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List Answers: Local and Long-distance

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NYU Semantics Group

Local List Answers:

Which student read which book? *John* read *Americana* and *Sue* read *The Lowland*.

Long-Distance List Answers:

Which teacher knows which student read which book?
Ms. Brown knows which student read *Americana* and *Mr. Smith* knows which student read *The Lowland*.

Which student will be upset if we read which book?
John will be upset if we read *The Lowland* and *Sue* will be upset if we read *Americana*

I. Scope-taking in Questions

1.1. Single wh questions

Three distinct interpretive mechanisms result in Hamblin sets (sets of possible answers) as question denotation.

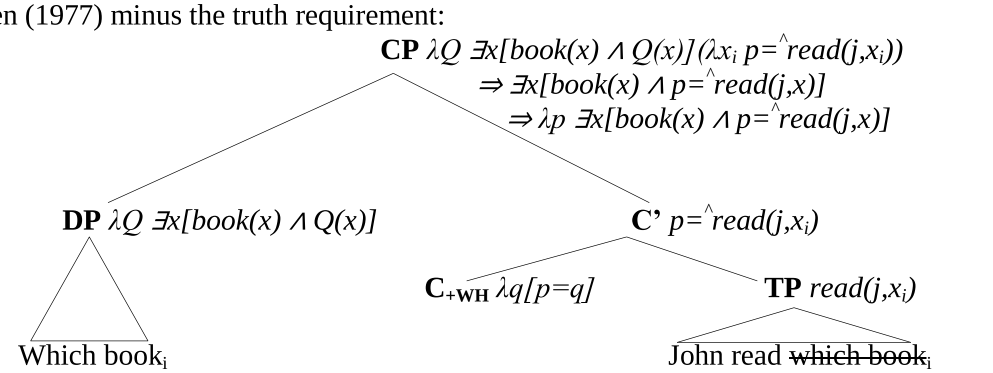
1a. Which book did John read? John read Americana.
b. {John read Americana, John read The Lowland}

2a. John-ne kaun-sii kitaab paRhii? John-ne Americana paRhii.
John-ERG which-PRT book read John-ERG Americana read
b. {John read Americana, John read The Lowland} *Wh in-situ languages (Hindi)*

3a. [$_{XP}$ which book$_i$ [$_{TP}$ John read ~~which book$_i$~~]]
b. [$_{XP}$ ~~which book$_i$~~ [$_{TP}$ John read which book$_i$]]

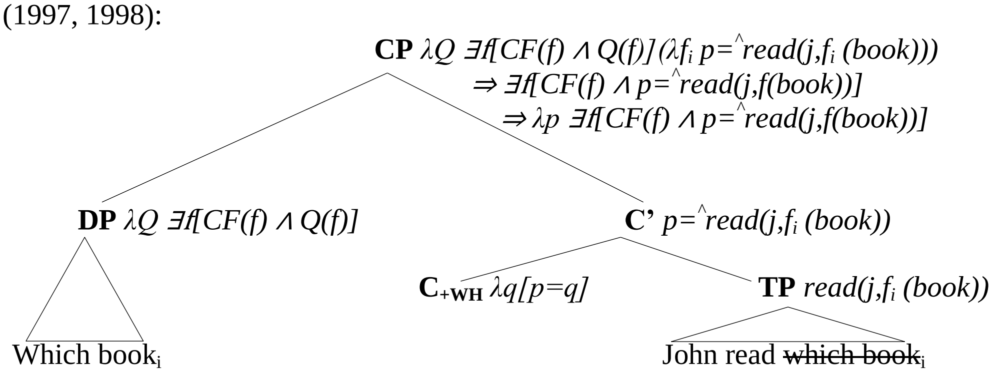
- Karttunen (1977) minus the truth requirement:

4a.



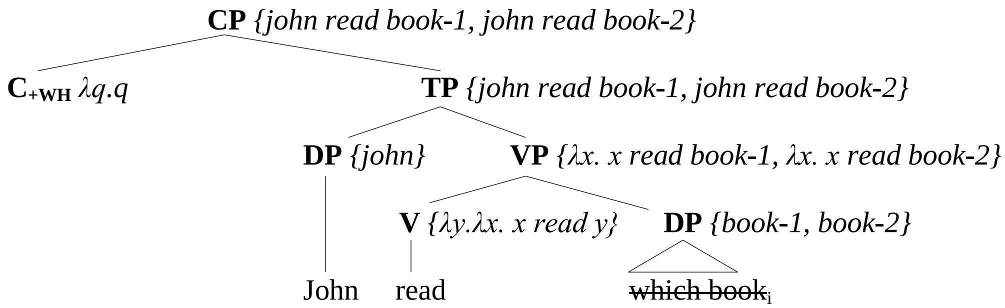
- Reinhart (1997, 1998):

4b.



- Hamblin (1973), Kratzer and Shimoyama (2002):

4c.



An answerhood operator (Dayal 1996) introduces Karttunen's truth requirement. It picks out the maximally informative true proposition (the one that entails all other true ones) from the set denoted by the question.

5. Ans-D(Q)(w) = $\iota p\, [Q(p) \wedge p(w) \wedge \forall q[\, [Q(q) \wedge q(w)] \rightarrow p \subseteq q]]$

- The uniqueness and existence presuppositions of *iota* lead to infelicity in the absence of a maximally informative true proposition. Underlining indicates the propositions that are true at the evaluation index.

6a. Ans-D({<u>John read A</u>, John read L}) ⇒ John read Americana
b. Ans-D({<u>John read A</u>, <u>John read L</u>}) ⇒ ***undefined***
c. Ans-D({<u>John read A</u>, <u>John read L</u>, <u>John read A+L</u> }) ⇒ John read Americana and Lowland.

Questions denote Hamblin sets over singular individuals (*which* N_{SING}) or over singular & plural individuals (*which* N_{PL} & *who/what*). This talk focuses primarily on *which* N_{SING} but can be extended to the plural domain.

7a. {John read A, John read L}
b. {John read A, John read L, John read A+L}

- Plural morphology implicates that a plurality will be named in the answer, via the existential presupposition of the question *John read some books.*

8a. Which book did John read? **i.** #John read Americana and The Lowland.
ii. John read Americana.
b. Which books did John read? **i.** John read Americana and The Lowland.
ii. #John read Americana.
c. What did John read? **i.** John read Americana and The Lowland.
ii. John read Americana.

9a. What did John read? Nothing.
b. #I'm not sure if John read anything but what did he read? *Karttunen and Peters, Comorovski, Dayal*

1.2. Multiple Wh Questions

Multiple wh questions allow for single pair as well as multiple-pair/pair-list answers.

10a. Which student read which book?
b. John read The Lowland. **c.** John read The Lowland and Sue read Americana.

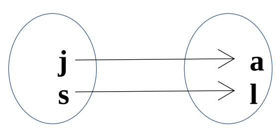
- Hamblin sets + Ans-D (section 1.1) predicts single pair answers – i.e. REF-Q, not ECHO-Q (Pope 1976).

> **11a.** That student read that book.
> **b.** WHICH STUDENT read WHICH BOOK?
> **c.** Ans-D({John read Americana, <u>John read Lowland</u>, Sue read Americana, Sue read Lowland})
> **d.** Ans-D({John read Americana, <u>John read Lowland</u>, <u>Sue read Americana</u>, Sue read Lowland}) **undefined**

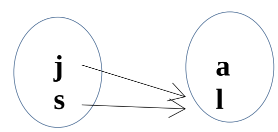
Dispensing with Ans-D and allowing answers to be the conjunction of the true answers in the context is not an option.

- We need Ans-D to account for number-based felicity effects demonstrated in (8).
- There are also semantic constraints on the nature of pairings, visible with singular wh expressions (Dayal 1996).

12a. Which student read which book? *Functionality: domain cover & point-wise uniqueness*
b. # John read The Lowland.
c. # John read The Lowland and Americana.
d. John and Sue both read The Lowland.

13a. 

one-one

b. 

many-one

b. **f-1:** j→a, s→l **f-2:** j→a, s→a **f-3:** j→l, s→l **f-4:** j→l, s→a

- There are constructions that allow single-pair answers but not multiple-pair answers (Pesetsky 2000):

14a. Which student didn't read which book?	*√multiple-pair*	*√single-pair*
b. Which book didn't which student read?	**multiple-pair*	*√single-pair*
c. Which book did which student only read?	**multiple-pair*	*√single-pair*

Two proposals for deriving the functionality of multiple-pair lists: the functional absorption & the iterated C approaches.

Functional Absorption

- Functional absorption creates sets of propositions built on functional dependencies (Dayal 1996 redone).
- A multiple-pair answer is the intersection of the propositions representing the graph of a function.

15a. $[_{CP}$ which student$_i$ $[_{CP}$ which book$_j$ $[_C$ +WH $[t_i$ read $t_j^i]]]]$

b. $\lambda p\ \exists f\ [\forall y[book(f(y))] \wedge p = \cap\ \lambda p'\ \exists x \in student\ [p' = {}^\wedge read(x, f(x))]]$

c.

∩{j read a, s read l}	*graph of f-1*	***A set of propositions***
∩{j read a, s read a}	*graph of f-2*	
∩{<u>j read l</u>, <u>s read l</u>}	***graph of f-3***	
∩{j read l, s read a}	*graph of f-4*	

d. $\text{Ans-D}(15c)(w) = \iota p\ [Q(p) \wedge p(w) \wedge \forall q[\ [Q(q) \wedge q(w)] \rightarrow p \subseteq q]]$
⇒ John read The Lowland and Sue read Americana

16a. Ans-D [∩{j read a, s read l}, ∩{j read a, s read a}, ∩{<u>j read l</u>, <u>s read l</u>}, ∩{j read l, s read a}]
Which student read which book?

b. Ans-D({j read a, s read l})
Which student read which book?

c. Ans-D({j read a, j read l})
Which book did John read?

Iterated C and List Answers

- The iterated C approach builds a set of questions and distributes Ans-D over the member questions (Hagstrom 1998, Fox 2012).
- A multiple-pair answer is the intersection of the unique true answer to each question in the family of questions

17a. $[_{CP\text{-}2}$ which student$_i$ $[_C$ +WH $[_{CP\text{-}1}$ which book$_j$ $[_C$ +WH $[t_i$ read $t_j]]]]]$

b. $[\![CP\text{-}1]\!] = \lambda p\ \exists x\ [book(x) \wedge p = {}^\wedge read(x_i, x)]$ $\Rightarrow$ $\{x_i$ read a, x_i read l$\}$
$[\![CP\text{-}2]\!] = \lambda Q\ \exists y\ [student(y) \wedge Q = \lambda p\ \exists x\ [book(x) \wedge p = {}^\wedge read(y, x)]]$

c. $\begin{bmatrix} \{\text{j read a, } \underline{\text{j read l}}\} \\ \{\text{s read a, } \underline{\text{s read l}}\} \end{bmatrix}$ *which book did j read?* ***A set of questions*** *which book did s read?*

d. Ans-H/F $(\mathbb{Q})(w) = \bigcap \{\text{Ans-D}(Q(w)) : Q \in \mathbb{Q}\}$

18a. $\bigcap \begin{bmatrix} \text{Ans-D}(\{\text{j read a, } \underline{\text{j read l}}\}) \\ \text{Ans-D}(\{\text{s read a, } \underline{\text{s read l}}\}) \end{bmatrix}$ **b.** Ans-D({j read a, s read l}) **c.** Ans-D({j read a, j read l})

Which student read which book? *Which student read which book* *Which book did John read?*

❖ Differences between the two accounts of pair-list/multiple-pair answers:
- Set of propositions (<<s,t>,t>) vs. Set of sets of propositions (<<<s,t>,t>,t>)
- Order in which Ans-D and ∩ are applied
- The crucial difference is in the nature of the propositions themselves. Functional absorption does not yield a set of questions at any level: {j read a, s read l} ≠ *which book did John read?* Or *Who read Americana?*

Iterated C and 2nd Order Questions

- An iterated C approach has been proposed to capture echo questions.
- Echo questions can denote sets of propositions or sets of questions.
- They can only denote sets of questions if there is at least one regular wh and one echo wh.

19a. John read $_{\text{Americana}}$. **b.** John read WHAT? **c.** {John read Americana, John read The Lowland}
20a. Who read $_{\text{Americana}}$? **b.** Who read WHAT? **c.** {Who read Americana? Who read The Lowland?}
21a. $_{\text{John}}$ read $_{\text{Americana}}$. **b.** WHO read WHAT?
c. {John read Americana, John read The Lowland, Sue read Americana, Sue read The Lowland }

22a. CP* *based on Dayal 1996, see also Comorovski 1989, 1996.*

OP_{ECHO} CP *<s,t> or <<s,t>,t>*

$\lambda Z\ \lambda Q\ [\ \exists f_1 \ldots \exists f_n\ [Q = Z(f_1)\ldots(f_n)]]$

b. OP_{ECHO} ([[John read WHAT]]) = λQ ∃f [Q = John read f(object)] *Response to19a: John read Americana.*

c. OP_{ECHO} ([[who read WHAT]]) = λQ ∃f [Q = λp ∃y [p= y read f(object)]] *Response to20a: Who read Americana?*

d. OP_{ECHO} ([[WHO read WHAT]])= λQ ∃f ∃g [Q = f(person) read f(object)]] *Response to21a: John read Americana.*

- A uniqueness-based Ans operator is needed -- to be fleshed out, following Szabolcsi (1982), Krifa (2014).

23. Ans-C/D_{ECHO}(Q)(c*) = ιq ∈ Q [uttered-by-addressee$_{C*}$ (p)(c)] *where c immediately precedes c**

❖ Unlike the iterated C approach for list answers, there is no distribution of a uniqueness based Ans operator over sub-questions. And there is a difference in predictions about embeddability because of reference to addressee(c*).

II. List Answers in Scope Marking

List answers in Scope Marking constructions argue against the iterated C approach. Evidence comes from (i) the truth requirement; (ii) the restriction against rogative predicates and (iii) echo questions

Some basics about Scope Marking

24.

CP-0 λT ⟦CP-1⟧ (⟦CP-2⟧)

⇒ λp ∃q [q ∈{we should go home, we should to school} ∧ p = john thinks q]

CP-1

What does John think?

λp ∃q [T(q) ∧ p = john thinks q]

{j thinks it's raining, j thinks we should go home}

CP-2

Where should we go?

λp' ∃x [place(x) ∧ p'= we should go to x]

{we should go home, we should to school}

- Indirect Dependency *(Dayal 1994, 1996, 2000):* All wh phrases have semantic content and are interpreted locally; CP-2 is the restriction on the variable quantified over by CP-1.
- Direct Dependency *(van Riemsdijk 1983 and many others)*: The wh in CP-1 is semantically vacuous and needs to be associated with a contentful wh phrase in CP-2; CP-2 is the complement of the predicate in CP-1.

There are two kinds of scope marking structures: sequential & subordinated *(Dayal 1996, 2000; Reis 1996, 2000)*.

- Sequential SM does not allow binding of variables in CP-2 from CP-1, subordinated SM does (25a, 25b, 26); this distinction argues against a syntactic reanalysis of sequential SM in terms of subordinated SM (which could then in principle be interpreted in terms of direct dependency).
- Both types of SM allow conjoined questions in CP-2 (26b), which argues against an analysis in terms of extraction/direct dependency.

25a. [$_{\text{CP-0}}$ [$_{\text{CP-1}}$ was glaubt **jeder$_i$**] [$_{\text{CP-2}}$ wohin werd **er$_{*i}$** gehen]] *German sequential SM (V2)*
what thinks everyone where will he go
"What does everyone think? Where should he go"

b. [$_{\text{CP-1}}$ [was t$_{\text{CP-2}}$] glaubt **jeder$_i$** [$_{\text{CP-2}}$ wohin **er$_i$** gehen werd]] *German Subordinated SM*
what thinks everyone where he go will

26a. What does everyone$_i$ think? What should he$_{*i}$ do?

b. What does John think? When will Mary come and what will she bring? *Based on Höhle (2000)*

The argument from the truth requirement

- The question denoted by CP-2 is not subject to the truth requirement -- it denotes a pure Hamblin set.

27. Context: John read The Lowland but Bill mistakenly believes that he read Americana.

a. [$_{\text{CP-0}}$ [$_{\text{CP-1}}$ What does Bill think?] [$_{\text{CP-2}}$ Which book did John read?]]

b. λp ∃q [q ∈ {John read Americana, John read Lowland} ∧ p = Bill thinks q]

⇒ {Bill thinks John read Americana, Bill thinks John read Lowland}

c. Ans-D(19b) ⇒Bill thinks John read Americana. *Ans-D does not apply to CP-2, only to CP-0*

- The question denoted by CP-2 can be a multiple wh question with a pair-list interpretation.

28. <u>Context</u>: John read The Lowland and Sue read Americana but Bill mistakenly believes that John read Americana and Sue The Lowland.

a. What does Bill think? Which student read which book?
b. Bill thinks that John read Americana and Sue read The Lowland.
c. $\lambda p\ \exists q\ [q \in [\![\text{CP-2}]\!] \wedge p = \text{Bill thinks } q]$

- If list answers involve functional absorption, as in (15), CP-2 denotes Hamblin sets. Ans-D does not come into the picture as CP-2 is the complement of matrix *what*, not of matrix V *think*.
- If list answers derive from iterating C, as in (17), we will need to get from a set of questions to a set of propositions, without introducing truth.
- This requires a type shift that collects ***possible*** answers into a set (type <<s,t>,t> to restrict a variable of type <s,t>). This leads to a non-uniform account for list answers in matrix/complement questions and list answers in scope marking.

29a. { {j read a, j read l}, {s read a, s read l}} *denotation of CP-2 in iterated C approach*
b. $\text{Ans-H/F}\ (\mathbb{Q})(w) = \bigcap \{\text{Ans-D}(Q(w)) : Q \in \mathbb{Q}\}$
⇒ John read The Lowland and Sue read Americana. *for matrix & regular complements*
c. $\text{SHIFT}(\text{Ans-H/F})\ (\mathbb{Q}) = \lambda p\ \exists w\ [p = \text{Ans-H/F}(\mathbb{Q})(w)]$ *for CP-2 in scope marking*
d. SHIFT(Ans-H/F) (29a) = {j read a and s read l, j read a and s read a, j read l and s read l, j read l and s read a}
same set of propositions as derived by functional absorption (cf. 15)

The argument from Rogative Predicates

- If CP-1 quantifies over variable of type α, CP-2 must be of type $<\alpha,t>$.
- Single wh questions are predicted to be impossible with rogative predicates in SM: type mismatch.

30a. *What did Bill ask? Which book did John read?
b. Type of the complement of *ask*, the variable quantified over in CP-1: <<s,t>,t>, a question meaning
Type of the restriction on the variable quantified over in CP-1: <<<s,t>,t>,t>, a family of questions
Type of CP-2 (single wh question): <<s,t>,t> , a question

- Rogative predicates are ruled out from scope marking, even with list readings of CP-2.
- This is not consistent with an account of list answers as denoting families of questions.

31a. *What did Bill ask? Which student read which book?
b. $\lambda p\ \exists Q\ [\ Q \in \{\ \{\text{j read a, j read l}\}, \{\text{s read a, s read l}\}\ \} \wedge p = \text{Bill asked } Q]$
what did John read? What did Sue read?
Incorrectly predicted good in the iterated C approach

c. $\lambda p\ \exists Q\ [\ Q \in \{\bigcap \{\text{j read a, s read l}\}, \bigcap\{\text{j read a, s read a}\}, \bigcap\{\text{j read l, s read l}\}, \bigcap\{\text{j read l, s read a}\}\} \wedge p = \text{Bill asked } Q]$
graph of f-1 *graph of f-2* *graph of f-3* *graph of f-4*

Correctly predicted bad in the functional absorption approach

The argument from Echo Questions

- A multiple wh with *one* echo wh is compatible with rogative predicates.
- On the functional absorption approach, the higher order interpretation for CP-2 is only available through OP_{ECHO} (cf. 19-23 on pg. 4).

32a. What did Bill ask? Who read WHAT?

b. $\lambda p\ \exists Q$ [$Q \in$ {who read Americana? Who read Lowland?} $\wedge$ p = Bill asked Q]

c. Bill asked who read The Lowland.

- Questions with quantifiers also allow pair-list readings and are compatible with responsive predicates.

33a. What does Bill think? What did everyone read?

b. Bill thinks John read Americana and Sue read Lowland.

- If list answers to questions with quantifiers involve functional absorption, as in (15), questions with quantifiers will be incompatible with rogative predicates, on par with multiple wh questions (cf.34b).
- If list answers involve a family of questions, they (like multiple wh questions) should not be ruled out (cf. 34c).

34a. *What did Bill ask? What did everyone read?

b. $\lambda p\ \exists Q[Q \in$ {j read a and s read l, j read a and s read a, j read l and j read l, j read l and s read a} $\wedge$ p = B asked Q]

c. $\lambda p\ \exists Q[Q \in$ {who read Americana? Who read Lowland?} $\wedge$ p = Bill asked Q]

- Rogative predicates are predicted to remain unacceptable, even when the wh has echo interpretation, since the echo operator will not shift its type up to a family of questions.

35a. *What did Bill ask? WHAT did everyone read?/everyone read WHAT?

b. OP_{ECHO} ($[\![$everyone read WHAT$]\!]$) $\Rightarrow$ {everyone read Americana, everyone read The Lowland} $<<s,t>,t>$

❖ **SCOPE MARKING:** A FAMILY OF QUES ACCOUNT (VIA ITERATED C) IS NOT SUPPORTED FOR LOCAL LIST ANSWERS.

- The truth requirement:
  - The iterated C approach requires two ways of shifting from a family of questions to a set of propositions, (i) through the distribution of Ans-D over the members of the family to ensure functionality in list answers to matrix questions and in list readings of complement clauses
  - (ii) through a weaker version that looks for possible answers.
  - Functional absorption does not impose truth at the level of question denotation so nothing special is needed for scope marking. Answerhood is not invoked in SM because it is a restriction on a variable.

- Rogative predicates:
  - Are incorrectly predicted to be bad with single wh questions and acceptable with multiple wh questions under their list reading since the two differ in their semantic type in the iterated C approach. To account for the facts, the shift from a set of questions to a set of propositions must happen at CP-2 and through the weaker version of Ans-H/F.
  - Are correctly predicted to be bad under the functional absorption approach where the types remain the same for single and multiple wh questions: a set of propositions.

- Echo Questions:
  - Under both accounts rogative predicates are correctly predicted possible with echo multiple wh questions.
  - The iterated C approach would have to conflate list readings and echo readings. This is a problem for Scope Marking which allows list readings questions with quantifiers (with responsive predicates) but rules out rogative predicates for them altogether.

III. Further Questions about Local List Readings

Question 1a: Why do questions with quantifiers & multiple wh questions have different LFs but same list readings?
Question 1b: The challenge for the functional absorption account has always been the mapping from syntax to semantics.

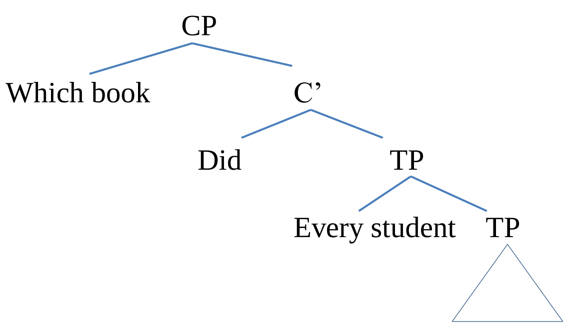
Question 2a: How does QVE work for questions with quantifiers or multiple wh questions with list readings?
Question 2b: Why do embedded questions with quantifiers show "wide scope" effects but not multiple wh questions?

Question 3a: Why can universal quantifiers function like wh phrases wrt to list answers but not wrt echo wh phrases?
Question 3b: Why does only wh in situ give rise to second order questions?

3.1. The Syntax-semantics Map

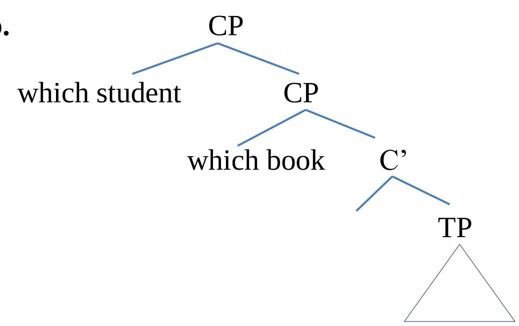
- The problem is that they have different baseline LFs but the same semantics, a problem for both approaches.
- In multiple fronting languages, quantifiers (I assume) are in situ, while the order for wh expressions is like (36b).
- In English, the overtly moved wh in (36a) is the range of the function (or its correspondent in the iterated C approach), the overtly moved wh in (36b) is the domain of the function (or its correspondent in the alternative).

36a.



$[_{CP}\ \textbf{\textit{wh-2}}_{\textbf{\textit{RANGE}}}\ [_{C'}\ C_{+wh}\ [_{TP}\ QP\text{-}1_{DOMAIN}\ [_{TP}\ t\text{-}1\ read\ \textbf{\textit{t-2}}]]]$

36b.



$[_{CP}\ \textbf{\textit{wh-1}}_{\textbf{\textit{DOMAIN}}}\ [wh\text{-}2_{RANGE}\ [_{C'}\ C_{+wh}\ [_{TP}\ [_{TP}\ \textbf{\textit{t-1}}\ read\ t\text{-}2]]]]$

37a. Which book did every/each student read?
b. Every/each student read his/her favorite book.
c. John read Americana and Sue read The Lowland. *#John read The Lowland*
 # John read The Lowland & Americana.

Iterated C approach

- Nicolae 2013 (pp.179-83) extends the Hagstrom/Fox account to questions with quantifiers in two ways.
- She allows the universal to be optionally interpreted as a wh existential in the presence of a wh phrase.

38a. $\lambda P\ \forall x\ [student(x) \rightarrow P(x)]$ $\quad WH_{\exists}\rightarrow \quad$ $\lambda P\ \exists x\ [student(x) \wedge P(x)]$

b. [wh-SUBJ $[_C$ C+wh [**wh-OBJ** $[_C$ C+wh [t-1 read **t-2**]]]]] *which student read which book?*

c. [**∀→WH∃-SUBJ** $[_C$ <u>C+wh</u> [wh- OBJ $[_C$ <u>C+wh</u> [**t-1** read t-2]]]]] *which book did every/each student read?*

- The second account, the one that is endorsed, uses minimal witness sets to generate the family of questions.

39. [**∃S(MINIMAL W-SET(∀)** $[_C$ C+wh [wh- OBJ $[_C$ C+wh [**t-1** read t-2]]]]]

- The re-analyzed universal takes scope above the fronted wh, contra the principle of "tucking-in" (Richards 1997).
- Unclear why the reanalyzed universal cannot yield second order echo questions, as this is what (38c/39) leads to.

Functional Absorption (Dayal 1996, 2016)

- Inspired by functional answers to questions with quantifiers (Engdahl 1980, 86, Groenendijk & Stokhof 1984, Chierchia 1992) but unlike those accounts seeks to percolate the functional meaning to the Ques-denotation for list answers.

40a. $[_{CP}$ which book$_i$ $[_{C'}$ did $[_{TP}$ every/each student$_j$ $[_{TP}$ t_j read $t_i^j]]]]$

b. $\lambda p\ \exists f_{<e,e>}\ [\forall y[book(f(y))] \wedge p = {}^\wedge\forall x[student(x) \rightarrow read(x,f(x))]]$

c. {<u>Every student read their favorite book</u>, Every student read the book assigned to them}

- Pair-list answers to questions with quantifiers require the extraction of a unique witness set from the universal quantifier to set the domain of the function & the creation of the appropriate functional dependency.
- For reasons having to do with QVE, we move from <<s,t>,t> (41a) to <<<s,t>,t>,t> type (41b).

41a. $\lambda p\ \exists f\ [\forall y[book(f(y))] \wedge p = \cap\ \lambda p'\ \exists x \in \textbf{student}\ [p' = {}^\wedge read(x, f(x)]]$
b. $\lambda p\ \exists f\ [\forall y[book(f(y))] \wedge p = \lambda p'\ \exists x \in \textbf{student}\ [p' = {}^\wedge read(x, f(x)]]$

The universal quantifier as the domain of the function

- All quantifiers have witness sets, universal quantifiers have unique witness sets.
- Wh expressions have the option of being interpreted functionally (cf. 40).
- When a functional wh finds a quantifier from which a unique witness set can be extracted, pair-list readings arise.
- There is no need for the $\forall \rightarrow WH_\exists$ shift or a witness-set based meaning above C_{+wh} to be construction specific.
- Universal quantifiers, whether they are interpreted as such or as their unique witness sets, cannot be bound by OP_{ECHO} and therefore do not participate in second order questions.

LF input to functional absorption

- We take a wh phrase to have three meanings, each independently motivated.

$[\![$which book$_i^j]\!] = \lambda Q\ \exists f_{<e,e>}\ [\forall y[book(f(y))] \wedge Q(f)]$	*functional wh-Engdahl*
$[\![$which book$]\!] = f_{<<e,t>,e>}$ (book)	*choice functions – Reinhart*
$[\![$which book$]\!] = \lambda Q\ \exists x\ [book(x) \wedge Q(x)]$	*existential quantifiers – Karttunen*

42a. $[_{CP*}\ [_{C'}\ C_{+wh}\ [_{CP}$ which book$_i^j$ $OP_j\ [\lambda j\ [_{C'}\ C_{+wh}\ [_{TP}$ cf(every student) read $t_i^j]]]]]]$ *step 1, discharge of a-index*

b. $[_{CP*}$ which book$_i^j$ $\lambda i\ [_{C'}\ C_{+wh}\ [_{CP}\ t_i^j\ OP_j\ [\lambda j\ [_{C'}\ C_{+wh}\ [$ cf(every student) read $t_i^j]]]]]]$ *step 2, discharge of i-index*

43a. *the inner CP of (42b)* $[\![[_{CP}\ t_i^j\ OP_j\ [\lambda j\ [_{C'}\ C_{+wh}\ [$ cf(every student) read $t_i^j]]]]]\!]$
$\lambda p'\ \exists cf\ [\ CF(cf) \wedge p' = {}^\wedge\ cf(\iota W(\text{every student}))\ \text{read}\ sf_i\ (cf(\iota W(\text{every student})))\ ]$
=simplified⇒ $\lambda p'\ \exists cf\ [\ CF(cf) \wedge p' = {}^\wedge\ cf(\text{student})\ \text{read}\ sf_i\ (cf(\text{student}))\ ]$
= {john read sf_i (john), sue read sf_i (sue)}

b. $[\![42b]\!] = \lambda p\ \exists sf\ [\ \forall x(book(sf(x)) \wedge p = \lambda p'\ \exists cf\ [\ CF(cf) \wedge p' = {}^\wedge\ cf(\text{student})\ \text{read}\ sf\ (cf(\text{student}))\ ]]$

{ {john read $sf_{favorite}$(john), sue read $sf_{favorite}$(sue)}, {john read $sf_{assigned\text{-}to}$(john), sue read $sf_{assigned\text{-}to}$(sue)},
{john read $sf_{gifted\text{-}to}$(john), sue read $sf_{gifted\text{-}to}$(sue)}, {john read $sf_{bought\text{-}by}$(john), sue read $sf_{bought\text{-}by}$(sue)}}
=
{ {john read Americana, sue read The LL}, {john read Americana, sue read Americana}, *type <<<s,t>,t>,t> but*
{john read The LL, sue read The LL}, {john read The LL, sue read Americana}} *not a family of questions*

- Wh phrases do not need to piggy back on another wh, so fronting is governed by syntactic considerations.
- If "tucking in" is interpreted at the same CP level (44a), the effect of quantification is rendered vacuous as in the standard applications of the Engdahl-Groenendijk/Stokhof-Chierchia systems and inherited by functional accounts of multiple-wh in Hornstein (1995) and Comorovski (1996).
- If "tucking in" involves distinct C_{+wh} (44b), we get a set of questions, which is a problem for scope marking.
- We need "tucking in" to be undone before interpretation (44c), to get the right results.

44a. $[_{CP}$ which student$_j$ $[\lambda j\ [_{C'}\ C_{+wh}\ [$ ~~which student~~$_j$ read which book$_i^j$$]]]]$
$[_{CP}$ which student$_j$ $[\lambda j\ [_{CP}$ which book$_i^j$ $\lambda i\ [_{C'}\ C_{+wh}\ [$ ~~which student~~$_j$ read which book$_i^j$$]]]]]$ *tucking into same C^o*
$\Rightarrow \lambda p\ \exists x\ \exists sf\ [student(x) \wedge \forall x(book(sf(x))) \wedge p = {}^\wedge x \text{ read } f(x)]$ *⇒ standard Hamblin sets: single pair answers*

44b. $[_{CP}$ which student$_j$ $[\lambda j\ [_{C'}\ C_{+wh}\ [$ ~~which student~~$_j$ read which book$_i^j$$]]]]$
$[_{CP}$ which student$_j$ $[\lambda j\ [_{C'}\ C_{+wh}\ [_{CP}$ which book$_i^j$ $\lambda i\ [_{C'}\ C_{+wh}\ [$ ~~which student~~$_j$ read which book$_i^j$$]]]]]$
tucking into a distinct C^0
$\Rightarrow \lambda Q\ \exists x\ [student(x) \wedge Q = \lambda p\ \exists sf\ [\forall x(book(sf(x))) \wedge p = {}^\wedge x \text{ read } f(x)]]$
⇒ set of questions, a problem for scope marking

44c. $[_{CP}$ which student$_j$ $[_{CP}$ ~~which book~~$_i^j$ $\lambda j\ [_{C'}\ C_{+wh}\ [$ ~~which student~~$_j$ read which book$_i^j$$]]]]$
$[_{CP}$ ~~which book~~$_i^j$ $\lambda i\ [_{C'}\ C_{+wh}\ [_{CP}$ which student$_j$ $[_{CP}\ \lambda j\ [_{C'}\ C_{+wh}\ [$ ~~which student~~$_j$ read which book$_i^j$$]]]]]]$
undoing tucking in and moving to a distinct C^0
$\Rightarrow \lambda Q\ \exists sf\ [\forall x(book(sf(x))) \wedge Q = \lambda p\ \exists x\ [student(x) \wedge p = {}^\wedge x \text{ read } f(x)]]$
⇒ set of non-questions, compatible with scope marking

- Not sure what principle would rule out (44b): I note that the a-index of the tucked-in wh does not c-command a C^0 that is sister to a lambda with that index.
- More work on a comparison with multiple fronting languages is needed to make further progress here.

Answerhood Operators

45a. Ans-D $= \lambda Q_{<<s,t>,t>}\ \lambda w\text{: } \exists q \in Q\ [q(w) = 1 \wedge \forall q' \in Q\ [q'(w) = 1 \rightarrow q \subseteq q']].\ \cap\ \lambda q \in Q\ [q(w) = 1].$
presupposes that the question has a unique maximally informative true answer,
the actual answer is the conjunction of the propositions in the set that are true.

45b. $\lambda Q_{<<<s,t>,t>,t>}\ \lambda w\text{: } \exists q \in Q\ [(\cap q)(w)=1 \wedge \forall q' \in Q\ [(\cap q')(w)=1 \rightarrow \cap q \subseteq \cap q'].\ \cap\ \lambda q \in Q\ [(\cap q)(w) = 1].$
presupposes that the set of set of propositions has a unique member containing all the true propositions,
the actual answer is the conjunction of the propositions in that set of propositions.

3.2. List Readings: QVE and Wide Scope Effects

QVE

- QVE is motivation for shifting from a set of proposition meaning for list answers to a set of set of proposition meaning.

46a. #John knows, for the most part, which book Bill read. *{<u>Bill read a</u>, Bill read b, Bill read c}*
b. John knows, for the most part, which books Bill read. *{<u>Bill read a</u>, <u>Bill read b</u>, <u>Bill read c</u>*
…<u>Bill read a+b+c</u>}
c. MOST p $[Q(p) \wedge \text{AT-}Q(p) \wedge p(w) = 1]$ [John knows p / Ans-D(Q) $\subseteq$ p]
AT-Q is the set of propositions in Q that do not entail any other proposition in Q
For Q to be defined is for it to have a unique maximally informative true proposition

- QVE is ruled out with singular wh phrases in the complement because the question can have only one true proposition, which does not provide a felicitous domain of quantification for the adverb.
- Lahiri (2000) builds his account on singular wh phrases, which is at odds with the paradigm in (46).

- Lahiri does point out a problem for list readings of multiple wh questions (an objection that extends to list readings of questions with quantifiers) for the original functional account in Dayal (1996), where a question denotes a set of function-based propositions (cf. section 1): the atomic propositions are no longer available at the level of the CP complement.

47a. Which student read which book? *Underlining indicates truth at an evaluation index*
b. { {<u>j read A</u>, <u>s read LL</u>} {<u>j read A</u>, s read A} {j read LL, <u>s read LL</u>}, {j read LL, s read A}} *Q is defined*
c. { {<u>j read A</u>, <u>s read LL</u>} {<u>j read A</u>, s read A} {<u>j read LL</u>, <u>s read LL</u>}, {j read LL, s read A}} *Q is undefined*
d. { {<u>j read A</u>, s read LL} {<u>j read A</u>, s read A} {j read LL, s read LL}, {j read LL, s read A}} *Q is undefined*

- On the revised account, every member of exactly one cell must be true (47b). If one student read two books, more than one cell will be true (47c). If some student didn't read a book, no cell will have only true propositions (47d).
- Some small adjustment is needed to accommodate the higher type to get QVE but otherwise it is parallel to the single wh case.

48a. John knows, for the most part, which student read which book.
b. MOST p [$\exists$q $\in$Q [q(p) $\wedge$ AT-q(p) $\wedge$ p(w) = 1] [John knows p / Ans-D(Q) $\subseteq$ p]
b'. MOST p [$\exists$q $\in$ Q[$\cap$q(w) = 1 $\wedge$ AT-q(p) $\wedge$ p(w) = 1] [John knows p / Ans-D(Q) $\subseteq$ p]

- Lahiri (2002: 125-31) has to move to an interpretation of list readings of questions as a set of sets of sets of propositions, a third order question, to handle such cases.
- Hungarian behaves like English wrt QVE if both wh phrases are fronted, but there is some difference if one of them is left in situ (B. Surányi, p.c.). Multiple wh questions with one wh in situ do not yield pair-list answers (A. Szabolcsi, K.Kiss p.c.).

Wide Scope Effects

49a. Some librarian found out which book every student read. *∀Student > ∃Librarian (Szabolcsi 1997)*
b. Some librarian found out which student read which book. **∀Student > ∃Librarian (S. Charlow, p.c.)*

- There may be a role for a family of questions meaning based on witness sets of quantifiers but it cannot be the source of list readings per se, as questions with quantifiers and multiple wh questions part company on wide scope effects.
- Here too facts from multiple fronting languages may be relevant.

3.3. 2nd Order Questions

- Questions with quantifiers do not have echo question readings because their list readings do not denote sets with members that are appropriate for a prior speech act of questioning.

50a. Q: Which book did EVERY STUDENT read? A. #Which book did John read?
b. =*⇒ { which book did John read? Which book did Sue read} *does not denote a family of questions*
c. { {j read A, s read LL}…}

51a. Every student read their favorite book.
b. WHICH BOOK did every student read? **b'.** Every student read WHICH BOOK?
c. {every student read their favorite book, every student read their textbook…}

52a. Which book did every student read?
b. John read Americana…
c. (I asked you) Which book did EVERY STUDENT read?

- Romanian second order questions can only be formed with wh in situ while list answers require multiple fronting (Comorovski 1996: 62-3).

53a. cine ce a spus ?
Who what has said
"Who said what?" *list reading*

b.* ce a spus cine ?
what has said who?
"Who said what?"

c. ce a spus CINE ?
what has said who?
"What did WHO say?" *{what did John say? What did Sue say?}*

IV. Interpreting Questions through Focus Projection

- The distinction between single-pair and list answers cannot be handled, in any obvious way.

- Intervention effects cannot be captured adequately.
- Beck (2006) uses focus semantics to explain intervention but focus semantics rules out the available single-pair reading (Kotek 2012 denies the existence of this reading). Implications for the multiple-pair reading are unclear since the derivation of multiple-pair readings in a focus-based semantics has not been articulated.

54a. Which student didn't read which book? *√multiple-pair √single-pair*

b. Which book didn't which student read? **multiple-pair √single-pair*

c. Which book did which student only read? **multiple-pair √single-pair*

- Kratzer and Shimoyama (2002) enforce locality of interpretation, which cannot capture the contrast in (15).

55a. Tanaka-kun-wa [Mary-ga doko-de dono hon-o kat-ta ka] sitte-imasu ka
Tanaka Mary where which book bought Q knows Q
"Does Tanaka know where Mary bought which book?" *Nishigauchi 1986, 90*

b. dono sensei-ga [Mary-ga doko-de dono hon-o kat-ta ka] sitte-imasu ka
which professor Mary where which book bought Q knows Q
"Which professor knows where Mary bought which book?" *Dayal 1996*

Appendix:

Triple pair readings

56a. Which teacher recommended which book to which student? PL (listing all three arguments)
b. Which book did every teacher recommend to which student? PL (I think)
c. Which student did every teacher recommend which book to? PL (I think)
d. Which book did every teacher recommend to every student? *PL
e. Which student did every teacher recommend every book to? *PL

- In the functional absorption account, the functional wh (the range argument) "activates" one domain argument so only one universal can participate in the pair-list reading.
- In the iterated C approach of Nicolae (2013), for example, there is no principled reason from banning any number of universal terms from moving to higher C projections, creating triple-layered PL readings.

Long-distance cases

Romanian (Ratiu 2011, to appear) & English (Cheng and Demirdache 2010) – trapping.

57a. [Which teacher got upset [$_{\text{ISLAND}}$ because which boy had a fight with which girl]?

b. The history teacher got upset because John had a fight with Sue. *Single triple answer*
c. The history teacher got upset because John had a fight with Sue
and Bill had a fight with Jane. *Trapped pair-list*
d. The history teacher got upset because John had a fight with Sue
and Bill had a fight with Jane, and the math teacher got upset
because Terry had a fight with Mary and Chris had a fight with Clare. *Lists of trapped pairs*

58a. [$_{\text{CP}}$ **wh-1** ….. [$_{\text{ISLAND}}$ …**wh-2**… **wh-3**...]] *no functional dependencies (57a)*

b. [$_{\text{CP}}$ **wh-1** ….. [**$_{\text{ISLAND}}$** … **wh-2**… **wh-3**...]] *functional dependency between wh-2, wh-3 (57b)*

c. [$_{\text{CP}}$ **wh-1** ….. [**$_{\text{ISLAND}}$** … **wh-2**… **wh-3**...]] *functional dependency between wh-2, wh-3 & between wh-1, the dependency in the island (57c)*

- MF languages like Romanian don't allow long-distance lists with wh islands, non-MF lang like English do.
- Cheng & Demirdache derive the difference wrt Baker ambiguities by claiming that overt wh movement respects islands while covert movement does not. Such a conclusion contradicts their account of trapped pair-lists.

Hungarian (Balázs Surányi 2006 & p.c)

59a. Melyik versenyző dicsekedett, hogy hol végzett melyik versenyen? *Wh in-situ = LPL*
Which sportsman boasted that where finished which competition-on
b. Melyik versenyző dicsekedett, hogy melyik versenyen hol végzett ? *Multiple fronting = *LPL*
Which sportsman boasted that which competition-on where finished
"Which sportsman boasted about where he finished in which competition?"

A Hypothesis

60a. [$_{\text{CP}}$ wh_2 [$_{\text{CP}}$ wh_3 […$\cancel{wh_2}$…$\cancel{wh_3}$]]] *overt fronting creates condition for PL via functional wh, no family of Q formed*
b. [$_{\text{CP*}}$ OP_3 [$_{\text{CP}}$ wh_2 […$\cancel{wh_2}$…wh_3]]] *wh in situ in MF languages leads to family of Q (cf.53c)*
c. [$_{\text{CP}}$ wh_2 [$_{\text{CP}}$ $\cancel{wh_3}$ […$\cancel{wh_2}$…wh_3]]] *wh in situ in non MF lang can be interpreted as (60a) or (60b)*

On this view, Baker ambiguities arise through a family of Q interacting with a matrix wh (*for each Q in {where did Mary buy A? Where did Mary buy LL?} which student knows the answer to Q?*). Multiple fronting may lead to a local pair-list reading, or to QVE, but not to a family of Questions needed for long-distance PL readings.