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CHAPTER 21

Alternative Semantics for definite NPs*

Klaus von Heusinger

The paper investigates the semantics of association with focus in complex definite NPs in Alternative Semantics. Three issues are discussed: First, alternative Semantics correctly captures the fact that the focus operator does not associate directly with the focused expression, but with a larger constituent the focused expression is part of. Second, the uniqueness condition of the definite NP that contains a focus cannot be maintained in the construction of alternatives. Third, the alternative function of the definite article cannot be derived from its ordinary semantics, but is determined by general principles of type shift operations.

1. Introduction

Focus semantics, like LF-movement theories or Alternative Semantics, are exemplified with proper names. However, proper names are quite exceptional because they do not contain linguistic material that could interact with grammatical structure. The only linguistic information they contribute is that they are of type *e*. For instance, the focused proper name *Sue* in (1a) below generates alternatives that are of the same type, namely type *e*. In LF-movement theories, these alternatives form the domain of quantification for the operator *only*. Thus, (1a) is true if nobody but Sue is such that Sam talked to her or him. In Alternative Semantics, the alternatives are projected to the VP level and the operator *only* quantifies over VP-alternatives, yielding – in principle – the same truth conditions as in the LF-movement approach.

(1) a. Sam only talked to [SUE$_F$]NP.
    b Nobody but Sue is such that Sam talked to him/her.

This paper investigates association with focus in definite NPs in order to understand more about the interaction between the semantics of focus and the semantic contribution of complex NPs as in (2a)-(7a). In particular, we will discuss three main issues: (i) the domain of quantification for the focus-sensitive operator, (ii) the whereabouts of

the uniqueness condition in the set of alternatives and (iii) the alternative function of the definite article.

The first issue can be illustrated by the informal analysis of examples (2a)-(5a). (1a) can be paraphrased as (1b) indicating that in a formal analysis the focus-sensitive operator quantifies over alternatives to the focused expression *Sue*. We could also use this strategy for (2a) and (3a): In (2a), we quantify over persons who have a spouse and, in (3a), we quantify over nationalities. While this strategy seems feasible for these examples, the correspondent paraphrase (4b) for (4a) predicts that John is the only child of his mother. In a situation in which Sam talked to Ann and to nobody else, and Ann is the mother of John and of Bob, the quantification over alternatives to the possessor, as in (4b), predicts contrary to fact that sentence (4a) is false. For the operator *only* does not quantify over alternatives to John, but over alternatives to a larger constituent, e.g. *John's mother* as illustrated by the paraphrase in (4c). Similarly, the paraphrase (5b) predicts contrary to fact that sentence (5a) is false if Sam had talked to Diana and to nobody else, and Diana had introduced Bob to John and Bill to John. Again, the operator *only* quantifies over the set of women who introduce someone to John, rather than over alternatives to Bob.

(2) a. Sam only talked to [John's spouse]$_{NP}$.
b. Nobody but John is such that Sam talked to his/her spouse.

(3) a. Sam only talked to [the first American astronaut in space]$_{NP}$.
b. There is no nationality but being American such that Sam talked to the astronaut of that nationality.

(4) a. Sam only talked to [John's mother]$_{NP}$.
b. Nobody but John is such that Sam talked to his/her mother.
c. No mother but John's mother is such that Sam talked to her.

(5) a. Sam only talked to [the woman who introduced Bob$_F$ to John]$_{NP}$.
b. There is nobody but Bob such that Sam talked to the woman who introduced him/her to John.
c. There is no woman who introduces someone to John but the woman who introduces Bob to John such that Sam talks to her.

The second issue concerns the uniqueness condition expressed by the definite NP, which claims in (6a) that John has only one sister and in (7a) that there is only one Dutch professor at the contextually given situation. However, this uniqueness condition cannot be maintained in the set of alternatives, which is illustrated by (6b) and (7b): In a situation where Sam talked to John's sister and to one of the two sisters of Bob and to no one else, the paraphrase (6b) predicts contrary to fact that (6a) is true, since Bob's sisters are not in the alternative sets. The expression *Bob's sister* is not defined because it violates the uniqueness condition for definites. Similarly, in a situation where Sam talked to the Dutch professor and to one of three German professors the analysis in (7b) predicts that the sentences is true because it does not contain any

German professors. It is obvious that the domain of quantification in (6a) is formed by sisters, rather than by unique sisters of a person, and the operator in (7a) quantifies over professors, and not over unique professors with respect to their nationality. The paraphrases in (6c) and (7c) illustrate that the alternatives to a definite NP do not carry the uniqueness condition of the ordinary meaning of the definite NP.

(6) a. Sam only talked to [JOHN's sister]$_{NP}$.
b. There is no one but John such that Sam talked to his/her sister.
c. There is no sister but John's sister such that Sam talked to her.

(7) a. Sam only talked to [the DUTCH$_F$ professor]$_{NP}$.
b. There is no nationality but being Dutch such that Sam talked to the professor of that nationality.
c. There is no professor but the Dutch professor such that Sam talked to him.

The paper is organized as follows: In section 2, I show that a simple LF-movement approach to association with focus runs short of explanations for the size of the alternative sets of certain classes of definite NPs. It predicts too many and too few alternatives in the domain of quantification. In section 3, I extend Alternative Semantics in order to analyze complex definite NPs with focused subconstituents. I first formulate the rules for deriving the alternatives for common nouns and their restrictive modifiers such as adjectives and relative clauses. Second, the alternative composition rules are given, and third, the alternative semantic function of the definite article is reconstructed and formally described. This function consists in forming a set of elements of type *e* by using the alternative properties to the property expressed in the descriptive material of the NP. Section 4 discusses the general problem which is caused by the particular alternative function of the definite article, which cannot be derived from its ordinary meaning. Five suggestions are presented which intend to solve this problem: First, we modify the *ALT*-function assuming that it generates very finegrained alternatives. Second, we substitute a general maximality condition for the uniqueness condition of the definite article. Third, the definite article is represented by choice functions. Forth, the ordinary and alternative function of the article is merged into one polymorph choice function. Fifth, the construction of alternative sets of definite NPs is analyzed as the alternative function of the type shift operation from a common noun to a NP. Section 5 summarizes the findings of this paper, hints to open problems, and indicates potentential extensions of the given analysis.

2. The domain of focus operators

Focus-sensitive particles like *only, also, even* etc. associate with a focused expression in their scope, i.e. in their c-commanded domain. They are interpreted as quantifiers that

range over a set of alternatives. In this section, we argue against the view of LF-movement theories that the domain of the quantifier consists of alternatives to the focused expression. Such an approach yields too many and too few alternatives. Association with focus in definite NPs indicates that the domain of quantification is at least formed by alternatives to the (highest) NP that contains the focus. This leads to the syntactic notion of Focus Phrase for this NP. However, the semantics of Focus Phrases can only be given in Alternative Semantics.

2.1 LF-movement theories

LF-movement theories assume that the focus is moved to a position adjoined to the focus operator at the level of Logical Form. The focus leaves a trace in its original position which is interpreted as a variable. The LF can be translated into the categorial language of the structured meaning approach (Jacobs 1983, von Stechow 1991b, Krifka 1991). The VP in (8) receives the surface structure (9a), the logical form (9b) and the interpretation (9c):

(8) Mary only introduced Sue_F to John

(9) a. only [VP introduced Sue_F to John]
b. only (Sue_1, λt_1 [VP introduced t_1 to John])
c. $[\![\text{only}]\!]$ ($[\![\text{Sue}]\!]$, $[\![\lambda t_1$ [VP introduced t_1 to John]$]\!]$)

The meaning of *only* combines with such a structured meaning consisting of the meaning of the focus (= F) and the meaning of the background (= B). The semantic rule (10) of this operation first asserts the application of the meaning of the background to the meaning of the focus, and second states that the background cannot be applied to another object than the meaning of the focus.

(10) $[\![\text{only}]\!]$ (**F**, **B**) = λx [**B**(**F**)(x) & $\forall y \in \text{ALT}(\mathbf{F})$ [**B**(y)(x) $\rightarrow$ y = **F**]

The domain of quantification of the operator is formed by a function *ALT* applied to the meaning of the focus F. The function *ALT* takes an object d and yields the set of elements that have the same type as d. We may also say that d generates the set of alternatives *ALT(d)*. The function *type* assigns a type to an object, e.g. the denotation of a proper name like *Sue* is of type *e*. Hence, the alternatives generated from the denotation of *Sue* are all elements of type *e*, i.e. the domain of individuals.[1]

(11) $\text{ALT}(\mathbf{d}) = D_{\text{type}(\mathbf{d})}$

(12) $\text{ALT}([\![\text{Sue}]\!]) = D_{\text{type}([\![\text{Sue}]\!])} = D_{\text{type}(\mathbf{s})} = D_e = \{\mathbf{b}, \mathbf{j}, \mathbf{m}, \mathbf{s}, \ldots.\}$

These rules can now be applied to example (8), repeated as (13a). In the LF (13b) the focused expression *Sue* is moved to a position adjoined to *only* leaving the trace t_1. This translation is compositionally interpreted in (13c) and (13d): Proper names and predicates denote constants, and the application of a predicate to its argument is defined as

functional application. In (13e), the semantics (10) of *only* combines with the meaning of the focus and the meaning of the background yielding the property of introducing nobody but Sue to John. Finally in (13f), this property combines with the meaning of the subject, returning the interpretation of the sentence. It correctly expresses that Mary introduces Sue to John and that she does not introduce anyone else to John.

(13) a. Mary $[_{VP}$ only $[_{VP}$ introduced SUE$_F$ to John$]\!]$
b. Mary $[_{VP}$ only $[\text{Sue}_1]_{Focus}$ $[\lambda t_1$ $[_{VP}$ introduced t_1 to John$]]_{Background}]$
c. $[\![\text{Mary}]\!] = \mathbf{m}$ $[\![\text{Sue}]\!] = \mathbf{s}$ $[\![\text{John}]\!] = \mathbf{j}$ $[\![\text{introduced}]\!] = \mathbf{intro'}$
d. $[\![\lambda t_1$ [introduced t_1 to John$]]\!] = \lambda z$ [**intro'**$(z)(\mathbf{j})$]
e. $[\![\text{only}]\!]$ $([[\![\text{Sue}]\!], [\![\lambda t_1$ [introduced t_1 to John$]]\!])$
$= \lambda x$ [**intro'**$(\mathbf{s})(\mathbf{j})(x)$ & $\forall y \in \text{ALT}(\mathbf{s})$ [**intro'**$(y)(\mathbf{j})(x) \rightarrow y = \mathbf{s}$]
f. $[\![$Mary only [Sue λt_1 [introduced t1 to John$]]]\!]$
= **intro'**$(\mathbf{s})(\mathbf{j})(\mathbf{m})$ & $\forall y \in \text{ALT}(\mathbf{s})$ [**intro'**$(y)(\mathbf{j})(\mathbf{m}) \rightarrow y = \mathbf{s}$

Focus movement is understood as one instantiation of a more general principle that also applies to quantifier movement and wh-movement (Chomsky 1976). However, focus movement does not obey island-restrictions that hold for quantifier or wh-movement (cf. Jackendoff 1972, Rooth 1985, von Stechow 1991a, Kratzer 1991b, Drubig 1994, 2003). A second problem of this approach is that the definition of the operator (10) has direct access to the meaning of the focus, which seems to be too powerful a device as Rooth (1985) convincingly argues. A third objection against the LF-movement theory concerns the assumption that the domain of quantification consists of alternatives to the meaning of the focused expression. This analysis makes incorrect predictions since it gives too many and too few alternatives as shown in the next section.

2.2 Focus and Focus Phrases

Krifka (1996, sect. 6; 2006, sect. 2) discusses the problem whether the focus-sensitive operator associates with the focused expression or the whole definite NP in the framework of LF-movement theories. According to the movement account, the focused expression *Bob* in (5a), repeated as (14a), must be moved to a position adjoined to the operator *only,* leaving a trace behind as in (14b). Krifka notes that the interpretation (14c) is not what (14a) intuitively expresses. (14c) asserts that Bob is the only y such that Sam talked to the woman who introduced y to John, as paraphrased in (14d). This interpretation predicts contrary to fact that (14a) is false in a situation in which Mary introduced Bob to John and she introduced Tim to John and there is no other woman who introduces someone to John. Sentence (14a) can be felicitously uttered in this situation since there is only one woman who introduces someone to John and Sam talked to this woman.

(14) a. Sam only talked to $[_{NP}$ the woman who introduced BOB$_F$ to John]
b. Sam [only [Bob] λt_1 [talked to $[_{NP}$ the woman who introduced t_1 to John]

c. ∀y∈ALT(**b**) **talk'**(ιx[**woman'**(x) & **intro'**(y)(**j**)(x)])(**s**) → y = **b**
d. Bob and nobody else is y such that Sam talked to the woman who introduced y to John.

Besides this semantic evidence, there are also syntactic considerations against the movement out of an island. The focused expression *Bob* cannot be moved due to an island constraint that also holds for wh-questions and quantifiers, as illustrated in (15) and (16). The question (15) is not wellformed because the wh-word cannot be moved out of the nominal island. Correspondingly, the universal quantifier in (16) cannot be moved out of this island, which is illustrated by the unwellformedness of the wide scope reading in (17).

(15) *Who$_1$ did Sam talk to the woman who introduced t_1 to John.

(16) Sam talked to the woman who introduced every man to John.

(17) *For every man y, Sam only talked to the woman who introduced y to John.

Nevertheless, movement theories do allow movement of the whole island containing wh-questions, as in (18a). Krifka (1996 following Drubig 1994) proposes such a "pied piping" of the focused expression with the whole island, as in (18b). In order to solve this problem for LF-moving theories, Krifka (1996: sec. 7, 2006: sect. 2) and Drubig (1994: 6; 2003: 19) propose the category of "Focus Phrase". The Focus Phrase *FP* (or *FocP*) is a syntactic constituent corresponding to a complex NP (or highest NP) including the focused constituent. A focus-sensitive operator takes a Focus Phrase as its argument, e.g. *the woman who introduced* Bob$_F$ *to John*, while the Focus Phrase itself associates with the focused constituent, here *Bob*$_F$. The first link is realized by movement of the whole complex NP as in (18b). Yet the interpretation (18c) is not the intended meaning of (14a) as it asserts that Sam talked to nobody but the woman who introduced Bob to John. This is not correct in a situation in which Sam talked to some other people, as well. Besides this, such a semantics is not sensitive to the place of the focus inside the Focus Phrase. It cannot distinguish (18b) from (18d), where the focus is on *John*.

(18) a. [Which woman who introduced Bob to John]1 did Sam talk to t_1?
b. Sam [only [$_{FP}$ the woman who introduced Bob$_F$ to John] λt_1 [talked to t_1]]
c. ∀y ∈ALT(ιx[**woman'**(x) & **intro'**(**b**)(**j**)(x)]) **talk'**(y)(**s**) → y = **w**
d. Sam [only [$_{FP}$ the woman who introduced Bob to John$_F$] λt_1 [talked to t_1]]

The problem is caused by definition (10), in which the quantifier ranges over values that are alternative to the semantic value of the focus. This semantics does not allow for a more structured, i.e. restricted, domain. In (14a), the quantifier must range over a domain that is further restricted to individuals that alternate only with respect to the focused expression. In our example, the domain of quantification for *only* consists of women who introduce someone (i.e. alternatives to Bob) to John: {**d**| ∃z[**woman**'(**d**) & **intro'**(z)(**j**)(**d**)]}. There might be several men or women, Sam talked to. There might be several persons who are introduced to John by a woman such that Sam talked to her.

But there is no woman who introduced someone to John and Sam talks to her, but the woman who introduced Bob (and possibly other persons) to John. This example shows that the focus-sensitive operator must be at least associated with the NP containing the focus, and not with the focused expression itself. Still, we have not solved the problem of computing the alternative of a such FPs. Krifka (1996, sec. 7; 2006, sec. 2) proposes a mixed approach ("Hybrid Theory"): the association with Focus Phrase is realized by moving, while the computation of the alternatives inside the definite NP will be done by alternative semantics.

3. Alternative Semantics for definite NPs

In this section, I propose an extension of Alternative Semantics for analyzing association with focus in complex definite NPs. After a short review of the basic mechanism of Alternative Semantics, three particular extensions are given: first the alternative interpretation rules of common nouns and their modifiers; second, the alternative composition rule for modification of common nouns; and third, the alternative semantic value of the definite article. This extended semantics is capable of analyzing focus in complex NPs. It will be shown that the problem discussed in the last section can be solved in the framework of Alternative Semantics.

3.1 Alternative Semantics

Alternative Semantics (Rooth 1985, 1992a) does not separate the meaning of the focus from the meaning of the background by extracting the focus out of the background as in LF-movement theories. It rather leaves the focus in situ and compositionally computes the alternatives that are generated by the focused expression on a new semantic level. Alternative Semantics distinguishes between two dimensions of meaning, the *ordinary meaning* $[\![\ ]\!]^O$ and the *alternative meaning* $[\![\ ]\!]^A$. The alternatives are formed by the function *ALT* applied to the ordinary meaning of the focused expression. The alternative value of an expression is a set containing elements of the same type as its ordinary meaning. The alternatives are projected parallel to the composition of the ordinary meaning until they reach a focus-sensitive operator, i.e. generally up to the level of VP.

We have to define two sets of interpretation rules, one for the ordinary and one for the alternative meaning. The ordinary interpretation (19) does not see the focus feature *F* and, therefore, interprets a focused expression like an unfocused one. The alternative interpretation of a focused expression (20) creates the set of alternatives, and the alternative semantics of an unfocused expression (21) is the singleton containing the ordinary semantic value maintaining the same type for the alternative values of all expression – focused or unfocused (cf. Rooth 1985, 1992a):

(19) $[\![\alpha]\!]^O = [\![\alpha_F]\!]^O$

(20) $[\![\alpha_F]\!]_A = ALT([\![\alpha]\!]_O) = D_{type([\![\alpha]\!]O)}$

(21) $[\![\alpha]\!]_A = \{[\![\alpha]\!]_O\}$

The interpretation of composition rules must also be formulated at the ordinary and alternative level. For the time being, there is only one composition rule, the application of a predicate to its arguments. The ordinary semantic function of this composition is functional application, as in (22). The alternative function of functional application (23) is more complex since it must warrant that the alternatives that are generated by a focused expression can be projected. It is a set formed by all possible expressions *X(Y)* that are derived from the application of an element *X* of the first alternative set to an element *Y* of the second alternative set.

(22) $[\![\alpha\ \beta]\!]_O = [\![\alpha]\!]_O\ ([\![\beta]\!]_O)$

(23) $[\![\alpha\ \beta]\!]_A = \{X\ (Y) |\ X \in [\![\alpha]\!]_A, Y \in [\![\beta]\!]_A\}$

The definition of the meaning (24) for the focus-sensitive operator *only* operates on both aspects of the meaning of an expression α. When applied to a VP, the ordinary meaning $[\![VP]\!]_O$ expresses the presupposition, whereas the alternative meaning $[\![VP]\!]_A$ determines the domain of quantification for the operator. There is no other property in the set of alternatives that holds of *x* than the property that is identical with the ordinary meaning. Here, the operator does not need two disjoint parts of the meaning of the expression as in the LF-moving account. It rather works with both dimensions of the meaning. Thus, the focused expression is not directly involved into the semantics of the operator. It merely generates alternatives, which are projected to the alternative meaning of the whole phrase. The question of which constituent is associated with the focus-operator does not evolve. The focus operator is always applied to the VP.

(24) $[\![only\ VP]\!]_O = \lambda x\ [[\![VP]\!]_O (x)\ \&\ \forall P \in [\![VP]\!]_A\ P(x) \rightarrow P = [\![VP]\!]_O]$

For illustration of this mechanism we analyze (13a), repeated as (25a). In (25b), the focused expression SUE_F generates a set of alternatives, whereas the alternative interpretations of *Mary*, *John* and *introduce* are singletons containing the ordinary meaning. The ordinary semantics of the application of the predicate *introduce* to its arguments *Sue* and *John* yields the property **intro'**(**s**)(**j**), as in (25d). The alternative value of this application is the set of properties consisting in introducing someone (i.e. an alternative value to Sue) to John. The semantics of *only* asserts in (25e) that there is only one such property, which consists of introducing Sue to John (and there is no other property of introducing someone else to John). This combines in (25f) with the subject yielding the correct semantic representation for the sentence, namely that Mary introduces Sue to John and for all predicates that are formed by the description *introduce someone to John* if they hold of Mary then they are identical with the property of introducing Sue to John.[2]

(25) a. Mary VP[only VP[introduced Sue_F to John]]
b. $[\![Sue_F]\!]_O$ = **s** $[\![Sue_F]\!]_A$ = ALT(**s**) = D_e
c. $[\![Mary]\!]_O$ = **m** $[\![Mary]\!]_A$ = {**m**}
$[\![John]\!]_O$ = **j** $[\![John]\!]_A$ = {**j**}
$[\![introduce]\!]_O$ = **intro'** [introduce]A = {**intro'**}
d. $[\![introduced\ Sue_F\ to\ John]\!]_O$ = **intro'**(**s**)(**j**)
$[\![introduced\ Sue_F\ to\ John]\!]_A$ = {**intro'**(x)(**j**)| x∈ALT(**s**)}
e.g. {**intro'**(**s**)(**j**), **intro'**(**b**)(**j**), **intro'**(**a**)(j),...}
e. $[\![only\ introduced\ Sue_F\ to\ John]\!]_O$ = λx [**intro'**(**s**)(**j**)(x) &
∀P∈{**intro'**(y)(**j**)| y∈ALT(**s**)} P(x) → P = **intro'**(**s**)(**j**)
f. $[\![Mary\ only\ introduced\ Sue_F\ to\ John]\!]_O$ = **intro'**(**s**)(**j**)(**m**) &
∀P∈{**intro'**(y)(**j**)| y∈ALT(**s**)} P(**m**) → P = **intro'**(**s**)(**j**)

3.2 CN and CN-modifier

We confine the discussion to common nouns (CN), restrictive adjectives (A) and relative clauses (RC) as being noun modifiers (CN-modifiers). Semantically, common nouns and adjectives are properties and have the same type as intransitive verbs, namely <*e,t*>. The ordinary semantic value (26a) and (27a) is a set of individuals (i.e. a property) regardless whether the expression is focused or not. The alternative semantic value (26b) and (27b) of a focused noun or adjective is the set consisting of alternative properties to the property expressed by the ordinary meaning. In absence of any further restriction, the alternative set is equal to the set of all sets of individuals. The alternative semantic value of an unfocused noun or adjective is the singleton consisting of the ordinary semantic value, as in (26c) and (27c):

(26) a. $[\![CN]\!]_O = [\![CN_F]\!]_O$ = **CN'**∈$D_{<e,t>}$
b. $[\![CN_F]\!]_A$ = ALT($[\![CN]\!]_O$)=$D_{<e,t>}$
c. $[\![CN]\!]_A$ = {$[\![CN]\!]_O$}

(27) a. $[\![A]\!]_O = [\![A_F]\!]_O$ = **A'**∈$D_{<e,t>}$
b. $[\![A_F]\!]_A$ = ALT($[\![A]\!]_O$)=$D_{<e,t>}$
c. $[\![A]\!]_A$ = {$[\![A]\!]_O$}

The modification of a head noun *α* by an adjective *β* is interpreted in the ordinary semantics as the intersection of the ordinary semantic value of *α* with the ordinary semantic value of *β*. The alternative value of the modification is the set consisting of sets that are formed by intersection of an element (i.e. set) of the alternative set of *α* with an element of the alternative set of *β*.[3]

(28) $[\![\alpha\ \beta]\!]_O = [\![\alpha]\!]_O \cap [\![\beta]\!]_O$
(29) $[\![\alpha\ \beta]\!]_A = \{Q \cap R \mid Q \in [\![\alpha]\!]_A\ R \in [\![\beta]\!]_A\}$

These definitions allow representations of the following combinations of the focus feature in the modifier-head construction *Dutch professor* in a context with professors and students, some of them English and some of them Dutch. The ordinary semantic value is the same for all the different focus feature combinations, namely the intersection of the set of Dutch with the set of professors as in (30a). The alternative semantic value of the unfocused combination in (30b) is the singleton containing the ordinary semantic value. The alternatives generated by *DUTCH$_F$ professor* are intersections of sets that are generated by the adjective *DUTCH$_F$* with the singleton set containing the set of professors. The composition of the modified noun *Dutch PROFESSOR$_F$* contains properties that are formed by combinations of the property of being a Dutch with the alternative properties to being a professor, namely the properties of being a professor, or being a student.

(30) a. $[\![[\text{Dutch}_{F/\emptyset}\ \text{professor}_{F/\emptyset}]_{F/\emptyset}]\!]_O$ = **Dutch'**$\cap$**professor'**
b. $[\![\text{Dutch professor}]\!]_A$ = {**Dutch'**$\cap$**professor'**}
c. $[\![\text{DUTCH}_F\ \text{professor}]\!]_A$ = $\{Q \cap R \mid Q \in [\![\text{DUTCH}_F]\!]_A\ R \in [\![\text{professor}]\!]_A\}$
= $\{Q \cap R \mid Q \in$ {**Dutch'**, **English'**$\}\ R \in$ {**professor'**$\}\}$
= {**Dutch'**$\cap$**professor'**, **English'**$\cap$**professor'**}
d. $[\![\text{Dutch PROFESSOR}_F]\!]_A$ = $\{Q \cap R \mid Q \in [\![\text{Dutch}]\!]_A\ R \in [\![\text{PROFESSOR}_F]\!]_A\}$
= $\{Q \cap R \mid Q \in$ {**Dutch'**$\}\ R \in$ {**professor'**, **student'**$\}\}$
= {**Dutch'**$\cap$**professor'**, **Dutch'**$\cap$**student'**}

An CN modified by a relative clause is interpreted according to the modification schemata given in (28) and (29). The relative clause RC is of type *<e,t>,* expressing a property, and can be instantiated either as an adjective (A) or as a predicate missing one argument. The relative pronoun does not receive a semantic interpretation: it merely indicates which argument of the relative clause predicate is related to the head noun.

(31) $[\![\text{CN who RC}]\!]_O = [\![\text{CN}]\!]_O \cap [\![\text{RC}]\!]_O$

(32) $[\![\text{CN who RC}]\!]_A = \{Q \cap R \mid Q \in [\![\text{CN}]\!]_A\ R \in [\![\text{RC}]\!]_A\}$

We can now analyze the complex CN *woman who introduced BOB$_F$ to John*. The ordinary and alternative semantics of the VP *introduce BOB$_F$ to John* are computed as in (33b) and (33c). The ordinary meaning of the whole CN is the property of being a woman and introducing Bob to John as in (33d). The alternatives generated by the whole phrase are combinations of the meaning of the head noun, **woman'**, with alternatives generated by the VP, **intro'**(x)(**j**)| x$\in$ALT(**b**). The alternative meaning is a set of sets of individuals such that each set comprises women who introduce one particular person to John, e.g. {**intro'**(**b**)(**j**), **intro'**(**s**)(**j**), **intro'**(**a**)(**j**),...}, as derived in (33e).

(33) a. woman who introduced BOB$_F$ to John
b. $[\![\text{introduced BOB}_F\ \text{to John}]\!]_O$ = **intro'**(**b**)(**j**)
c. $[\![\text{introduced BOB}_F\ \text{to John}]\!]_A$ = {**intro'**(x)(**j**)| x$\in$ALT(**b**)}
e.g. {**intro'**(**b**)(**j**), **intro'**(**s**)(**j**), **intro'**(**a**)(**j**),...}

d. $[\![$woman who introduced Bob_F to John$]\!]_O$ = γx [**woman'**(x) & **intro'**(**b**)(**j**)(x)]
e. $[\![$woman who introduced Bob_F to John$]\!]_A$
= {Q ∩ R | Q∈$[\![$woman$]\!]_A$ R∈{**intro'**(z)(**j**)| z∈ALT(**b**)}}
= {Q ∩ R | Q∈{**woman'**} R∈{**intro'**(z)(**j**)| z∈ALT(**b**)}}
= {P| P = γx [**woman'**(x) & **intro'**(z)(**j**)(x)] z∈ALT(**b**)}}
e.g. {γx [**woman'**(x) & **intro'**(**b**)(**j**)(x)], γx [**woman'**(x) & **intro'**(**s**)(**j**)(x)], γx [**woman'**(x) & **intro'**(**a**)(**j**)(x)],...}

3.3 The definite article

At the international faculty party, some students, several German, Italian and American professors, but only one Dutch professor appeared. In this context, sentence (34a) can be felicitously uttered. In order to compute the alternatives of the definite NP from the alternatives of the CN we have to account for the alternative meaning of the article. In a first approach we assume according to the general rule (21) in section 3.1 that the alternative meaning of the article is the singleton of its ordinary meaning.[4] If we take the iota operator as the ordinary meaning of the definite article, we then have the singleton containing the iota operator as the alternative meaning. However, this would result in the alternatives described in (34c). Here, the alternative set consists of unique professors with respect to a nationality. Since there is more than one professor for each country but the Netherlands, all iota expressions are undefined except the one for the Dutch professor. Hence, the alternatives would include one single individual, namely the unique Dutch professor. However, the alternatives to *the* Dutch_F *professor* intuitively include all other professors at the party. The semantics of (34c) predicts contrary to fact that sentence (34a) is true in a situation in which Sam talked to the Dutch professor and one German professor.

(34) a. Sam only introduced [the Dutch_F professor]$_{NP}$ to John.
b. $[\![$the Dutch_F professor$]\!]_O$ = ιx [**Dutch'**(x) & **prof'**(x)]
c. $[\![$the Dutch_F professor$]\!]_A$ = {X(Y)| X∈{ι}, Y∈$[\![\text{Dutch}_F$ professor$]\!]_A$}
= {d| d = ιx Rx & **prof'**(x)] for some R∈$[\![\text{Dutch}_F]\!]_A$}
= {ιx [**Dutch'**(x) & **prof'**(x)]}

This example clearly demonstrates that the uniqueness condition of the ordinary meaning of the definite NP must not be preserved in the set of alternatives since this would exclude several proper alternatives. Intuitively, the set of alternatives rather consists of all professors at that party. In order to yield this set from the alternative set of the common noun $Dutch_F$ *professor* (cf. 30b), we have to assume that the alternative function of the definite article is to collect all individuals from all alternatives to the property expressed in the modified noun as indicated in (35), and more general in (36). Thus the most natural way to model the alternative function of the definite ar-

ticle is the generalized union, as in (37). The consequences of this reconstruction are discussed in section 4.

(35) $[\![\text{the DUTCH}_F \text{ professor}]\!]_A = \{d|\ d \in R \text{ for some } R \in [\![\text{DUTCH}_F \text{ professor}]\!]_A\}$
$= \{d|\ d \in R \text{ for some } R \in \{\gamma x\ [\textbf{Dutch'}(x) \,\&\, \textbf{prof'}(x)], \gamma x\ [\textbf{Germ'}(x) \,\&\, \textbf{prof'}(x)],$
$x\ [\textbf{Ital'}(x) \,\&\, \textbf{prof'}(x)], \gamma x\ [\textbf{Amer'}(x) \,\&\, \textbf{prof'}(x)]\}$

(36) $[\![\text{the CN}]\!]_A = \{d|\ d \in R \text{ for some } R \in [\![\text{CN}]\!]_A\} = \cup([\![\text{CN}]\!]_A)$

(37) $[\![\text{the}]\!]_A = \cup$

With this extension, we can give the complete interpretation of (34a) in Alternative Semantics. In (38a), the ordinary and the alternative value of the VP *introduced the DUTCH$_F$ professor to John* is computed. The alternative meaning is the set of properties such that each property consists in introducing a professor of some nationality *R* – or simplified some professor (at the party) – to John. In (38b), *only* quantifies over such properties and asserts that there is only one such property and this property is equal to introducing the Dutch professor to John. Finally, this combines with the subject in (38c), yielding the intuitively correct meaning.

(38) a. $[\![\text{introduced the DUTCH}_F \text{ professor to John}]\!]_O$
$= \textbf{intro'}(\iota x\ [\textbf{Dutch'}(x) \,\&\, \textbf{prof'}(x)])(\textbf{j})$
$[\![\text{introduced the DUTCH}_F \text{ professor to John}]\!]_A$
$= \{\textbf{intro'}(x)(\textbf{j})|\ x \in [\![\text{the DUTCH}_F \text{ professor}]\!]_A\}$
$= \{\textbf{intro'}(x)(\textbf{j})|\ x \in \{d|\ d \in R \text{ for some } R \in [\![\text{DUTCH}_F \text{ professor}]\!]_A\}\}$
$= \{\textbf{intro'}(x)(\textbf{j})|\ x \in \cup[\![\text{the DUTCH}_F \text{ professor}]\!]_A\}$
$= \{\textbf{intro'}(x)(\textbf{j})|\ x \in [\![\text{professor}]\!]_O\}$

b. $[\![\text{only introduced the DUTCH}_F \text{ professor to John}]\!]_O$
$= \gamma x\ [\textbf{intro'}(\iota x\ [\textbf{Dutch'}(x) \,\&\, \textbf{prof'}(x)])(\textbf{j}) \,\&\, \forall P \in \{\textbf{intro'}(x)(\textbf{j})|x \in$
$[\![\text{professor}]\!]_O\}\ P(x) \rightarrow P = \textbf{intro'}(\iota x\ [\textbf{Dutch'}(x) \,\&\, \textbf{prof'}(x)])(\textbf{j})]]$

c. $[\![\text{Sam only introduced the DUTCH}_F \text{ professor to John}]\!]_O$
$= \textbf{intro'}(\iota x\ [\textbf{Dutch'}(x) \,\&\, \textbf{prof'}(x)])(\textbf{j})(\textbf{s}) \,\&\, \forall P \in \{\textbf{intro'}(x)(\textbf{j})|$
$x \in [\![\text{professor}]\!]_O\}\ P(\textbf{s}) \rightarrow P = \textbf{intro'}(\iota x\ [\textbf{Dutch'}(x) \,\&\, \textbf{prof'}(x)])(\textbf{j})]]$

Given this alternative interpretation of definite NPs, we can now analyze the example (5a), repeated as (39a), in Alternative Semantics and without LF-moving. In (39b) the interpretations of the new constants are given. (39c) and (39d) repeat the interpretation of the complex phrase *woman who introduced BOB$_F$ to John* from (33a) in section 3.2. This semantics combines with the article, the ordinary interpretation yielding a iota expression in (39e), and the alternative interpretation (39f) forming the set of elements that are women who introduce an alternative of Bob to John. We can simplify this set by replacing the restriction on *y* by an existential quantifier.

(39) a. Sam only talked to [$_{NP}$ the woman who introduced BOB$_F$ to John]
b. $[\![\text{Sam}]\!]_O = \textbf{s}\ [\![\text{talk}]\!]_O = \textbf{talk'}\ [\![\text{talk}]\!]_A = \{\textbf{talk'}\}$

c. ⟦woman who introduced Bob_F to John⟧$_O$ = γx [**woman'**(x) & **intro'**(**b**)(**j**)(x)]
d. ⟦woman who introduced Bob_F to John⟧$_A$
= {P| P = γx [**woman'**(x) & **intro'**(z)(**j**)(x)] z∈ALT(**b**)}}
e. ⟦the woman who introduced Bob_F to John⟧$_O$ = ιx [**woman'**(x) & **intro'**(**b**)(**j**)(x)]
f. ⟦the woman who introduced Bob_F to John⟧$_A$
= ∪{P| P = γx [**woman'**(x) & **intro'**(z)(**j**)(x)] z∈ALT(**b**)}}
= {d| [**woman'**(d) & **intro'**(z)(**j**)(d)] z∈ALT(**b**)}
= {d| ∃z [**woman'**(d) & **intro'**(z)(**j**)(d)]}

Combining the NP with the verb *talk* we get the ordinary interpretation (39g) by functional application and the alternatives (39h) by the alternative semantics of functional application, as defined in (23). (39h) describes the set of properties of talking to a woman who introduces someone to John. The interpretation (24) of *only* combines the ordinary meaning of the VP with its alternative interpretation. It quantifies over the alternatives and states that no value but the ordinary one holds of the subject. This semantics is applied to our example yielding (39i), which applied to the subject results in (39j). It correctly expresses that Sam talked to the woman who introduces Bob to John and for all properties of talking to a woman who introduces someone to John that hold of Sam, they are identical with the property of talking to the woman who introduced Bob to John.

(39) g. ⟦talk to the woman who introduced Bob_F to John⟧$_O$
= **talk'**(ιx [**woman**(x) & **intro'**(**b**)(**j**)(x)])
h. ⟦talk to the woman who introduced Bob_F to John⟧$_A$ =
= {**talk'**(y) | y∈{d| ∃z [**woman'**(d) & **intro'**(z)(**j**)(d)]}}
i. ⟦only talked to the woman who introduced Bob_F to John⟧$_O$
= γu [**talk'**(ιx [**woman**(x) & **intro'**(**b**)(**j**)(x)])(u) & ∀P∈{**talk'**(y) | y∈{d| ∃z [**woman'**(d) & **intro'**(z)(**j**)(d)]}} P(u) →P = **talk'**(ιx [**woman**(x) & **intro'**(**b**)(**j**)(x))]
j. ⟦Sam only talked to the woman who introduced Bob_F to John⟧$_O$ = [**talk'**(ιx [**woman**(x) & **intro'**(**b**)(**j**)(x)](**s**) & ∀P∈{**talk'**(y) | y∈{d| ∃z [**woman'**(d) & **intro'**(z)(**j**)(d)]}} P(**s**) →P = **talk'**(ιx [**woman**(x) & **intro'**(**b**)(**j**)(x))]

It was shown that this extension of Alternative Semantics is capable of analyzing association with focus in complex definite NPs and solving the puzzle discussed in section 2.2. The question of whether the focus-operator associates with the focused expression or a larger constituent that contains the focused expression does not arise in this framework. The focus-operator associates with the VP that contains a focus. We have settled the question of the whereabouts of the uniqueness condition in the alternative set by an ad-hoc "solution", motivated by the data. However, the proposed alternative

function for the definite article cannot be derived from its ordinary function. This calls for a discussion of the general architecture of Alternative Semantics.

4. The architecture of Alternative Semantics

The alternative level of meaning in Alternative Semantics, as introduced in section 3.1, is formed by two basic rules. The first rule ties the alternative semantic value of an expression α to its ordinary value. If the ordinary semantic value is of type π, then the alternative semantic value (or "p-set") is a set of elements of this type, i.e. of type $<\pi, t>$. The two interpretation rules (40)-(41) govern this dependency of the alternatives from the ordinary semantic values:

(40) by creating singleton sets $[\![\alpha]\!]_A = \{[\![\alpha]\!]_O\}$

(41) by creating alternatives (p-sets) $[\![\alpha_F]\!]_A = ALT([\![\alpha]\!]_O)$

The second essential component of Alternative Semantics is the compositional construction of complex meanings. The construction rules must also warrant that the main relation between the ordinary meaning of a complex expression $\alpha\beta$ and its alternative meaning is preserved. Thus, the alternative interpretation of functional application and modification must project the alternatives such that they fit the type requirement given in the rules (40) and (41). The alternative function of a construction rule © is derived from its ordinary interpretation (42i) in a schematic way: The construction rule is applied to the elements of the alternative sets of the expression involved, rather than to the sets themselves. The alternative value of the whole composition (42ii) consists of elements created in the described way. The alternative meaning of functional application (43ii) is a set of elements that is formed by functional application of one element in the alternatives set of the functor to one element of the alternative set of the argument. The alternative function of modification (44ii) is the set that is formed from the intersection of one element of the alternative set of the modifier with one element out of the alternative set of the modified.

(42) Construction rule ©
- (i) ordinary function $[\![\alpha\beta]\!]_O = [\![\alpha]\!]_O \,©\, [\![\beta]\!]_O$
- (ii) alternative semantic function $[\![\alpha\beta]\!]_A = \{X © Y \mid X \in [\![\alpha]\!]_A, Y \in [\![\beta]\!]_A\}$

(43) Functional Application
- (i) ordinary function $[\![\alpha\beta]\!]_O = [\![\alpha]\!]_O ([\![\beta]\!]_O)$
- (ii) alternative semantic function $[\![\alpha\beta]\!]_A = \{X (Y) \mid X \in [\![\alpha]\!]_A, Y \in [\![\beta]\!]_A\}$

(44) Modification
- (i) ordinary function $[\![\alpha\beta]\!]_O = [\![\alpha]\!]_O \cap [\![\beta]\!]_O$
- (ii) alternative semantic function $[\![\alpha\beta]\!]_A = \{R \cap Q \mid R \in [\![\alpha]\!]_A, Q \in [\![\beta]\!]_A\}$

These rules warrant that the alternatives generated by the focused expression are projected in the alternative meaning. In the last section we have encountered the problem of the transition from the alternative meaning of a complex common noun, like *Dutch$_F$ professor* to the alternative meaning of the definite NP *the Dutch$_F$ professor*. While the former is a set of sets of individuals, the latter is represented by a set of individuals. Therefore, we assumed that the union represents the alternative meaning of the definite article. This, however, violates the two just given principles of Alternative Semantics.

Let us assume that the ordinary meaning (45) of the definite article is a function of type *<<e,t>,e>*, i.e. a function that assigns one element to a set.[5] According to rule (40), Alternative Semantics predicts that the alternative function is the singleton containing the ordinary meaning as in (46). This meaning correctly predicts the alternative sets for definite NPs without focus, as in (47) and for definite NPs that contain a focus and that are formed by semantically definite concepts, such as the ordinal number construction in (48) or the functional concept *spouse* in (49).

(45) $[\![\text{the}]\!]_O = f_{<<e,t>,e>}$

(46) $[\![\text{the}]\!]_A = \{f_{<<e,t>,e>}\}_{<<<e,t>,e>,t>}$

(47) $[\![\text{the old professor}]\!]_A = \{X(Y) \mid X \in \{f_{<<e,t>,e>}\}\ Y \in \{\textbf{old'prof'}_{<e,t>})\}\}$
$= \{f_{<<e,t>,e>}(\textbf{old'prof'}_{<e,t>})\}_{<e,t>} = \{\textbf{the unique old prof'e}\}_{<e,t>}$

(48) $[\![\text{the first American}_F \text{ astronaut in space}]\!]_A$ = {**the unique first American Astronaut in space'**, **the unique first Russian Astronaut in space'**, **the unique first French Astronaut in space'**,...}

(49) $[\![\text{John's spouse}]\!]_A$ = {**Bill's spouse'**, **John's spouse'**, **Ann's spouse'**,...}

Yet, this semantics is too restrictive for the formation of the alternative set of the other classes of definite NPs discussed in section 1, such as *John's$_F$ sister* in (6a) or *the Dutch$_F$ professor* in (7a):

(6) a. Sam only talked to [John's sister]$_{NP}$.

(7) a. Sam only talked to [the Dutch$_F$ professor]$_{NP}$.

As shown in the last section, the uniqueness condition would exclude most of the relevant alternatives. Therefore, we assumed that the alternative function is the general union over a set of sets of individuals, i.e. it is of type *<<e,t>,t>, <e,t>>*, as in (50). But this type cannot be derived from the ordinary type in (45).[6]

(50) $[\![\text{the CN}]\!]_A = \{d \mid d \in R \text{ for some } R \in [\![\text{CN}]\!]_A\} = \cup([\![\text{CN}]\!]_A)$
$[\![\text{the}]\!]_A = f_{<<e,t>,t>,<e,t>>}$

(45) $[\![\text{the}]\!]_O = f_{<<e,t>,e>}$

With this semantics of the definite article, two problems arise for the general architecture of Alternative Semantics: (i) the alternative meaning of type *<<e,t>,t>,<e,t>>* cannot be derived by (40) from the ordinary meaning of type *<<e,t>,e>*, and (ii) the

application of the article to the complex common noun is reconstructed by ordinary functional application (43i), rather than by its alternative function (43ii). Thus, this alternative function of the definite article does not fit into the general architecture of Alternative Semantics.

In the remainder of this section we give five suggestions to treat this problem, continuously stripping off the semantic contribution of the article to the construction of the alternative set of definite NPs. The first three suggestions keep to the two mentioned principles, discussed in (40)-(44) of Alternative Semantics, while the last two deviate from them. In the first and most conservative suggestion, we modify the *ALT*-function that generates the alternatives. In a second suggestion, we replace the uniqueness condition of the definite article by a maximality condition and take the number information as being not essential to the semantics. In a third approach, we defend the idea that the definite article is represented by a choice function. The fourth suggestion assumes that both the ordinary and alternative meaning of the definite article is reconstructed as a polymorph choice function. And finally, in the fifth suggestion we present the idea that the definite article does not contribute to the semantics proper. It only happens to be located at a place where we have to assume a type shift from the common noun to the NP. It is the alternative function of the type shift rule that yields the construction principles for the alternative sets of definite NPs.

4.1 Fine-grained descriptions

Assuming the classic semantics of the definite article and the main principles of Alternative Semantics, we can suggest the following treatment: Suppose that the function *ALT* produces so many alternatives that there is at least one alternative description for each individual in the intended domain of quantification that holds exclusively of this individual. In (51a), *ALT* produces so many fine-grained alternative properties of *Dutch* that we find for each professor at the party (at least) one unique description. In (51c), the alternative meaning of the definite NP is computed according to the interpretation of functional application. The iota operator is applied to all alternatives to being Dutch, but only those alternatives "survive" that are singleton sets.

(51) a. $[\![\text{DutchF}]\!]_A$ = ALT($[\![\text{Dutch}]\!]_O$) = ALT(**Dutch'**) = {**Dutch'**, **German'**,..., **German'**∩**from_Berlin'**, **German'**∩**from_Tübingen'**,...}

b. $[\![\text{DutchF professor}]\!]_A$ = {**Dutch'**∩**prof'**, **German'**∩**prof'**,..., **German'**∩**from_Berlin'**∩**prof'**, **German'**∩**from_Tübingen'**∩**prof'**,...}

c. $[\![\text{the DutchF professor}]\!]_A$
= {X(Y)| X∈{ι}, Y∈$[\![\text{Dutch}_F \text{ professor}]\!]_A$} = {ιx [**Dutch'**(x) & **prof'**(x)], ιx [**Germ'**(x) & **prof'**(x) & **from Berlin**(x)], ιx [**Germ'**(x) & **prof'**(x) & **from Tübingen**],...}

This solution preserves the general architecture of Alternative Semantics as described in the last section. The definite article is a functor that is applied to the common noun se-

mantics, both in the ordinary as in the alternative meaning. However, the repair is highly artificial and not very convincing. In particular, it is not clear how the ALT-function "knows" the appropriate descriptions that fit single individuals given in the discourse. Moreover, it seems that it cannot produce the correct descriptions if part of the common noun restricts the choice of predicates, like *the professor of* $\textsc{Dutch}_F$ *nationality* or *the* $\textsc{green}_F$*-colored apple.* It is not clear how we may distinguish between different German professors since there is no *professor of German-from-Tübingen nationality*.

4.2 No number information

It has been suggested that the definite article does not contribute the uniqueness condition directly, but rather in a derived way.[7] It contributes a maximality condition which is realized in the singular as uniqueness and in the plural as the maximal set. If the number information of the common noun is not to be preserved in the alternatives, we could design the following picture: The focused adjective $\textsc{Dutch}_F$ generates alternative sets of individuals, which combine with the meaning of *professor* by intersection in (52b). The application of the maximality condition to each of the subsets of the alternative meaning of the common noun yields the set (52c) consisting of maximal elements, being the unique element of a set or its maximal extension, for example as a sum individual. All subsets of the alternative set of the common noun are preserved as elements of the alternative set of the NP. The alternative set of the definite NP *the* $\textsc{Dutch}_F$ *professor* consists of the Dutch professor, the German professors (comprised in some maximal element) etc.

(52) a. $[\![\textsc{DutchF}]\!]_A = \text{ALT}([\![\textsc{Dutch}]\!]_O) = \text{ALT}(\textbf{Dutch'}) = \{\textbf{Dutch'}, \textbf{German'}, \ldots, \}$
b. $[\![\textsc{Dutch}_F \text{ professor}]\!]_A = \{\textbf{Dutch'} \cap \textbf{prof'}, \textbf{German'} \cap \textbf{prof'}, \ldots\}$
c. $[\![\text{the } \textsc{Dutch}_F \text{ professor}]\!]_A$
$= \{X(Y) \mid X \in \{\max\}, Y \in [\![\textsc{Dutch}_F \text{ professor}]\!]_A\} = \{\max[\textbf{Dutch'}(x) \,\&\, \textbf{prof'}(x)], \max[\textbf{Germ'}(x) \,\&\, \textbf{prof'}(x)], \ldots\}$
$= \{\textbf{the Dutch professor'}, \textbf{the German professors'}, \ldots\}$

This solution also preserves the general architecture of Alternative Semantics. Furthermore, we do not have to assume a strange *ALT*-functions; we do not lose alternatives in the transition from the set of subsets to the p-set of the NP, since elements of non-singleton sets are comprised into sum individuals. This also resembles the treatment of plural semantics. Nevertheless, we get a new problem with predication of a part of a sum-individual. In a situation, where Sam talked to the Dutch professor and to one of the German professors, sentence (7a) is intuitively false. We have to assume that the predication applies to the Dutch professor and the sum individual representing the German professors. This, however, is far from being intuitive. It is not clear, whether Sam talked to the German professors when he talked to one of them. One would expect some kind of uncertainty in the judgment of such cases.[8]

4.3 Choice functions

Let us "impoverish" the semantic contribution of the definite article further and assume that the semantics of the definite article is purely a function that selects one element out of the set denoted by the common noun. Thus, we replace the uniqueness and maximality condition by the principle of choice and we interpret the article by a choice function *f*. A Choice function is a function that assigns to a non-empty set one of its elements, or: $f_{cf}(CN') \in CN'$ (cf. Egli and von Heusinger 1995, von Heusinger 1997, Winter 1997, Kratzer 1998, among others). We can now compose the alternative set (53a), which is based on the alternative set of the common noun in (52b). We paraphrase the element selected by the choice function as the *chosen* element.

(53) a. $[\![\text{the DUTCH}_F \text{ professor}]\!]_A = \{X(Y) \mid X \in \{f_{cf}\}, Y \in [\![\text{DUTCH}_F \text{ professor}]\!]_A\}$
$= \{f_{cf}(\textbf{Dutch'} \cap \textbf{prof'}), f_{cf}(\textbf{Germ'} \cap \textbf{prof'}), \ldots\}$
$= \{\textbf{the chosen Dutch professor'}, \textbf{the chosen German professor'}, \ldots\}$

Each subset of a p-set of the common noun is represented by one element in the p-set of the definite NP. But this gives us not enough alternatives, e.g. the choice function gives us only one German professor. There are two ways of modifying this choice function approach further: (i) we argue that the choice is undetermined, or (ii) we assume that we quantify over different choice functions.

Hilbert & Bernays (1939), who were the first to work with choice functions, define them in an undetermined way, i.e. the choice function selects one element out of a set, but we do not know which one. This is also used in semantics for describing E-type pronouns (e.g. Ballmer 1978, Neale 1990, Chierchia 1992). Such definite NPs can be paraphrased by *whoever*-phrases. Informally, this would result in the following alternative set, in which we find one representative for each of the subsets in (53a). Again, we run into the same trouble as in (52c) in section 4.2 since we do not have a good definition of predication over *whoever*-phrases. Another way to attack the problem is to take a family of choice functions $f_1, f_2, f_3 \ldots fn$ instead of one choice function. Each choice function can assign a different element to a certain set. Therefore, the expressions *f1(**Germ'**∩ **prof')**, f2(**Germ'**∩ **prof')**,...* denote different German professors such that we collect all elements of the subsets into the set of alternatives to the definite NP.

(53) b. $[\![\text{the DUTCH}_F \text{ professor}]\!]_A = \{X(Y) \mid X \in \{f_{cf}\}, Y \in [\![\text{DUTCH}_F \text{ professor}]\!]_A\}$
$= \{f_{cf}(\textbf{Dutch'} \cap \textbf{prof'}), f_{cf}(\textbf{Germ'} \cap \textbf{prof'}), \ldots\}$
$= \{\textbf{whoever is a Dutch professor'}, \textbf{whoever is a German professor'}, \ldots\}$

c. $[\![\text{the DUTCH}_F \text{ professor}]\!]_A = \{f_i(Y) \mid f_i \in \{f_1, f_2, f_3 \ldots\}, Y \in [\![\text{DUTCH}_F \text{ professor}]\!]_A\}$
$= \{f_1(\textbf{Dutch'} \cap \textbf{prof'}), f_1[\textbf{Germ'} \cap \textbf{prof'}), f_2[\textbf{Germ'} \cap \textbf{prof'}), f_3[\textbf{Germ'} \cap \textbf{prof'}), \ldots\}$

The set in (53c) comprises the number of alternatives we need for the domain of quantification. Still, we have not explained how the idea of a family of choice function can be matched with the ordinary semantics of the article.[9]

4.4 Polymorph choice function

The last three subsections tried to defend the two principles of alternative semantics (i) the alternative meaning is the set consisting of the ordinary meaning and (ii) the alternative function of functional application is the process of building a set of elements such that the elements are derived from functional application of elements of the alternative sets involved. Since none of the three suggestion could totally convince, we decide to abandon this requirement and investigate other possibilities. In particular, we abandon the correspondence between the ordinary and the alternative function of the article and propose to merge both functions of the definite article into a more abstract function: The meaning of the article is a function *f* that takes a set of type $<\pi,t>$, and yields one of its elements of type π. In this view, the article stands for a polymorph choice function or a general "type shifter", as in (54). In the ordinary interpretation (55), the definite article assigns to a set one of its elements. In its alternative use (56), the function assigns to the set of subsets one of its subsets. For instance, it assigns to the alternative meaning of *DUTCH$_F$ professors* in (57a) the subset of professors at the party in (57b) yielding the appropriate domain of quantification for the operator.

(54) $[\![\text{the}]\!] = f_{<<\pi,t>,\pi>}$

(55) $[\![\text{the}]\!]([\![\text{man}]\!]_O)_{<e,t>} = (f_{<<e,t>,e>}(\textbf{man'}_{<e,t>}))_e \in \textbf{man'}$

(56) $[\![\text{the}]\!]([\![\text{man}]\!]A)_{<<e,t>,t>} = f_{<<e,t>,t>,<e,t>>}(\{\textbf{man'}, \textbf{woman'}, \textbf{child'}, \text{etc.}\}) \in D_{<e,t>}$

(57) a. $[\![\text{DUTCH}_F \text{ professor}]\!]_A$ = {**Dutch'**∩**prof'**, **German'**∩**prof'**,..., **prof'**∩**at_the_party**,...}

b. $[\![\text{the DUTCH}_F \text{ professor}]\!]_A = f_{<<e,t>,t>,<e,t>>}([\![\text{DUTCH}_F \text{ professor}]\!]_A)$ = **prof'**∩**at_the_party**

The advantage of this approach is that we can keep to one general interpretation of the definite article. Intuitively, the function of the article is to pick out one element from a set. In the alternative function it selects one subset. This choice may either be governed by some maximality condition (chose the largest set) or by pragmatic information (take the appropriate set). The latter option supplies a parameter to encode contextual information restricting the alternatives. This additional contextual information is needed in any other account, as well. In the original approach of Rooth (1985), the actual domain of quantification of the focus operator is part of the p-set. Here, we argue that the context determines which of the many subsets generated by the common noun is the appropriate for the alternative meaning of the NP. Of course, we abandon the idea that the article has an ordinary and an alternative meaning. It has just one function. One can speculate that content words easily generate alternative, while function words like the article do not. Still, we can raise the same objection as in the first proposed solution (Ariel Cohen pointed this out to me): This solution heaviliy depends on contextual information that controls the right choice of the the subset. This contextual dependeny

of the proposed analysis does not correspond the generality of the problem. We, therefore, do not think that it is the correct modification of the analysis.

4.5 Type shifting operation

In a final approach to the problem we assume that the definite article does not make a semantic contribution to both the ordinary semantics and the alternative semantics. That is not to say that the article has no meaing: it has definitely a pragmatic meaning including some uniqueness and familiarity presuppostion or implicature (see Roberts 2003, Abbott 2004 for discussion). However, this pragmatic meaning does not play a role for the compositional process of ordinary and alternative meaning values. In this view the core semantic function of the article is to indicate where a type shift operation from a common noun to an NP has taken place. The type shift rule is a construction rule, whose alternative function can be derived from its ordinary function in a schematic way described in (42ii). The construction rule is applied to the elements of the alternative sets of the expression involved, rather than to the sets themselves.

(42) Construction rule ©
(i) ordinary function $[\![\alpha\beta]\!]_O = [\![\alpha]\!]_O \,©\, [\![\beta]\!]_O$
(ii) alternative semantic function $[\![\alpha\beta]\!]_A = \{X \,©\, Y \mid X \in [\![\alpha]\!]_A, Y \in [\![\beta]\!]_A\}$

Since type shifting rules involve only one expression α that is transformed from type β to a different semantic type π, we have to modify this schema slightly. We assume in (58) that the ordinary meaning $[\![\alpha\pi]\!]_O$ of the type shifted expression stands in a the semantic relation © to the ordinary meaning $[\![\alpha\beta]\!]_O$ of the expression. In other words, the value of the type shifted expression depends on the value of the original expression plus some semantic operation. For the alternative function of the type shift we assume according to the schema in (42) that an element X of the alternative set $[\![\alpha_\pi]\!]_A$ of the type shifted expression stands in that relation © to an element Y of the alternative set $[\![\alpha_\beta]\!]_A$ of the original expression. We can now form the construction rule (59), which transforms a common noun (CN) of type $<e,t>$ into an NP of type e. We state the following minimal requirement: The denotation of the NP must be an element of the denotation of the CN. The alternative interpretation of this type shifting rule requires that an element X of the alternative set $[\![\alpha_{NP}]\!]_A$ of the NP must be element of an element Y of the alternative set $[\![\alpha_{CN}]\!]_A$ of the common noun. The definition (60) of the alternative set $[\![\alpha_{NP}]\!]_A$ of an NP follows directly from this requirement: It consists of objects d that are elements of some Y such that Y is element of the alternative set $[\![\alpha_{CN}]\!]_A$ of the common noun. This is the union over the alternative set $[\![\alpha_{CN}]\!]_A$ of the common noun and what we had inferred from the data in section 3.3 in (36). However, the union is not the alternative meaning of the article since there is no such meaning. It is the alternative semantic function of the particular type shift operation from a common noun to an NP.[10]

(58) Type shifting rules – general schema
(i) ordinary function $[\![\alpha_\beta]\!]_O$ => $[\![\alpha_\pi]\!]_O$ with $[\![\alpha_\pi]\!]_O$ © $[\![\alpha_\beta]\!]_O$
(ii) alternative semantic function
$[\![\alpha_\beta]\!]_A$ => $[\![\alpha_\pi]\!]_A$ with X©Y $X\in[\![\alpha_\pi]\!]_A$ $Y\in[\![\alpha_\beta]\!]_A$

(59) Type shifting rules for CN => NP
(i) $([\![\alpha_{CN}]\!]_O)_{<e,t>}$ => $([\![\alpha_{NP}]\!]_O)_e$ with $[\![\alpha_{NP}]\!]_O\in[\![\alpha_{CN}]\!]_O$
(ii) $([\![\alpha_{CN}]\!]_A)_{<<e,t>,t>}$ => $([\![\alpha_{NP}]\!]_A)_{<e,t>}$ with $X\in Y$ $X\in[\![\alpha_{NP}]\!]_A$ $Y\in[\![\alpha_{CN}]\!]_A$

(60) $[\![\alpha_{NP}]\!]_A = \{d|\ d\in Y \text{ for some } Y\in[\![\alpha_{CN}]\!]_A\} = \cup([\![\alpha_{CN}]\!]_A)$

This proposal allows to derive the alternative function of the definite article from the parallel composition of ordinary and alternative meaning values and from a type shift construction rule. The solution does not assign any core semantic value to the definite article, but allows for pragmatic meaning such as uniqueness or familiarity presupposition or implicature, which however is not relevant for the alternative value. Such assumption about the meaning of the definite article coincides with the assumption on the semantics of definiteness in discourse representation theories.

5. Concluding remarks

The given analysis of the alternative semantics of the definite article calls for more investigation into the alternative function of other determiners and familiar expression, as illustrated in (61)-(64). In (61), the domain of quantification generated by the indefinite NP is similar to that one generated by the definite NP in (7a). It is not clear how the domain of quantification is formed in (62), where *five* is a weak quantifier. In the case of strong quantifiers, like in (63), we have a clear preference to compare sets of five professors with respect to a nationality. Plural NPs as in (64) and (65) generate alternatives similar to the singular cases in (7a) and (61).

(61) Sam only introduced a DUTCH_F professor to John.

(62) Sam only introduced five DUTCH_F professors to John.

(63) Sam only introduced exactly five DUTCH_F professor to John.

(64) Sam only introduced the GERMAN_F professors to John.

(65) Sam only introduced GERMAN_F professors to John.

All these data suggest that the alternative function of determiners and the role of type shift rules in the semantics of NPs are not yet fully understood. However, the present analysis of association with focus in definite NPs provides a comprehensive discussion of the alternative function of the definite article. The analysis of association with focus in definite NPs developed in this paper has shown three main points: First, the focus-sensitive operator does not associate directly with the focused expression, but with a larger constituent that contains the focused expression. In LF-movement the-

ories, this larger constituent is the Focus Phrase, or the highest NP containing the focused expression. However, the only way to account for the interpretation of the Focus Phrase was in terms of Alternative Semantics. Therefore, we developed an extension of Alternative Semantics to cover the data. In Alternative Semantics, the focus operator quantifies over the alternative meaning of the VP. The question of whether the operator associates with the focused expression or a larger constituent does not arise. Second, the construction of alternative sets of definite NPs in Alternative Semantics did not allow for any uniqueness condition at the level of alternatives. It rather seemed that the function of the article was the generalized union over the alternative set of the common noun. Third, this assumed alternative function of the article created new problems with respect to the general architecture of Alternative Semantics. After discussing several treatments of this problem, we concluded that the article does not contribute to the formation of the alternative set. It is rather the alternative function of the type shift from the common noun to the NP that creates the particular type of alternative set necessary.

Notes

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1. This (ontological) type restriction on alternatives is only a necessary condition. Sortal and contextual restrictions must also be applied. In other words, the appropriate domain of quantification must be included in the set formed by the *ALT*-function. Note that the alternative set (or p-set in Rooth's terminology) always includes the object from which the set is generated.

2. Alternative semantics must be defined intensionally to distinguish between extensionally equivalent p-sets which express a different intension. For instance, in a situation where Mary introduces Sue to John and Ann to John, and no other introductions are undertaken, the meaning of both predicates ⟦introduced Sue to John⟧ and ⟦introduced Ann to John⟧ are extensionally equivalent. In such a situation, sentence (25a) would be true because the meaning **intro'(a)(j)** that are generated from the alternatives of *Sue* is identical with **intro'(s)(j)**. However, the sentence (25a) is intuitively false in the given situation. LF-moving theories do not need intensions since they have direct access to the meaning of the focus, which on the other hand makes them too powerful (cf. Rooth 1985). In the following I give the extensional version, which could be easily transformed into an intensional one.

Another problem arises in sentences with more than one focus-sensitive operator (cf. Krifka 1996 sec. 4) and with bound anaphoric pronouns. The latter problem has prompted a slightly different account of Alternative Semantics developed by Kratzer (1991b). Although I use Rooth's formulation of Alternative Semantics in the remainder of this paper, the proposed extension can also implemented in any other form of Alternative Semantics.

3. Alternatively, the CN-modifier can be raised to the higher type *<<e,t>,<e,t>>*, which takes a property and yields a property, i.e. the adjective denotes a function from sets into sets. This semantics results in the same ordinary and alternative value for CN-modification:

(28*) $[\![\alpha\beta]\!]_O = [\![\alpha]\!]_O ([\![\beta]\!]_O) = \{d |\ d_{<e,t>} = f_{<<e,t>,<e,t>>}(e_{<e,t>})\ f = [\![\alpha]\!]_O\ e = [\![\beta]\!]_O\}$

(29*) $[\![\alpha\beta]\!]_A = \{X\ (Y) |\ X \in [\![\alpha]\!]_A, Y \in [\![\beta]\!]_A\}$

4. Here, we exclude the possibility that the definite article can be focused. It is questionable whether sentence (i) is wellformed and what it could mean. It seems that the sentence becomes much better if the demonstrative *this* replaces the definite article, as in (ii). Example (iii) is from a letter to the editor (SF Chronicle from October 8, 1997), which discussed the location of a museum in San Francisco. However, this use of focus is clearly contrastive, and it is not clear whether the focused article would associate with a focus-sensitive operator.

(i) ?Sam only saw THE$_F$ man.
(ii) Sam only saw THIS$_F$ man.
(iii) Getting there isn't half the problem. It is THE problem.

5. In this view, the article is a term-creating operator of type *<<e,t>,e>*. We could also keep to the more traditional view that it is a generalized quantifier of type *<<e,t>, <<e,t>,t>>*. The argument can be expressed with this type, too. We assume the simpler type for the sake of conceptual simplicity.

6. It is interesting to note that Rooth (1985: 172–173) uses the union in the analysis of adverbs of quantification and focus. An adverb of quantification is a relation between two sets of time intervals (or situations). The first set consists of those time intervals at which the ordinary meaning of the sentence holds, while the second argument has to be built from the alternative meaning of the sentence or its p-set. However, the p-set is a set of sets of time intervals, which does not fit the type of the argument of the adverb. Thus, Rooth suggests to take the union of the p-set, rather than the p-set itself, as the second argument of the adverb.

7. Manfred Krifka, Daniel Büring and Roger Schwarzschild among others suggested this line of argument to me.

8. Cf. Krifka (1995b), who discusses similar cases and reports from uncertainties in the judgments of predication of sum individuals.

9. It rather seems as if we use in (53c) an alternative set of choice functions. This might be more appropriate for demonstrative expressions. On the other hand, this picture would meet a theory that explains definiteness by the indexical principle of salience. The context provides the choice function that selects a element. The alternative set to this element is formed without this indexical anchoring, and thus using all available choice functions.

10. The same argument can be given for a type shift from a common noun to a NP of type *<<e,t>,t>*. Here, the relation between the meanings are reversed. In (59*i), the common noun meaning must be element of the NP meaning. Therefore, an element X of the alternative meaning $[\![\alpha_{CN}]\!]_A$ of the common noun must be element of an element Y that is in the alternative set $[\![\alpha_{NP}]\!]_A$ of the NP. Thus, the alternative set of an NP of type *<<e,t>,t>* consists of generalized

quantifiers Q that include one of the elements Y of the alternative set $[\![\alpha_{CN}]\!]_A$ of the common noun. This set is certainly too large and must be restricted in one way or other.

(59*) Type shifting rules for CN => NP

(i) $([\![\alpha_{CN}]\!]_O)_{<e,t>}$ => $([\![\alpha_{NP}]\!]_O)_{<<e,t>,t>}$ with $[\![\alpha_{CN}]\!]O \in [\![\alpha_{NP}]\!]_O$

(ii) $([\![\alpha_{CN}]\!]_A)_{<<e,t>,t>}$ => $([\![\alpha_{NP}]\!]_A)_{<<<e,t>,t>,t>}$ with $X \in Y\ X \in [\![\alpha_{CN}]\!]_A\ Y \in [\![\alpha_{NP}]\!]_A$

(60*) $[\![\alpha_{NP}]\!]_A = \{Q |\ Y \in Q$ for some $Y \in [\![\alpha_{CN}]\!]_A\}$