

## Lecture 1: Prosodic Boundary Strength and Syntactic Bracketing

Mini-Class on Prosody. Santa Cruz, May 19 2008

Structural ambiguities:

- (1) a. The old men and women stayed at home. (Hockett, 1954)
- b. He rolled over the carpet. (Halle, 1969)

Lehiste (1973) (for 1a,b,) and Price et al. (1991) (for 1b) show these are reliably disambiguated by prosody, by way of boundary strength:

- (2) Prosody and Attachment:  
In a sequence  $A \prec B \prec C$ , if the boundary separating A and B is weaker than the one separating B and C, then C attaches high, if it is stronger, then C attaches low.

$$\begin{aligned} A | B || C &\rightarrow [ [ A B ] C ] \\ A || B | C &\rightarrow [ A [ B C ] ] \end{aligned}$$

‘weak, strong’: percept of prosodic boundary strength. Listeners have solid intuitions about relative strength (Price et al., 1991, Collier et al., 1993); these are based on multiple acoustic cues, duration and pitch being the most important ones.

### Mismatching Boundaries:

However, sometimes prosody seems to contradict (2) (Chomsky, 1965, 13):

- (3) This is the cat || that caught the rat || that stole the cheese.

Selkirk (1984, 294): often several phrasings are possible, some mismatch syntax:

- (4) a. Jane || tried to begin to learn Spanish.
- b. Jane tried || to begin to learn Spanish.
- c. Jane tried to begin || to learn Spanish.
- d. Jane tried to begin to learn || Spanish.

A common mismatch across languages: V + coordination (cf. Cho, 1990, Drescher, 1994):

- (5) Maria invited John || and her friend from Toronto.

### Missing Boundaries:

Sometimes prosody is too ‘flat’ and does not reflect the assumed syntactic bracketing:

- (6) The hostess greeted the girl with a smile.

Lehiste (1973) finds that the instrumental/NP modifier ambiguity (6) is not reliably disambiguated by every subject; Snedeker and Trueswell (2003) find that subjects only disambiguate when they’re made aware of the ambiguity.

Prosody reflects syntax sometimes but not always—what are the generalizations about matches and mismatches?

## 2. Two Types of Approaches

First, a general assumption is made—in this case, that syntactic pauses occur at the ends of major constituents. Then we find an apparent exception—(3), which can be accounted for either by altering the presumed structure of the exception or by abandoning the general assumption. (Cooper and Paccia-Cooper, 1980, 9)

### I. Syntactic and Prosodic constituency can be contradictory

**Edge-based theory:** Only the left or right edges of certain syntactic constituents count. (cf. Selkirk, 1986, Chen, 1987, Selkirk, 1995b, Truckenbrodt, 1995)

- (7) The edge-based theory of the syntax-prosody interface (Selkirk, 1996, 444)  
 Right/Left edge of  $\alpha \rightarrow$  edge of  $\beta$  ( $\alpha$  is a syntactic category,  $\beta$  is a prosodic category)

Assumption about Phonological Categories:

- (8) Prosodic Hierarchy (Selkirk, 1986, 384):
- |   |     |
|---|-----|
| (-----)                                       | Utt |
| (-----)(-----)                                | IPh |
| (-----)(-----)(-----)                         | PPh |
| (-----)(-----)(-----)(-----)(-----)           | PWd |
| (-)(-----)(-----)(-)(-----)(-----)(-)(-----)  | Ft  |
| (-)(-)(-)(-)(-)(-)(-)(-)(-)(-)(-)(-)(-)(-)(-) | Syl |

Possible analysis of (3): Left edges of sentences are mapped to intonational phrases:

- (9) **Syntax:** [<sub>S</sub> This is the cat [<sub>S</sub> that caught the rat [<sub>S</sub> that stole the cheese ] ] ].  
**Prosody:** [ This is the cat ]<sub>IP</sub> [ that caught the rat ]<sub>IP</sub> [ that stole the cheese ]<sub>IP</sub>.

Possible analysis of (5): Right edges of XPs are mapped to phonological phrases:

- (10) **Syntax:** [ Maria [ invited [ John and her friend. ] ] ]  
**Prosody:** [ Maria ]<sub>PPh</sub> [ invited John ]<sub>PPh</sub> [and her friend. ]<sub>PPh</sub>

- (i) Edge-Marking predicts systematic contradictions in constituent structure.
- (ii) Edge-Marking predicts certain boundaries to be ‘missing’.

Since this doesn’t work in all cases, Truckenbrodt (1995, 1999) proposes a constraint counteracting XP-edge alignment, a high ranking of which helps avoid certain mismatches:

WRAP-XP: For each XP there must be a p-phrase that contains the XP.

- Edge-marking is not committed to the analyses in (9) and (10), and if syntax and prosody turn out to match, this is not necessarily an argument against it...
- ...but it predicts a language *could* work like this. So the question is: does this ever happen? More generally: Does the theory predict the right *kinds* of mismatches?

## II. Syntactic and prosodic constituency match up

Solution proposed in SPE: ‘readjustment’:

“The resulting structure appears then as a conjunction of elementary sentences (that is, sentences without embeddings). This allows us to say that intonation breaks precede every occurrence of the category S (sentence) in the surface structure, and that otherwise the ordinary rules prevail” (SPE, 372).

Syntactic Approach:

- (11) a. This is the cat || that caught the rat || that stole the cheese.  
b. This is a cat, || it caught a rat, || and it stole the cheese.

Both structures involve a list of three of three clauses. The same line of argument was made in Lieberman (1967), Cooper and Paccia-Cooper (1980), Pierrehumbert (1980).

More recently, based on different data, work in categorial grammar has made the case that apparent mismatches are often not really mismatches (Moortgart, 1988, Steedman, 2000).

Expectations:

- Contradictory constituent structure should be impossible.
- Generalizations about possible and impossible apparent mismatches should reflect independently motivated constraints on movement/syntactic bracketing options.
- Less clear what to expect about how phonological categories should line up with syntax...

It turns out that time and again apparent mismatches involves structures that are more list-like than one might have expected—the example in (3) is just one instance of this tendency.

Lists and coordinate structures seem to enjoy a privileged status in grammar.

Let’s look at lists and coordinate structures...

- When are boundaries missing?
- How do prosodic boundaries relate to syntax?
- What about the choice of the type of phonological boundary?

...and then use this as the baseline to look at other structures:

- The same generalizations hold in other syntactic structures.
- In cases where they seem to be contradicted, the syntax is not what it seems at first sight, and often it turns out to be more ‘list-like’ than expected.

### 3.1. Coordinate Structures: A Recursive Generalization

Conjuncts are usually separated by boundaries of equal strength ('flat prosodic structure'):

(12) Who came to the dinner? John | (and) Mary | and Sally.

An articulated prosody seems to be dispreferred when not motivated, so the following are used when there is some reason to group John and Mary together or Mary and Sally:

- (13) Who came to the party?
- a. John | and Mary || and Sally.
  - b. John || and Mary | and Sally.

Also, a typical rendition of (14) does not involve intonational boundaries (final lengthening, boundary tone), but some weaker kind of boundary:

(14) John | and Mary | and Sally.

However, the presence of a weaker boundary within a coordinate makes it more likely that a IP will coordinate at the higher level:

(15) John || (and) Mary || and (Sally | or Johanna)

- The syntactic status of the relation between the coordinates is always the same.
- The type of phonological junctures depends on the overall structure.

This is unexpected in theories that operate with designated syntactic categories, (Selkirk, 1986, Chen, 1987, Selkirk, 1995b, Truckenbrodt, 1995) that directly align the edges of certain syntactic domains (e.g. XP) with the edges of certain prosodic domains (e.g.  $\Phi$ ):

(16) \* (John) $_{\Phi}$  (and Mary) $_{\Phi}$  (or Sally.) $_{\Phi}$

The generalization is recursive. Taglicht (1998, 192):

- (17) *Coordination Constraint (CC)*  
For any coordinating node X, if any two daughter nodes of X are separated by an IP boundary, all the daughter nodes of X must be separated by IP boundaries.

Or more generally (Wagner, 2005):

- (18) If the Boundary Rank at a given level of embedding is n, the rank of the boundaries between constituents of the next higher level is n+1.

- There is a *recursive generalization* about boundary strength.
- Syntax fixes relative boundary ranks, rather than the exact phonological realization.
- What exactly are coordinate structures flat or articulated?

## 3.2. Implementing Boundary Ranks

There is some flexibility on how exactly boundary ranks are implemented:

- (19) a. Flap only across weak boundary:  
(a car or a rat?) and a hat?  
b. Flap across the board:  
(a car or a rar) and a hat?  
c. \* Flap only across strong boundary:  
(a cat? or a rar) and a hat?

- At least within this fragment, it looks like syntax fixes certain boundary ranks, but phonology is free to implement them in different ways.
- This is compatible with the claim of prosodic hierarchy theory that there is a fixed prosodic hierarchy.

However, it might be that boundary strength is a more fine-grained and gradient notion:

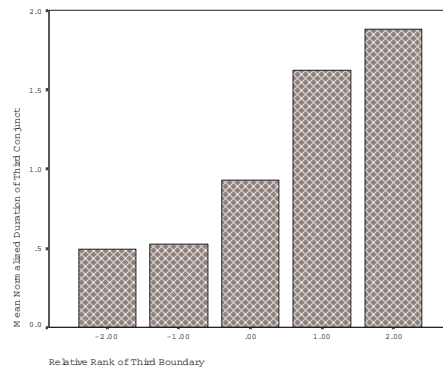


Figure 1: *Normalized Length of Third Constituent depending on boundary rank relative to boundary after first constituent. (Wagner, 2005, 179)*

- Evidence in favor of some recursion in prosody: Ladd (1986, 1988), Drescher (1994), Selkirk (1995a), Truckenbrodt (1995), Keating (to appear), Fougeron and Keating (1997), Féry and Truckenbrodt (2004),...
- Evidence that listener's interpret prosodic boundaries relatively (as opposed to absolutely): Clifton et al. (2002),...
- ...but there is also ample evidence that *some* kinds of prosodic boundaries have to be distinguished (presence/absence of boundary tone, ...)

### 3.2. When is the prosody flat? Interpretation and Prosody

Consider orthography of logic notation: Formulas (20a,b) are well-formed as they are, while formula (20c) seems incomplete.

- (20) a.  $A \vee B \vee C$   
b.  $A \wedge B \wedge C$   
c.  $A \vee B \wedge C$

Associative structures in language:

- (21) ASSOCIATIVITY  
 $([[x]][[yz]] = [[xy]][[z]])$

#### (22) Hypothesis about Associativity and Prosody

A structure is prosodically flat  $\leftrightarrow$  it is associative (Wagner, 2005, Winter, 2006)

Non-Associative coordinate structures are prosodically articulated:

- (23) a. Both John || and (Mary | and Sally).  
b. Both (John | and Mary) || and Sally.  
c. \* Both John, | (and) Mary, | and Sally.
- (24) Altogether, John, Sally and Mary weigh 400 lbs.  
a. John | and Sally || and Mary weigh 200 lbs (respectively).  
b. John || and Sally | and Mary weigh 200 lbs (respectively).  
c. ?\* John | (and) Sally | and Mary weigh 200 lbs (respectively).

(see similar examples in Lasersohn (1995), Winter (2001))

- (25) Two apples were given out, but I don't know to who. Who was given an apple?  
a. John | and Sally || and Mary.  
b. John || and Sally | and Mary.  
c. # John | (and) Sally | and Mary.
- (26) Min (1996)  
a. John | and Johanna || or Sally.  
b. John || and Johanna | or Sally.  
c. ?\* John | and Johanna | or Sally.

- Coordinate Structures:  
Prosodically flat  $\rightarrow$  associative (non-associative  $\rightarrow$  prosodically articulated)
- What does the syntax look like?

### 3.3. Coordinate Structure: Syntax

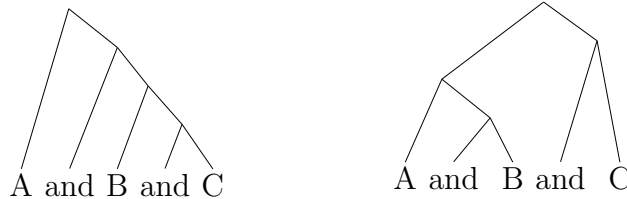
A parsimonious theory should provide the right number of bracketings, and not more or less. There are three bracketings for structures with three conjuncts:

- (27) a. John | (and) Mary | and Sally.  
 b. John || and (Mary | or Sally).  
 c. (John and | Mary) || or Sally.

...however, there are only two binary branching trees over three elements:

- (28) Two Binary Branching Trees, Assuming Binary Functors

- a. Right-Branching                      b. Left-Branching

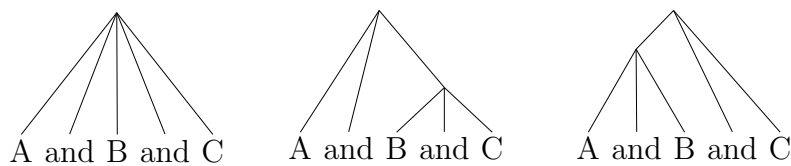


Number of bracketings for  $n$  conjuncts is the Super-Catalan number of  $n$ , not the Catalan-number of  $n$ , which is the number of binary branching trees over  $n$  elements (Stanley, 1997).

What to do? One option is to follow Culicover and Jackendoff (2005): allow for  $n$ -ary branching trees.

- (29) Trees with  $n$ -ary branching

- a. Flat                      b. Right-Branching      c. Left-Branching



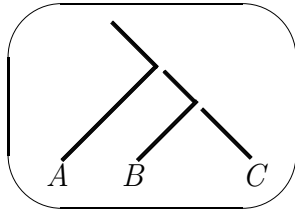
Even prosodically ‘flat’ structures seem to be right-branching though:

- (30) a. Everyone<sub>*i*</sub> and his<sub>*i*</sub> goat was at the party.  
 Every student<sub>*i*</sub>, his<sub>*i*</sub> advisor, and a guest are invited.  
 b. \* His<sub>*i*</sub> brother and John<sub>*i*</sub> went to the city.

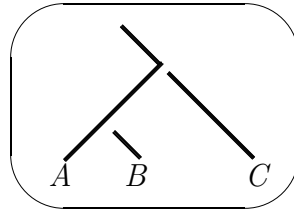
A derivational theory offers a different way to reach the same combinatorial power, using only binary branching trees. To get the right combinatorial power, we have to restrict the direction of branching within a cycle (privileged status of right-branching: Larson (1988), Kayne (1994), Pesetsky (1995), Phillips (1996)...)

(31) Structure within a Cycle

a. Possible:



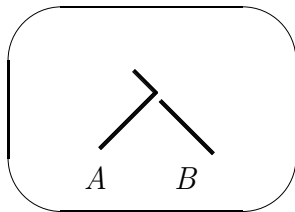
b. Impossible:



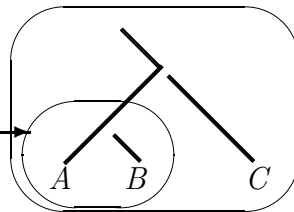
Language is **recursive**: Any output of a workspace can be re-used as a primitive building block of a new work space. (Similar: Uriagareka (1999), Johnson (2002))

(32) Creating a Left-Branching Structure

a. First Cycle

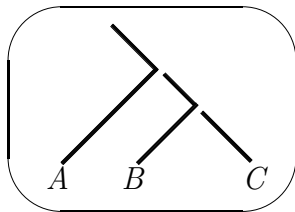


b. Second Cycle:

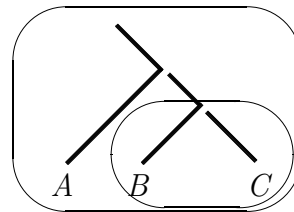


We can then derive the prosody by applying phonology at every point there is a spell out, building up a relational grid (Wagner, 2005).

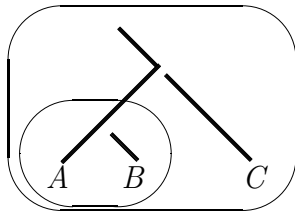
(33) Three Derivations, three different relational grids



→ A | B | C



→ A || B | C



→ A | B || C

(Use of syntactic derivation in deriving prosody also in Bierwisch (1968), Bresnan (1971), more recently in Arregi (2002), Dobashi (2003), Ishihara (2003), Kahnemuyipour (2003), Legate (2001).

Of course, we could alternatively also assume flat trees and assume left-to-right c-command among sisters (Büring, 2005), and the choice depends on assumptions about how to explain c-command facts (variable binding, NPI licensing). But the combinatorics tell us that we need **either** flat trees **or** the cycle—but **not both**.

## 4. Prosodic Mismatches I: Missing Boundaries

- Coordinate ‘Flat’ Structures are associative, and show evidence for right-branchingness (assuming common c-command tests).
- Does this carry over to other types of structures?

### 4.1. VP-Modifiers and Secondary Predicates

VP-final adverbials seem to modify the meaning of entire VPs (Taglicht, 1984, 67):

(34) She saw him once, in 1939, outside the Albert Hall, after a concert.

Under one analysis of VP-adverbials is that they take scope over the VP material preceding them, leading to a ‘right-ascending’ structure (cf. Andrews (1983), Ernst (2001)). But:

(35) ?? She saw him once, | in 1939, || outside the Albert Hall, ||| after a concert.

Taglicht (1984, 67) in fact analyzes sequences of VP-adverbials as coordinate structures, Larson (2005) argues they are coordinated event predicates, that don’t take scope (Phillips, 1996):

- (36) a. kissed Mary in the forest for an hour.  
b.  $\exists e$  [ kiss(L, H, e) & in-the-forest(e) & for-an-hour (e)].

Similar to ‘flat’ coordinate structures, they have a right-branching syntax:

- (37) a. The guard saw nobody in any room at any time.  
b. John spoke rarely during any of our meetings. (Larson, 2005)

- (38) a. Sue spoke to every child on his or her birthday.  
b. John spoke during every session for as long as it lasted.

- (39) Secondary Predicates  
Mary was dancing, completely drunk, without any fear, unaware of the abyss.

- (40) Mary Poppins rewarded every child convinced of his worthiness.

Pylkkänen (2002, 27) argues that secondary predicates are event predicates:

- (41) \*? Mary was dancing tall.

But: not every order is equally unmarked. This could have semantic reasons:

- (42) a. open Monday, Tuesday and Friday.  
b. big, bigger, biggest.  
c. Friends, Romans, countrymen, lend me...

Focus also plays a role (Larson, 2005)...

## 4.2. Prosody and Associativity: Predicate Sequences

(43) She wanted | to try | to begin | to plan | to move.

Each predicate can (but not need not be) accented (rhythm plays a role).

(44) to want, to try, to begin, to plan, and to move.

Do predicates sequences form associative domains? A rebracketing might not affect meaning:

(45) ( $\lambda x$ . wanted to try to begin x) ([ to plan to move]).

In principle, this renders any predicate order interpretable:

(46) \*She wanted to begin to move to try.

The reason (46) is not grammatical is the movement step is ruled out by the constraints on rightward movement (Sabbagh, 2007). Consider right-node raising:

(47) a. She wrote | and defended || her dissertation.

b. She wrote || and defended | her dissertation.

(48) a. She (wanted | to try) || [and...] (to begin | to write).

b. She (wanted) || [and...] (to try | to begin | to write).

Alternative to  $\lambda$ -abstraction: forward function composition (Steedman (2001, 40)).

(49) Forward composition (simplified)  
 $X/Y : f \ Y/Z : g \Rightarrow X/Z : \lambda x.f(gx)$

The definition makes sure that the associative law holds for forward composition.

## 4.3. Prosody and Associativity: Possessors

Consider the following prosodically ‘flat’ expression, which is evidently *left-branching*:

(50) John’s brother’s sister’s dog’s house.

(51) Larson and Cho (1999): John’s former house:

a. A former house that belongs to John (dispreferred).

b. A house that formerly belonged to John (preferred).

Left-branching structure gives wrong bracketing. Larson and Cho (1999):

(52) Movement analysis: the house to John  $\rightarrow$ . John to.the house

- Prosodically flat structures are associative
- Prosodically flat structures are (underlyingly) right-branching.

## 5. Prosodic Mismatches II: Contradictory Boundaries

If matching view is correct, then attested and unattested apparent mismatches should be explainable in terms of constraints on movement, extraposition, and basic constituent structure.

- (53) a. \* Three mathematicians || in ten derive a lemma. (Pierrehumbert, 1980, 20)  
b. \* John || saw the play and Mary went to the concert. (Taglicht, 1998, 187)
- (54) a. Jane tried to begin || to learn Spanish. (Selkirk, 1984, 294)  
b. Sesame Street is brought to you by || the children's television workshop. (Shattuck-Hufnagel and Turk, 1996, 191)

### 5.1. Relative Clauses

Chomsky (1965, 13), Chomsky and Halle (1968, 372):

- (55) This is | the cat || that chased | the rat || that stole | the cheese.

The relative clause forms its own phonological domain. According to SPE, the syntactic bracketing in syntax should be as follows:

- (56) This is [ the cat that chased [ the rat that stole the cheese. ]]

Edge-marking takes readjustment to be a mismatching mapping between syntax and prosody. This would always predict mismatching phrasing ...but here are two possible phrasings:

- (57) a. that chased | the rat || that stole the cheese.  
b. that chased || the rat | that stole the cheese

Idea here: mismatching prosody involves 'Extraposition'.

- (58) I saw the cat yesterday that caught the rat on Monday.

...but is extraposition necessarily involved in the 'mismatching' phrasing? Hulse and Sauerland (2006) show restrictions on extraposition:

- (59) a. Mary praised the headway that John made.  
b. ?? Mary praised the headway last year that John made.

Matching Phrasing is possible also with idiom chunk examples:

- (60) a. This was entirely due || to the advantage that he took of the new system.  
b. This was entirely due || to the extra funds that he took from the recent surplus.

As expected, 'Mismatching' is prosody degraded with idiom chunks:

- (61) a. ?? This was entirely due to the advantage || that he took of the new system.  
b. This was entirely due to the extra funds || that he took from the recent surplus.

(62) Comparison with the OV version in German

Ich glaube dass dies die Katze ist, die die Ratte gejagt hat, die den Käse gestohlen hat.  
I believe that this the cat is that the rat chased has, that the cheese stolen has

‘I think this the cat that chased the rat that stole the cheese.’

Extraposition is impossible in German when the head of the relative clause is an idiom chunk:

- (63) a. Peter war über den Bären den Maria ihm aufgebunden hatte verärgert.  
Peter was about the bear that Maria him given had annoyed  
‘Peter was annoyed about the prank that Maria played on him.’  
b. ?\*Peter war über den Bären verärgert, den Maria ihm aufgebunden hatte.

Extraposition might be preferred when possible for reasons that relate to production or perception, see in SPE (p. 372) and also in Lieberman (1967, 120–121). The center-embedding order in German is word salad:

(64) ?\*Ich glaube dass dies die Katze die die Ratte die den Käse gestohlen hat gejagt hat ist.

If prosody is really negotiated in syntax, then this makes predictions for more complex structures that have been amply studied in the processing literature (e.g. Clifton et al., 2002):

- (65) a. I met the daughter of the colonel || who was on the balcony  
b. I met the daughter || of the colonel who was on the balcony

Sentence (65a) should be ambiguous, and (65b) should not be—there is no way to extrapose ‘of the colonel who was on the balcony’ as a constituent.

**Does matching prosody never involve extraposition?** Maybe: see non-restrictive relative clauses, which are obligatorily construed as adjuncts and obligatorily separated by a boundary.

## 5.2. Heads with a Coordinated Argument

(66) Common Phrasing crosslinguistically: (Predicate A) (and B)

Again, both matching and mismatching phrasing are possible:

- (67) a. She kissed || John | and Sally.  
b. She kissed | John || and Sally.

One context in which (67a) may be attested is the following:

(68) She hugged Mary, and she kissed || John | and Sally.

Is extraposition at play? **Extraposition is possible** (Munn, 1993):

(69) John bought a book yesterday, and a newspaper.

**Is extraposition always involved in the mismatching phrasing?** A look at OV structures is instructive. It shows that what looks like extraposition is probably **gapping**.

- (70) a. A student attends, and one professor from another department.  
 b. \*A student attend, and one professor from another department.

Prediction is that prosody should correlate with first/second conjunct agreement:

- (71) a. In the seminar room there were || a teacher | and two students.  
 b. In the seminar room there was | a teacher || and two students.

Agreement suggests sth bigger is coordinated (2 clauses), and the predicate in the second conjunct is gapped. More evidence:

- (72) a. John has arrived, and Mary, too. So two people have arrived.  
 b. # John and Mary have arrived, too. So two people have arrived.

Consider now the string-vacuous case:

- (73) a. I saw John, || and Mary, too. So two people have arrived.  
 b. # I saw John | and Mary, || too. So two people have arrived.

For a converse case, compare:

- (74) a. # I saw John, || and Mary, together.  
 b. I saw John | and Mary, || together.

These syntactic differences are unexpected for edge-alignment view (Chen, 1987, Selkirk, 1986, et seq.), which would predict the mismatching prosody without ‘extraposition’!

- (75) a. [saw [John<sub>XP</sub> [ and Mary<sub>XP</sub>]<sub>X̄</sub>] <sub>XP</sub>.  
 b. (saw John)<sub>ϕ</sub> (and Mary)<sub>ϕ</sub>.

The syntactic analysis correctly rules out certain kinds of mismatches (Shattuck-Hufnagel and Turk, 1996, 198):

- (76) a. George and Mary give blood.  
 b. George and Mary || give blood.  
 c. George || and Mary || give blood.  
 d. \* George || and Mary give blood.

Consider also (adapted from Mccawley, 1998, 275):

- (77) a. Tom washed and dried || the dishes.  
 b. \* Tom washed || and dried the dishes.

Alternative edge-based theory (i) does not give interesting predictions for different phrasing options; (ii) even more troublesome, allows to derive the right prosody from the wrong syntax.

## Conclusion

- Apparent mismatches might actually not be mismatches, and involve the choice of a different kind of syntactic derivation.
- Lists seem to be a preferred way of constructing complex meaning, maybe because they are easier to process.
- One motivation for chunking material differently is information structure. The different bracketings in Selkirk (1984, 294) are probably motivated by different foci:

- (78)
- a. Jane || tried to begin to learn Spanish.
  - b. Jane tried || to begin to learn Spanish.
  - c. Jane tried to begin || to learn Spanish.
  - d. Jane tried to begin to learn || Spanish.

- There are, however, some mismatches that appear real: e.g., second-position clitics... Obviously, these need to be accounted for as well.
- Two avenues for future work: (i) understand better the phonetic implementation of boundary strength and its relation to processing; (ii) understand the nature of the list-like construction of meaning better.

## References

- Andrews, A. 1983. A note on the constituent structure of modifiers. *Linguistic Inquiry* 14:695–97.
- Arregi, Karlos. 2002. Focus on Basque movement. Doctoral Dissertation, MIT, Cambridge, Ma.
- Bierwisch, Manfred. 1968. Two critical problems in accent rules. *Linguistics* 4:173–178.
- Bresnan, Joan. 1971. Sentence stress and syntactic transformations. *Language* 47:257–81.
- Büring, Daniel. 2005. *Binding theory*. Cambridge: Cambridge University Press.
- Chen, M. Y. 1987. The syntax of Xiamen tone sandhi. *Phonology Yearbook* 4:109–49.
- Cho, Young-Mee Yu. 1990. Syntax and phrasing in Korean. In Inkelas and Zec (1990), 47–62.
- Chomsky, Noam. 1965. *Aspects of a theory of grammar*. Cambridge, Ma: MIT Press.
- Chomsky, Noam, and Morris Halle. 1968. *The sound pattern of English*. New York: Harper & Row.
- Clifton, C. Jr., K. Carlson, and L. Frazier. 2002. Informative prosodic boundaries. *Language and Speech* 45:87–114.
- Collier, R., J.R. de Pijper, and A. Sanderman. 1993. Perceived prosodic boundaries and their phonetic correlates. *Proceedings of the workshop on Human Language Technology* 341–345.
- Cooper, William E., and Jeanne Paccia-Cooper. 1980. *Syntax and speech*. Cambridge, Mass.: Harvard University Press.
- Culicover, Peter W., and Ray Jackendoff. 2005. *Simpler syntax*. Oxford University Press.

- Dobashi, Yoshihito. 2003. Phonological phrasing and syntactic derivation. Doctoral Dissertation, Cornell University.
- Dresher, Elan B. 1994. The prosodic basis of the Tiberian Hebrew system of accents. *Language* 70:1–52.
- Ernst, Thomas. 2001. *The syntax of adjuncts*. Cambridge: Cambridge University Press.
- Féry, Caroline, and Hubert Truckenbrodt. 2004. Tonal scaling and the sisterhood principle. Universität Potsdam and Universität Tübingen.
- Fougeron, C., and P. Keating. 1997. Articulatory strengthening at edges of prosodic domains. *Journal of the Acoustical Society of America* 101:3728–3740.
- Goldsmith, John A., ed. 1995. *The handbook of phonological theory*. London: Blackwell.
- Halle, Morris. 1969. Questions in linguistics. In *Modern studies in English. readings in transformational grammar*, ed. David A. Reibel and Sanford A. Schane, 45–52. Prentice Hall.
- Hockett, Charles. 1954. Two models of grammatical description. *Word* 10:210–234.
- Hulsey, Sarah, and Uli Sauerland. 2006. Sorting out relative clauses. *Natural Language Semantics* 12:111–137.
- Inkelas, Sharon, and Draga Zec, ed. 1990. *The phonology-syntax connection*. CSLI and CUP.
- Ishihara, Shinishiro. 2003. Intonation and interface conditions. Doctoral Dissertation, MIT.
- Johnson, Kyle. 2002. Towards an etiology of adjunct islands. UMass Amherst.
- Kahnemuyipour, Arsalan. 2003. Toward a phase-based theory of phrasal stress. Workshop on Phases. MIT 2003.
- Kayne, Richard. 1994. *The antisymmetry of syntax*. Cambridge, Ma.: MIT Press.
- Keating, Patricia. to appear. Phonetic encoding of prosodic structure. In *Speech production: Models, phonetic processes and techniques*, ed. J. Harrington and M. Tabain. New York: Psychology Press.
- Kratzer, Angelika, and Elisabeth Selkirk. 2004. Class notes. UMass Amherst.
- Ladd, Robert. 1986. Intonational phrasing: the case for recursive prosodic structure. *Phonology Yearbook* 3:311–340.
- Ladd, Robert. 1988. Declination and ‘reset’ and the hierarchical organization of utterances. *JASA* 84.
- Larson, Richard K. 1988. On the double object construction. *Linguistic Inquiry* 19:335–391.
- Larson, Richard K., and Sungeon Cho. 1999. Temporal adjectives and structure of possessive dps. In *Proceedings of WCCFL 18*. Somerville, Ma.: Cascadilla Press.
- Larson, Richard K. 2005. Sentence final adverbs and scope. In *Proceedings of NELS 34*, ed. Keir Moulton and Matt Wolff, 23–43. Amherst: GLSA.
- Lasnik, Howard. 1995. *Plurality, conjunction and events*. Dordrecht: Kluwer Academic Publishers.
- Legate, Julie Anne. 2001. Some interface properties of the phase. *Linguistic Inquiry* 34:506–516.
- Lehiste, Ilse. 1973. Phonetic disambiguation of syntactic ambiguity. *Glossa* 7:107–122.
- Lieberman, P. 1967. *Intonation, perception, and language*. Cambridge, Ma.: MIT Press.

- Mccawley, James D. 1998. *The syntactic phenomena of English*. Chicago: Chicago University Press, 2nd edition.
- Min, Young-Gie. 1996. Role of punctuation in disambiguation of coordinate compounds. University of Arizona, Tucson.
- Moortgart, Michael. 1988. *Categorial investigations*. Dordrecht: Foris.
- Munn, Alan. 1993. Topics in the syntax and semantics of coordinate structures. Doctoral Dissertation, University of Maryland.
- Pesetsky, David. 1995. *Zero syntax. experiencers and cascades*. Cambridge, Ma: MIT Press.
- Phillips, Colin. 1996. Order and structure. Doctoral Dissertation, MIT.
- Pierrehumbert, Janet. 1980. The phonology and phonetics of english intonation. Doctoral Dissertation, MIT.
- Price, P.J., S. Ostendorf, S. Shattuck-Hufnagel, and C. Fong. 1991. The use of prosody in syntactic disambiguation. *Journal of the Acoustical Society of America* 9:2956–2970.
- Pykkänen, Liina. 2002. Introducing arguments. Doctoral Dissertation, MIT.
- Sabbagh, Joey. 2007. Ordering and linearizing rightward movement. *Natural Language and Linguistic Theory* .
- Selkirk, Elisabeth. 1986. On derived domains in sentence phonology. *Phonology Yearbook* 3:371–405.
- Selkirk, Elisabeth. 1995a. The prosodic structure of function words. In *Papers in optimality theory. university of massachusetts occasional papers*, ed. Jill N. Beckman, Laura Walsh Dickey, and Suzanne Urbanczyk. Amherst, Ma.: Umass.
- Selkirk, Elisabeth. 1996. The prosodic structure of function words. In *Signal to syntax*, ed. J.L. Morgan and K. Demuth, 187–213. Mahwah, NJ: Lawrence Erlbaum Associates.
- Selkirk, Elisabeth O. 1984. *Phonology and syntax. the relation between sound and structure*. Cambridge, Ma.: MIT Press.
- Selkirk, Elizabeth O. 1995b. Sentence prosody: Intonation, stress, and phrasing. In Goldsmith (1995), 550–569.
- Shattuck-Hufnagel, Stefanie, and Alice E. Turk. 1996. A prosody tutorial for investigators of auditory sentence processing. *Journal of Psycholinguistic Research* 25:193–247.
- Snedeker, J., and J. Trueswell. 2003. Using prosody to avoid ambiguity: Effects of speaker awareness and referential context. *Journal of Memory and Language* 48:103–130.
- Stanley, Richard P. 1997. Hipparchus, Plutarch, Schröder, Hough. *American Mathematics Monthly* 104:344–350. [Http://www-math.mit.edu/istan/papers.html](http://www-math.mit.edu/istan/papers.html).
- Steedman, Mark. 2000. Information structure and the phonology-syntax interface. *Linguistic Inquiry* 34.
- Steedman, Mark. 2001. *The syntactic process*. Cambridge, Ma.: MIT Press.
- Taglicht, Josef. 1984. *Message and emphasis. on focus and scope in English*, volume 15 of *English Language Series*. London and New York: Longman.
- Taglicht, Josef. 1998. Constraints on intonational phrasing in English. *Journal of Linguistics* 34:181–211.

- Truckenbrodt, Hubert. 1995. Phonological phrases: Their relation to syntax, focus, and prominence. Doctoral Dissertation, MIT, Cambridge, Mass.
- Truckenbrodt, Hubert. 1999. On the relation between syntactic phrases and phonological phrases. *Linguistic Inquiry* 30:219–255.
- Uriagareka, Juan. 1999. Multiple spell-out. In *Working minimalism*, ed. Samuel David Epstein and Robert Hornstein, 251–283. Cambridge, Ma.: MIT Press.
- Wagner, Michael. 2005. Prosody and recursion. Doctoral Dissertation, MIT.
- Winter, Yoad. 2001. *Flexibility principles in boolean semantics*. Cambridge, Ma.: MIT Press.
- Winter, Yoad. 2006. Multiple coordination: Meaning composition vs. the syntax-semantic interface. Ms. Technion/NIAS.