Relativized Amounts

1   Varieties of relative clauses

Are the following types of constructions semantically and syntactically identical?

(1)   a.   *Classifier Relatives*
             Kim didn't read the NUMBER OF PAPERS that Lee wrote.
       b.   *Degree Relatives*
             I could insulate my house with the PAPERS Lee has written on this topic.
       c.   *Restrictive Relatives*
             Kim read every PAPER that Lee wrote.

How do these relate to comparative clauses like (2)?

(2)   a.   *Comparative Deletion*
             Kim read more PAPERS than Lee wrote.
       b.   *Comparative Subdeletion*
             Kim read more PAPERS than Lee wrote abstracts.

1.1   Raising vs. matching

Two different analysis have been proposed for relative clauses the "Raising Analysis" in (3) and the "Matching Analysis" in (4) (cf. null operator analyses).

(3)   *The Raising Analysis*
       Kim read [$_{DP}$ every [$_{CP}$ paper that Lee wrote ~~paper~~]]

(4)   *The Matching Analysis*
       Kim read [$_{DP}$ every paper [$_{CP}$ ~~wh-paper~~ that Lee wrote ~~wh-paper~~]]

The crucial difference between the two approaches is that in the Matching Analysis, there are two instances of the head of the relative/comparative clause—an external one and an internal one—and in the Raising Analysis, there is only one instance of the head—the internal one, which appears in an external position in the surface form.

This raises a number of questions:

(5)   *Raising vs. matching*
       i.   Are are relative clauses derived in the same way (Chomsky 1965; Rivero 1981; Kayne 1994; Lechner 1999) or are there differences both between and within the various construction types (Carlson 1977; Grosu and Landman 1998; Sauerland 1998)?
       ii.   Are multiple analyses possible (Sauerland 1998)?

(6)   *Syntax-semantics interface*
       i.   What syntactic and semantic factors determine the relation between the external head and the corresponding clause-internal position?

ii. Does the syntax of these constructions correlate with their meanings?

The goal of today's talk is to look at a range of syntactic and semantic facts (some old, some new) to see if we can isolate some crucial differences between the constructions, and to use these differences as a basis for some (initial) answers to the previous questions.

We will see that the facts suggest a close connection between the semantic function of a particular modifier clause — roughly, whether it provides sortal restrictions on a variable or not — and its syntactic derivation.

2 Comparative and relative clauses compared

2.1 Subdeletion

Comparatives and classifier relatives (esp. with *same*) permit "subdeletion".

(7)   a.   [Michael Jordan] has more scoring titles than Dennis Rodman has tattoos. (*Chicago Tribune*, 7.17.98)
      b.   I hate to trust you to him, a man with as many sins as he has hairs. (Sterling, Bruce: 1997, *The Artificial Kid*, Hardwired, San Francisco, p. 164)

(8)   a.   In all, the Bears got rid of 19 players, including third-down back Ronnie Harmon and linebacker Shont'e Peoples, meaning the Bears have the same number of guys with apostrophes in their names as [that] they have sacks in the preseason. (*Chicago Tribune*, 8.25.98)
      b.   ?The recipe requires you to add the (same) amount of water that you have already added flour.

Degree relatives and restrictive relatives do not.

(9)   a.   *The Bears cut the (same) guys with apostrophes in their names as/that they had sacks in the preseason.
      b.   *Gregory gave every student that there was (a) final project an A.
      c.   *Gregory gave the students that there were final projects As.

(10)   a.   *Gregory allowed every student that he was advising (a) linguistics major to enroll in "Language and Sexuality".
       b.   *Gregory gave an A to the (same) students in his class that Judith gave Bs to sophomores.

It is important to keep in mind that these sentences are (in principle) semantically coherent. We could imagine assigning (10a), for example, the interpretation in (11a), which *can* be expressed with a stacked relative, as in (11b).

(11)   a. $\forall x[student(x) \wedge lx\text{-}major(x) \wedge advising(G, x)][allow(G, x, enroll\text{-}in(x, L\&S))]$
       b.   Gregory allowed every student that he was advising who was a linguistics major to enroll in "Language and Sexuality".

2.2 Deletion

Deletion of the correlate is in general obligatory for all of these constructions.

(12)   a. *There are more stars in the sky than the eye can see stars.
          b. *I counted the same number of stars that you counted stars.
          c. *It is inconceivable that anyone could count all the stars there are stars.
          d. *I can see every star that you can see (a) star.

In comparatives, however, a contrastively focused correlate can remain (Chomsky 1977).

(13)   a. A: This desk is higher than that one is wide.
              B: What is more, this desk is higher than that one is HIGH.
          b. Watching the Cubs on his satellite dish has been almost as difficult for Beck as watching Beck close games has been difficult for the CUBS. (*Chicacgo Tribune*, 6.8.99)

This is (marginally) possible in classifier relatives as well (contra Grosu and Landman 1998).

(14)   a. ?We need to catalogue the (same) number of stars that they catalogued planets. We also need to catalogue (at least) the same number of stars that they catalogued STARS.
          b. ?We need to catalogue the (same) number of stars in Quadrant 47 that we catalogued (stars) in QUADRANT 46.

The correlate can never be overt in degree relatives and restrictive *that*-relatives, regardless of the focus/prosodic structure.

(15)   a. *We'll never be able to catalogue the stars in Quadrant 47 that there are (stars) in QUADRANT 46.
          b. *I can not only see every star that you can see (a) planet, I can see every star that you can see (a) STAR.

It's worth observing, however, there is a class of *which*-relatives that permit an overt correlate. (These seem to be associated with a particular register/dialect.)

(16)   a. Between his ribs and on each side of his spine he is supplied with a remarkable involved Cretan labyrinth of vermicelli-like vessels, which vessels, when he quits the surface, are completely distended with oxygenated blood. (*Moby-Dick*, Modern Library Edition, p. 537)
          b. THE DECK — FIRST NIGHT WATCH: Carpenter standing before his vice-bench, and by the light of two lanterns busily filing the ivory joist for the leg, which joist is firmly fixed in the vice. (*Moby-Dick*, p. 674)
          c. We're in the money. The breakage TA is in, now all we're waiting for is the "extra" ESL TA, which decision is being handed down tomorrow. The end is in sight. (Gregory Ward email to CK, 25 May, 2000)

2.3 Parasitic gaps and VP-deletion

All of the constructions license parasitic gaps (with varying degrees of acceptability).

(17)   a. Hillary threw away more books than she kept without reading.
          b. That's a lot of money that you can make without ever paying taxes on. (Uttered by CK in a discussion about Roth IRAs.)

     c.   You can enjoy a fine retirement on the money you'll make without paying taxes on.

     d.   These are the books that Hillary threw away without reading.

However, VP-deletion bleeds parasitic gaps in comparatives (Kennedy and Merchant 2000; Kennedy 2002).

(18)   a.   We recruited fewer students than Psych recruited without giving fellowships to.

        b.   *We recruited fewer students than Psych did without giving fellowships to.

(19)   a.   I made more money than you made without paying taxes on.

        b.   *I made more money than you did without paying taxes on.

This also seems to be true of classifier relatives.

(20)   a.   We can't even recruit the number of students that Psych recruits without giving fellowships to.

        b.   *We can't even recruit the number of students that Psych does without giving fellowships to.

(21)   a.   If you want to make the amount of money that I make without paying taxes on, then you should get a Roth IRA.

        b.   *If you want to make the amount of money that I do without paying taxes on, then you should get a Roth IRA.

VP-deletion does not alter the acceptability of parasitic gaps in degree relatives, however.

(22)   a.   We can't even recruit the students that Psych recruits without giving fellowships to.

        b.   We can't even recruit the students that Psych does without giving fellowships to.

(23)   a.   If you want to make the money that I make without paying taxes on, then you should get a Roth IRA.

        b.   If you want to make the money that I do without paying taxes on, then you should get a Roth IRA.

Ditto for restrictive relatives:

(24)   a.   We recruited every student that Psych couldn't recruit without giving a big fellowship to.

        b.   We recruited every student that Psych couldn't without giving a big fellowship to.

(25)   a.   Hillary wanted to buy the same car that I wanted to buy after seeing advertised in the paper.

        b.   Hillary wanted to buy the same car that I did after seeing advertised in the paper.

2.4 Sloppy Identity

Comparatives permit sloppy readings of head-contained pronouns, if the constituent that contains the correlate is elided (Bach, Wasow, and Bresnan 1974).

(26)   a.   John encountered more criticisms of his work than Bill encountered/did.
           b.   *the number of criticisms of John's work that John encountered > the number of criticisms of Bill's work that Bill encountered*

(27)   a.   John drank more of his wine than Bill drank/did.
           b.   *the amount of John's wine that John drank > the amount of Bill's wine that Bill drank*

(28)   a.   John bought more pictures of himself than you said Bill bought/did.
           b.   *the number of pictures of John that John bought > the number of pictures of Bill that you said Bill bought*

classifier relatives appear to behave in exactly the same way:

(29)   a.   John didn't have to respond to the number of attacks on his work that Bill had to respond to/did.
           b.   *the number of attacks on John's work that John had to respond to ≠ the number of attacks on Bill's work that Bill had to respond to*

(30)   a.   John had to rewrite the (same) parts of his thesis that Bill had to rewrite/did.
           b.   *the parts of John's thesis that John had to rewrite correspond to the parts of Bill's thesis that Bill had to rewrite*

(31)   a.   John drank the (same) amount of his wine that Bill drank/did.
           b.   *the amount of John's wine that John drank = the amount of Bill's wine that Bill drank*

Degree relatives strongly resist a sloppy reading of a head-contained pronoun, however, regardless of whether the base position of the correlate is in an ellipsis site.

(32)   a.   It would have taken weeks for John to drink the wine of his that Bill drank/did that night.
           b.   **it would have taken weeks for John to drink the amount N of his wine such that Bill drank N-much of Bill's wine that night*

(33)   a.   John didn't expect to encounter the criticisms of his work that Bill encountered/did.
           b.   **John didn't expect that the number of criticisms of his work that he would encounter would equal the number of criticisms of Bill's work that Bill encountered*

(34)   a.   Given the more tolerant intellectual climate, John didn't expect to encounter the criticisms of his work that Bill said there were when he was starting out.
           b.   **the number n of criticisms of John's work such that Bill said there were n criticisms of Bill's work when he was starting out.*

(33) can have a sloppy reading if it receives a 'type/kind of' interpretation:

(35)   John didn't expect to encounter the (same) type of criticisms of his work that Bill
         had (encountered).

Finally, a sloppy reading is also impossible with restrictive relatives.

(36)   a.   John, a Republican, read a damning exposee of his candidate that Bill, a
              Democrat, read/did too.
         b.   *$\exists x[exposee\text{-}of(x, J's\ candidate) \land exposee\text{-}of(x, B's\ candidate) \land read(B, x)][read(J, x)]$

(37)   a.   John lives with two relatives of his that Bill lives with/does.
         b. $\text{TWO}x[relatives\text{-}of(x, J) \land relatives\text{-}of(x, B) \land live\text{-}with(x, B)][live\text{-}with(x, J)]$

(38) demonstrates that the head of a restrictive relative clause can have narrow scope with
respect to other expressions in the relative clause (Bhatt 2000).

(38)   a.   This is the first book that John said he read.
         b.   *This is the first book such that John said that he read it.*
         c.   *This is the book such that John said it was the first book he read.*

"Narrow scope sloppy readings" are impossible however, as shown by (40).

(39)   a.   John read every review of his book that you thought Bill read/did.
         b.   *$\forall x[review(x, J's\ book) \land thought(you, [review(x, B's\ book) \land read(B, x)]]]$
              $[read(J, x)]$

(40)   a.   John bought a picture of himself that you said Bill bought/did.
         b.   *$\exists x[picture(x, j) \land thought(you, [picture(x, b) \land bought(b, x)]) \land bought(j, x)]$

As with degree relatives, however, if the head can be assigned a functional or kind reading,
then a sloppy reading is possible.

(41)   a.   John lives with the relative of his that Bill lives with.   ($\sqrt{}$sloppy)
         b.   John lives with two relatives of his that Bill lives with.   (*sloppy)

(42)   a.   John made every addition to his wine collection that Bill made/did.
         b.   The Linguistics Department made two changes to its grad program that the
              Psych Department made/did.

The semantic similarity between these exceptions and classifier relatives suggests that the
former may be related to the latter. Is there a syntactic similarity as well?

3   Raising vs. Matching

The following table summarizes the observations made so far:

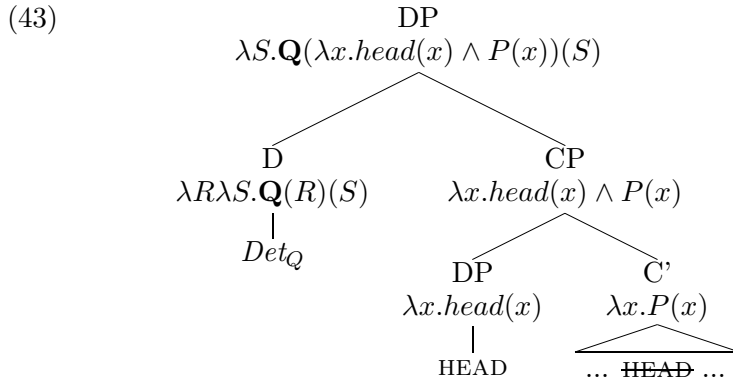What are the predictions of 'vanilla' Raising and Matching analyses?

	DEL	SUBDEL	PG+VPD	SLOPPY ID
Comparatives	always except focus	√	*	√
classifier Relatives	always except focus	√	*	√
Degree Relatives	always	*	√	*
Restrictive Relatives	always	*	√	*

3.1 Raising

Syntax: The head is derived from a clause internal position: HEAD = CORRELATE.

Semantics: The head is interpreted once, presumably either internally or externally, depending on whether it is reconstructed: ONE INSTANCE OF HEAD PREDICATION.

This gives us something like (43) for a typical relative clause construction, assuming the structural analysis in Bianchi 2000.

(43)
$$
\begin{array}{c}
\text{DP} \\
\lambda S.\mathbf{Q}(\lambda x.head(x) \wedge P(x))(S)
\end{array}
$$

D
$\lambda R \lambda S.\mathbf{Q}(R)(S)$
Det_Q

CP
$\lambda x.head(x) \wedge P(x)$

DP
$\lambda x.head(x)$
HEAD

C'
$\lambda x.P(x)$
... ~~HEAD~~ ...

This strict interpretation of the raising analysis, in which the head and the correlate are literally the same expression, makes very clear predictions:

(44) *Predictions of the Raising Analysis*
   i.   *Subdeletion*: Should be impossible if chain copies must be identical.
   ii. *Deletion*: Should be obligatory if only one copy of a chain is pronounced.
   iii. *Parasitic gaps*: Should be possible regardless of whether the base position of the head is contained in an elided phrase, assuming raising involves overt $\overline{\text{A}}$-movement.
   iv. *Sloppy identity*: Should be impossible, since there is only one semantic occurrence of the head.
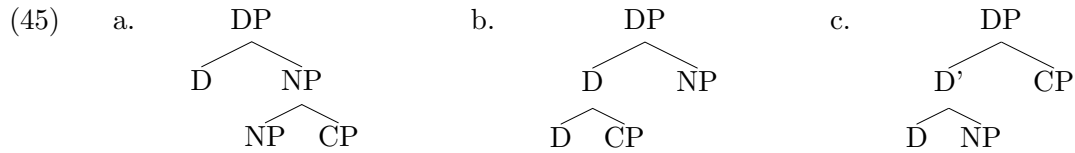
The match between these predictions and our observations suggests that a raising analysis is correct for degree and restrictive relatives, as many people have claimed.
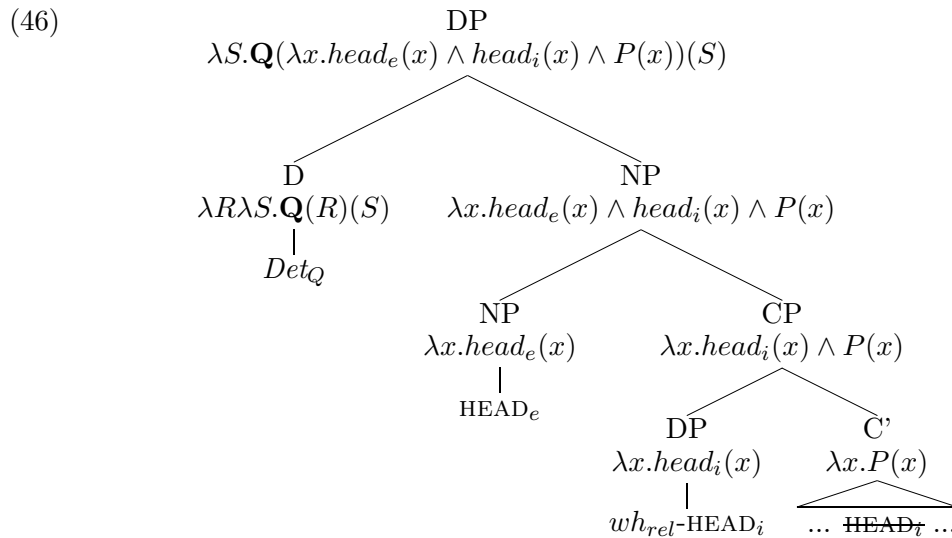
3.2 Matching

Syntax: The head originates in a position external to the clause; the correlate is an "internal" head which raises to SpecCP and deletes under identity with the external head: HEAD ≠ CORRELATE.

Semantics: The head and correlate are each interpreted once: TWO INSTANCES OF HEAD PREDICATION.

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These options allow for a number of different basic structures/interpretations. In particular, we could have an analysis that is parallel to the Raising structure, in which the external head and clause are syntactic/semantic constituents (e.g., (45a)), or one in which they are syntactically/semantically independent (e.g., (45b-c)).

(45)　　a.　　DP　　　　　　　　b.　　DP　　　　　　　c.　　DP

$$\text{a.}\quad [_{DP}\ D\ [_{NP}\ NP\ CP]]\qquad \text{b.}\quad [_{DP}\ D\ [_{NP}\ [D\ CP]]]\qquad \text{c.}\quad [_{DP}\ [D'\ D\ NP]\ CP]$$

Relative clauses are often analyzed in terms of (45a), as shown in (46); something like (45b) or (45c) is what we get in comparatives, as we will see in more detail below.

(46)

$$
\begin{array}{c}
\text{DP}\\
\lambda S.\mathbf{Q}(\lambda x.head_e(x)\wedge head_i(x)\wedge P(x))(S)
\end{array}
$$

$$
\begin{array}{cc}
\text{D} & \text{NP}\\
\lambda R\lambda S.\mathbf{Q}(R)(S) & \lambda x.head_e(x)\wedge head_i(x)\wedge P(x)\\
\mid & \\
Det_Q &
\end{array}
$$

$$
\begin{array}{cc}
\text{NP} & \text{CP}\\
\lambda x.head_e(x) & \lambda x.head_i(x)\wedge P(x)\\
\mid & \\
\textsc{head}_e &
\end{array}
$$

$$
\begin{array}{cc}
\text{DP} & \text{C'}\\
\lambda x.head_i(x) & \lambda x.P(x)\\
\mid & \\
wh_{rel}\text{-}\textsc{head}_i & \ldots \ \sout{\textsc{head}_i}\ \ldots
\end{array}
$$

The predictions of the matching analysis are fairly clear, though there are some questions that need to be answered as well:

(47)　　*Predictions of the Matching Analysis*
　　　　i.　　*Subdeletion*: If the internal and external heads are independent, subdeletion should at least be possible.
　　　　ii.　　*Deletion*: If the external and internal heads are independent, non-deletion should be an option.
　　　　iii.　　*Parasitic gaps*: Since the external head is base generated in its surface position, it is at least possible that no overt $\overline{\text{A}}$-movement occurs.
　　　　iv.　　*Sloppy identity*: If both the internal and external head are interpreted, then sloppy identity is in principle possible.

(48)　　*Questions for the Matching Analysis*
　　　　i.　　Why is deletion of the correlate obligatory in the normal case?
　　　　ii.　　Why does ellipsis of the constituent containing the correlate bleed parasitic gaps?
　　　　iii.　　Why is the sloppy reading so much easier to get when the constituent containing the correlate is elided?

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These predictions point in the direction of a matching analysis for comparatives and classifier relatives. To resolve the open questions, however, we would need to look at a specific implementation of the matching analysis. For those who are interested, check out Kennedy to appear.

4 Raising vs. matching revisited

If the analysis of comparatives extends to matching structures in general, then we are left with the following (no doubt idealized) picture:

- Comparatives and classifier relatives involve matching.

- Degree relatives and restrictive relatives involve raising.

Subdeletion requires some sort of matching structure to get the meaning right, and Kennedy (2002) argues that a raising analysis is descriptively inadequate for comparative deletion (contra Rivero 1981; Kayne 1994; Lechner 1999).

For relative clauses however, we could assign either structure the right interpretation. *Why, then, do we see these correlations?*

4.1 Semantic heads and syntactic heads

I think that the answer has to do with the semantic function of the different clauses.

- Restrictive and degree relatives provide restrictions on quantifiers.

- classifier relatives and comparative clauses denote properties of amounts/degrees.

This suggests the following picture of the syntax-semantics mapping relations in relative and comparative clauses:

- DPs with degree relatives and restrictive relatives have only one head because that's all that's needed to restrict the variable introduced by the quantifier.

- DPs with comparative clauses and classifier relatives have two heads because they introduce relations between degrees. Since degrees are degrees of *something* (cf. Cresswell 1977; Grosu and Landman 1998), we need two nominal heads to supply sortal restrictions on the two degrees.

This needs to be made more precise, but it seems to be on the right track. It would certainly be interesting if it were true, since it would indicate a very tight fit between the syntax and semantics of these constructions.

5 Conclusions

Comparative and relative clauses are not the same, but their differences may follow from their different semantic functions/requirements:

- one semantic sortal ⇔ one syntactic sortal (one head, Raising)

- two semantic sortals ⇔ two syntactic sortals (two heads, Matching)

A minimalist moral?

The amount of structure that a particular construction makes use of is the *minimal* amount that it requires in order to get the meaning right.

The next step is to see how this picture fits with e.g. reconstruction/binding theory phenomena in relative and comparative clauses, and to branch out to other related constructions: free relatives, correlatives, etc.

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