Semantics of metalinguistic focus *

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Abstract

Focus on metalinguistic aspects of utterances, despite being a robust phenomenon in natural language, is unamenable to the standard semantics of focus. Nonetheless, I show that this type of focus can be understood in terms of standard focus semantics, if we incorporate insights from Pott's [21] multi-dimensional semantics of mixed quotations. Moreover, I develop a scope-taking account to compositionally synthesize focus semantics and quotation semantics.

1 Metalinguistic focus

It is standardly assumed that focusing a word indicates that alternatives to the word are considered. The alternatives are derived from the denotation of the word (Rooth [22, 23]). For example, the focused noun $geese_{\mathrm{F}}$ triggers a set of alternatives including all entities of type $e \rightarrow t$. However, in natural language, focus is not only determined based on the denotation, i.e., the meaning, of a word, but also based on its *non-semantic aspect*, as exemplified in (1).

(1) a. A: Look! Some gooses are flying.
b. B: No. Some $[\text{geese}]_{\mathrm{F}}$ are flying.

Native speakers share the intuition that what B objects to in (1) is not the meaning of A's utterance, but rather the realization of the plural morphology on *goose* A has chosen. Since one's preference of phonological form is an attribute of utterances, focus on these aspects have been said to be 'metalinguistic' (Selkirk [25]).

Metalinguistic focus is a robust phenomenon found not just in English. In the Mandarin example (2), B corrects A's pronunciation of the city name by focusing the final syllable.

(2) a. A: Libai qu-le Ha'erbing.
Libai go-Asp Harbin
'Libai went to Harbing.'

b. B: Ta qu-le Ha'er$[\text{bin}]_{\mathrm{F}}$.
he go-Asp Harbin
'He went to Har$[\text{bin}]_{\mathrm{F}}$.'

In (2b), focus is assigned to the syllable bin, which does not have an identifiable separate meaning in this case[1]. The focus can only be interpreted in metalinguistic terms.

Metalinguistic focus has the same set of phonological properties as normal, semantic use of focus (Selkirk [25]). The close affinity in ordinary focus and metalinguistic focus naturally leads us to expect a uniform focus theory that accounts for both. However, nontrivial challenges arise when the classical compositional semantics for focus is extended to metalinguistic focus.

The primary difficulty lies in the fact that our classical focus theory is based on denotation, something that phonological forms lack. This property is shared by many semantic theories of focus, like Kratzer [15], Krifka [16] and Rooth [22, 23]. For concreteness I base the discussion

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[1] While most monosyllabic units bear meaning in Mandarin, *Ha'erbin* is a loanword from Manchu and hence it does not have a decomposable meaning for Mandarin native speakers.

on Rooth's focus semantics. In this theory, it is assumed that a focused phrase α_F is associated with two semantic values: the ordinary value $[\![\alpha]\!]$, which is the normal denotation, and the focus value $[\![\alpha]\!]^f$, which is a set of alternative denotations to $[\![\alpha]\!]$. The focus value of a larger phrase Σ embedding α_F is derived from $[\![\alpha]\!]^f$ via the pointwise function application rule. Finally, [23] formalizes his theory of focus licensing by positing an operator $\sim$. This operator requires a contextual restriction C, which is subject to the following constraints:

(3) $$[\![[\Sigma] \sim C]\!] = \begin{cases} [\![\Sigma]\!] \text{ if } C \subseteq [\![\Sigma]\!]^f \wedge [\![\Sigma]\!] \in C \wedge \exists y[y \in C \wedge y \neq [\![\Sigma]\!]] \\ \text{otherwise undefined} \end{cases}$$

It says that C is the subset of $[\![\alpha]\!]^f$ and must contain a contextual salient antecedent that differs from $[\![\alpha]\!]$. Focus in a sentence is felicitous only if the requirement of $\sim$ is satisfied. Although $\sim$ is not present in all versions of compositional semantics for focus, its requirements are always implemented in some way, for example by the **assert** operator in Krifka [16].

Returning to the dialogue in (1), (1b) and its antecedent (1a) have the same denotation, as *gooses* share the same denotation as *geese*, at least from B's perspective. What this means is that (1b) does not semantically differ from its contextual antecedent. As a result, the requirement of $\sim$ is not satisfied and B's use of focus on *geese* should not be appropriate in this context, contrary to fact.

In order to take care of metalinguistic focus, one may try directly upgrading the focus theory with a mechanism that can generate focus alternatives with metalinguistic information. A potential analysis is made possible by Katzir's [13] structural alternative approach. To put simply, metalinguistic focus can be understood as focus on the whole word, which has both form and meaning. The sentence in (1b) can be taken to be a structure consisting of words, i.e., units with form and meaning. Its focus alternative is derived by replacing the focused word *geese* with the word *gooses*. Consequently, although (1b) has the same semantic interpretation as its alternative, i.e., (1a), they have different forms: (1b) has the word *geese*, but its alternative has the word *gooses*.

However, the solution generates an undesirably strong requirement on focus licensing. Since a word has both form and meaning, judging whether focus is licensed should depend not only on meaning but also on form. The condition is too strong as it wrongly rules out the felicitous use of focus in (2b). Following the structural alternative assumption, we can generate alternatives to (2b) by replacing *Ha'erbin* with other nouns. So, the focus alternative set is $\{[_S \text{ ta shi qu-le } x] \mid x \text{ is a noun}\}$. The antecedent sentence (2a) cannot belong to this set, because the first word in (2a) is *Libai* instead of *ta*. The requirement of $\sim$ should not be satisfied.

2 The two-dimensional meaning of metalinguistic focus

I analyze metalinguistic focus as **focus on linguistic expressions**. Linguistic expressions have been studied in the literature of quotation, such as Koev [14], Maier [17], Potts [21] and Shan [28]. Based on the previous studies, I enrich the ontology by adding the type of linguistic expressions u. The domain of linguistic expressions D_u contains all possible phonological strings, not only the ones that are a part of the language. This domain is closed under concatenation $^\frown$. If a and b are phonological strings (linguistic expressions), then $\mathsf{a}^\frown\mathsf{b}$ is also a phonological string (linguistic expression). Throughout this paper I write linguistic expressions in $\mathsf{sans\ serif}$. Other basic types are individuals (type e), truth values (type $t := \{0, 1\}$) and variables ($\mathcal{V} := \{x, y, v, ...\}$). I assume that models $\mathcal{M}$ are tuples of the form $\langle L, D, [\![\cdot]\!]^c\rangle$, where L is a natural language, D is the domain of any type and $[\![\cdot]\!]^c : L \to D$ is the interpretation function relativized to an utterance context c, which involves the information of the author, the hear, the world and the time of an utterance (Kaplan [11]; Schlenker [24]).

Following Potts [21], I propose a two-dimensional semantics for linguistic expressions. In particular, I define an operator $\ulcorner\cdot\urcorner$ to model the semantic contribution of a linguistic expression. This function is applied to a linguistic expression u and returns a pair involving the meaning of u in the context c and an 'expression' meaning, as in (4).

(4) $$[\![\ulcorner \mathsf{u} \urcorner]\!]^c = \begin{cases} (\!|\mathsf{u}|\!)(c) \bullet \mathbf{exp}(c, \mathsf{u}, (\!|\mathsf{u}|\!)(c)) & \text{if } \mathsf{u} \text{ is a meaning bear element in } c; \\ \text{otherwise, undefined} \end{cases}$$

a. c is an utterance context.

b. $(\!|\cdot|\!)$ is a function taking a linguistic expression u and returning another function from an utterance context c to the content that u is used to express in c (i.e., Kaplanian characters, see also Shan [28])

c. $\mathbf{exp}$ is a three-place predicate, associating a context and a linguistic expression to a semantic representation (cf. Maier [17]):

$$\mathbf{exp}(c, \mathsf{u}, x) ::= \text{the linguistic expression } \mathsf{u} \text{ is used to express } x \text{ in } c$$

d. $\alpha \bullet \beta$ stands for $\langle \alpha, \beta \rangle$

The 'expression' meaning captures the implication of using metalinguistic focus. For example, in (1b), the core proposition is that there are some geese flying. B also indicates that the intended property is expressed by the phonological form geese, instead of gooses (see also Bolinger [4]). The 'expression' meaning conveys a non-at-issue information. It is not canceled when the sentence is embedded under a truth value negation[2] or a modal. For example, in (5a), *it's not true* only negates the at-issue meaning of its complement. Therefore, the continuation, which confirms that the speaker managed to solve the problem, is not felicitous. In (5b), it is clear that the information of the plural form of *mongoose* project out of the scope of *might*.

(5) a. ?*It's not true that I [mìʸəniǰd]$_\mathrm{F}$ to solve the problem — I [mæ̀ʸəniǰd]$_\mathrm{F}$ to solve the problem. (Horn [10]: 146)

b. Yesterday, Lee might have caught two mongeese. — Uh, sorry, he might have caught two mon[gooses]$_\mathrm{F}$.

The multi-dimensional semantics was designed by Karttunen and Peters [12] to compositionally derives the non-at-issue meaning. This approach has recently been revived by Dekker [7], Gutzmann [8], Potts [20] and so on.

Returning to our examples, for instance (1b), if focus is assigned to the linguistic expression geese, then the puzzle can potentially be resolved. The salient alternative to geese is another linguistic expression gooses in the context. Applying the $\ulcorner\cdot\urcorner$ to them yields:

(6) a. $[\![\ulcorner \mathsf{geese} \urcorner]\!]^c = \lambda x.\mathbf{*goose}(x) \bullet \mathbf{exp}(c, \mathsf{geese}, \lambda x.\mathbf{*goose}(x))$

b. $[\![\ulcorner \mathsf{gooses} \urcorner]\!]^c = \lambda x.\mathbf{*goose}(x) \bullet \mathbf{exp}(c, \mathsf{gooses}, \lambda x.\mathbf{*goose}(x))$

As a result, the two linguistic expressions give rise to different 'expression' meanings, though their semantic values are identical relative to c: the semantic value of geese is the property $\lambda x.\mathbf{*goose}(x)$ in the B's (the author of c) English and gooses denotes the same thing in the A's (the hearer of c) English. Then, if we can compositionally derive the meaning of (1b) and make the 'expression' meaning project globally, the sentence *some* $\ulcorner$*geese*$\urcorner$ *are flying* does not have the same denotation as *some* $\ulcorner$*gooses*$\urcorner$ *are flying*. In this sense, the problem discussed in section

[2]It is noticed that the 'expression' meaning can be negated by metalinguistic use of *not* (Horn [10]). In the literature, it is still debated whether metalinguistic negation is one use of *not* or the homonym of *not*.

$$\begin{tikzcd} e \arrow[r, "\mathsf{Lift}"] \arrow[d, "\mathsf{ident}"'] & (e \to t) \to t \\ e \to t \arrow[ur, "\mathsf{A}"'] & \end{tikzcd}$$

(a) Partee Triangle

$$\begin{tikzcd} a \arrow[r, "\mathsf{Lift}"] \arrow[d, "\eta_{\mathsf{F}}"'] & (a \to \mathsf{F}b) \to \mathsf{F}b \\ \mathsf{F}a \arrow[ur, "\Uparrow_{\mathsf{F}}"'] & \end{tikzcd}$$

(b) $\mathsf{Lift}, \eta_{\mathsf{F}}, \Uparrow_{\mathsf{F}}$

$$\begin{tikzcd} a \arrow[r, "\mathsf{Lift}"] \arrow[d, "\eta_{\mathsf{U}}"'] & (a \to \mathsf{U}b) \to \mathsf{U}b \\ \mathsf{U}a \arrow[ur, "\Uparrow_{\mathsf{U}}"'] & \end{tikzcd}$$

(c) $\mathsf{Lift}, \eta_{\mathsf{U}}, \Uparrow_{\mathsf{U}}$

Figure 1: Decomposition of **Lift**

1 does not arise. In the next section, I will show that the goal sketched here can be achieved by fully composing the linguistic expression that $\ulcorner\cdot\urcorner$ operates on with other ordinary elements. In my compositional analysis, only linguistic expressions give rise to the information of form via the application of $\ulcorner\cdot\urcorner$. Consequently, the forms of other ordinary items do not affect the semantic computation of focus licensing. We will not run into the under-generation problem as the structural alternative approach faces.

3 Metalinguistic focus takes scope

In this section, I show that metalinguistic focus can be composed with other ordinary lexical items. The main idea follows the classical Montagovian method of composing quantifiers, i.e., metalinguistic focus, which has a 'fancy' type, **takes scope out of a bigger constituent**, which has a 'plain' type. These two constituents then compose with the help of two pairs of type shifters and Function Application.[3] Note that there is an alternative 'in-situ' compositional analysis, which is more faithful to Rooth's focus semantics and Pott's multi-dimensional semantics. I will return to this analysis in section 5 and show that it has some non-trivial problems.

Partee [18] defines a group of type shifters, **Lift**, **A** and **ident**, that connect basic NP types e, $e \to t$ and $(e \to t) \to t$. Their relationship is summarized in the famous Partee triangle, as shown in Figure 1a. The diagram fully commutes. Hence, **Lift** can be considered as the composition $\mathsf{ident} \circ \mathsf{A}$.

There is no real reason to assume that the idea of type shifting only manifests itself in the nominal domain. **Lift** as a polymorphic function is defined for arbitrary input types (Hendricks [9]; Partee and Rooth [19]). Moreover, following Partee's logic, Charlow [6] shows that **Lift** can be decomposed in other ways. Hence, we may have various groups of type shifters, which are used to compose the items with 'fancy' types, like alternatives or pairs, with ordinary items.

This approach can be extended to focus. Following Rooth [22, 23], I assume that the focused phrase α_{F} denotes a pair consisting of its ordinary value $[\![\alpha]\!]$ and the alternative set to $[\![\alpha]\!]$. If α has some type a, then the type of α_{F} is $a \times (a \to t)$. This 'fancy' type is abbreviated as $\mathsf{F}a$. I define the type shifting functions η_{F} and $\Uparrow_{\mathsf{F}}$ in (7) (see also Charlow [5]; Shan [26]).

(7) a. $\eta_{\mathsf{F}}(x) := x \bullet \{x\}$ $\qquad \mathbf{F} : a \to \mathsf{F}a$

b. $(x \bullet X)^{\Uparrow_{\mathsf{F}}} := \lambda f.\mathsf{fst}(f(x)) \bullet \bigcup_{x' \in X} \mathsf{snd}(f(x'))$ $\qquad \Uparrow_{\mathsf{F}}: \mathsf{F}a \to ((a \to \mathsf{F}b) \to \mathsf{F}b)$

fst and **snd** are operators on pairs. They yield the first member and second member of a pair,

[3] The compositional mechanism used here comprises something known to Category theorists and computer scientists as a 'monad.' I will not formally introduce monads in this paper, but rather represent the monadic spirit in a way that linguists are more familiar with (see also Charlow [6]).

respectively. Through η_{F}, any value can be mapped in a consistent way to a paired value, with the first member the input value and the second member a singleton containing the input value. $\Uparrow_{\mathsf{F}}$ allows an item bearing focus to take scope. Applying the two functions to x, i.e., $(\eta_{\mathsf{F}}(x))^{\Uparrow_{\mathsf{F}}}$, we have actually lifted x from a to $(a \to \mathsf{F}b) \to \mathsf{F}b$. This is essentially **Lift**. Based on this connection, we can draw a Partee-style triangle for a type-a item and its type shifters, as shown in Figure 1b.

Figure 2a shows a sample derivation of *some [geese]*$_{\mathrm{F}}$ *are flying* with the use of the type shifters. The focused phrase takes scope via the application of $\Uparrow_{\mathsf{F}}$, as in (8a). In this paper, I present the scope-taking mechanism using Quantifier Raising. It is also compatible with other theories of scope-taking, such as Continuation (Barker and Shan [2]), Flexible Types (Hendricks [9]), etc. Applying the function η_{F} to *some P are flying* results in a pair of the proposition $\exists x.P(x) \wedge \textbf{fly}(x)$ and a singleton set containing it, as in (8b). The final result is given in (8c).

(8) a. $(\llbracket \text{geese} \rrbracket^c \bullet \textbf{alt}(\llbracket \text{geese} \rrbracket^c))^{\Uparrow_{\mathsf{F}}} = \lambda f.\textbf{fst}(f(\llbracket \text{geese} \rrbracket^c)) \bullet \bigcup_{P \in \textbf{alt}(\llbracket \text{geese} \rrbracket^c)} \textbf{snd}(f(P))$

b. $\eta_{\mathsf{F}}(\exists x.P(x) \wedge \textbf{fly}(x)) = \exists x.P(x) \wedge \textbf{fly}(x) \bullet \{\exists x.P(x) \wedge \textbf{fly}(x)\}$

c. $(\llbracket \text{geese} \rrbracket^c \bullet \textbf{alt}(\llbracket \text{geese} \rrbracket^c))^{\Uparrow_{\mathsf{F}}}\ \lambda P.\ \eta_{\mathsf{F}}(\exists x.P(x) \wedge \textbf{fly}(x))$
$= \exists x.{}^{*}\textbf{goose}(x) \wedge \textbf{fly}(x) \bullet \{\exists x.P(x) \wedge \textbf{fly}(x) \mid P \in \textbf{alt}(\llbracket \text{geese} \rrbracket^c)\}$

As discussed in section 2, the linguistic expression u operated by $\ulcorner \cdot \urcorner$ denotes a pair consisting of the denotation of u in the context c, i.e., $(\!|\mathsf{u}|\!)(c)$, and the propositional 'expression' meaning, i.e., u is used to express $(\!|\mathsf{u}|\!)(c)$ in c. If $(\!|\mathsf{u}|\!)(c)$ has the type a, then $\ulcorner \mathsf{u} \urcorner$ has the type $a \times t$, which is abbreviated as $\mathsf{U}a$. Along the same lines as focus, we can define another pair of type shifters, as in (9), to integrate $\ulcorner \mathsf{u} \urcorner$ into compositional semantics.

(9) a. $\eta_{\mathsf{U}}(x) := x \bullet \mathbf{T}$ $\qquad \eta_{\mathsf{U}} : a \to \mathsf{U}a$

b. $(x \bullet p)^{\Uparrow_{\mathsf{U}}} := \lambda f.\textbf{fst}(f(x)) \bullet p \wedge \textbf{snd}(f(x))$ $\qquad \Uparrow_{\mathsf{U}}: \mathsf{U}a \to ((a \to \mathsf{U}b) \to \mathsf{U}b)$

Similar to η_{F}, η_{U} maps any value to a trivial pair value (being paired with the tautology $\mathbf{T}$). $\Uparrow_{\mathsf{U}}$ is a mapping from pairs into pair-friendly scope takers. The composition $\Uparrow_{\mathsf{U}} \cdot \eta_{\mathsf{F}}$ is also **Lift**. Their relationship is demonstrated in Figure 1c, another Partee-style triangle.

Returning to (1b), I analyze it as (10): the linguistic expression geese inside $\ulcorner \cdot \urcorner$ bears focus.

(10) Some $\ulcorner \mathsf{geese}_{\mathrm{F}} \urcorner$ are flying.

The LF depicting the derivation of (10) is given in Figure 2b. The derivation consists of two steps. First, $\ulcorner \mathsf{geese}_{\mathrm{F}} \urcorner$ takes scope via the application of $\Uparrow_{\mathsf{U}}$. η_{U} is applied to its scope, i.e., $\exists x.P(x) \wedge \textbf{fly}(x)$. Second, $\mathsf{geese}_{\mathrm{F}}$ as a focused item also takes scope, leaving a type u trace inside $\ulcorner \cdot \urcorner$. η_{F} is applied to its scope, in which $\ulcorner \mathsf{u} \urcorner$ composes with $\exists x.P(x) \wedge \textbf{fly}(x)$ through $\Uparrow_{\mathsf{U}}$ and η_{U}, as shown in (11).

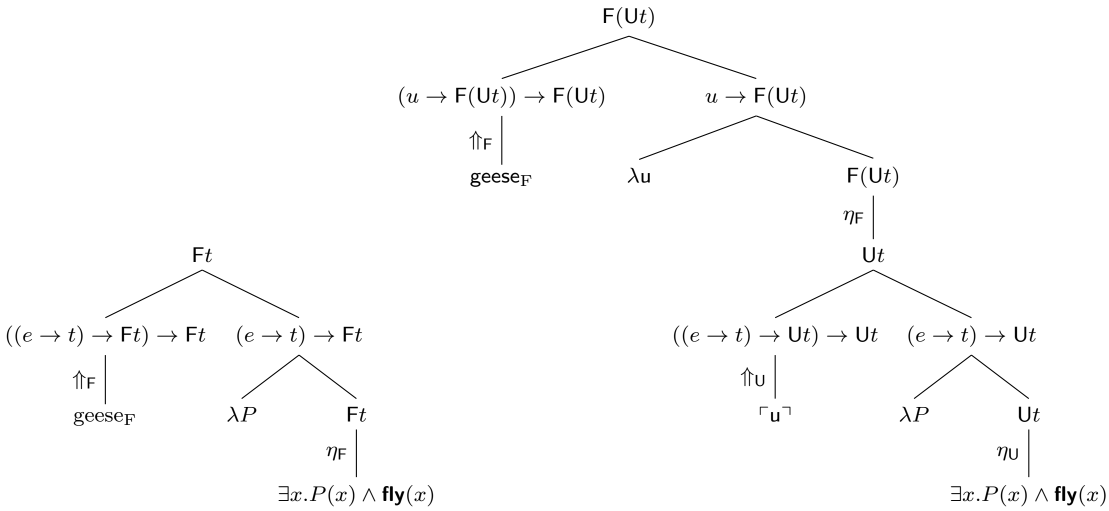
(11) a. $(\llbracket \ulcorner \mathsf{u} \urcorner \rrbracket^c)^{\Uparrow_{\mathsf{U}}} = ((\!|\mathsf{u}|\!)(c) \bullet \textbf{exp}(c, \mathsf{u}, (\!|\mathsf{u}|\!)(c)))^{\Uparrow_{\mathsf{U}}} = \lambda f \left(\begin{array}{c} \textbf{fst}(f((\!|\mathsf{u}|\!)(c))) \\ \bullet \\ \textbf{exp}(c, \mathsf{u}, (\!|\mathsf{u}|\!)(c)) \wedge \textbf{snd}(f((\!|\mathsf{u}|\!)(c))) \end{array} \right)$

b. $\eta_{\mathsf{U}}(\exists x.P(x) \wedge \textbf{fly}(x)) = \exists x.P(x) \wedge \textbf{fly}(x) \bullet \mathbf{T}$

c. $((\!|\mathsf{u}|\!)(c) \bullet \textbf{exp}(c, \mathsf{u}, (\!|\mathsf{u}|\!)(c)))^{\Uparrow_{\mathsf{U}}}\ \lambda P.\ \eta_{\mathsf{U}}(\exists x.P(x) \wedge \textbf{fly}(x)) = \begin{array}{c} \exists x.(\!|\mathsf{u}|\!)(c)(x) \wedge \textbf{fly}(x) \\ \bullet \\ \textbf{exp}(c, \mathsf{u}, (\!|\mathsf{u}|\!)(c)) \end{array}$

Then, $\mathsf{geese}_{\mathrm{F}}$ is composed with (11c) in the same way as the one illustrated in (12):

(12) a. $(\llbracket \mathsf{geese} \rrbracket^c)^{\Uparrow_{\mathsf{F}}} = \lambda f.\textbf{fst}(f(\mathsf{geese})) \bullet \bigcup_{\mathsf{u}' \in \textbf{alt}(\mathsf{geese})} \textbf{snd}(f(\mathsf{u}'))$



(a) Focus (b) Metalinguistic focus

Figure 2: Composition: Focus and metalinguistic focus take scope

b. $$\eta_{\mathsf{F}} \begin{pmatrix} \exists x.\llparenthesis \mathsf{u} \rrparenthesis(c)(x) \wedge \mathbf{fly}(x) \\ \bullet \\ \mathbf{exp}(c, \mathsf{u}, \llparenthesis \mathsf{u} \rrparenthesis(c)) \end{pmatrix} = \begin{pmatrix} \exists x.\llparenthesis \mathsf{u} \rrparenthesis(c)(x) \wedge \mathbf{fly}(x) \\ \bullet \\ \mathbf{exp}(c, \mathsf{u}, \llparenthesis \mathsf{u} \rrparenthesis(c)) \end{pmatrix} \bullet \left\{ \begin{matrix} \exists x.\llparenthesis \mathsf{u} \rrparenthesis(c)(x) \wedge \mathbf{fly}(x) \\ \bullet \\ \mathbf{exp}(c, \mathsf{u}, \llparenthesis \mathsf{u} \rrparenthesis(c)) \end{matrix} \right\}$$

c. $$(\llbracket \mathsf{geese} \rrbracket^{c})^{\Uparrow_{\mathsf{F}}}\ \lambda \mathsf{u}.\ \eta_{\mathsf{F}} \begin{pmatrix} \exists x.\llparenthesis \mathsf{u} \rrparenthesis(c)(x) \wedge \mathbf{fly}(x) \\ \bullet \\ \mathbf{exp}(c, \mathsf{u}, \llparenthesis \mathsf{u} \rrparenthesis(c)) \end{pmatrix}$$
$$= \begin{pmatrix} \exists x.\llparenthesis \mathsf{geese} \rrparenthesis(c)(x) \wedge \mathbf{fly}(x) \\ \bullet \\ \mathbf{exp}(c, \mathsf{geese}, \llparenthesis \mathsf{geese} \rrparenthesis(c)) \end{pmatrix} \bullet \left\{ \begin{matrix} \exists x.\llparenthesis \mathsf{u}' \rrparenthesis(c)(x) \wedge \mathbf{fly}(x) \\ \bullet \\ \mathbf{exp}(c, \mathsf{u}', \llparenthesis \mathsf{u}' \rrparenthesis(c)) \end{matrix} \;\middle|\; \mathsf{u}' \in \mathbf{alt}(\mathsf{geese}) \right\}$$

After these two steps, we apply Rooth's focus interpretation operator $\sim$, which is re-defined in (13) to be compatible with the present analysis. Compositionally, it is an operation for discharging focus values (bringing $\mathsf{F}a$ back to a).

(13) $$(x \bullet X){\sim}C := \begin{cases} x \text{ if } C \subseteq X \wedge x \in C \wedge \exists y[y \in C \wedge y \neq x] \\ \text{otherwise undefined} \end{cases} \qquad {\sim}C : \mathsf{F}a \to a$$

Given the context, the free variable C contains two members—*some* $\ulcorner$*geese*$\urcorner$ *are flying* and *some* $\ulcorner$*gooses*$\urcorner$ *are flying*. The requirement of $\sim$ is fulfilled.

4 Focus below the word level

The present analysis can be extended to another intriguing focus phenomenon, first discussed by Bolinger [3]—focus below the word level. In particular, focus can be realized on a different syllable in a word than the one stress normally falls on. When this happens, the meaning of a sentence is also affected. Artstein [1] represents Bolinger's observation by revising his 'stalagmite' example. Consider the sentences in (14). The stress of the word *stalagmite* is normally assigned to the second syllable, as in (14a). In this example, the whole word is considered focused. However, the stress can alternatively be assigned to the final syllable of *stalagmite*, as in (14b). Here, only the syllable mite is focused.

(14) a. John only brought home a [stalágmite]$_F$ from the cave.
b. John only brought home a stalag[míte]$_F$ from the cave.

These two sentences have different truth conditions. Suppose a scenario that John brought home a stalagmite and a rock from the cave, then (14a) is false, but (14b) can be true. This is because in (14b) the alternative to *stalagmite* is restricted to a word which has a similar form, i.e., *stalactite*. Therefore, (14b) only entails that John didn't bring home a stalactite, but he might have brought home anything else.

Focus below the word level is intriguing because the focus bearing elements, mite in this case, often do not have a meaning, just like focus on phonological forms in metalinguistic focus. In order to resolve this puzzle, Artstein [1] postulates a semantic process of phonological decomposition, which assigns denotations to units that lack an independent meaning. Briefly, the focused part of a word denotes a phonological string and the rest of the word is a function from phonological strings to word meanings. For example, $[\![\text{stalag}]\!]([\![\textsf{mite}]\!]) = [\![\text{stalagmite}]\!]$. Therefore, the meaning of the word parts is fully compositional. Any compositional semantics of focus can apply to parts of words without modification.

Although phonological decomposition is also used to explain focus on phonological strings, it cannot be extended to metalinguistic focus. Let's return to the Mandarin example (2), repeated in (15), in which the final syllable of *Ha'erbin* is focused and in Mandarin, generally, the first syllable of a word is prosodically prominent. It looks similar to focus below the word level.

(15) a. A: Libai qu-le Ha'erbing.
Libai go-Asp Harbin
'Libai went to Harbing.'

b. B: Ta qu-le Ha'er[bin]$_F$.
he go-Asp Harbin
'He went to Har[bin]$_F$.'

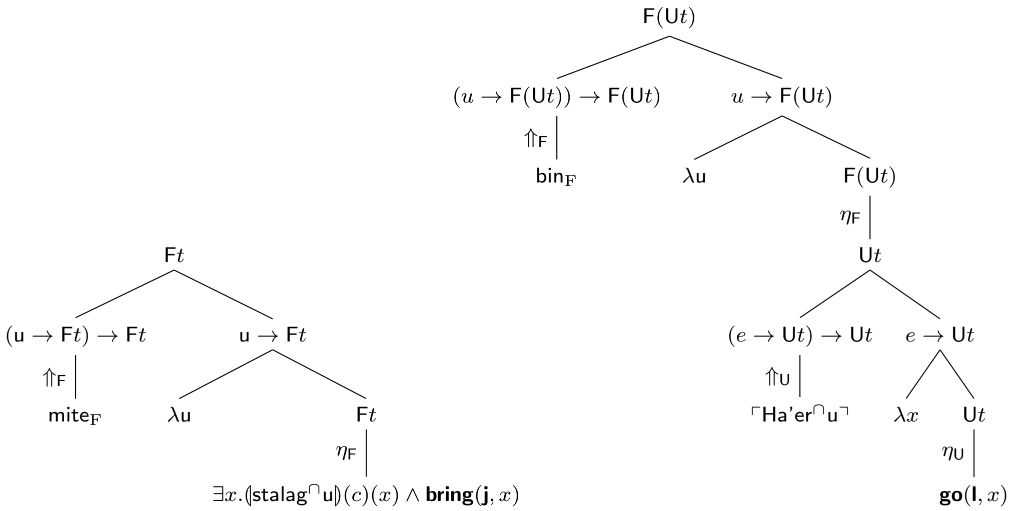
According to phonological decomposition, applying the function denoted by *Ha'er* to the syllable bin yields the denotation of the word, i.e., the capital city of Heilongjiang Province. It cannot resolve the problem pointed out in section 1 and cannot capture the 'expression' meaning of metalinguistic focus.

In fact, focus below the word level is not necessarily metalinguistic (cf. Selkirk [25]). Intuitively, (14b) does not express the contrast on forms. *Stalagmite* contrasts with its alternative *stalactite* with respect to meaning. Additionally, the sentence does not imply the 'expression' meaning. The focus on mite only imposes a restriction on possible alternatives, i.e., their phonological forms must share stalag.

However, the present analysis is able to capture (14) as well as (15). I uniformly assume that focus in both examples is assigned to the part of the linguistic expressions (phonological strings) stalagmite and Ha'erbin, but I apply $\ulcorner \cdot \urcorner$ to Ha'erbin, while $(\!|\cdot|\!)$ to stalagmite. Consequently, $\ulcorner$Ha'erbin$\urcorner$ denotes a pair meaning, whereas $(\!|$stalagmite$|\!)$ denotes a property in the context of utterance. The derivations of (14b) and (15b) are shown in Figure 3a and 3b, respectively.[4] I sketch the composition of (14b) as follows but leave that of (15b) for the reader.

In (14b), the phonological string stalagmite is decomposed into three syllables—sta, lag and mite, which are also linguistic expressions and may compose by concatenation (see section 2). Since mite is focused, it takes scope via the application of $\Uparrow_F$. $(\!|\cdot|\!)$ is applied to the remaining parts and transforms a linguistic expression into a character. In the context of utterance c,

[4] I have omited *only* in the derivation for simplification. The classical definition of *only* is compatible with my analysis.



(a) Stalag[mite]$_{\mathrm{F}}$ (b) Ha'er[bin]$_{\mathrm{F}}$

Figure 3: Focus below the word level: Metalinguistic and non-metalinguistic

$(\!|\mathsf{stalag}^\cap\mathsf{u}|\!)(c)$ denotes a $e \to t$ type property. So, it directly composes with other lexical items in the sentence, yielding a proposition. Applying η_{F} to the proposition results in (16a). Then, composing the result with $(\llbracket \mathsf{mite}_{\mathrm{F}} \rrbracket)^{\Uparrow_{\mathsf{F}}}$ leads to (16b).

(16) a. $$\eta_{\mathsf{F}}(\exists x.(\!|\mathsf{stalag}^\cap\mathsf{u}|\!)(c)(x) \wedge \mathbf{bring}(\mathbf{j}, x)) = \begin{array}{c} \exists x.(\!|\mathsf{stalag}^\cap\mathsf{u}|\!)(c)(x) \wedge \mathbf{bring}(\mathbf{j}, x) \\ \bullet \\ \{\exists x.(\!|\mathsf{stalag}^\cap\mathsf{u}|\!)(c)(x) \wedge \mathbf{bring}(\mathbf{j}, x)\} \end{array}$$

b. $$(\mathsf{mite} \bullet \mathbf{alt}(\mathsf{mite}))^{\Uparrow_{\mathsf{F}}}\ \lambda\mathsf{u}. \left(\begin{array}{c} \exists x.(\!|\mathsf{stalag}^\cap\mathsf{u}|\!)(c)(x) \wedge \mathbf{bring}(\mathbf{j}, x) \\ \bullet \\ \{\exists x.(\!|\mathsf{stalag}^\cap\mathsf{u}|\!)(c)(x) \wedge \mathbf{bring}(\mathbf{j}, x)\} \end{array} \right)$$
$$= \begin{array}{c} \exists x.(\!|\mathsf{stalag}^\cap\mathsf{mite}|\!)(c)(x) \wedge \mathbf{bring}(\mathbf{j}, x) \\ \bullet \\ \{\exists x.(\!|\mathsf{stalag}^\cap\mathsf{u}|\!)(c)(x) \wedge \mathbf{bring}(\mathbf{j}, x) \mid \mathsf{u} \in \mathbf{alt}(\mathsf{mite})\} \end{array}$$

5 Comparison with the 'in-situ' composition

In my analysis, both focus and linguistic expressions take scope. However, scope taking may not be necessary if we only consider simple cases. Let's still take (1b) as an example. Assuming Rooth's focus semantics and Koev's [14] two-dimensional function application, as in (17) (cf. [21]), we can compose the meaning of (1b) without letting the metalinguistic focus take scope.

(17) Two-dimensional function application:
If $\llbracket\alpha\rrbracket_{(\sigma\to\tau)\times t} = a_1 \bullet p_2$ and $\llbracket\beta\rrbracket_{\sigma\times t} = b_1 \bullet p_2$, then $\llbracket\alpha(\beta)\rrbracket_{\tau\times t} = a_1(b_1) \bullet p_1 \wedge p_2$.

When the $\ulcorner\cdot\urcorner$ operator is applied to $\mathsf{geese}_{\mathsf{F}}$, a two-dimensional meaning is generated which interacts focus. As the ordinary value, a two-dimensional meaning is computed based on the form geese. As the focus value, a set of two-dimensional meanings are computed based on the alternative forms .

(18) a. $[\![\ulcorner \mathsf{geese_F} \urcorner]\!]^c = \ulcorner \mathsf{geese} \urcorner = \lambda x.\mathbf{*goose}(x) \bullet \mathbf{exp}(c, \mathsf{geese}, \lambda x.\mathbf{*goose}(x))$

b. $[\![\ulcorner \mathsf{geese_F} \urcorner]\!]^c_f = \{\ulcorner \mathsf{u} \urcorner \mid \mathsf{u} \in \mathbf{alt}(\mathsf{geese})\}$

We also assume that other lexical items have trivial two-dimensional meanings, i.e., they denote pairs of their denotations and $\mathbf{T}$. For example, $[\![\text{fly}]\!]^c = \lambda x.\mathbf{fly}(x) \bullet \mathbf{T}$ and $[\![\text{some}]\!]^c = \lambda P \lambda Q \exists x.P(x) \wedge Q(x) \bullet \mathbf{T}$. Hence, their focus values are singleton sets of a pair: $[\![\text{fly}]\!]^c_f = \{[\![\text{fly}]\!]^c\}$ and $[\![\text{some}]\!]^c_f = \{[\![\text{some}]\!]^c\}$. In the ordinary dimension, we compose (1b) via the two-dimensional function application, yielding (19a), the ordinary value of (1b); whereas in the focus dimension, we pointwisely compose $[\![\ulcorner \mathsf{geese_F} \urcorner]\!]^c_f$ with $[\![\text{some}]\!]^c_f$ and $[\![\text{fly}]\!]^c_f$, yielding (19b), the focus value of (1b). This result is equivalent to (12c).

(19) a. $\exists x.\mathbf{*goose}(x) \wedge \mathbf{fly}(x) \bullet \mathbf{exp}(c, \mathsf{geese}, \lambda x.\mathbf{*goose}(x))$

b. $\{\exists x.(\!|\mathsf{u}|\!)(c)(x) \wedge \mathbf{fly}(x) \bullet \mathbf{exp}(c, \mathsf{u}, \lambda x.(\!|\mathsf{u}|\!)(c)(x)) \mid \mathsf{u} \in \mathbf{alt}(\mathsf{geese})\}$

Indeed, the 'in-situ' composition presented here is more in line with the classical version of Rooth's focus semantic, but it also inherits its problems. First, the standard λ-abstraction rule cannot be applied. Consider (20a), whose LF is given in (20b). The quantifier *nobody* takes scope. At the ordinary dimension, if we apply the standard λ-abstraction rule to the scope of *nobody*, then we end up with a type $e \to (t \times t)$ element, which cannot compose with *nobody* by (17) due to type mismatch.

(20) a. The pólice, uh sorry, the [polı́ce]$_{\mathrm{F}}$ arrested nobody.

b. $\underbrace{\text{nobody}}_{o:\ ((e\to t)\to t)\times t \quad f:\ (((e\to t)\to t)\times t)\to t} \quad \lambda x\ \underbrace{[\text{the [polı́ce]}_{\mathrm{F}} \text{ arrested } x]}_{o:\ t\times t \quad f:\ (t\times t)\to t}$

In the focus dimension, λ-abstraction has to apply to the focus alternative set generated by *[polı́ce]*$_{\mathrm{F}}$. Shan [27] has already shown that λ-abstraction over an alternative set is problematic.

Second, the 'in situ' composition predicts that metalinguistic focus and ordinary focus must be evaluated unselectively when they co-occur in the scope of a focus sensitive adverbial like *only*. This is not true. Consider (21), where *only* is associated with *Peter* rather than *coffee*.

(21) Lee only asked [Peter]$_{\mathrm{F}}$ to buy coffin. Uh sorry, he only asked [Peter]$_{\mathrm{F}}$ to buy co[ffee]$_{\mathrm{F}}$.

These two problems do not arise with the scope-taking approach. It has already been shown in other studies (Charlow [5, 6]) that enriched composition coupled with scope-taking is compatible with standard λ-abstraction. In addition, since focus takes scope, the selectivity effect in (21) can be captured (cf. Krifka [16]).

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