Lexicalized intonational meaning[*]

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1 Intonation yields minimal pairs

This is a work of lexical semantics. Here is a somewhat playful (but accurate enough) look at the lexical items under investigation:

(1)   a.   ,   —   ( )

     b.   " "   ' '

     c.   SO   <u>so</u>   *so*

They are all, of course, ambiguous and homographic, though the indeterminacy here seems not to be more extreme than in the realm of traditional lexical items. My concern is with (a few of) the uses of these items on which they mark reliable intonational and semantic effects. In particular, I aim to identify cases where they serve as windows into multidimensional content in the sense of Potts 2005.

The devices in (1a) are all available for isolating supplementary (appositive, parenthetical) material from the clauses that contain them (Potts 2005). In this paper, I look in particular at contrasting relative clauses cases like (2a, b), where the commas signal important features of the intended structure, meaning, and pronunciation.

(2)   a.   #The linguist, who works on presuppositions, is taller than the linguist, who
              works on vowel harmony.

       b.   The linguist who works on presuppositions is taller than the linguist who
              works on vowel harmony.

The meaning of the restrictive relative in (2b) combines with the property expressed by
linguist to form the argument to the determiner, whereas, in (2a), the supplementary rel-
atives' denotations apply to the entity denotation of *the linguist* to yield propositions that
are independent of the main-clause's content, which is identical to that of #*The linguist is
taller than the linguist.*

       Quotation marks such as those in (1b) serve many purposes: distinguishing use
from mention, highlighting linguistic objects, defining terms, etc. The analysis of these
uses is complex and important (see Recanati 2001 for discussion), but I mostly set them
aside in favor of examples like (3a), where the quotation marks indicate that the strings
they contain are to be treated as picking out specific linguistic objects in addition to their
their regular denotations (or something like them).

(3)   a.   Chris asked for "[æ]pricots", not "[eɪ]pricots".

       b.   #Chris asked for apricots, not apricots.

Example (3a) entails that Chris asked for apricots, and it also contributes a proposition ex-
pressible as roughly 'Someone (possibly Chris, possibly the speaker or addressee) uttered
the word *apricots* with an initial low front vowel'. In virtue of the intonation, this single
sentence expresses two distinct propositions; cf. (3b), which lacks the quotative contour
and is thus contradictory.

       My third and final case study is the stressed particle *SO* in (4a), which is of interest
primarily because, I argue, it is an English lexical item with inherent focal stress.

(4)   a.   Chris is SO next in line.

       b.   *Chris is so next in line.

Example (4a) functions primarily to express the proposition that Chris is next in line. But it
has a secondary dimension of meaning: *SO* indicates that the speaker is strongly committed
to the propositional content. So, for the secondary meaning, we enter the realm of speech-
acts (Krifka 2001; Truckenbrodt 2004, among others).

       Space is limited, and the constructions are complex and, with the exception of *SO*,
discussed elsewhere (Potts 2004, 2005), so I will focus most of my attention on establishing
the following theoretical claims:

(5)   a.   In each of the (a) examples in (2)–(4), we have some kind of semantic multi-
              dimensionality (Bach 1999; Potts 2005).

       b.   Intonation is the defining feature of each of the (a) examples in (2)–(4).

       c.   It's no surprise that intonation and multidimensionality arrive together: *sepa-
              rate messages travel more easily on separate channels.*

The idea behind (5c) is that an utterances's intonation contour is sufficiently independent of the word- and phrase-level phonology that it can carry its own message. So we have a functional explanation for why these two areas of grammar are intertwined.

Broadly speaking, my goal is to showcase the complex connection between intonational phonology and semantic multidimensionality.

2   Comma intonation

The commas in (6), like those in (2a), are to be taken seriously. They have reliable intonational effects, and a host of semantic contrasts with restrictive relative clauses flow from their presence (Emonds 1976, 1979; Potts 2005).

(6)   Arlo thinks that Ali, who works on presuppositions, is a phonologist.

Supplementary relatives have an extremely wide syntactic distribution. They can modify all nonquantificational nominal phrases as well as predicates and full clauses. But their scopal properties remain uniform: they always have widest scope, which is in effect the same as saying that they are scopeless. Thus, in (6), though the supplementary relative *who works on presuppositions* is in the syntactic scope of the belief predicate *think*, its content is not evaluated in that attitude context. Rather, it is treated as though it were unembedded (asserted) content. At the level of information structure, we can say that it introduces new but typically secondary information — commentary, in the sense of Asher 2000.

The only overt aspect of these relatives that distinguishes them from their integrated counterparts (e.g., (2b)) is found at the level of intonational phrasing. Selkirk (2004) argues for the following structure for the supplementary relative *the Romans, who arrived early*.

(7)

```
                    IntP
            ┌────────┴────────┐
          MaP                 MaP
        ┌──┴──┐          ┌─────┴─────┐
       H*    L-      !H* L- !H*L-H%
     the Romans     who arrived  ear ly
```
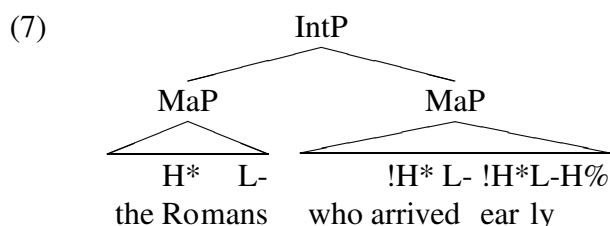
A supplementary relative is made up of two important pieces: the anchor (*the Romans* in (7)) and the supplementary clause (*who arrived early*). Each of these is parsed as a Major Phrase. The entire supplementary relative is an Intonation Phrase, and, in turn, it is distinguished by a continuation (L–H%) rise at its right edge, so that subsequent material is also parsed as an Intonation Phrase:

(8) $[_{\text{IntP}}$ the Romans, who arrived early, $]$ $[_{\text{IntP}}$ found a land of wooded hills $]$

In contrast, according to Selkirk's analysis, the restrictive relative is intonationally no bigger than a Major Phrase, and it does not induce any significant pitch reset at its right edge:

(9)   MaP

         H*   !H*   !H*L
      the Romans who arrived ear ly
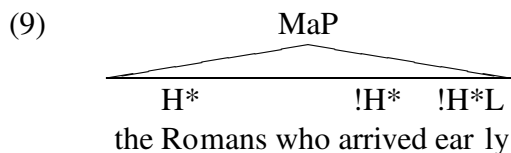
This contrasting analysis in the intonational phonology is easily paired with the semantics developed in Potts 2005. On that analysis, the comma intonation (loosely characterized in that work) is interpreted as a function that takes property-level expressions (typically) and maps them to their conventionally-implicated counterparts. It is difficult to say exactly what conventionally-implicated content consists of and how it differs from regular content (Potts 2003; Potts and Kawahara 2004), but, fortunately, a well-developed type theory permits us to explore the issues relating to semantic composition while remaining relatively free of commitments regarding the denotations in question. At the heart of the analysis is the following theory of semantic types and their (very generally specified) model-theoretic domains:

(10) **semantic types**

   a. e and t are regular types

   b. ε is a conventional-implicature type

   c.   if σ and τ are regular types, then $\langle \sigma, \tau \rangle$ is a regular type

   d.   [... see (27) ...]

   e.   if σ is a regular type and τ is a conventional-implicature type, then $\langle \sigma, \tau \rangle$ is a conventional-implicature type

   f.   nothing else is a type

(11) **domains**

   a.   the domain for type e is D_e, a set of entities

   b.   the domain for type t is D_t, a set of propositions

   c.   the domain for type $\langle \sigma, \tau \rangle$ is $D_{\langle \sigma, \tau \rangle}$, the set of all functions from D_σ into D_τ

   d.   [... see (28) ...]

   e.   the domain for type ε is D_ε, the set of conventionally-implicated meanings

In section 4, I fill in the (d) clauses with product types and their associated Cartesian-product domains, thereby accessing a second sense of semantic multidimensionality. For extensive discussion of definitions like (10), see Potts 2005:§3.

     The lexical entry for comma intonation should capture its shift into the type space of conventional implicatures as well as its complex effect on the intonation. The semantic shift is easily achieved, as in (12).

(12) $\lambda f \lambda x \, . \, f(x) : \langle \langle e, t \rangle, \langle e, \varepsilon \rangle \rangle$

This meaning handles only nominal supplementary relatives like those in (2a) and (6); for a generalization to those that modify verb phrases and clauses, see Potts 2005:§4. The change in meaning specified in (12) is purely syntactic: a regularly-typed property expression is shifted to one with a conventional-implicature type. On this analysis, we remain in the

realm of propositional meanings ($D_t = D_\varepsilon$). However, the composition rule in (13) treats the input in (12) much differently than the output. This has widespread effects on the nature of semantic denotations for sentences.

(13)   **multidimensional application**

$$\gamma : \sigma$$
$$\bullet$$
$$\beta(\gamma) : \varepsilon$$
$$\beta : \langle \sigma, \varepsilon \rangle \quad \gamma : \sigma$$
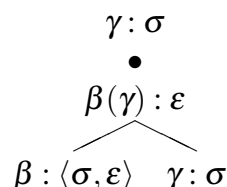
The root node in this tree is multidimensional in the sense that it is decorated with two completely independent logical expressions. Each in turn has an independent denotation. We specify, as part of the interpretive process, that all ε-type expressions contribute to the tuple of meanings that constitutes the overall semantic value of the sentence in question. This gives such meanings widest scope, and it delivers multidimensional final semantic values.

I now turn to the lexical entry's intonational phonology. Selkirk's analysis suggests that, in the realm of supplementary relatives, we are dealing with the following sort of local intonational tree:

(14)   IntP

         MaP   MaP
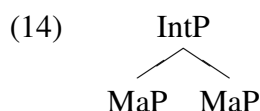
This could stand as part of the lexical entry. But it seems better to encode it in a form that moves in step with the semantics in (12). The slash notation of categorial grammar is ideally suited for this task, and it requires a minimum of technical apparatus:

(15)   a. $A/_{\mathbf{R}}B$ is the category of an expression that is looking for a B to its right and will output an A if it finds one:

$$\frac{A/_{\mathbf{R}}B \quad B}{A}$$

b. $A/_{\mathbf{L}}B$ the category of an expression that is looking for a B to its left and will output an A if it finds one:

$$\frac{B \quad A/_{\mathbf{R}}B}{A}$$

With this notation for categories, we can collapse the local tree in (14) to the single category in (16).

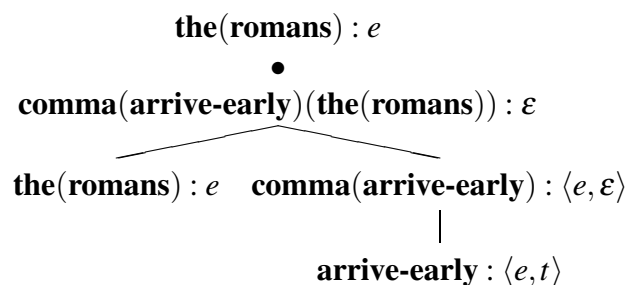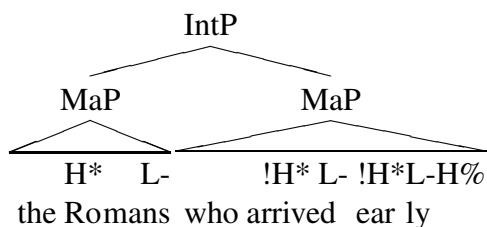(16) $(IntP/_{\mathbf{L}}MaP)/_{\mathbf{R}}MaP$

Thus, in sum, the lexical entry for comma intonation can take the form of the pair consisting of (12) and (16):

(17)   **comma intonation**

$\langle\ (\text{IntP}/_\mathbf{L}\text{MaP})/_\mathbf{R}\text{MaP}\ \ ,\ \ \lambda f \lambda x\,.\,f(x):\langle\langle e,t\rangle,\langle e,\varepsilon\rangle\rangle\ \rangle$

I close this section with a look at the overall analysis of the supplementary relative *the Romans, who arrived early.*

(18)

IntP

MaP   MaP

H*   L-   !H* L- !H*L-H%
the Romans who arrived ear ly

$\mathbf{the}(\mathbf{romans}):e$
$\bullet$
$\mathbf{comma}(\mathbf{arrive\text{-}early})(\mathbf{the}(\mathbf{romans})):\varepsilon$

$\mathbf{the}(\mathbf{romans}):e$ $\mathbf{comma}(\mathbf{arrive\text{-}early}):\langle e,\varepsilon\rangle$

$\mathbf{arrive\text{-}early}:\langle e,t\rangle$

The expression **comma** abbreviates the function specified in (12). The root node in the semantic parsetree is, as noted above, semantically multidimensional. With the intonational phonology right next to it, we can easily identify a connection between the two: the word- and phrase-level phonology is the vehicle for the entity-level expression **the**(**romans**), whereas the intonational phonology contributes the conventional implicature expressed with **comma**(**arrive-early**)(**the**(**romans**)).

3   Intonational reductions

The above analysis depends heavily on the intonational phonology — the perceived comma intonation — of supplementary relatives. One might wonder, though, about the reliability of these intonational contrasts. Watson and Gibson (2004) are reassuring. They provide experimental evidence that intonation is in fact essential to the contrast between these two classes of relative clauses, but the results present a puzzle whose solution arguably hinges on a systematic and widely attested kind of phonetic reduction.

Watson and Gibson presented subjects with examples like those in (19) and asked them to read them aloud for listeners.

(19)   a.   **restrictive interpretation of a subject relative**

A group of film critics praised a director at a banquet and another director at a film premiere. *The director who the critics praised at a banquet insulted an actor from an action movie during an interview.*

b. **nonrestrictive interpretation of a subject relative**

A group of film critics praised a director and a producer. *The director who the critics praised at a banquet insulted an actor from an action movie during an interview*.

Here are the results of their experiment, for both subject- and object-modifying relative clauses:

(20)   **percentage of pre-relative clause intonational boundaries**

	subject modifier	object modifier
restrictive interpretation	10.0%	38.6%
nonrestrictive interpretation	27.7%	49.1%

Of these results, Watson and Gibson write:

> As expected, discourse structure appears to play a role in determining intonational phrase placement. In particular, relative clauses with non-restrictive readings and relative clauses that modified a direct object were more likely to be preceded by an intonational phrase boundary than relative clauses with restrictive interpretations and relative clauses that modified a subject. These data suggest that speakers use intonational boundaries to disambiguate relative clauses. (Watson and Gibson 2004:47)

These results can thus be taken as supporting the semantic analysis of Potts 2005, in which intonation is the crux of this division in the relative-clause domain. One might nonetheless wonder why the numbers are not more definitive. Why, for instance, are subject supplementary relatives introduced by discernible intonational boundaries less than 30% of the time? Could these results in fact be construed as questioning the central role of intonation that Potts (2005) and Selkirk (2004) assume?

I think that this negative conclusion would be too hasty, because there is a generally available explanation for why the percentage of intonational boundaries with supplements is relatively low. A conjecture:

(21)   **Conjecture**

Intonational effects are often reduced when the (linguistic or extra-linguistic) context biases in favor of the interpretation it would deliver.

This conjecture makes predictions for a wide variety of constructions that seem based, in whole or in part, in properties of intonational phonology. For instance, many languages (e.g., Russian, Italian) distinguish declaratives from polar interrogatives entirely in the intonational phonology. But when the context indicates that the speaker is not in a position to assert the declarative's content, the question interpretation is the only one possible, given the Gricean maxim of quality (assert only what you have sufficient evidence for). In this setting, the intonation is not essential to choosing between the two potentially available meanings, and thus, by (21), it should often surface in phonetically reduced form.

Similarly, if the sentence contains a discourse particle that appears only in interrogatives (or only in declaratives), the intonational contour is in effect redundant. It can safely be reduced, and so, by (21), it should often surface this way.

Focus provides a second area of support. When the focus associate of an expression like *only* is clear from the context, the focal stress can be reduced. Written language often provides examples of maximal reduction of the intended focus: when the writer fails to use capitals, italics, bold, or one of the other orthographic devices for indicating a pitch accent, the reader is left to recover the semantic focus entirely from the context. The *American Heritage Dictionary* is quite sensible on this point:

> Though strict grammarians insist that the rule for placement of *only* should always be followed, there are occasions when placement of *only* earlier in the sentence seems much more natural, and if the context is sufficiently clear, there is no chance of being misunderstood. (*American Heritage Dictionary*)

Thus, in light of this evidence, we can reexamine Watson and Gibson's (2004) numbers, (20). We now expect the introductory comma intonation of a supplementary relative to be reduced, perhaps even eliminated from the phonetic representation, if the head noun cannot be interpreted restrictively. This can happen for grammatical reasons. For example, proper names cannot be modified by restrictive modifiers (unless they are pressed into service as common nouns with determiners). Thus, a sequence of the form *Chris who likes walking at night* can involve only a supplementary relative and might in turn lose its distinctive contour, coming to resemble a restrictive relative intonationally. Similarly, in Watson and Gibson's examples, the experimental scenario works to ensure that speakers choose one or the other interpretation for the relative clause. This paves the way for phonetic reductions of the intonational boundary.

4   The quotative contour

A few years ago, the *Atlantic Monthly* tackled the important issue of how to identify quoted material in speech:

> DAVID RADWIN, of Berkeley, Calif., writes, "How does one vocalize the quotation marks that begin and end a quotation? Are quote and unquote correct?"
>
> If you want to get technical, you can say quote and close (the opposite of open, not the opposite of far) quote instead. [...] Oddly, these words are often said together. For instance, from a February CNN transcript: "...had phone calls made to three–quote unquote–'prominent Indian government officials.' " How the listener is supposed to know where the quotation ends I have no idea. (From Word Court, By Barbara Wallraff, *The Atlantic Monthly*, May 2002 (p. 116))

I suspect that Wallraff is being disingenuous. After all, the person making the CNN transcript seems to have figured out where the quotation ends. So there must be something in

the signal that indicates both boundaries of the quotation. My hypothesis is that this is a fact about intonation. A quotative contour. For the example at hand, the string probably sounded much like this:

(22)
$$\text{H* L H\% H*L H\% H* L H\% H*L H\%}$$
They made phone calls to three "prominent Indian government officials".

Although I am presently unsure of exactly how to characterize the quotative contour, (22) seems representative, and suggests the following hypothesis:

(23) **Lexicalization hypothesis**

In quotation, each prosodic word projects to its own intonational phrase with a rise–fall–rise contour.

This contour might be supplemented in speech by body language — air quotes, though it should be noted that these, like *quote–unquote*, are often prefixing. In print, speakers use quotation marks and related devices. Like comma intonation, the quotative contour is subject to phonetic reduction when the linguistic or utterance context clearly demarcates the boundaries of the quotation. The considerations of section 3 are perhaps even more important for this case than for comma intonation, since the quotative contour, as depicted in (23), and exemplified in (22), is demanding in its constant pitch resetting.

Quotations of this kind are analyzed in detail in Potts 2004. I do not review the complete analysis here, opting instead to highlight the multidimensional aspect of it, which is basically localized in the semantics for the quoted phrase. Simplifying somewhat, we can say that the quoted phrase *"[æ]apricots"* in (3a) makes the following dual contribution:

(24) "[æ]pricots"

     a.   the set of all apricots (a real-world object)

     b.   the linguistic object [æ]pricots, with its particular phonology and syntax

The compositional semantics of Potts 2004 is designed to ensure that both these meanings are fully incorporated into the semantics, so that the final meaning of the first clause of (3a) is as in (25).

(25)   a.   Chris asked for some apricots

     b.   *x* uttered the phrase *[æ]pricots*

The value of *x* is supplied by the context of utterance. The felicity conditions for the free variable are similar to those associated with deictic pronouns, which accounts for the anaphoric character of this kind of quotation.

Quotation manifests a different kind of multidimensionality than we saw above for supplementary relatives. For supplementary relatives, the secondary meaning must in effect be removed from the compositional semantics, so that it has invariably widest scope; examples like (6) show us that even attitude predicates cannot scope over such content.

With quotation, the situation is more complex. Examples like (26) indicate that both dimensions of meaning paraphrased in (25) can be under the scope of adverbial quantifiers (which are typical in this regard).

(26)   Whenever he is in Amherst, Chris asks for "[æ]pricots".

   a.   Whenever Chris is in Amherst, Chris asks for apricots

   b.   Whenever Chris is in Amherst, *x* says [æ]*pricots*

This example is many-ways ambiguous: both dimensions can be evaluated in the scope of the *whenever* clause, or externally to it, in tandem or separately. This freedom indicates that we need to integrate both dimensions of meaning into the compositional semantics. In Potts 2005 and Potts 2004, I use pair formation to capture this integrated multidimensionality. It serves as a useful contrast with supplements, thereby further illustrating the diversity of relations between intonation and multidimensional meaning.

   We can use the type theory to distinguish quotation from apposition at a technical level. The kind of multidimensionality represented by (24) and (25) is best handled by means of product-typed expressions, where product types are defined in the following fleshing-out of definitions (10) and (11):

(27)   **product types**

if σ and τ are regular types, then $\sigma \times \tau$ is a regular type

(28)   **product domain**

the domain of $\sigma \times \tau$ is $D_\sigma \times D_\tau$, the set of all ordered pairs in which the first member is drawn from D_σ, the second from D_τ

   Once we have product-typed expressions in the grammar, we can define quantifiers and the like to optionally or obligatorily take such expressions as arguments. It is typically straightforward to shift from the intuitive (one-dimensional) definitions to the more complex multi-dimensional versions required for quotation as well as for expressions like *but* and *therefore*; see Potts 2005:§7.

   Before closing this section, I want to try to deflect the hypothesis that quotation involves something like focus. Since short quotations often sound as though they have focal stress, this hypothesis is tempting. But it seems to be mistaken both semantically and phonologically; there is at best a superficial connection between these two phenomena.

   First, quotation does not involve a focal stress pattern. This can be hard to hear with short phrases, but it is clear with long ones like (22) above. In (29), I provide the focal stress pattern (contrastive focus) for the quotation-free version of the same phrase.

                          H*   L   H*   L
(29)   They didn't call reporters, they called prominent Indian government officials.

Instead, of the repeated rise–fall–rise of (22), we have a relatively flat contour with focal stress on the syntactic head.

Second, quotation and focus have little in common in the way of conditions on appropriate use. Focused items are nearly always new; when a pitch accent falls on given material, the result is typically infelicitous (Schwarzschild 1999), as in (30).

(30) a. Burns: *The Godfather II* is a total snooze.

  b. #Homer: *Godfather I* is a TOTAL SNOOZE as well.

In contrast, quoted material must be given, in the sense that it nearly always requires an identical string to precede it in the discourse:

(31) a. Burns: *The Godfather II* is a total snooze.

  b. Homer: Well, Pauline Kael said that this "total snooze" is a defining moment in American cinema.

We can isolate the semantic difference between quotation and contrastive focus by considering how they are both anaphoric. Contrastive focus on a phase P presupposes that the preceding discourse contains a phrase P' that is a member of P's comparison class and distinct from P. The distinctness requirement is the important one. It is this requirement that quotation *must* violate: quotation of a phrase P is felicitous only if the preceding discourse contains an utterance of P itself, sometimes up to and including special phonetic resemblances.

Summing up: Quoted expressions pick out linguistic objects but also have the usual semantics of their quotation-free counterparts. Their semantics is thus multidimensional. This multidimensionality traces back to an element of the intonational lexicon, namely, " " (and their variants).

5   "Metalinguistic" negation

The above analysis of quotation extends in every important sense to so-called metalinguistic negation (Horn 1989; Geurts 1998). On this extension, there is nothing metalinguistic about such negation, exemplified in (32). The sentences in question are semantically multidimensional. Negation can target one dimension or the other, but it remains a regular propositional negation on both of its uses. Thus, the multidimensional approach achieves the unification sought by Horn (1989).

(32)   He didn't call the POlice, he called the poLICE.

The intonation required to signal this kind of contrast is, I claim, identical to that used for quotation. Moreover, it is subject to the same discourse conditions: (32) is felicitous only if the context provides some agent to whom we can attribute an utterance of stress-initial *police*. Thus, at a descriptive level, we have grounds for assimilating these examples to quotation.

As with the quoted form [æ]*pricots*, we need to begin with multidimensional denotations for the quoted strings. Example (32) is felicitous because its first and second sentences employ different pronunciations of *police*, as indicated informally in (33).

(33)   a. $\langle$ ˈpo.lis   ,   **police** : $\langle e,t \rangle$ $\rangle$

        b. $\langle$ po.ˈlis   ,   **police** : $\langle e,t \rangle$ $\rangle$

In the compositional semantics of Potts (2004), these meanings can combine with predicates, in basically the usual fashion, to produce pairs of propositions, just as we saw with quotation. In this setting, it is easy to define negation in a way that captures both its regular and "metalinguistic" uses. Those denotations are given in (34), where $[\mathbf{p} \cdot \mathbf{q}]$ is a product-typed expression and thus denotes an ordered pair (by (28)).

(34)   a. $[\![\mathbf{not}_1([\mathbf{p} \cdot \mathbf{q}])]\!] = \Big\langle \{w \mid w \notin [\![\mathbf{p}]\!]\}, [\![\mathbf{q}]\!] \Big\rangle$

        b. $[\![\mathbf{not}_2([\mathbf{p} \cdot \mathbf{q}])]\!] = \Big\langle [\![\mathbf{p}]\!], \{w \mid w \notin [\![\mathbf{q}]\!]\} \Big\rangle$

This negation is a function taking pairs of propositions into pairs of propositions, a slight deviation from what one might expect from, e.g., classical logic. But at its heart it remains a regular unary predicate, since it negates just one of the two dimensions. If it targets the first proposition in the pair, we have a regular negation. If it targets the second, we have the metalinguistic reading, which is given informally in (35) (a representation of the meaning for the first sentence in (32)).

(35) $\mathbf{not}_2 \left(\begin{array}{c} \text{he called the police,} \\ \text{the speaker utters [ˈpo.lis]} \end{array} \right)$

Thus, the present theoretical setting elucidates the fact that quotation and metalinguistic negation are essentially the same phenomenon.

6   Speech-act *SO*

I move now to the third and final lexicalized intonational meaning discussed in this paper: speech-act *SO*. Like comma intonation and quotation, it contributes a secondary meaning that we can identify as independent of the main semantic content.

When unstressed, the modifier *so* functions as an intensifier like *very* and *really*, and thus it combines only with gradable predicates:

(36)   a.   Ed is so angry he could scream.

        b.   *The number 7 is so prime that it is often used in examples.

In addition, unstressed *so* modifies only adjectives; it cannot appear as a verbal modifier:

(37)   a.   *Ali so ran the marathon.

        b.   *The road so surrounds the campus.

However, unstressed *so*'s stressed counterpart, speech-act *SO*, which was first brought to my attention by Lyn Frazier (personal communication), has a much freer distribution. While it retains something like a degree-based semantics, it can appear as the syntactic modifier of nongradable predicates, (38), and it can adjoin to the left edge of the verb phrase, (39).

(38)   a.   I am SO looking forward to your being here.

         b.   I am SO next in line.

(39)   a.   Ali could SO run win that race.

   b.   Nancy could SO wear that dress.

Throughout, *SO* seems to contribute something like *I am strongly committed to the proposition that S*, where *S* is the clause in question with *SO* removed. For instance, (39a) says roughly that the speaker feels strongly that Ali could win that race. Example (38b) might indicate the speaker's strong moral and legal certainty about his position in the queue.

      Intonational prominence seems to be the factor that distinguishes *SO* from *so*. The two have gradability in common, but they appear to be defined for much different domains: unstressed *so* has functions from degrees into properties in its domain, whereas *SO* seems to have in its domain functions from entities into acts of assertion. Thus, unlike supplementary relatives and quotation, the contribution of speech-act *SO* seems fundamentally different from what we find in the realm of regular content. We might look to proposals like that of Krifka (2001) to characterize it in terms of the theory of speech-acts (Searle 1969). (But see Geurts and Maier 2003 and Truckenbrodt 2004 for more conservative alternatives.)

7   The design of the grammar

Examples like those discussed in this paper suggest that it might be wise to reconsider the design of the grammar with particular attention to the ways that sound and meaning are permitted to interact. In my view, the examples suggest that we should move to a model like that of Ginzburg and Sag (2001) or Steedman (2000, 2001), in which sound, form, and meaning all interact freely. But more restrictive models can probably encode the same basic insights (though they might have to be craftier about it).
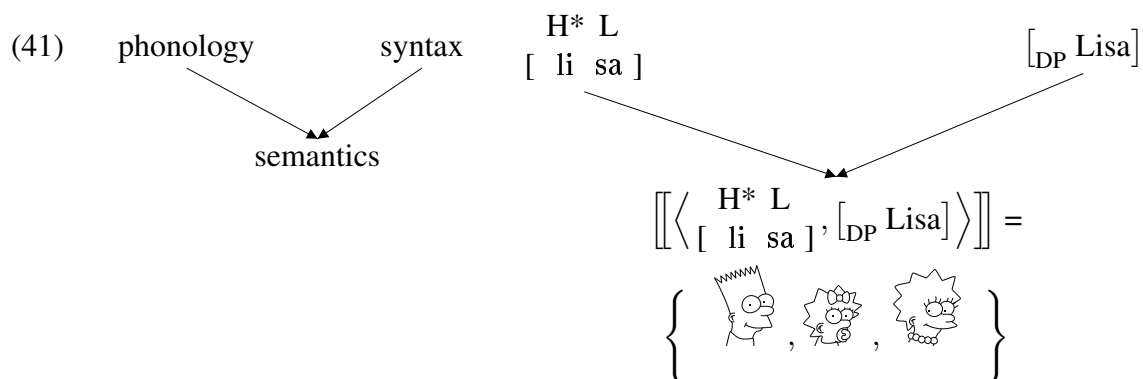
      In (40), I present a stripped-down version of the popular Y-model for linguistic frameworks, along with a typical example involving syntactic F-marking in the service of an alternative semantics for focus.

(40)
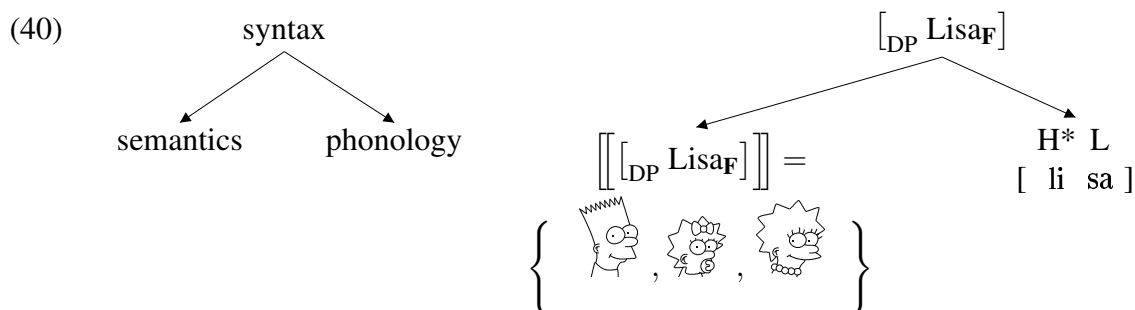
The arrows represent mappings from representation-types into representation-types. In this mode, the arrows flow from the syntax to the phonology and the semantics, which are not themselves related. However, to the extent that focus semantics correlates with a

phonological pitch accent (for discussion, see Rooth 1985; Beaver et al. 2004), we need to import some phonological information into the semantics. This is achieved, in this limited model, via syntactic marking, which has both phonological and semantic reflexes.

This model works well, and brings with it the force of tradition, but it seems worth exploring alternatives. One might, for instance, look askance at the 'forward-looking' features (e.g., the F-marking) required on this view. Here is an alternative model that eliminates the need for them:

(41)   phonology   syntax $\begin{matrix} \text{H* L} \\ [\ \text{li}\ \text{sa}\ ] \end{matrix}$ $[_{\text{DP}}\ \text{Lisa}]$

         semantics

$$\left[\!\left[\left\langle \begin{matrix} \text{H* L} \\ [\ \text{li}\ \text{sa}\ ] \end{matrix},\ [_{\text{DP}}\ \text{Lisa}]\right\rangle\right]\!\right] =$$

$$\left\{ \raisebox{-0.5em}{\includegraphics}, \raisebox{-0.5em}{\includegraphics}, \raisebox{-0.5em}{\includegraphics} \right\}$$
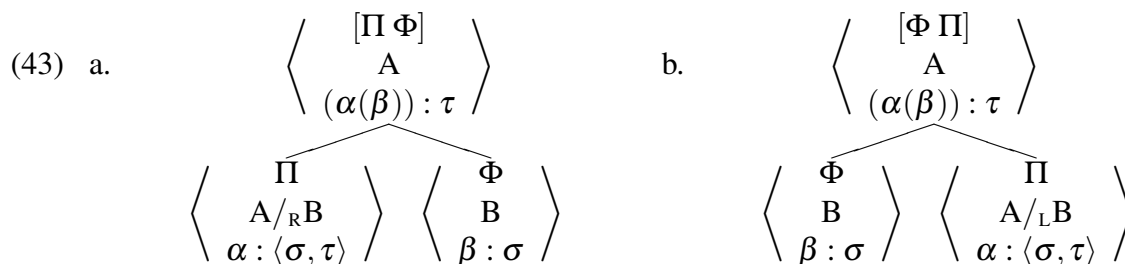
In essence, this model assumes that the semantically interpreted objects are pairs consisting of a phonological representation and a syntactic representation.

I should note that these two models might be descriptively equivalent. For instance, to make (40) work, one must have some intonational features in the syntax. To make (41) work, the interpretation function, $[\![\cdot]\!]$, must have pairs $\langle$phonology, syntax$\rangle$ in its domain. Thus, stepping back, we see that, in both models, the semantics must integrate information from both the P- and S- sides of the grammar to deliver the intended denotations.

We could move to an even more integrated model, in which sound, form, and meaning are not restricted in their interactions. Bach and Wheeler (1981) first made this move, in the setting of categorial grammar. I employ their model in Potts 2004, where the basic objects of the theory — its lexical items — encode sound, form, and meaning as triples:

(42) $\langle$ [hoʊmər] ; NP   ; **homer** : e $\rangle$
      $\langle$ [bɑld]   ; S$/_{\text{L}}$NP   ; **bald** : $\langle e,t \rangle$ $\rangle$
      $\langle$ [si]   ; (S$/_{\text{L}}$NP)$/_{\text{R}}$NP ; **see** : $\langle e,\langle e,t \rangle\rangle$ $\rangle$

In this setting, phonological and syntactic representations are built in tandem, in lockstep with semantic composition. It is possible to develop highly expressive theories using just the pair of rules in (43).

(43) a. $\left\langle \begin{matrix} [\Pi\ \Phi] \\ \text{A} \\ (\alpha(\beta)) : \tau \end{matrix} \right\rangle$ b. $\left\langle \begin{matrix} [\Phi\ \Pi] \\ \text{A} \\ (\alpha(\beta)) : \tau \end{matrix} \right\rangle$

$\left\langle \begin{matrix} \Pi \\ \text{A}/_{\text{R}}\text{B} \\ \alpha : \langle\sigma,\tau\rangle \end{matrix} \right\rangle$ $\left\langle \begin{matrix} \Phi \\ \text{B} \\ \beta : \sigma \end{matrix} \right\rangle$ $\left\langle \begin{matrix} \Phi \\ \text{B} \\ \beta : \sigma \end{matrix} \right\rangle$ $\left\langle \begin{matrix} \Pi \\ \text{A}/_{\text{L}}\text{B} \\ \alpha : \langle\sigma,\tau\rangle \end{matrix} \right\rangle$

These accomplish concatenation in the phonology (a simplification), feature (category) projection in the syntax, and functional application in the semantics. Additional rules could, for example, make the nature of semantic composition dependent on facts about the phonological structure in exactly the way that the constructions discussed in this paper seem to require.

8   What's next?

The primary examples of this paper were chosen to reflect the diverse ways in which intonation and meaning can interact to produce multidimensional denotations. The comma intonation of supplementary relatives produces independent denotations — sentence meanings as tuples of propositions. In quotation, we find a more integrated brand of multidimensionality: the dimensions can contribute separately, but they can also scope under quantificational operators together. Finally, *SO* establishes a connection with the realm of speech-acts: in examples like *I am SO next*, the narrowly semantic denotation is the proposition that the speaker is next in line; *SO* contributes at the level of speech-acts, indicating the speaker's high level of commitment to the narrowly semantic denotation.

These are by no means the only examples in which intonation and meaning interact in a way that seems partially or totally lexical (see also Ward and Hirschberg 1988; Hirschberg and Ward 1992). For instance, the lexical item *vice versa* is highly sensitive to the intonation contour of the full sentence it associates with, as we can see in the multiply ambiguous example (44).

(44)   Ali introduced Chris to Wesley, and vice versa.

      a.   *vice versa* ≈ Ali introduced Wesley to Chris

      b.   *vice versa* ≈ Chris introduced Ali to Wesley

      c.   . . .

The intended interpretation is conveyed by the intonation contour of *Ali introduced Chris to Wesley*. It might be that focus is relevant, but one must be cautious about invoking focus alternatives, as the interpretation of *vice versa* is tightly constrained by the preceding lexical material. Thus, for instance, there is no way for (44) to say, with *vice versa*, that Ali introduced Chris to Ellen, no matter how salient Ellen is as an alternative to Wesley, Ali, or Chris.

It would be worthwhile also to pursue the kind of contrast suggested by the differences between *SO* and *so* discussed in section 6. German discourse particles quite often come in stressed and unstressed pairs. The particle *wohl*, the focus of Zimmermann (2004:30), provides a case in point:

(45)   a.   Hein ist wohl   auf See.
           Hein is presumably on sea
           'Hein is at the beach, isn't he?'

> b. #Hein ist WOHL   auf See.   (Zimmermann 2004:3, 30)
>   Hein is most-definitely on sea
>   'Hein is most definitely at the beach.' (a reaction to a previous claim that Hein
>   isn't.)

Zimmermann writes that "The speaker of (45a) is not completely certain that Hein is at the beach. In contrast, the speaker of (45b), with stressed *WOHL*, is convinced that Hein is at the beach" (p. 30). It is conceivable that these two uses can be systematically related. That would be exciting. It would be equally exciting to have convincing arguments that they cannot be related, since these would provide additional evidence that lexical items can have inherent focal stress even in non-tonal languages.

So it would be easy to enrich the factual domain suggested by this paper. There are also a number of theoretical issues to be explored. In addition to the architectural questions discussed in section 7, we could ask about the role and extent of intonational phonology. For example, this paper's title, 'Lexicalized intonational meaning', is oxymoronic from the perspective of Ladd (1996), who stipulates that intonational phonology is "postlexical":

> intonation conveys meanings that apply to phrases or utterances as a whole, such as sentence type or speech act, or focus and information structure. By this definition, intonation excludes features of stress, accent, and tone that are determined in the lexicon, which serve to distinguish one word from another. (Ladd 1996:6)

The above analyses are lexical. But the elements in question seem clearly to be grounded in intonation. This might turn out to be a mere terminological dispute, or it might ultimately contribute to our understanding of the ways in which the secondary dimensions of meaning discussed in this paper are distinguished from regular meanings. In sum, many of the central questions in this area remain wide open. It's my hope that these preliminary remarks point us in the direction of answers to them.

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