A Recursive Phonology Interface for WH-F Alternative Semantics

Mats Rooth and Hongyuan Dong

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(1) he earns more than I earn

phonology [ay] "I" has highest prominence in phonological interval φ.
semantics 'x2 earns d much' and 'spkr earns d much' are substitution alternatives, with substitution in the y position of 'y earns d much'.

(2) an American farmer told a Canadian farmer a joke

phonology Second syllable of Canadian has highest prominence in phonological interval φ.
semantics \( \lambda P \exists x [\text{american}(x) \land \text{farmer}(x)] \) are substitution alternatives, with substitution in the position Y of \( \lambda P \exists y [Y(y) \land \text{farmer}(x)] \).

(3) ah11alt — embedded wh-question (focus prosody within the embedded clause)
Naoya still remembers what Mari drank at the bar.

ah11alt

ah11b1t — embedded yes/no-question (no focus prosody)
Naoya still remembers whether Mari drank something at the bar.

ah11b1t

Shin Ishihara

(4) Hokenzyo-wa [syokutyuudoku-kanzya-zen’in-ga
NA ni-o tabeta-ka] ma da kakunin-dekimai-no? health.department-TOP food.poisoning-victim-all-NOM

Is the Department of Health yet to be able to confirm [what all of those who suffered from food poisoning ate]? Kitagawa (2007)

(5) Hokenzyo-wa [syokutyuudoku-kanzya-zen’in-ga
NA ni-o tabeta-ka] kakunin-siyoo-tositeiru-no? health.department-TOP food.poisoning-victim-all-NOM

What is such that the Department of Health is trying to confirm [whether all of those who suffered from food poisoning ate it]? Kitagawa (2007)
Phonology-Semantics Homomorphy I

The scope of F in English, and the scope of WH-F in Japanese agrees with the phonological domain of prominence.

(6) You used to earn a little bit more than I did. Now you earn much more than I do.

Narrower-scope focus

| phonology | [ay] "I" has highest prominence in phonological interval φ. |
| semantics | hearer earns d much and spkr earns d much are substitution alternatives, with substitution in the y position of 'y earns d much'. |

Wider-scope focus

| phonology | NOW and MUCH have more prominence than anything else in phonological interval ψ. |
| semantics | 'then hearer earned a little bit more than spkr earned' and 'now heared earns much more than spkr earns' are substitution alternatives, with substitution in the t and x positions of 'at t hearer earns x much more than spkr earns'. |

(7) Amy-wa [DA re-ga asokode nani-o katta-ka] sonnani siritagatteiru-no? -TOP who-NOM there what-ACC bought-COMPWh that.much.want.to.know-COMPWh WHO is such that Amy wants to know so eagerly [what he, bought there]?'

Kitagawa (2005)

Phonology-Semantics Homomorphy II

In configurations with two F’s or two WH-F’s with different semantic scopes, relative phonological prominence parallels relative semantic scope.

(8) Stress F

Let β be an F-marked phrase with scope φ. Then the strongest stress in the phonological realization of φ falls within the realization of β.

The core cases of SOF and recursive WH-F fall out of stress F.
(9) **Hypothesis**
1. WH in Japanese is literally focused.
2. WH/WH in Japanese is isomorphic to F/SOF in English
   This is stated explicitly in Ishihara (2006).
3. Pretty good accounts of the recursive effects, either stress F or cyclic spellout.

(10) **Syntactic F movement**
1. F drives movement
2. F has a phonological interpretation that is sensitive to LF scope. F-marked phrase is spelled out in a cycle later than its scope, with interpretation of greater prominence or specific intonational profile.
3. F+WH and F-WH have semantic interpretations that are sensitive to LF scope, like anything.

Why does WH subclassify F?

(11) **UG feature geometry says that WH subclassifies F.**
1. +F+WH so-called WH
2. +F-WH so-called F

(12) F and WH both use alternative semantics—they have a common meaning component, an ‘alternative semantic value’.
The phonology interface that is relevant for F and F+WH is the recursive phonology interface for alternative semantic values.

Alternative semantics architecture

(13) **Hamblin**
- [ν0, Mary-o aisiteiru]  \{λx.love(x, m)\}
- [ν0, dare-o aisiteiru]  \{λx.love(x, y) | person(y)\}
- [ν0, Mary-ο aisiteiru]  not analyzed

(14) **Rooth**
- [ν0, Mary-o aisiteiru]  ordinary \{λx.love(x, m)\}
- focus \{λx.love(x, m)\}
- [ν0, dare-o aisiteiru]  ordinary \{λx.love(x, y) | person(y)\}
- focus \{λx.love(x, m) | person(y)\}
- [ν0, Mary-ο aisiteiru]  ordinary \{λx.love(x, m)\}
- focus \{λx.love(x, y) | yεD\}
Four local operators that project alternatives differently.

10 project alternatives from left child
01 project alternatives from right child
11 project alternatives from both
00 don’t project alternatives

Let \( h \) be the ordinary semantic operation, e.g. leftward function application or rightward function application.

\[
\begin{align*}
\llbracket \alpha \ominus \beta \rrbracket^I & = \{ h(a, [\beta]^o) \}_{\alpha [\beta]^o} \\
\llbracket \alpha \ominus \beta \rrbracket^I & = \{ h([\alpha]^o, b) \}_{b[\beta]^o} \\
\llbracket \alpha \ominus \beta \rrbracket^I & = \{ h(a, b) \}_{a[\alpha]^o} \land b[\beta]^o \\
\llbracket \alpha \ominus \beta \rrbracket^I & = \{ h([\alpha]^o, [\beta]^o) \}
\end{align*}
\]

15 Beck

\[
\begin{align*}
\llbracket \text{Mary-o aisiteiru} \rrbracket & \text{ ordinary } \lambda x. \text{love}(x, m) \\
\llbracket \text{dare-o aisiteiru} \rrbracket & \text{ ordinary } \lambda x. \text{love}(x, y) \\
\llbracket \text{Mary-oP aisiteiru} \rrbracket & \text{ ordinary } \lambda x. \text{love}(x, m)
\end{align*}
\]

In the focus semantic values, \( y \) is a distinguished focus variable. Or really, meanings are functions from assignments to semantic values, with a focus variables distinguished in the domain of assignment functions (Wold 1996).

\[
\lambda g \lambda x. \text{if } \text{person}(g(y)) \text{ then } \text{love}(x, g(y)) \text{ else undefined}
\]

16 Same, but with alternatives at recursive levels.

\[
\begin{align*}
\llbracket \text{Mary-o aisiteiru} \rrbracket & \text{ ordinary } \lambda x. \text{love}(x, m) \\
\llbracket \text{dare-o aisiteiru} \rrbracket & \text{ ordinary } \{ \lambda x. \text{love}(x, m) \} \\
\llbracket \text{Mary-oP aisiteiru} \rrbracket & \text{ ordinary } \lambda x. \text{love}(x, m)
\end{align*}
\]

17 Plan

1. \( \llbracket \text{dare-o aisiteiru} \rrbracket \) and \( \llbracket \text{Mary-oP aisiteiru} \rrbracket \) have an identical meaning component, the focus semantic value.
2. That meaning component is obtained by recursively projecting alternatives.
3. The alternatives can project from the left in \( \llbracket \alpha \ominus \beta \rrbracket \) only if \( \alpha \) is phonologically stronger than \( \beta \).
4. Factor both the semantics and the phonology locally
   4.1 Semantics: recursive projection of alternatives
   4.2 Phonology: local comparision of prominence in binary tree

18 Standardly, alternatives are projected automatically, using an image construction. The alternative set for a complex phrase \( \alpha \ominus \beta \) is the image of the normal semantic-combination function acting on the alternative sets for \( \alpha \) and \( \beta \).

\[
\begin{align*}
\llbracket \text{dare-o} \rrbracket^I & = \{ x \}_{\text{person}(y)} \\
\llbracket \text{aisiteiru} \rrbracket^I & = \{ \text{love} \} \\
\text{semantic op} & = \lambda a b. b(a) \text{ (leftward function application)} \\
\llbracket \text{dare-o aisiteiru} \rrbracket^I & = \{ b(a) \}_{a[\alpha]^o} \land b[\beta]^o \\
& = \{ \text{love}(y) \}_{\text{person}(y)}
\end{align*}
\]

20 A binary node embedding WH on the left has to be labeled 1x if the alternative-scope is to project. A binary node embedding WH on the right has to be labeled x1 if the alternative-scope is to project. Since \( \llbracket \text{dare-o} \rrbracket^I \) is undefined, if this condition is not met \( \llbracket \text{dare-o} \rrbracket^I \) are both undefined.
(21) Phonology (constraint version)
Given a node \([\alpha, \beta]\), there is a grid column in the phonological interval corresponding to \(\alpha\) that is higher than every grid column in the phonological interval corresponding to \(\beta\).
Given a node \([\alpha, \beta]\), there is a grid column in the phonological interval corresponding to \(\beta\) that is higher than every grid column in the phonological interval corresponding to \(\alpha\).

00  no constraint
11  maximal heights are equal, or no constraint?

Termination operator for questions

\[\sim\]

\[
\begin{array}{c}
01  \text{ka} \\
\text{Jacob-ga} 10 \\
\text{dare-o}  \text{aisiteiru}
\end{array}
\]

\([\phi]^\circ\) set of propositions of the form \(\lambda w \text{love}(w, j, y)\)
\([\phi]^f\) \(\{[\phi]^\circ\}\)
\([\sim \psi \text{ka}]^\circ = [\psi]^f\)
\([\sim \psi \text{ka}]^f = \{[\sim \psi \text{ka}]^\circ\}\)

Termination operator for ordinary F.

\[\sim\]

\[
\begin{array}{c}
01  i \\
\text{Jacob-ga} 10 \\
\text{Madison-o}  \text{aisiteiru}
\end{array}
\]

\([\phi]^\circ\text{love}(w, j, m)\), with presupposition that \(g(i)\) entails that Jacob loves some entity.
\([\phi]^f\) \(\{[\phi]^\circ\}\)
\([\sim \psi \text{i}]^\circ = \partial[g(i) \rightarrow \cup[\psi]] \land [\psi]^\circ\)

Type generalization of the licensing condition, as in givenness semantics for focus.
(But with no interpretation of F at intermediate scopes.)

Two farmers in “farmer example” have a different phonological/phonetic status—first observed by Craig Roberts.

(22) \([\text{an American farmer}] \sim 4 \text{ was talking to } [\text{a Canadian farmer}] \sim 3\)

Fery and Ishihara (2010) and Katz and Selkirk (in press) propose theories where an F can have a given scope (resulting in de-stressing of the scope) or a non-given scope. Selkirk represents this with FOC and F, or F and f.

This way of combining alternative semantics and givenness semantics is wrong, because givenness semantics is a generalization of alternative semantics.
**Advantages of stress-first architecture**

Pitch is not the only correlate of F

Howell and Rooth (2009a, 2009b): web-derived corpus of comparatives with *than I did* in the than-clause.

(23) a. She did more than I did.
   b. I wish I had done more than I did.
   c. I did more than I did before.

The features that are useful an SVM binary classifier for focusing of subject "I" include pitch, but also vowel duration and vowel-quality.

(24) Classification experiment (Howell and Rooth 2009)

1. Sample of 91, 40 with subject focus and 51 with focus on *did* or later.
2. Hand labeling of intervals in signal.
3. Extract 308 acoustic parameters, including values for duration, intensity, energy, amplitude, f0, vowel formants, measures of spectral tilt or balance.
4. One-held out crossvalidation—in each run use 90 items for training, one for testing.
5. Train SVM binary classifier, and use it to classify the test item; pool classifications of test items.

Models without pitch do about as well as models with pitch.

89.0% just duration of V1
92.3% duration of V1, distance between F1 and F2 40% into V1, duration of [d] closure