

# **Multiple wh- and wh-quantifier dependencies in correlatives and interrogatives**

Veneeta Dayal  
Rutgers University

**Workshop: Multiple wh- constructions and their kin**  
Laboratoire de Linguistique de Nantes  
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## I. Multiple Wh: Then and Now

### *0. Overview*

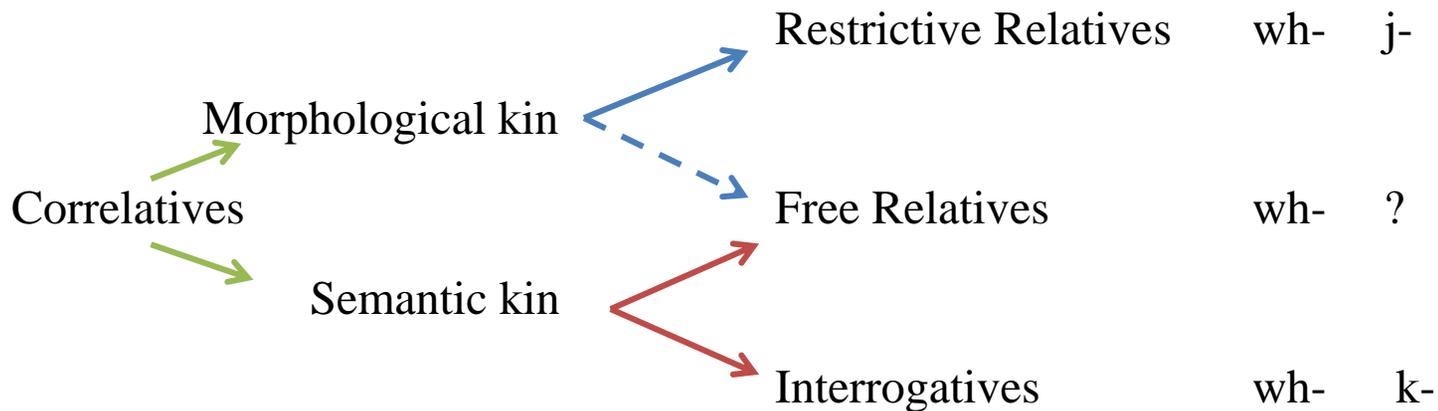
- Multiple Wh: Then and Now
- Multiple Sluicing and Pair-list Readings
- Pair-list Readings through Skolem Functions

***Who is your kin? Morpho-syntax or semantics as a guide?***

***Correlatives in the eighties:***

**1a.** jo laRkii khaRii hai, vo lambii hai **Hindi**  
 wh girl standing is she tall is  
 Literally: “Which girl is standing, that/she is tall.  
 Colloquially: “The girl who is standing is tall.”

**1b.** jis laRki-ne jis laRke-ke saath khelaa, us-ne us-ko haraayaa **Eng Hindi**  
 wh girl-ERG wh boy-WITH played she-ERG he-ACC defeated



## *Correlatives in the eighties:*

**Single wh correlatives** (Bach and Cooper 1978):

2. [ **[which girl is standing]** [the [N & R]] is tall]]

- A syntactic variant of a headed relative.
- Did not capture the restriction of correlatives to NPs headed by demonstratives in the main clause.
- Left many differences between correlatives and restrictive relatives unexplained: for example, the possibility of *bhii* (=ever) in the former.
- The notion of the correlative clause as topic that was to be commented upon was around in the South Asian literature but was considered stipulative and/or a descriptive generalization by formal linguists.
- Did not extend to multiple wh correlatives.

## *Correlatives in the eighties:*

### **Multiple wh correlatives (Andrews 1985):**

An algorithm for rendering the meaning of a multiple wh correlative: Replace the wh with an indefinite and recast the correlative as a conditional.

3. [ $\forall$ [a girl-i played with a boy-j] [she-i defeated him-j]]

- A variant of the very popular tripartite structure at the time (Heim 1982).  
BUT
- Did not capture the obligatory requirement of the demonstrative.
- Did not impose any restriction on the nature of the pairing: (3) allows one girl to play with three boys, for example, but the intuition is that (1b) would be infelicitous in such a context.

## *Interrogatives in the eighties:*

### *What is a good answer?*

#### *Single or Multiple Wh Questions*

Anything goes.

Hamblin (1973), Karttunen 1977, Groenendijk & Stokhof 1984, Engdahl 1981, 86.

#### *Wh Questions*

Restricted

Single wh questions have a uniqueness requirement (*which*  $N_{SING}$ )

Multiple wh questions encode bijectivity; through the semantic operation of ‘absorption’.

Higginbotham and May 1981

- Even proponents of the functional approach (for example, Engdahl and Chierchia) adhered to “anything goes”.

## I. Multiple Wh: Then and Now

Srivastav/Dayal 1991, 1995 (and work leading up to it):

- Single wh correlatives & Single wh interrogatives

- Correlatives

jo laRkii (wh girl)	= uniqueness	} definite determiner
jo laRkiyaaN (wh girls)	= universal	

jo bhii laRkii (wh-ever girl)	= identity reading	} free relative
	free choice reading	

(independently: Jacobson on free relatives 1988, 1995).

- Interrogatives – wh expressions as iota operators

(later also Rullmann 1995)

## I. Multiple Wh: Then and Now

Srivastav/Dayal 1991, 1995 (and work leading up to it):

- Multiple wh correlatives & Multiple wh interrogatives
  - Correlatives

polyadic quantifiers that relativized the iota denoted by each wh in a dependency that forced bijective pairings.
  - Interrogatives

A version of ‘absorption’ using propositional approach to question meanings (Karttunen, specifically) and extending the iota-based approach to force bijective pairings.

*The Functional Turn in the Nineties (Chierchia 1991, 93):*

- Questions with (universal) quantifiers are 3-way ambiguous between individual, functional and pair-list readings.
  - Pair-list readings are dependent on functional readings  
(Engdahl, Chierchia).
  - Pair-list readings are independent, though derived from the functional reading through “absorption” of the wh expression and the witness set of the quantifier (Chierchia).
  - Functional readings have a syntactic correlate in that wh expressions denoting skolem functions have a complex trace, with an a-index that can be bound by a c-commanding DP and an i-index that is identified by the skolem function.
  - Subject-object asymmetries in functional and pair-list readings of questions with quantifiers have a common source, based on the positions of the a-index of the wh and its antecedent:

## I. Multiple Wh: Then and Now

- 4a. Which book did every author recommend? His/her first book.
- b.  $\lambda p \exists F [\text{Range}(F) = \text{book} \wedge p = \forall x [\text{author}(x) \rightarrow \text{recommend}(x, F(x))]]$
- c. {Every author recommended his/her 1<sup>st</sup> book,  
Every author recommended his/her last book...}

### The Functional Approach to Multiple wh Interrogatives

- A perceived subject-object asymmetry in multiple wh interrogatives with respect to domain cover/exhaustivity: 1<sup>st</sup> wh  $\Rightarrow \forall$ . (Kiss 1993)
- Chierchia's functional approach to pair-list readings adopted by Hornstein (1995), Comorovsky (1996), Dayal (1996) to explain the phenomenon of 1<sup>st</sup> wh  $\Rightarrow \forall$ .
- The semantics of multiple wh in Engdahl (1986) and the semantics of pair-list readings of questions with quantifiers in Chierchia (1993) does not capture the nature of pairings and ends up equivalent to 'anything goes'.

## I. Multiple Wh: Then and Now

### Dayal 1996 - Interrogatives

- Questions denote Hamblin sets (set of all possible answers) – also in Dayal 1994 on the basis of Scope Marking.
- Answerhood operators deliver uniqueness and functionality of pair-lists:

$$\text{Ans-D}(Q)(w) = \lambda Q \text{ } \iota p \text{ } p \in Q [p(w) \wedge \forall p' \in Q [p'(w) \rightarrow p \subseteq p']]$$

- Multiple wh questions are not bijective but rather functional: Domain cover and point-wise uniqueness (ie exhaustivity on the first wh & one-one or many-one pairings, crucially not one-many pairings.)

## I. Multiple Wh: Then and Now

- Multiple wh questions are 2-way ambiguous between single-pair and multiple-pair readings; but derivable by the same operator -- Ans-D.
  - Single-pair readings are based on an iteration of wh phrases, interpreted as existential quantifiers:

**5a.**  $\text{Ans-D}(\{a \text{ read } c, a \text{ read } d, b \text{ read } c, b \text{ read } d\}) \Rightarrow a \text{ read } c$

- Multiple-pair readings are based on a functional C that packs all of the functionality into a single node; rightly criticized as stipulative, brute-force, crazy:

**5b.**  $\text{Ans-D} \left[ \left[ \begin{array}{l} a \text{ read } c \text{ and } b \text{ read } d \\ a \text{ read } c \text{ and } b \text{ read } c \\ a \text{ read } d \text{ and } b \text{ read } c \\ a \text{ read } d \text{ and } b \text{ read } d \end{array} \right] \right] \Rightarrow a \text{ read } c \text{ and } b \text{ read } d$

## I. Multiple Wh: Then and Now

### *Do we really need skolem functions?*

- Hagstrom (1998) captures this reading without functions, developed and implemented compositionally in Fox (2012). See also Nicolae (2013) and Kotek (2014). A multiple wh question = a set of questions, and an answer is the intersection of answers to each question in the set.
- It is possible to capture the functionality of pair-list answers without using skolem functions, but note that there is no argument from parsimony here.
- There is no other way to derive functional answers to questions with quantifiers, such as (4a). And if wh expressions can have denotations rooted in skolem functions, as functional answers tell us they need to, it would take a lot to block that from being generally available.

## I. Multiple Wh: Then and Now

- It may also help explain why universal quantifiers can flip to a set denoting term when there is another wh that becomes dependent on it and why an existential wh quantifiers can also flip when another wh becomes dependent on it.

- 6a.** Which student read which book?  
**b.** Which book did every student read?  
**c.** Mary read Namesake and Bill read Emma.

**7a.** [**which student**<sub>i</sub> [ C [t<sub>i</sub> read **which book**<sup>i</sup><sub>j</sub>]]]]

**b.** [**which book**<sub>j</sub> [ did [ **every student**<sub>i</sub> read t<sub>j</sub><sup>i</sup>]]]]

- A functional wh is an inherently dependent term that looks for an argument that can bind it's a-index: Universals can provide this argument via Witness Sets; Existential Wh Quantifiers can provide this argument by undergoing type-shift via BE.
- Fronting/Overt Wh Movement: C attracts closest wh phrase.

## I. Multiple Wh: Then and Now

### Dayal 1996 – Correlatives

- Correlatives are quantificational structures (as in Srivastav 1991).
- Single wh correlatives quantify over wh expressions that have essentially the semantics of iota (as in Srivastav 1991).
- Multiple wh correlatives involve quantification over skolem functions.

$\llbracket(1b)\rrbracket = \llbracket\text{correlative}\rrbracket (\llbracket\text{main clause}\rrbracket)$

$\lambda R \exists F' [F' = \iota F [\text{Dom}(F) = \text{girl} \wedge \text{Range}(F) = \text{boy} \wedge \forall y \in \text{girl} [\text{play-with}(y, F(y))]] \wedge \forall y \in \text{girl} [R(y, F'(y))]] (\lambda x \lambda y \text{defeated}(x,y))$

$\Rightarrow \exists F' [F' = \iota F [\text{Dom}(F) = \text{girl} \wedge \text{Range}(F) = \text{boy} \wedge \forall y \in \text{girl} [\text{play-with}(y, F(y))]] \wedge \forall y \in \text{girl} [\text{defeated}(y, F'(y))]]$

- An alternative without functions is proposed in Gajewsky (2008), which has some points of resemblance with the version in Srivastav (1991) – I think.

## I. Multiple Wh: Then and Now

### **Who counts as kin? Is kinship morphological or semantic?**

- In the case of multiple correlatives, semantic kinship to interrogatives proved to be a better and more productive guide, leading to a better understanding of correlatives as well to a better understanding of questions.
- English free relatives share a morpho-logical as well as a semantic kinship with restrictive relatives and interrogatives, but their semantics had not been studied in depth in the eighties (a short discussion in Cooper 1983).
- The analysis of free relatives as definites, now taken as a baseline, was arguably prompted by their semantic kinship with definite determiners and/or correlatives rather than with their morphological kinship with relative clauses or interrogatives.

### **The Nineties: multiple and single pair readings are formally distinct.**

- Wh expressions interpreted as simple existentials lead to a set of “atomic” propositions varying in more than one position, wh expressions under “functional absorption” lead to a set of propositions, each one a graph of a function (Dayal 1996).
- There are languages in which multiple wh interrogatives do not have single-pair readings (Boskovic 2003, for example).
- Interveners block multiple-pair readings but not single-pair readings of superiority violating interrogatives (Pesetky 2000).
- Children acquire single-pair readings before they acquire multiple-pair readings (Roeper and de Villiers 2011).

## II. Multiple Sluicing and Pair-list Readings

### **Sluicing – the pre-sluice and the sluice** (Abels and Dayal 2017)

- The pre-sluice provides a diagnostic for testing the existence of single pair reading in any language, whether it allows multiple sluicing or not.

**8a.** Someone wrote something but I can't tell you who wrote what.

**b.** Everyone wrote something but I can't tell you who wrote what.

- Boskovic's claim is about fronting languages, including English. It is worth checking if multiple fronting languages allow pre-sluices like (8a), where *who* and *what* would both be fronted. The discussion in Boskovic is more nuanced, so his claim needs to be looked at more carefully.
- The existence of both pre-sluices in (8) does not determine that single and multiple pair readings are formally distinct. It is quite compatible with the view that there is a uniform pair-list reading, which may in a given context only yield a single-pair answer.

## II. Multiple Sluicing and Pair-list Readings

**Sluicing as ellipsis** of material up to the left periphery.

- Multiple sluicing is possible in English, especially if one wh is a PP – 9a.
- English does not allow multiple sluicing across islands (or clause boundaries) – 9b.
- The acceptability of the pre-sluice tells that there must be an alternative to covert wh movement for interpreting wh in-situ non-locally – 9c.

**9a.** Some linguist worked on some topic, but I can't tell you

[<sub>CP</sub> which linguist [<sub>CP</sub> on which topic [<sub>C'</sub> [<sub>TP</sub> t<sub>i</sub> worked on t<sub>j</sub>]]]]

**b.** \*Some linguist will be upset if I work on some topic, but I can't tell you

[<sub>CP</sub> which linguist-I [<sub>CP</sub> on which topic

[<sub>C'</sub> [<sub>TP</sub> t<sub>i</sub> I will be upset if I work on t<sub>j</sub>]]]]

**c.** Some linguist will be upset if I work on some topic, but I can't tell you

[<sub>CP</sub> which linguist-i [<sub>C'</sub> [<sub>TP</sub> t<sub>i</sub> I will be upset if I work on **which topic**]]]]

- Question 1: What mechanism is used to interpret the wh in situ in 9c?
- Question 2: Does multiple sluicing apply to questions with quantifiers under their pair-list readings?

## II. Multiple Sluicing and Pair-list Readings

### Interpreting wh in situ

- There are two non-movement approaches to interpreting wh in-situ, the choice function approach (Reinhart 1997, 1998; Winter 1998) and the focus-based approach (Hamblin 1973, Ramchand 1997, Kratzer and Shimoyama 2002).

**10a.** [<sub>CP</sub> which linguist-i [<sub>C'</sub> [<sub>TP</sub> t-i will be upset if I work on **which topic**]]] ⇒  
 $\lambda p \exists x \exists f$  [linguist (x) ∧ CF(f) ∧ x will be upset if I work on **f(topic)**]

**b.** [<sub>CP</sub> which linguist-i [<sub>C'</sub> [<sub>TP</sub> t-i will be upset if I work on **which topic**]]]] ⇒

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- A major argument for a focus-based approach is its ability to account for intervention (Beck 2006).

## II. Multiple Sluicing and Pair-list Readings

### Intervention effects:

- Superiority obeying structures are impervious to interveners because they allow covert wh movement.
- Superiority obeying structures are sensitive to interveners because they don't allow covert wh movement.

**11a.** Which student didn't read which book?

SP MP

[which student-i [which book-j didn't [t-i read t-j]]

←

←-----

**11b.** Which book didn't which student read?

SP \*MP

[Which book-j [didn't [which student read t-j]]]

←

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- Beck (2006) uses focus semantics to derive intervention effects in superiority violations.
- Wh expressions have only a focus semantic value, negation is a focus sensitive expression. Wh-focus + intervener  $\Rightarrow$  uninterpretable LF.

## II. Multiple Sluicing and Pair-list Readings

BUT

- The uninterpretability should apply equally to single-pair as to multiple-pair readings, but single-pair readings survive interveners (Pesetsky 2000, Beck 2006, Kotek 2014).
- Kotek 2014 tries to argue that English lacks single-pair readings and what we perceive in superiority violations are not genuine single-pair readings. This argument cannot be maintained.

**Conclusion:** Natural language grammar must include Choice Functions; Focus semantics is not the way to derive intervention effects.

## II. Multiple Sluicing and Pair-list Readings

### Sluicing in wh-wh questions and wh- $\forall$ questions

- Multiple pair-list readings are possible with sluicing, but only in multiple wh questions (12a-b), not in questions with quantifiers (13a-b).

**12a.** I know each student is working on a different topic, but I can't remember which student is working on which topic.

**b.** I know each student is working on a different topic, but I can't remember [which student-i [on which topic-j [~~t-i is working t-j~~]]]

**13a.** I know each student is working on a different topic, but I can't remember which topic each student is working on.

**b.** \*I know each student is working on a different topic, but I can't remember [each student-i [on which topic-j [~~t-i is working t-j~~]]].

- Do we want to restrict sluicing in a construction specific way to wh expressions? (Note: superiority violating questions also disallow sluicing).
- Or do we want to derive pair-list readings of questions with quantifiers without covert movement of the quantifier to the left periphery?
- In Abels and Dayal (2017) we take the second route but we won't go into it here.

## II. Multiple Sluicing and Pair-list Readings

### Conclusion: Sluicing and Question Semantics

- A recent survey of the semantics and pragmatics of questions says the following about sluicing (Dayal 2016):

“Within the domain of questions, I did not mention the extremely interesting phenomenon of. Sluicing lies at the interface between syntax and semantics. Work on this topic has drawn on a precise theory of questions. I would venture to say that **work on sluicing**, while adding much to our understanding of how ellipsis works in natural language, **has not prompted significant shifts in the semantics of questions.**”

- This clearly misguided statement was based on the sluicing literature prior to work on the semantic aspects of multiple wh sluicing (Abels and Dayal 2017).

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### III. Pair Lists Through Skolem Functions

#### **Returning to skolem functions, do we need them?**

- They are needed for functional readings of questions with quantifiers:

**14a.** Which professor does every student admire?

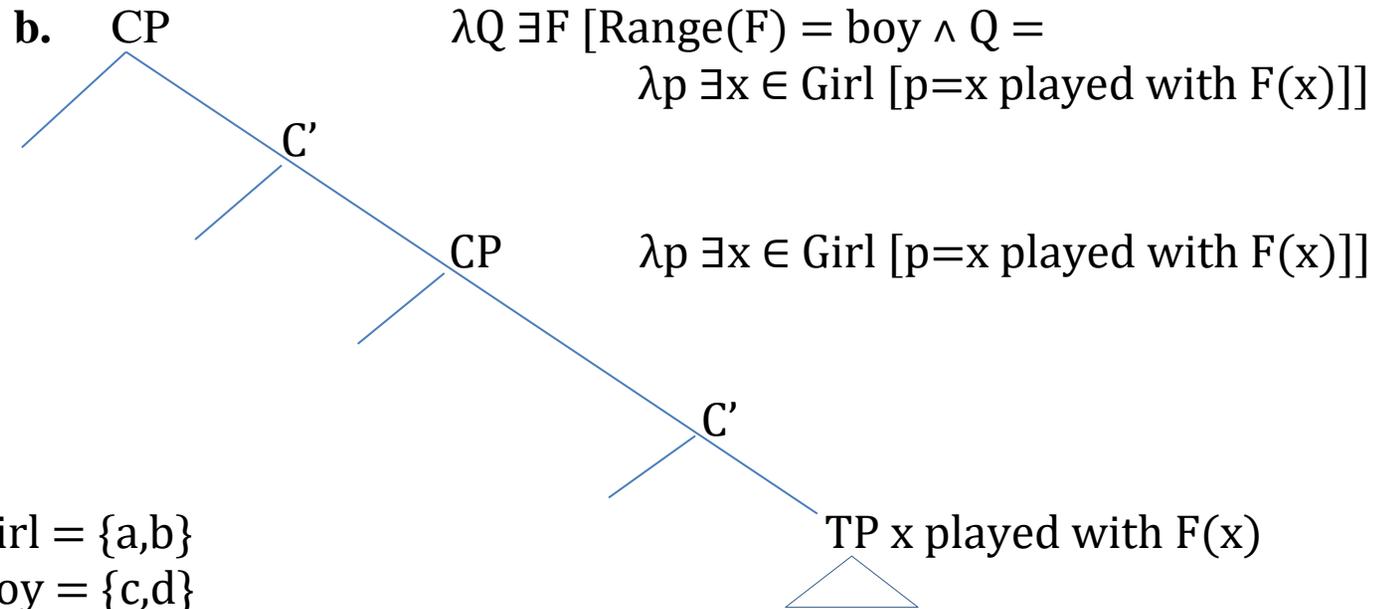
**b.** His/Her advisor.

- If they are there in natural language, there is no parsimony argument against using them for pair-lists. The question is are they needed for PL?
- Xiang (2016) builds sets of questions built on a functional core but, as we saw yesterday, she voids the exhaustivity/domain-cover requirement.

### III. Pair-lists through Skolem Functions

An alternative that also treats multiple wh interrogatives as sets of sets of propositions (but not sets of questions) -- Dayal (2017).

#### 15a. Which girl played with which boy?



- {a played with c, b played with d}
- {a played with d, b played with d}
- {a played with c, b played with c}
- {a played with d, b played with c}

$$\text{Ans}(\mathbb{Q}) = \bigcap \iota Q \in \mathbb{Q} [\forall q \in Q \rightarrow q(w)]$$

### III. Pair-lists through Skolem Functions

- Can this approach be extended to interrogatives with more than 2 wh or interrogatives with a quantifier and 2 wh?

16a. Which girl gave which book to which boy?

b. CP  $\lambda Q \exists F \exists F' [\text{Range}(F') = \text{boy} \wedge \text{Range}(F) = \text{book} \wedge Q = \lambda p \exists x \in \text{Girl} [p=x \text{ gave } F(x) \text{ to } F'(F(x))]]$

C'

CP  $\lambda p \exists x \in \text{Girl} [p=x \text{ gave } F(x) \text{ to } F'(F(x))]$

Book = {e,f}

Girl = {a,b}

Boy = {c,d}

C'

TP x gave F(x) to F'(F(x))

{ a gave e to c, b gave e to c }  
 { a gave f to d, b gave f to d }  
 { a gave e to d, b gave e to d }  
 { a gave f to c, b gave f to c }  
 .....

Ans(Q) =  
 $\cap \{ Q \in \mathcal{Q} [\forall q \in Q \rightarrow q(w)]$

### III. Pair-lists through Skolem Functions

- Can the set of sets approach be extended to Correlatives?
- Should we even expect it to extend to Correlatives?

#### 17. [Which girl played with which boy] [she defeated him]

- Correlatives do not allow pair-list readings with  $\forall$ -quantifiers

18. \*? jis laRke-ke saath har laRkii-ne khelaa, us-ne us-ko haraaya  
Wh girl-with every boy played she him defeated  
“The boy with whom every girl played,

- Correlatives allow *bhii* (roughly equivalent to *-ever* in Free Relatives; the NPI/FCI *any*) while interrogatives do not.

19a. jo-bhii laRkii khaRii hai, vo lambii hai  
“The girl who is standing, whoever she is, is tall.”

b. kaun(\*-bhii) laRkii khaRii hai?  
Which girl standing is  
“Which girl is standing?”

### III. Pair-lists through Skolem Functions

#### *How do we choose our kin?*

- Morpho-syntactic and/or semantic kinship only goes so far: wh phrases share something with indefinites, but they are not indefinites – one is crucially interpreted outside the nucleus (in a Hamblin-Karttunen semantics for questions) and one within; one has to lead to a set of propositions, the other not. This distinction is real and must be part of our toolkit as we continue to discover and understand new ways in which natural language uses wh phrases and indefinites to communicate.
- Each construction must stand on its own, its semantic and syntactic contributions identified and formally analyzed. Of course, the theory of grammar must be economical and a certain amount of “kinship considerations” will play a role and emerge in the normal process of semantic analysis.
- Languages, after all, are learnable by little kids – individual analyses must lead to a theory of grammar that keeps in mind this fundamental goal of the linguistic research endeavor.

**THANK YOU!**

**Particularly, to Anamaria and Ivano for making it possible  
for us to think and talk multiple wh for multiple days**