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At the frontier of quantification: Correlatives, movement and scope.

Eppur si muove. [Galileo]
'And yet, it does move'

I. What are they and why study them: The classics (and their problems).

(1) Goal: A movement analysis of multiple correlatives.
Correlatives (CRs) occur in many languages (Hindi, Romanian, Bulgarian, Georgian,..). Today, we will focus on multiple correlatives in Hindi (H, henceforth), starting from the classic work of Dayal (1991a,b, 1996) [henceforth, all included under the label **D 96**] and Bhatt (2003) [henceforth, **B 03**]. In spite of the progress in our understanding of these constructions, there are some hard questions pertaining to at least two of their key features, namely bijectivity and locality, that remain in need of satisfactory answers. I'd like to propose a new take on them, based on a movement analysis of all CRs, something that prima facie appears to be hopeless. Such an analysis not only might well be right for H, but it also extends to CRs in other languages and might enable us to place these constructions in their proper place in the space of UG quantifiers.

(2) Main features of CRs.
   a. CRs are internally headed, with a tendentially maximal/definite interpretation.
   b. They typically occur to the left periphery of a clause.
   c. They can involve a single wh or multiple ones (SG CR vs MUL CRs). MUL CRs often admit of 'list' interpretations.
   d. Examples:
      i. Jo laRkii khaRii hai vo (laRkhii) lambii hai SG CR
      which girl standing be-PR that (girl) tall is-PR
      'The girl who is standing is tall'
      ii. Jis laRkii-ne$_3$ jis larke$_1$-ke saath khelaa us-ne$_3$ us-ko$_1$ haraayaa MUL CR
      which girl-E which boy with play-P she-E he-A defeated **D 96**
      Approximate glosses:
      'Any girl who played with any boy defeated him' or
      'If a boy played with a girl, she defeated him'
      'For any girl x and boy y such that x played with y, x defeated y'
      'Which girl played with which boy, she defeated him.'

   How do CRs fit with our current understanding of NL quantifiers? Are they 'main stream' or 'fringe'?

(3) A typology of quantifiers.
   a. **Type 1**. Category specific quantifiers (CS-Qs): *every, most,..., -er,...*
      i. Most cats purr
      ii. John is taller than Bill

a'. *Defining features*:
   i. Semantically, they are relations between sets
   ii. Syntactically, their restriction is determined by sisterhood (simple merge). Their scope, by movement (copy merge).

b. **Type 2**. Adverbial Qs (Adv-Qs): *always, often, usually, Gen*…
   i. If a dog sees a mouse, it usually/never runs away from it
   ii. A cat is rarely/usually/never aggressive

b'. *Defining features:*
   i. Semantically, they are polyadic, intensional operators
   ii. Syntactically they are adjoined to the clausal spine; their scope is usually their C-command domain (no movement, no locality effects – examples to follow in (8)).

c. **Type 3**. Alternative sensitive quantifiers (AltS-Qs):
only (exclusives), *also* (additives), *even* (miratives).
   i. I only like John. $\forall p \in ALT_C\ [p \rightarrow \lambda w.\ like_w(john)(I) \subseteq p]$
   $||only|| = \lambda A_{<<p,t>,t>} \lambda q.\ \forall p \in A\ [p \rightarrow q \subseteq p]$
   ii. I even like John. $: (\forall p \in ALT_C\ [\lambda w.\ like_w(john)(I) < p).\ like_w(john)(I)$
   $||even|| = \lambda A_{<<p,t>,t>} \lambda q: \forall p \in A\ [p < q].\ q$

c'. *Defining features:*
   i. Semantically they quantify over propositions
   ii. Syntactically their scope is their prejacent, their restriction a set of alternatives to the prejacent.

d. **Type 4**. Polarity sensitive Qs (Pol S-Q): *ever, any, some$_{SG}$,* …
   i. NPIs: I didn't ever eat that dish
   ii. Epistemic/PPIs: Some student (or other) will complain
   iii. FCIs: Any student might complain

d'. *Defining features:*
   i. They are sensitive to the polarity (and modality) of their local environment
   ii. They are the combination of a CS-Q and an AltS-Q

Example (Hindi, again)
iii. ek bhii admii nahiiN aayaa
one even man not came-P 'no man came'
iv. EVEN(ALT) (one(man)(came))

Type 3-Q + **Type 1**-Q = **Type 4**-Q

CRs probably fit among the CS-Q's: they are formed out of wh-words, like questions; *but* they can be polyadic:
$[wh_1](P)(Q)$ $[wh_1 + wh_2]\ (R^2_i)(R^2_j)$ $[wh_1 + wh_2 + wh_3]\ (R^3_i)(R^3_j)$.
Moreover, according to our current understanding (D 96, B 03), unlike 'regular' DPs (i.e. CS Qs), the scope of CRs does not involve movement: MUL CRs Qs, are NOT moved from their base position to their scope position. This is a bit of a mystery.
In fact, if we are right, this second assumption turns out to be wrong. Hence, CRs might be more 'main stream' than what appears at first sight.
[Btw, CRs also have FC counterparts; so they also fit in Type 4]

(4) Adding (in)definites: the complete (?) picture.
(In)definites cut across quantifiers of all four types, in the sense that on the one hand they have non quantificational meanings, but but they also have counterparts in each of the four major categories of Qs.

Type 1: CS-Qs	**(in)definites**
Type 2: Adv-Qs	
Type 3: AltS-Qs	
Type 4: PS-Qs	

Indefinites across quantifier types:

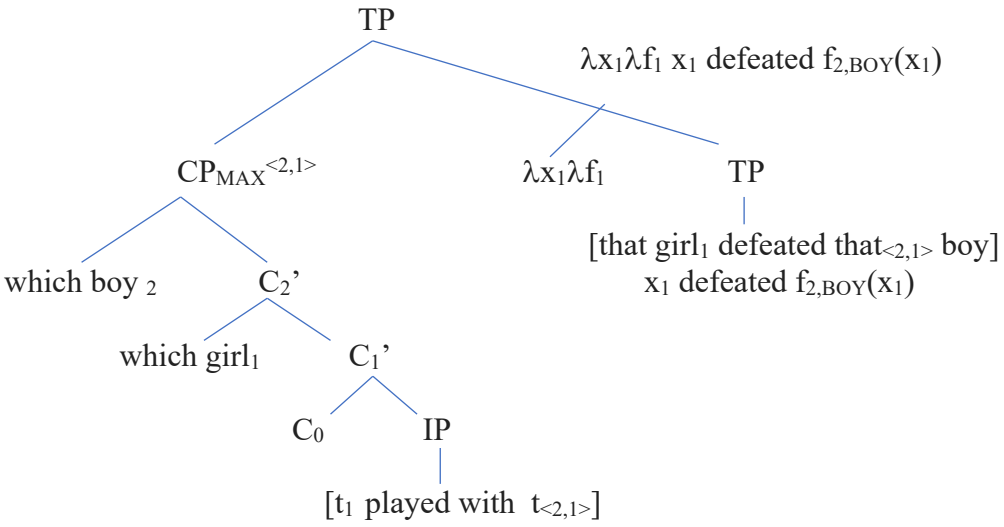
a. Someone from Rome walked in — Type 1
b. Someone from Rome usually doesn't route for AC Milan. — Type 2 (as their restriction)
c. ?? I don't know someone from Rome — Type 4 (as Pos Pol Items)

Definites across quantifier types -- illustrated through free relatives:

d. I ate what was on my plate — (Maximality) — Type 1
e. I usually get to type what John writes — (Q-variability effect) — Type 2 (as their restriction)
f. You may read whatever John writes — (FC reading) — Type 4 (as Free Ch Items)

CRs are closely related to Free Relatives and as such they share (d)-(f).

(5) The classics: D 96.
a. Syntax: All CRs are generated in a (left) adjoined position.
   i. To clauses or
   ii. To DP for SINGLE CRs (unavailable to multiple CRs) – cf (6).
b. LF of a multiple CR



c. There is a unique function from girls to boys that verifies *x played with* $f_{BOY(y)}$ (the CR);

That function also verifies *x defeated* $f_{BOY}(x)$, for any x in its domain (the main clause).

So, the CR is a dyadic generalized quantifier; but it's based on a function. The quantifier, binds two slots in the main clause, one that corresponds to the domain of the function, the other to the function itself (and through it, it gets to the things in its range).

d. The functionality requirement.
Which girl played with which boy, that girl defeated that boy (= 2.d.ii)

(i) Girl 1 → Boy 1
Girl 2 → Boy 2

(ii) Girl 1 → Boy 1
Girl 2 → Boy 2

* (iii) Girl 1 → Boy 1
Girl 2 → Boy 2

e. The compositional build up.
i. The final meaning of the CR (GQ-Type)
$\| CP_{MAX} \| = \lambda R \exists f' [f' = \iota f [DOM(f) = girl \wedge RNG(f) = boy \wedge \forall x [x \in girl \rightarrow x$ play-with $(f(x))] \wedge \forall x [x \in girl \rightarrow R(x)(f)]]$

ii. Where everything is packed: a 4-argument Comp.
$\|C_0\| = \lambda R_1 \lambda P_2 \lambda P_3 \lambda R_4 \exists f' [f' = \iota f [DOM(f) = P_2 \wedge RNG(f) = P_3 \wedge \forall x [x \in P_2 \rightarrow R_1(x)(f)] \wedge \forall x [x \in P_2 \rightarrow R_4(x)(f)]]$

Things to improve on:
- The type of the dislocated wh's and of the traces do not fit readily with each other
- Can the complex and, perhaps, ad hoc Comp be 'parceled out' into reasonable units?

(6) DP-adjoined CRs.
Jo aaye un-kaa kaam jo gaye un-ke kaam-se behtar hai
who came their-Gen work who left their-Gen work better is
The work of those who came is better than the work of those who left.
Here, the comparative adjective *better* requires two DP. The relative clauses are clearly adjoined to the two DPs in the main clause.

(7) The bijectivity issue.
Each wh in a CR has to be matched by a formally determined correlate, typically a demonstrative (with or without a head), which in specified conditions can be replaced by *pro*.
a. jo khaRii hai *(vo) laRkii lambii hai SG CR (Bare NPs cannot act as correlates)
who standing be-PR that girl tall is 'the girl who is standing is tall'
b. *jo larRhii jiis laRke-ke saat khelegii vo jiit jayegii MUL CR (No correlate can be left out)
which girl which boy with play she win-PERF-F
c. Jis DaakTar-ne jiis mariiz-ko dekhaa us-ne us-ko paisaa diyaa (Fixed ordered matching)
which doctor which patient see-P he-E him-D money give
Which doctor saw which patient the doctor gave the patient the money' D 96.
Bijectivity is captured by D 96 through something like a type-matching requirement: a function in the restriction (the CR) has to be matched by a function of the same type in the scope (the main clause). Note however that this remains a somewhat informal/suggestive account. The tightness of the bijectivity requirement (which involves morphological shape, number and order of the correlates) is reminiscent of movement. Notice moreover that the other known kind of polyadic quantifiers, namely A-Qs are *not* subject to matching

requirements of this sort:

d. If a person$_1$ has a business$_2$ with a younger partner$_3$,
that person$_1$ usually shares responsibilities with the partner$_3$
the younger partner$_3$ will have to take on some of the financial costs.

Most x,y [x has a business with y][x shares responsibilities with y]
[y will have to take on some financial costs]

In (d) two of the possible three targets for the A-Q *usually* (a proportional Q akin to *most*). Appear to be bound by it. And clearly not all targets of quantification (potential or actual) need to a have a correlate (much less, one of a specified grammatical shape and in a specific order). This is true also of languages that use wh-words as 'variable-like' in, e.g., conditionals, like Mandarin:

e. Ruguo shei dui ni shuo LE shenme, ni yinggai jinliang kuaidian huifu ta.
if who to you speak ASP what you should try-to quickly answer him
'If is someone says something to you, you should try to reply to him quickly'

So, bijectivity doesn't fall out smoothly from a base generated hypothesis on the nature of CRs and can use further probing.

(8) The locality issue I.

Base generated quantificational dependencies typically are not island sensitive

a. i. If someone dislikes a movie, she mistrusts every critic who praises it.
ii. ALWAYS$_{1,3}$ [someone$_1$ hates a movie$_3$][she$_1$ mistrusts every critic who praises it$_3$]

But correlatives have to be in a local relationship to the demonstrative correlates in the main clause.

b. * Jo vahaaN rahtaa hai maiN [yeh baat ki vo nahiiN aayeega] jaantii thii. SG CR
who there live-PR I this matter that he not come know
'Who lives there, I knew the fact that he will not come'

c. * [jis bacce-ne(i) jo kitaab paRhii(j)], MUL CR
Wh kid-ERG wh book read
[us bacce-ko(i) lagaa [ki [ek/vo Tiichar jis-ne vo kitaab (j) recommend kii thii]
that kid-DAT seemed that a/that teacher who-ERG that book had-recommended
zaroor khush hoga
definitely happy will-be
'which kid read which book that kid thought that a teacher who had recommended that book would be happy'

Both D 96 and B 03 claim that the locality of multiple correlatives is as strict as to require the correlates to be clausemates:

f. * jis-ne jis-ko dekh-aa us-ne kah-aa ki [voj aa-yegaa]
Who-E who-A see-P he-E say-P that he come-F

As it turns out, this claim is controversial and we will have to come back to it.

But the sensitivity to strong islands for both SING and MUL CRs is uncontroversial,

How come, if they are base generated?

(9) The locality issue II.

Sometimes, correlatives exploit movement of the correlate (often, a demonstrative) in the main clause. Here is an example from Romanian (A. Fălăuş, pc; see also Izvorski (1996) for related facts in Bulgarian):

a. *Ce sportiv a câștigat medalia de aur, Maria crede că Ion îl va intervieva pe acel sportiv
what athlete won a medal of gold Maria thinks that John will interview that athlete
b. Ce sportiv a câștigat medalia de aur, pe acela crede Maria că îl va intervieva Ion.
what athlete won medal of gold acc that-one thinks Maria that him interview John
c. Ce sportiv a câștigat medalia de aur, Maria crede că pe acela îl va intervieva Ion.
what athlete won medal of gold Maria thinks that acc that-one him interview John

As you can see from (a), leaving the demonstrative in situ is not an option; the preferred form is (b) with long distance movement of the Demonstrative Phrase (DemP). But movement to the embedded TP is also acceptable.

A way to account for the locality effect with correlatives, in general, would be to match them with a requirement that always forces them to co-occur with demonstrative movement, which can happen overtly, as in Romanian, or covertly, as it would have to be the case in Hindi. For our lead Hindi example, this hypothesis amounts to adopting a structure of the following form:

d. which girl$_1$ with boy$_2$ [t_1 playes with t_2] that boy$_1$ that girl$_2$ [t_1 defeated t_2] B 03

In (b) two independent series of movements have to take place in the restriction and in the scope of the multiple quantifier.

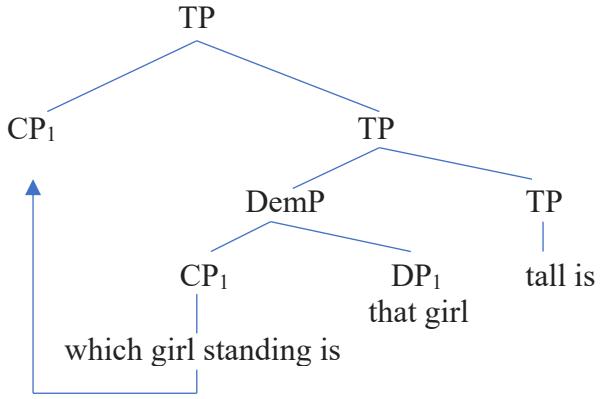
D 96 doesn't give a specific mechanism through which locality is enforced, pointing at the fact that generally quantifier-variable relations are local (though not those associated with A-Qs). B 03, on the other hand explicitly goes for a structure like (d).

So here is the crux: if CRs are based generated in an adjoined position, (a) the assemblage of a CR and (b) obligatory movement of the correlates in the main clause must be put in sink with e.o. This obviously is a costly assumption. One might expect there to be languages where the two mechanisms are not coordinated. Such languages would have correlatives insensitive to strong islands (like donkey dependencies). But correlatives of this sort are up to now unattested.

(10) Developments: The movement analysis of SG CRs (B 03).

Partly in response to the above issues, B 03 argues for a movement analysis of SG CRs along the following lines. SG CRs are base generated adjoined to DP, an option we know on independent grounds to be possible – cf. (6), and (optionally) moved to the left periphery (possibly to a topic-like position). This kind of movement would be a sort of 'intermediate' scrambling, differing from local scrambling (that shifts around arguments and adjuncts within the clause) as it pulls a constituent out of a DP.

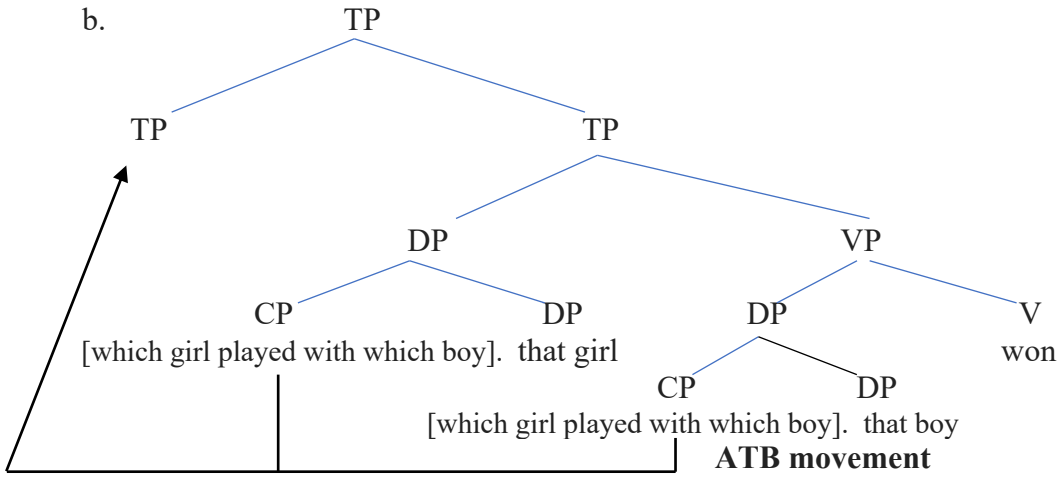
a.



This analysis meets head on all the above concerns about bijectivity and locality.

[It closely resembles the analysis of Clitic Left Dislocation in, e.g., Cecchetto (1999)].

Unfortunately, extending movement to multiple CRs appears to be unwieldly. Here is an attempt that B 03 considers and quickly rejects:



On this analysis (B 03, fn. 11) the relative clause starts out adjoined to *both* DemPs in the main clause. Then it is moved leftwards, across the board. [One might imagine a 'multiattachment' variant of it.] B mentions several empirical and theoretical factors that make it unviable. For example, the contrast with SG CRs, where the base structures are grammatical and the leftwards movement is optional remains very stark and unexplained. Then one would like to see how the DemP hosts relate to the appropriate wh's in the correlatives, and so on. In view of these problems, B 03 sticks to a base generated, Dayal-like story for MUL CRs. He valiantly tries to justify the asymmetry between his analysis of SG CRs and that of MUL CRs in terms of the absence of Principle C and pronoun binding reconstruction effects for MUL CRs vs. SG CRs (something we will have to come back to). The problem is that the locality effects are identical in both cases, and for this reason B 03 is forced towards the solution sketched in (9) of independent LF movements in the RC clause and in the main clause, a costly option. It is this problem we are going to address next.

(11) Intermediate summary

a. Two analyses of CRs

Analysis I: Uniform base generation in adjoined position D 06

Analysis II: Differentiated structures for SG vs. Mul CRs: B 03

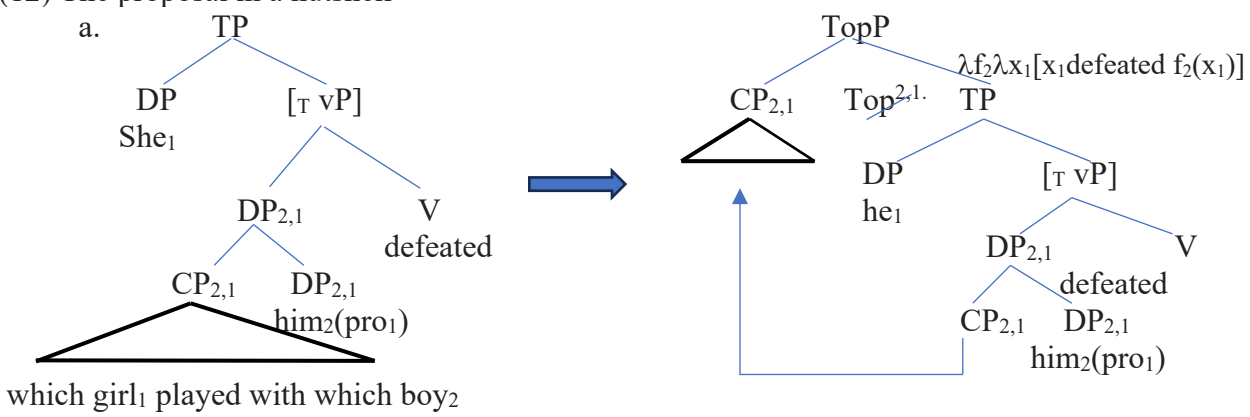
- SG CRs are always based generated attached to a DemP host in the main clause. Then they are optionally moved to clause adjoined position.
- MUL CRs always base generated adjoined to a clause

b. Semantically, CRs are interpreted as polyadic Qs.

c. Problems for both analyses (i) and (ii): bijectivity and locality in MUL CR. Plus perhaps the complex nature of the semantic composition that leads to (b).

II. The functional analysis of multiple wh-constructions.

(12) The proposal in a nutshell

a. 

which girl$_1$ played with which boy$_2$

b. Informal description:

i. The CR is adjoined to the lower pronoun

ii. The lower pronoun is a functional one as in a 'paycheck' case (see iii.). The main clause is interpreted as: [x_1 defeated $f_2(x_1)$]

iii. Everyone except John put his paycheck in the bank.
John decided **he would reinvest it i**n the company
x would reinvest f(x)

iv. The multiple correlative $CP_{2,1}$ denotes a specific function ϕ, which therefore starts out adjoined to a constituent of the same type. In the case at hand, the MUL CR denotes a function that maps girls into boys they played with.

v. The MUL CR is then moved leftwards. I am making this a movement driven by a dedicated Topic-like head. But this is not essential.

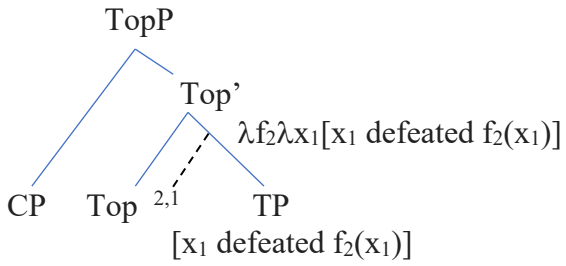
vi. Through movement, the variables free in the main clause are abstracted over:
$\lambda f_2 \lambda x_1 [x_1$defeated $f_2(x_1)]$

vii. Topicalizing a function provides the content of what ties the subject of the main clause to its object. This can be done through an operation of the following sort:
$SAT(\phi, R) = \forall \in x[x \in D(\phi) \rightarrow R(f)(x)]$
where R is a relation between an individual and a function.
I.e. a function ϕ 'saturates' the main clause [x_1 defeated $f_2(x_1)$] with respect to x_1 and f_2 iff for every u in the domain of ϕ, [u defeated ϕ(u)];
(i.e. $\| [x_1$ defeated $f_2(x_1)] \|^{g[u/x1,\ f2/\phi]} = 1$)

A small change, and the movement analysis starts making sense…

(13) The proposal in more detail

a. The indices on Top indicated which constituent is attracted to the left periphery. Semantically, they act as abstractors over the main clause (cf. e.g. Heim and Kratzer 1998 on Quantifier Raising):



||CP|| = ϕ , where ϕ maps girls into boys they played with.

b. *Top* itself acts as a combinator similar in type to a Determiner:
Top ⇒ λRλf. SAT(f, R) = λRλf. ∀x[x∈D(f) → R(f)(x)]

c. Derivation
   i. Top' ⇒ λRλf.∀x[x∈D(f) → R(f)(x)](λf2λx1[x1 defeated f2(x1)] =
   ii. = λf.∀x[x∈D(f) → x defeated f(x)]
   iii. TopP ⇒ λf.∀x[x∈D(f) → x defeated f(x)] (ϕ) = ∀x[x∈D(ϕ) → x defeated ϕ(x)]
   iv. For any x in the domain of the function ϕ that maps girls into boys they played with, x defeated ϕ(x); i.e. any girl that played with a boy defeated him.

(14) Background: Functions and functional readings.

Four phenomena involving functions:

a. E-type pronouns:
   i. every man who has a donkey beats it
   ii. ∀x [man(x) ∧ ∃y [donkey (y) has(y)(x)] → beat (f_{donkey}(x))(x)]
   where for any x, f(x) = the donkey(s) x owns

Functional wh's:

b. Questions about functions
   i. Who does everyone love? His mother
   ii. Who does no one ever have dinner with? His undertaker
   iii. Which function f is such that for no x x has dinner with f(x)?

c. Quantifier-wh interactions.
   i. Which guest did everyone bring? Mary brought John, Paul brought Sue,…
   ii. Which function f verifies every x brought f(x)?

d. Multiple wh-questions.
   i. Which girl played with which boy
   ii. Which function from girls into boys verifies for any x in its D, x played with f(x)

Generalized crossover phenomena:

   i. * its$_1$ mother kicks every farmer who beats [a donkey]$_1$ Donkey crossover
   ii. * Who has dinner with no one? His undertaker No functional answer
   iii. * Which guest brought everybody? John brought Sue, Lee brought … No list answer
   iv. Who brought what? vs. * what did who bring? Superiority

On the functional analysis, all of these phenomena get reduced to crossover violations. E.g. to get a functional reading of (ii), we would have to have a structure like:

   vi. Which f is such that for no x [f(x) has dinner with x]
   Where the quantifier *no one* would have to cross over the element it seeks to bind.

(15) The direct precursor of MUL CR: Multiple wh-questions.

Multiple wh questions as questions about functions. (Dayal 2016)

a. Which girl played with which boy? The target meaning:

i. $\lambda q.\ \exists f\ q = \cap$ **$\lambda p.\ \exists x$ [p = play-with($f_{BOY}(x)$)(x)]** =

= { $\cap$\{ x play-with f_1(boy)(x): x$\in$girl},

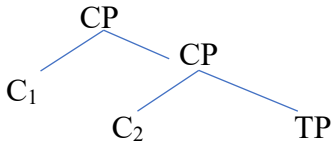
$\cap$\{ x play-with f_2(boy)(x): x$\in$girl }, …} One proposition per function.

Note that the part in boldface is also a question denotation. The question in (i) is obtained by 'lowering' an inner question about girls.

Note also that the members of the set in (a.i) are independent of e.o.; hence, the answerhood operator ANS, which picks the strongest member of a set, will be defined only in worlds where there is just one function that makes just one of the members of the set (a.i) true. This accounts for Domain-exhaustivity and functionality.

ii. Rough LF: The split C hypothesis.

which$_f$ ~~boy~~ $C_\cap$ which girl C [x plays with ~~which~~$_f$ boy(x)]



b. The pieces:

which girl$_i$ C [x_i play-with $f_{boy}(x_i)$]

This is a regular question, to be obtained in the normal Karttunen way (the C creates a question meaning, the wh is an indefinite that gets quantified in pointwise:

i. $\lambda p.\ \exists x_i$ [girl(x_i) $\wedge$ p = λw.play-with$_w$($f_{BOY}(x_i)$)(x_i)] =

{λw.plays-with$_w$(f_{BOY} (s_1))(s_1), λw.plays-with$_w$(f_{BOY}(s_2))(s_2), …}

(b.i) denotes a set of propositions relative to a choice of f.

The upper C, works almost normally, except that it lowers the type of (i) to that of a proposition, by taking its intersection.

ii. $\lambda p.\exists f$[p = $\cap${λw.plays-with$_w$(f_{boy}(s_1))(s_1), λw.plays-with$_w$(f_{boy} (s_2))(s_2), …}]

= { $\cap$\{ x plays-with $f_{1,\,BOY}$(x): x$\in$girl},

$\cap$\{ x plays with $f_{2,\,BOY}$(x): x$\in$girl }, …}

This is what we want, namely (a.i) above. So, the meaning of $C_\cap$ is:

iii. $C_\cap = \lambda Q \lambda p.\ p = \cap Q$

The further pieces are:

iv. which girl = $\lambda P \exists x$ [girl(x) $\wedge$ P(x)]

v. which$_f$ boy = $\lambda P \exists f$ [P(f_{BOY})]

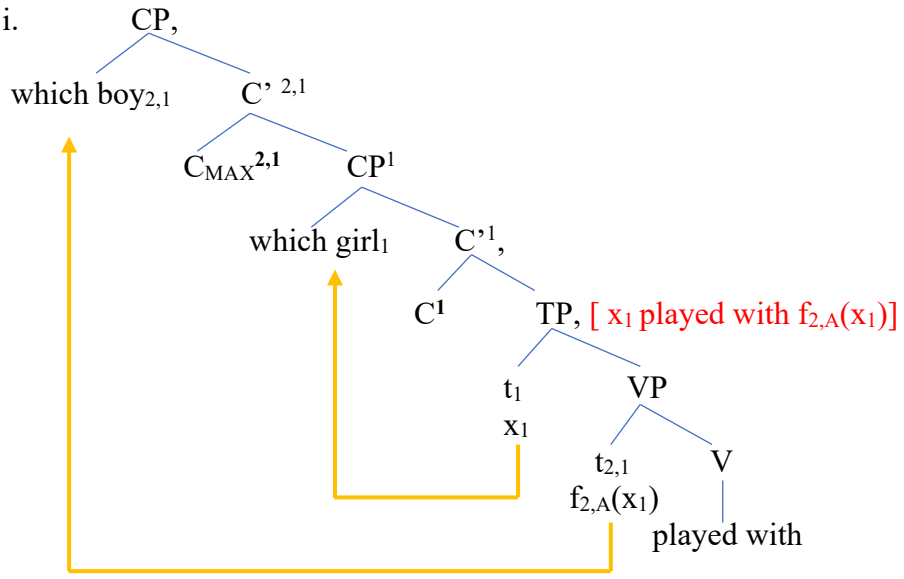
These quantifiers are quantified into Q-meanings pointwise, in the usual way.

The only difference with respect to non functional Qs is in $C_\cap$, which in turn differs minimally from the standard C.

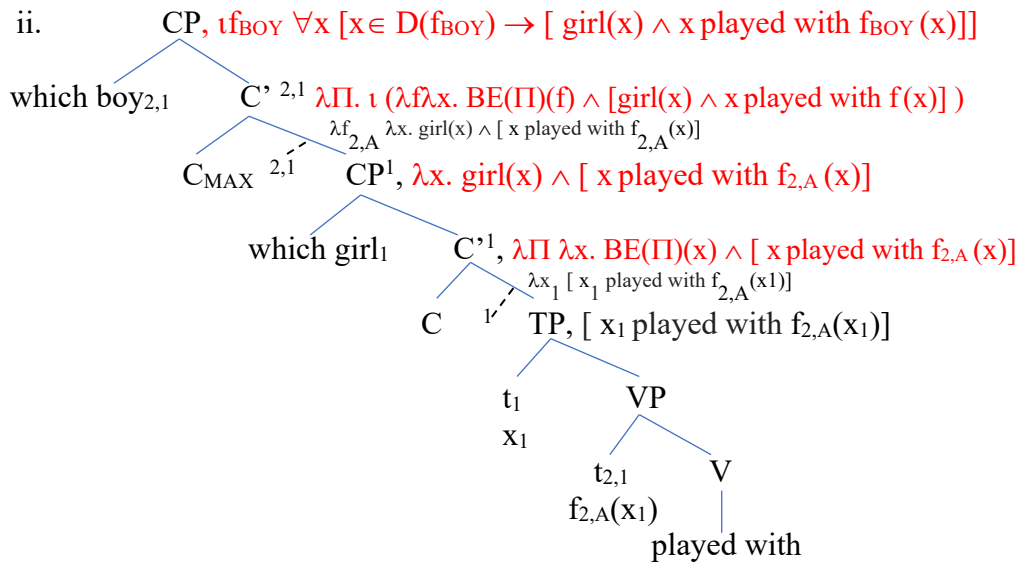
(16) MUL CR = functional relative clauses.

MUL CR are just the relative clause counterpart of multiple wh-questions. In different but equivalent terms, MUL CRs are to multiple wh-questions exactly what free relatives are to single wh-questions. They fill out what would otherwise be a strange gap.

a. i.



ii.



b. TP ⇒ [x_1 played with $f_{2,A}(x_1)$]
The lower wh-trace is interpreted functionally; the upper as a variable of type e; f_A is a variable ranging over Skolem functions (restricted to range A).

c. [1] TP ⇒ λx_1 [x_1 played with $f_{2,A}(x_1)$]
The superscript attracts the wh with the same index and semantically forms an abstract.

d. which girl = ∃(girl) = λP∃x [girl(x) ∧ P(x)]
wh-words are interpreted as in questions. Indices on (non pronominal) DPs are meaningless.

e. i. C ⇒ λP λΠ λx. BE(Π)(x) ∧ P(x)
The lower C pulls the property out of the indefinite (via Partee's BE) and uses it to restrict the clause (Caponigro 2003):

ii. C'[1] ⇒ λΠ λx. BE(Π)(x) ∧ [x played with $f_{2,A}$ (x)]

iii. CP[1] ⇒ λx. girl(x) ∧ [x played with $f_{2,A}$ (x)]

f. $^{2,1}\text{CP}^{1} \Rightarrow \lambda f_{2,A}\, \lambda x.\ \text{girl}(x) \wedge [\ x \text{ played with } f_{2,A}(x)]$
The index on the upper C behaves just like the lower one

g. Which boy $\Rightarrow \lambda P\ \exists f_{BOY}\ P(f_{BOY})$
An existential quantifier over boy-valued skolemized choice functions

h. $\lambda R\ \lambda \Pi\ \iota\ (\lambda f \lambda x.\ BE(\Pi)(f) \wedge R(x)(f)]\ )$
The upper C behaves like the lower C (restricts the embedded function to boy-valued ones) + maximization

i. $\text{C}'\ ^{2,1} \Rightarrow \lambda \Pi\ \iota\ (\lambda f \lambda x.\ BE(\Pi)(f) \wedge [\text{girl}(x) \wedge x \text{ played with } f(x)]\ )$

j. $\text{CP} \Rightarrow \iota\ (\lambda f_{BOY}\, \lambda x.\ [\ \text{girl}(x) \wedge x \text{ played with } f_{BOY}(x)]\ )$
ι in (i) is a binary maximization operator defined in terms of the unary one as follows:

k. i. $\iota(R) = \iota f\ \forall x\ [x \in D(f) \rightarrow R(f)(x)]$

ii. $\|\iota f\ \forall x\ [x \in D(f) \rightarrow R(f)(x)\|^{g} = h$, where f is such that
$\|\forall x\ [x \in D(f) \rightarrow R(f)(x)\|^{g[f/h]} = 1$ and there is no h' such that $D(h) \subset D(h')$ such that
$\|\forall x\ [x \in D(f) \rightarrow R(f)(x)\|^{g[f/h']} = 1$;
if there is no such h, then $\|\iota f\ \forall x\ [x \in D(f) \rightarrow R(f)(x)\|^{g}$ is undefined.

By the definition in (k), (j) becomes:

l. $\iota f_{BOY}\ \forall x\ [x \in D(f_{BOY}) \rightarrow [\ \text{girl}(x) \wedge x \text{ played with } f_{BOY}(x)]]$
Everything in the domain of f_{BOY} must be a girl who played with a unique boy. We pick the largest such f (i.e. the one defined over the greatest number of girls of which it is true that they played with a unique boy)

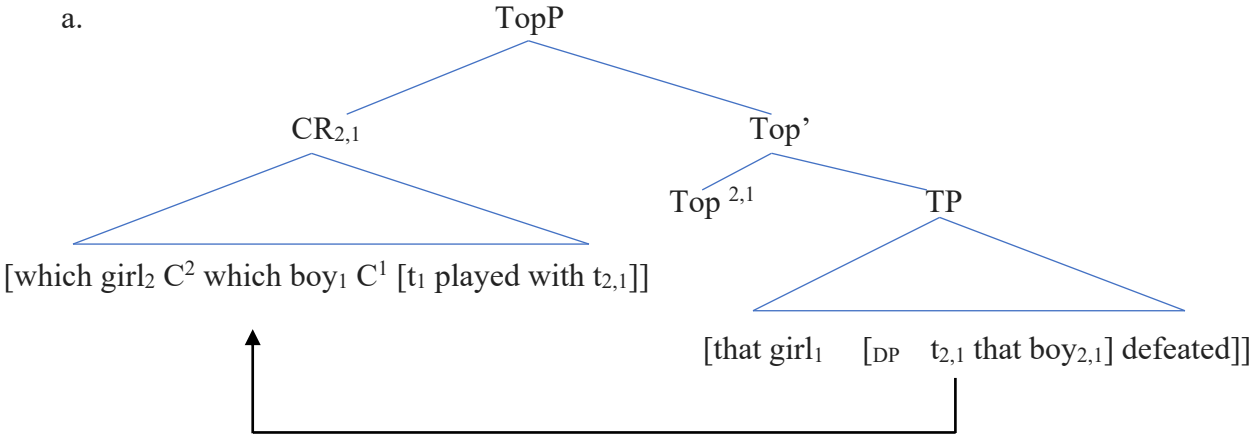
(17) The twin nature of questions and relative clauses.
The derivation of a multiple wh question and that of a MUL CR are fully parallel. Wh-words have the same meaning in questions and relative clauses; they are indefinite quantifiers.

a. The interrogative Comp: (i) forms an abstract
(ii) forms a question meaning with the abstract and
(iii) quantifies in the wh-words.

b. The relative clause Comp: (i) forms an abstract
(ii) uses the wh-words to restrict the abstract and
(iii) maximizes (i.e. pulls out the largest element that satisfied the abstract).

(18) Our battle horse

a.



b. Abbreviation:

$PLAY_{girl \rightarrow boy} = \iota f_{BOY}\ \forall x\ [x \in D(f_{BOY}) \rightarrow [\ girl(x) \wedge x \text{ played with } f_{BOY}(x)]]$

The meaning of (a), as anticipated, comes to:

c. $\forall x\ [x \in D(PLAY_{girl \rightarrow boy}) \rightarrow \text{ defeat}(\ PLAY_{girl \rightarrow boy}(x))(x)]$

d. Bijectivity follows: a correlative, SG or MUL is always generated adjoined to its correlate. In the MUL case, each correlate is dependent on the preceding one and the relative clause is adjoined to the dependent one. So any morphosyntactic requirements (e.g., that the correlate be a demonstrative rather than a bare noun) can be enforced locally, via sisterhood and agreement, as such morphosyntactic requirements typically are.

e. Locality follows via movement (scrambling of the RC to some Topic-like position), again, as locality in general does.

f. This is obtained exploiting the same devices arguably required for multiple wh-questions.

(19) Crossclausal CRs in Hindi.

Consider:

a. $[_{CR}$ …wh_1…wh_2…] […DEM_1 …$[_{CP}$ …DEM_2…]]

In (a) the two correlates of a MUL CR are separated by a clause boundary. I am going to call structures of this sort Crossclausal Correlatives. Both D 96 and B 03 claim Crossclausal CRs to be ungrammatical. They both base their claim on one and the same example, attributed to Wali (1982):

b. * [jis-ne$_1$ jis-ko$_2$ dekha] [us-ne$_1$ kahaa [ki vo$_2$ aayegaa]]
who-E whom-A saw-P he-E1 say-P that he-E will come
who saw who he said that he will come

However, a quick inspection of the gloss reveals that a sentence like (b) can be hardly regarded as pragmatically felicitous. As one makes the pragmatics more plausible, people in fact appear to accept Crossclausal CRs. Here are some examples, collected from three interviewees:

c. i. $[_{CR}$ jis laRkii-ne jis laRke-ko parTii-meN bulaayaa],
wh girl-ERG wh boy party-in called

us (laRkii)-ko puuri umeed hai ki vo zaroor aayegaa
that-girl-DAT full hope is that he definitely will-come

[which girl$_1$ invited which boy$_2$ to the party] [she$_1$ fully expects that he$_2$ will definitely come]]

ii. jis bacce-ne jo kitaab paRhii, us bacce-ko lagaa ki vo kitaab bahut acchii hai
Wh kid-ERG wh book read that kid-DAT seemed that that book very good is

[which kid$_1$ read which book$_1$] [that kid$_1$ thought that that book$_2$ was very good]

At the same time, Crossclausal CRs are swiftly rejected if one of the two correlate is in a strong island. The following form minimal pairs with the sentences in (c):

d. i. * $[_{CR}$ jis bacce-ne(i) jo kitaab paRhii(j)],
wh kid-E wh book read

[us bacce-ko(i) lagaa [ki [ek/vo Tiichar jis-ne vo kitaab (j) recommend kii thii]
that kid-DAT seemed that a/that teacher who-ERG that book had recommended

zaroor khush hoga
definitely happy will-be

'which kid read which book that kid thinks that a/the teacher who recommended that book will be happy'

ii. * [$_{CR}$ jis laRkii-ne(i) jis laRke ko(j) haraayaa]
wh girl-E wh boy defeated-P

us (laRkii)-ko Dar hai [ki [ek Tiichar [jo us-laRke-ko pasand kartaa hai]]
that-girl-DAT fear is that a teacher who that-boy-ACC likes

gussaa ho jaegaa
angry will-get

'which girl defeated which boy that girl fears that a teacher that likes that boy will get angry.

The sentences in (d) are unfailingly ranked below the sentences in (c), in spite of the fact that their pragmatics is kept constant and quite sensible.

(20) Crossclausal CRs in Romanian
The H pattern discussed in (19) reproduces itself unchanged in Romanian, which suggests it's no fluke.

a. Ce sportiv ce medalie a câștigat, acela crede că aceea
what athlete(M) what medal(F) has won that-one.MSG thinks that that-one.FSG
acea medalie e cea mai valoroasă.
that.FSG medal is the more valuable.FSG

which athlete which medal won, that athlete thinks that that medal is the most valuable
'Every athlete thinks that the medal they won is the most valuable.'

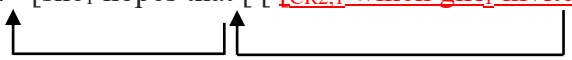
b. *Ce sportiv ce medalie a câștigat, acel sportiv credea că persoana care
what athlete.MSG what medal.FSG has won that athlete thought that person.DEF which
i-a dat-o e amabilă.
CL.DAT 3SG-has given-CL.ACC.3FSG is nice

'which athlete which medal won, that athlete thought that the person who gave him the medal was nice.'

'every athlete thought that the person who gave him the medal was nice'.

(21) Deriving cross-clausal correlatives.
On the present approach, Crossclausal CRs would be derived as follows:

a. [she$_1$ hopes that [[[$_{CR2,1}$ which girl$_1$ invited which boy$_2$ to the party] he$_{2,1}$] will come]]



The CR is base generated adjoined to the lowest pronoun (which is going to have to be a functional one). Then it is moved in two steps to its spell out position, as indicated by the arrows, each step being locality compliant. It's a case of *overt* long distance scrambling, which we know is possible in Hindi.

Neither D 96 nor B 03 have a straightforward way of deriving these sentences. According to such approaches, MUL CRs have to be base generated adjoined to a clause, either as in (b) or as in (c).

b. [$_{CR}$ which girl$_1$ invited **which boy$_2$** to the party] [she$_1$ hopes that [**he$_2$** will come]] D 96

c. [she$_1$ hopes that [[$_{CR}$ which girl$_1$ invited which boy$_2$ to the party]] [**he$_2$**,will come]] B 03

The structure in (b) corresponds to an analysis a la D 96, where the CR would be base generated in its spell out position. This structure has a non local link between the second wh-word and the second demonstrative, contrary to D's generalization that CRs are subject to locality. In B 03's terms, a structure of this sort would involve covert movement of the second demonstrative out of a tensed clause, which is NOT an option in Hindi – see (22) below.

The analysis in (c), which corresponds to the line adopted in B 03, is even more problematic. For one thing, the base form is ungrammatical, as the correlative in the base position would be lacking a correlate in its C-command domain. Hence movement would be obligatory, an option that B seeks to avoid. If we relax B's constraint and assume that the base form may be ill-formed (to the extent that the spell out form winds up well formed), then we are back to the same problem as with analysis (b): we need to establish a non local relation between the second wh-form and the second correlate.

In so far as I can see, a base generated analysis for MUL CRs has no way of deriving Cross-clausal CRs. But they appear to be attested in H, as they are in other languages. Crossclausal CRs are expected on the approach developed here.

(22) Strict locality of LF movement in Hindi.

Unlike what happens in Mandarin, wh-words embedded in finite clauses in H can only take narrow scope:

a. Tum jaante-ho [ki us-ne kyaa kiyaa]
   You know-PR [that he-E what do-P]
   You know what he did ‘NOT: what you know that he did?

This shows that the embedded wh-word cannot be extracted at LF out of a finite clause. To get a direct question interpretation, the embedded wh-word has to be *overtly* scrambled into the matrix clause:

b. Kyaa [tum jaante-ho [ki us-ne t kiyaa]
   What$_1$ you know-PR that he t$_1$ did] what do you know that he did? D 96, B 03

Thus movement as a way to get locality in crossclausal CRs is not an option.

III. Open issues, further perspectives and conclusions.

(23) Bhatt's generalization.

B 03 justifies his non uniform analysis by arguing that SG CRs display systematic reconstruction effects, while MUL CRs do not. Here are B's main data points.

a. Principle C-based reconstruction effects:

i. * [jo laR.kii$_1$ Sita-ko$_2$ pyaar kar-tii hai] [us-ne$_2$ [__us-ko$_1$] Thukraa diyaa] **B (39b) p.513**
which girl$_1$ Sita-Acc$_2$ love do-Hab.F she$_2$ [__that girl$_1$] reject did
She$_i$ rejected the girl who loves Sita$_i$ = Sita rejected the girl who loves her.

The base position for the SG CR is adjoined to the Dem Phrase, where it is C-commanded by the subject, creating a Principle C violation.

Scrambling of the demonstrative in the main clause seems to change things:

ii. [jo laR.kii Sita-ko$_j$ pyaar kar-tii hai]$_i$ [us-ko$_i$ us-ne$_j$ _Thukraa diyaa]
which girl$_1$ Sita-Acc$_2$ love do-Hab.F [__that girl$_1$] she$_2$ reject did

B's claim: Principle C effects arise if the subject of the main clause C-commands the Demonstrative which is the correlate of the CR (at the POST Local Scrambling level, where Local Scrambling behaves in this regard like A-movement).

b. Pronoun binding reconstruction effects:

[jis laR.ke-ko vo$_1$ pasand kar-tii hai]$_2$ [har laR.ki:$_1$ [t$_2$ [us laR.ke-ko]j] buddhimaan samajh-ti: hai]
which boy-D she like do-Hab.F be.P every girl that boy-D intelligent consider-Hab.F be.Pr
'Every girl considers the boy who she likes to be intelligent.' **B (43) p. 515**

In (b) the quantifier *every girl* in the main clause is claimed to be able to bind the pronoun in the dislocated SG CR, as one might expect if movement is involved.

B 03 claims that these reconstructions effects are not there with MUL CRs.

(24) Deriving B's generalization?

On an approach where CRs are uniformly derived via movement, one would have to maintain that SG CRs can (and do) reconstruct, yielding B's reconstruction effects. But multiple CRs can't reconstruct (and hence do not).

This is indeed, arguably, what the present theory leads us to expect.

A SG CR gets ultimately interpreted as a definite description, which can readily be interpreted in situ. Consider for example (23b) above. The dislocated constituent could be λ-ed back in its original site, as schematically indicated here:

a. i. [which boy she$_1$ likes]$_2$ every girl$_1$ considers him$_2$ to be intelligent
ii $\lambda\alpha$. $\forall$x [girl(x) $\rightarrow$ x considers α intelligent] (the boy x likes)

λ-conversion in (a.ii) would, of course, be 'improper'. But there are various ways to make it work, for example, using, again functions:

b. λf $\forall$x [girl(x) $\rightarrow$ x considers f(x) intelligent] (λy. ιz[boys(z) $\wedge$ likes(z)(y)]) =
$\forall$x [girl(x) $\rightarrow$ x considers ιz[boys(z) $\wedge$ likes(z)(y)] intelligent]

Another way to go would be using Dynamic Semantics. The possibility of having direct binding onto the dislocated constituent, in turn would trigger 'disjoint reference' effects via Rule I (Reinhart 1983).

In situ interpretation for Mul CRs is on the other hand impossible or very hard. The interpretation of a Mul CR like (c) must take place at a level where the CR can bind the argument on which the function is dependent, namely the subject of the main clause she1:

b. i. which girl$_1$ played with which boy$_{2,1}$, she$_1$ defeated that boy$_{2,1}$.

ii. she$_1$ defeated [[which girl$_1$ played with which boy$_{2,1}$] that boy$_{2,1}$]

The in situ position of the correlative is as in (b.ii). But from its base position, the correlative cannot provide an antecedent for the pronoun in subject position of the main clause, unlike what happens in the case of SG CRs.

So interpreting the CR in situ is easy for SG CR, hard or impossible for MUL CRs, without Binding the subject from the base position of the CR

a major re-engineering of known interpretive mechanisms, which in turn affects coreference. Thus, the present take may provide a solid way of grounding B's generalization into a clear structural asymmetry between SG vs. MUL CRs.

(25) Empirical clouds on B's generalization.

One finds, however, data that do not fit with B's generalization (some of them in the literature, as indicated, other from my interviews).

a. Absence of Principle C effects:

i. [jo kitab Anu-ko$_1$ Ravi-ne dii thii], us-ne$_1$ [__vo kitab] tumhaare liye bhejii hai
which book Anu-D$_1$ Ravi-E give-P she-E$_1$ that book you-G for send-PERF-PR
'which book Ravi gave to Anu$_1$, she$_1$ sent you that book' **D (06), p. 164**

ii. [jo kitaab John-ko$_1$ sabse achii lagii], [us-ne$_1$ vo kitaab mujh-e de dii]
Which book John-D of-all good seemed he-E that book I-D gave
'which book John liked best, he gave that book to me'

In both (i) and (ii), the subject of the main clause C-commands the demonstrative correlate (and hence the trace of of the SG CR).

b. Absence of binding into dislocated pronouns:

* jis larke-se vo$_1$ sabse pahle miltii hai har larkii$_1$ us-se shaadii kartii hai
Which boy-INS she$_1$ of-all before meet-PR every girl$_1$ he-INS marriage do-PR
'Every girl$_1$ marries the boy she$_1$ meets first.' **D (06), p. 163**

A similar absence of reconstruction effects is found in languages like Romanian, whose correlatives are also amenable to a movement analysis like the one pursued here.

The variability of reconstruction effects induces prudence in making swift claims, pending further inquiry.

(26) TBD (= To be done)

a. n- place CRs, for n > 2.

i. [$_{CR}$ jis Tiicar-ne jis vidyaarthii-ko jis afsar-se milaayaa],
wh teacher-E wh student-A wh officer-with introduce-P
us Tiicar-ne us vidyaarthii-kii us afsar-se bahut tarif kii
that teacher-R that student-of that officer-A lot praise did
'Which teacher introduced which student to which officer, that teacher praised that student to that officer.'

ii. [$_{CR}$jis laRkii-ne jo kitaab jis laRke-ko dii],
which girl-E wh book wh boy-D give-P
us laRke-ne vo kitaab us laRkii-ko vaapas kar dii
that boy-E that book that girl-A return do-P
'Which girl gave which book to which boy, that boy returned that book to that girl'

b. Free choice effects.
jo bhii laRkii jis laRke-ke (?bhii) saath kheltii hai, vo us-ko haraa detii hai
wh ever girl wh boy with-ever plays she him defeats.
d. Generics and Quantificational Variability effects.
See Dayal (1995).

And, of course, more crosslinguistic variation…

(27) Concluding remarks
a. CRs are non interrogative counterparts of multiple wh-Qs:
Multiple wh-questions ask about functional dependencies, MUL CRs 'name' them.
b. The functional analysis of multiple wh-dependencies makes it easy (/-ier) to see why and how multiple wh constructions are related: it posits an asymmetry in the base (between the function and its argument) that makes it easy to track what depends on what.
A polyadic quantifier approach non based on functional dependencies (see, e.g. Gajewski 2008) has to rely
solely on movement, and this is likely to complicate things (see on this Thalluri 2024).
c. More specifically, the functional analysis of MUL CR makes a movement analysis very natural: The multiple CR begins its life adjoined to a functional pronoun, which in turn encodes a dependency, and is moved leftwards.
d. The locality and matching effects, including those associated with multiclausal CRs that have been so resilient, finally begin to yield and to reduce to something very familiar: the locality of scope assignment (i.e. 'QR').

The panorama of quantifiers in NL may be getting clearer…

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