identical in 'background' but

¹⁹ Structures of this kind are easily interpreted by phonology, cf. Schwarzschild (1999) and Reich (2003).

differs in ‘focus’. The relevant definition thus is the following (where $\pi_2(\llbracket \alpha \rrbracket^w)$ is the ‘background’ of $\llbracket \alpha \rrbracket^w$):

$$(78) \quad \text{alt}(\llbracket \alpha \rrbracket^w) = \begin{cases} \text{alt}_c(\llbracket \alpha \rrbracket^w) & \text{if } \llbracket \alpha \rrbracket^w \text{ is unstructured,} \\ \{\langle f, \pi_2(\llbracket \alpha \rrbracket^w) \rangle; \text{min-ch}(f, \pi_2(\llbracket \alpha \rrbracket^w))\} & \text{else.} \end{cases}$$

If the set of contextually salient alternatives to *Bill* is the set $\{Bill, Tim\}$, then the set of alternatives to the structured individual concept in (77) is set A in (79).

$$(79) \quad A = \{ \langle f_{\text{Bill}}, \lambda f_2 \lambda w. \text{the woman}_w \text{ that } \dots f_2(\text{alt}(Bill)) \text{ to John} \rangle, \\ \langle f_{\text{Tim}}, \lambda f_2 \lambda w. \text{the woman}_w \text{ that } \dots f_2(\text{alt}(Bill)) \text{ to John} \rangle \}$$

(76) is then interpreted as (80), where f is the unique choice function defined on $\{A\}$ so that the proposition $\lambda w. \text{Sam talked}_w \text{ to } f(A)$ is identical to the proposition $\lambda w. \text{Sam talked}_w \text{ to } \langle f_{\text{Bill}}, \lambda f_2 \lambda w. \text{the woman}_w \text{ that introduced}_w f_2(\text{alt}(Bill)) \text{ to John} \rangle$.

$$(80) \quad \llbracket \text{only} \rrbracket^w(\langle f, \lambda f_1 \lambda w. \text{Sam talked}_w \text{ to } f_1(A) \rangle)$$

Here we encounter a small technical problem: The predicate *talk to* is defined for unstructured objects of type e , but not for structured individual concepts. The solution is, of course, to destroy the structure of the structured individual concept again, cf. definition (80).

$$(81) \quad \text{If } \llbracket \text{Pred} \rrbracket^w \text{ is a function of type } \langle e, \tau \rangle, \tau \text{ some arbitrary type,} \\ \text{and } \llbracket \alpha \rrbracket^w \text{ is a structured individual concept, then } \llbracket \text{Pred } \alpha \rrbracket^w = \\ \llbracket \text{Pred} \rrbracket^w(((\pi_2(\llbracket \alpha \rrbracket^w))(\pi_1(\llbracket \alpha \rrbracket^w)))(w)) =: \llbracket \text{Pred} \rrbracket^w((\downarrow \llbracket \alpha \rrbracket^w)(w)).$$

Because of (81) we know that the proposition $\lambda w. \text{Sam talked}_w \text{ to } \langle f_{\text{Bill}}, \lambda f_2 \lambda w. \text{the woman}_w \text{ that introduced}_w f_2(\text{alt}(Bill)) \text{ to John} \rangle$ is identical with $\lambda w. \text{Sam talked}_w \text{ to the woman}_w \text{ that introduced}_w \text{ Bill to John}$, and that f chooses $\langle f_{\text{Bill}}, \lambda f_2 \lambda w. \text{the woman}_w \text{ that introduced}_w f_2(\text{alt}(Bill)) \text{ to John} \rangle$ from A . Thus (80) is equivalent to (82):

$$(82) \quad \llbracket \text{only} \rrbracket^w(\langle f_{\langle f_{\text{Bill}}, \lambda f_2 \dots \rangle}, \lambda f_1 \lambda w. \text{Sam talked}_w \text{ to } f_1(A) \rangle)$$

One question remains to be answered: How do we interpret *only*? If *only* is interpreted along the lines of (36), section 3.3, i.e. by comparing the relevant choice functions $f_{\langle f_{\text{Bill}}, \lambda f_2 \dots \rangle}$ and $f_{\langle f_{\text{Tim}}, \lambda f_2 \dots \rangle}$ which *only* quantifies over, then we still derive the wrong truth-conditions, for each of these functions corresponds to exactly one element in the set $\{Bill, Tim\}$ of alternatives to Bill. We know, however, from the discussion of Krifka’s (1996) proposal that, in this case, we have to compare extensional rather than intensional objects. Roughly speaking, the relevant condition is as follows: If there is a choice function f' besides f such

that the proposition $(\lambda w'. Sam \text{ talked}_{w'} \text{ to } f'(A))$ is true in w , then f and f' map their argument(s) to the same extension in w , cf. (83).

$$(83) \quad \llbracket \text{only} \rrbracket^w(\langle f, \lambda f_i. \llbracket \alpha \rrbracket \rangle) = 1 \text{ iff } \forall f' \forall A [\text{Dom}(f') = \text{Dom}(f) \wedge A \in \text{Dom}(f) \wedge (\lambda f_i. \llbracket \alpha \rrbracket)(f')(w) = 1 \rightarrow (\downarrow f'(A))(w) = (\downarrow f(A))(w)].$$

In the case of (82) this basically means the following: If the proposition $(\lambda w'. Sam \text{ talked}_{w'} \text{ to } f_{\langle f_{Tim}, \lambda f_2 \dots \rangle}(A))$ — which is identical with the proposition $(\lambda w'. Sam \text{ talked}_{w'} \text{ to the woman}_{w'} \text{ that introduced}_{w'} Bill \text{ to John})$ — is true in w , then the woman that introduced Tim to John in w is the same as the woman that introduced Bill to John in w — and this is exactly what the relevant scenario was all about. This shows that in this way the correct truth-conditions are derived.

If this analysis is compared to the one proposed in Krifka (1996), one has to concede that it looks a bit more complicated, since it makes use of choice functions and structural information.²⁰ But it is in fact a very simple generalization of the analysis proposed in section 3: Apart from some minor technicalities, the only additional assumptions are, first, that the set of alternatives can also depend on linguistic structure, and, second, that in some cases the focus particle *only* only compares extensional objects rather than intensional ones. The latter assumption may cast some doubt on both the analysis proposed here and the one in Krifka (1996), but at the moment I see no straightforward way to derive the correct truth-conditions without having reference to the extensions of the relevant complex noun phrases. The way this information is made available is, however, quite different from the analysis in Krifka (1996): Whereas in Krifka's approach the existence of a 'focus phrase' is assumed which is moved to the focus phrase sensitive particle *only*, the choice function approach starts from the assumption that the complex noun phrase is focused and associates with the focus particle *only* in the same way as the embedded focus associates with the focus on the complex noun phrase. This raises of course the question of why this complex noun phrase is focused to begin with, and why this focus — in contrast to the embedded focus — seems to be sensitive to restrictions on operator movement. In Reich (2003) I argued that, first, *wh*-phrases (in German) behave island-sensitively, and that, second, complex *wh*-phrases induce corresponding foci in answers. Thus, in a model like the one in Roberts (1996) that relates every utterance to an explicit or implicit *wh*-question, the focus on the complex noun phrase as well as its apparent island-sensitivity can be considered to be an epiphenomenon

²⁰ In Reich (2002a, 2003) it is argued that the use of choice functions and structural information is essential for an explanation of the so-called pied piping problem in the related case of *wh*-questions.

of the properties of complex *wh*-phrases. This, of course, is an empirical question that needs thorough investigation.

6. Summary

In this paper, I have proposed a selective binding approach to association with focus based on choice functions. Since it is a binding approach, focus is interpreted in situ and association with focus is not subject to any island constraints imposed on LF-movement; since it is selective, cases of selective association with focus can be accounted for, too. Moreover, introducing choice functions into the analysis of association with focus allows for an explicit treatment of alternative sets and, more importantly, to consider indefinites, (in situ) *wh*-phrases and association with focus as a natural class of ‘weak’ phenomena. Having compared this analysis to a similar proposal made by Wold (1996), I have proposed a possible extension of the choice function approach that copes with the so-called problem of association with ‘focus phrase’ without assuming the existence of such an additional concept.

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