

# Relative pronoun pied-piping, the structure of which informs the analysis of relative clauses<sup>1</sup>

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English allows the construction of relative clauses (RC) which use *wh*-words as relative pronouns, fronted to the edge of the RC.

- (1) **English relative pronoun RC:** (McCawley, 1988, p. 417)  
 $[_{DP}$  The person  $[_{RC}$  *who* John asked  $\_\_\_$  for help]] thinks John is an idiot.

**Today:** We investigate the structure and interpretation of *relative pronoun pied-piping* (RPPP). (We do not discuss *that* /  $\emptyset$  RC.)

- (2) **The relative pronoun can pied-pipe material with it:**  
 $[_{DP}$  The person  $[_{RC}$   $[_{RPPP}$  *whose* parrot] John asked  $\_\_\_$  for help]] thinks John is an idiot.

§1 Background

§2 New evidence from intervention effects

§3 Proposal

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## 1 Background

English RCs come in **restrictive and non-restrictive** (appositive, supplemental) varieties. Both can use relative pronouns with (some degree of) pied-piping. Consider first a simple restrictive RC, as in (3).

- (3) Every semanticist  $[_{RC}$  who I met at SuB] gave a great presentation.

Following Quine (1960); Partee (1973), a.o., the restrictor of *every* is the set of individuals satisfying *semanticist* and " $\lambda x . I \text{ met } x \text{ at SuB}$ ."

Non-restrictive RCs have a very different semantics, **traditionally compared to an independent (conjoined) clause**: (Quine, 1960; Taglicht, 1972; Thorne, 1972; Emonds, 1979; McCawley, 1981; de Vries, 2006)

- (4) Mary, who I met at SuB, gave a great presentation.  
 $\approx$  Mary gave a great presentation. (And) *I met Mary at SuB*.

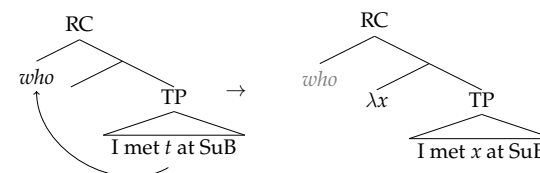
(Following Potts (2005) and citations there, this meaning introduced by the non-restrictive) RC is not part of the asserted content.

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- ☞ This meaning, "I met Mary at SuB," is derived by combining the referent described, *Mary*, with the predicate " $\lambda x . I \text{ met } x \text{ at SuB}$ ."

For both restrictive and non-restrictive RCs, then, we need the RC structure to yield the derived predicate " $\lambda x . I \text{ met } x \text{ at SuB}$ ."

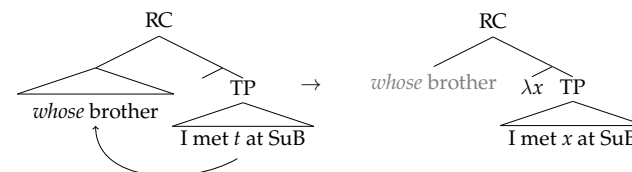
- ☞ This predicate " $\lambda x . I \text{ met } x \text{ at SuB}$ " is formed through **movement of the relative pronoun**, interpreted as  **$\lambda$ -abstraction**.



(Here, assume the relative pronoun is semantically vacuous, as in Heim and Kratzer (1998), p. 186).

This process is complicated with **relative pronoun pied-piping (RPPP)**:

- (5) The girl  $[_{RC}$   $[_{RPPP}$  *whose* brother] I met at SuB]...



Again, movement and  $\lambda$ -abstraction gives us " $\lambda x . I \text{ met } x \text{ at SuB}$ ."

**But this is not the predicate we want.** For the correct interpretation, we need to somehow derive " $\lambda x . I \text{ met } [x's \text{ brother}] \text{ at SuB}$ ."

Two ways to solve this problem of pied-piping:

- ① Covert movement of the *wh*-pronoun out of the pied-piping<sup>2</sup>

- (6)  $[_{RC}$  *who*  $\lambda y$   $[[_{RPPP}$  *y's* brother]  $\lambda x . I \text{ met } x \dots]]$

- ② Interpret the pied-piping as is, with the relative pronoun *in-situ*<sup>3</sup>

**Today:** An argument for the second approach for **English non-restrictive RCs**.

<sup>2</sup>Or similarly: movement of the head of the RC from the relative pronoun itself (Kayne, 1994).

<sup>3</sup>See von Stechow (1996, 2000) for a similar discussion for *wh*-pied-piping.

## 2 New evidence from intervention effects

**Today:** The *wh* relative pronoun in non-restrictive RCs is interpreted *in-situ* inside the pied-piping, specifically using **Rooth-Hamblin alternative computation** (squiggly arrow) (Hamblin, 1973; Rooth, 1985, a.o.).

- (7) [RC [[RPPP *who's* brother]  $\lambda x$  . I met *x*...]]

### 2.1 Intervention effects

Descriptively, *in-situ wh*-elements cannot be c-commanded by *interveners*:

- (8) **Japanese: Intervention effects avoided through scrambling** (exx Tomioka, 2007)
- a. ✓ Hanako-ga nani-o yon-da-no?  
 Hanako-NOM what-ACC read-PAST-Q  
 'What did Hanako read?'
- b. ?? **Dare-mo** nani-o yom-ana-katta-no?  
 no.one what-ACC read-NEG-PAST-Q
- c. ✓ Nani-o **dare-mo** \_\_\_ yom-ana-katta-no?  
  
 what-ACC no.one read-NEG-PAST-Q  
 'What did no one read?'

**Intervention effects affect regions of alternative computation**, but not (overt or covert) mvmt (Beck, 2006; Beck and Kim, 2006; Kotek and Erlewine, to appear; Kotek, 2014, 2015)

- (9) **Intervention affects alternatives, not movement:**
- a. \* [<sub>CP</sub> C ... **intervener** ... *wh* ]
- b. ✓ [<sub>CP</sub> C ... *wh* **intervener** ... *t* ]

### 2.2 Pied-piping and intervention effects

We can also observe intervention effects in *wh*-question pied-piping.

- (10) Jim owns a picture of *which* president
- a. [*Which* president] does Jim own a picture of \_\_\_?  
 b. [*Of which* president] does Jim own a picture \_\_\_?  
 c. [A picture of *which* president] does Jim own \_\_\_?

Cable (2007): In the derivation of a question like (10c), two steps occur:

- Movement of the pied-piping constituent to Spec,CP.
- Inside pied-piping, *wh* is interpreted via Rooth-Hamblin alternative computation between *wh* and the edge of pied-piping.

- (11) **Interpreting (10c) via movement & alternative computation:**  
  
 Rooth-Hamblin alternatives      movement with pied-piping

(A similar proposal has also been made for pied-piping in focus movement (Krifka, 2006; Wagner, 2006; Erlewine and Kotek, 2014).

Sauerland and Heck (2003); Cable (2007); Kotek and Erlewine (to appear) show that *intervention effects* occur inside pied-piped constituents:

- (12) **Intervention effect in English pied-piping:** (exx Cable, 2007)
- a. [A picture of *which* president] does Jim own \_\_\_?  
 b. \* [No pictures of *which* president] does Jim own \_\_\_?  
 c. \* [Few pictures of *which* president] does Jim own \_\_\_?  
 d. \* [Only PICTURES of *which* president] does Jim own \_\_\_?

If an *intervener* is placed between the *wh*-word and the edge of its pied-piping constituent, it results in ungrammaticality.

- (13) **The pied-piping intervention schema:**

\* [<sub>pied-piping</sub> ... **intervener** ... *wh* ]

### 2.3 Intervention in relative pronoun pied-piping

**Recall:** Two theories for the interpretation of RPPP

- ① Covert movement of the *wh*-pronoun out of the pied-piping

(14) ✓ [RC *wh*  $\lambda y$  [[RPPP ... **intervener** ... *y* ... ]  $\lambda x$  . ... *x* ...]]

- ② *In-situ* interpretation of the *wh*-pronoun using Rooth-Hamblin alternative computation

(15) \* [RC [[RPPP ... **intervener** ... *wh* ... ]  $\lambda x$  . ... *x* ...]]

**Prediction:** expect intervention effects if and only if alternatives are used ②!

- ☞ **Relative pronoun pied-piping in non-restrictive relatives is sensitive to this form of intervention:**

- (16) a. ✓ This is the unfortunate recipe, [[an ingredient for *which*] I am missing].  
 b. \* This is the unfortunate recipe, [[no ingredients for *which*] I have at home].

This pattern is not limited to *no*. It occurs with other known pied-piping interveners (Cable, 2007, 2010; Kotek and Erlewine, to appear; Erlewine and Kotek, 2014):

- (17) a. ✓ This recipe, [[three ingredients for *which*] I have...],  
 b. ?? This recipe, [[only [one]<sub>F</sub> ingredient for *which*] I have...],  
 c. ?? This recipe, [[very few ingredients for *which*] I have...],

It is also not the case that these are strange meanings in some way...

☞ No intervention if smaller pied-piping is chosen:

- (18) a. \*  $[_{RC} [_{RPPP} \text{ no ingredients for } \textit{which}] \text{ I have } \_\_ \dots]$  (=16b)  
 b. ✓  $[_{RC} [_{RPPP} \text{ for } \textit{which}] \text{ I have } \text{no ingredients } \_\_ \text{ at home}]$   
 c. ✓  $[_{RC} [_{RP} \textit{which}] \text{ I have } \text{no ingredients for } \_\_ \text{ at home}]$

**NB:** This contrast shows that the pied-piping constituent is not uniformly *reconstructed* into its base position. That would predict no contrast between these pied-piping options.

- (19) **Hypothetical LFs with reconstructed RPPP:**  
 $[_{RC} \text{ I have } \text{no ingredients for } \textit{which} \text{ at home}]$

We observe intervention effects in RPPP whenever an intervener occurs **above the relative pronoun, inside its pied-piping.**

☞ This is explained if **RPPP in non-restrictive RCs is interpreted using Rooth-Hamblin alternative computation**, but not if RPPP is interpreted using (covert) movement of the relative pronoun.

Further support against the movement approach comes from island diagnostics (Ross, 1967). (Covert) movement is island-sensitive.

☞ The relative pronoun can be inside a syntactic island, inside the RPPP.

- (20) a. This portrait,  $[[\text{the background of } \textit{which}] \text{ is quite stunning}]$ ,  
 b. ? This portrait,  $[[\text{the background that was chosen for } \textit{which}] \text{ is quite stunning}]$ , is...

☞ **Non-restrictive RCs allow for larger pied-piping than restrictives** (Emonds, 1976, 1979; Jackendoff, 1977; Nanni and Stillings, 1978, a.o.).

- (21) **Larger pied-piping in non-restrictive relatives:** (exx Cable, 2010)  
 a. This book,  $[_{RC} [_{RPPP} \text{ the reviews of } \textit{which}] \text{ were awful}]$ , is really quite nice.  
 b. \* No book  $[_{RC} [_{RPPP} \text{ the reviews of } \textit{which}] \text{ are awful}]$  is really quite nice.

Hence we cannot test intervention effects in restrictive relatives:


- (22) a. \* QR is one topic  $[[\text{an/every/the/some article(s) about } \textit{which}] \text{ the journal rejected}]$ .  
 b. \* QR is one topic  $[[\text{only one/no/very few article(s) about } \textit{which}] \text{ the journal rejected}]$ .

☞ **We will argue that this is not a coincidence, but points to a fundamental difference between restrictive and non-restrictive relatives.**

### 3 Proposal

We propose that Relative Pronoun Pied-Piping in English non-restrictive RCs is interpreted using **Rooth-Hamblin alternative computation**.

#### 3.1 Background: Rooth-Hamblin alternative computation

- (23)  $[_{RC} [[[_{RPPP} \dots \textit{wh} \dots] \lambda x . \dots x \dots]]$   


- Alternative computation is a method of semantic composition in another “dimension.”
- Alternative computation has been used for the interpretation of in-situ focus (Rooth, 1985, 1992), as well as for interrogative *wh*-words (Hamblin, 1973; Beck, 2006, a.o.).

For example, for a *wh*-in-situ question, alternatives are computed between the in-situ *wh*-word and C (Hamblin, 1973; Beck, 2006, a.o.).

- (24)  $[C [_{TP} \text{ Alex likes } \textit{who} ]]$   


Ordinary semantic values are computed using  $[[\cdot]]^o$  and the alternatives (focus semantic values) using  $[[\cdot]]^f$  (Rooth, 1992, a.o.).

- (25) **The denotation of a *wh*-word:** (Beck, 2006)  
 a.  $[[\textit{who}]^o]$  undefined  
 b.  $[[\textit{who}]^f] = \text{the set of human individuals} = \{\text{Bobby, Chris, Dana}\dots\}$

$[[\cdot]]^f$  is computed recursively, like  $[[\cdot]]^o$ , composing alternatives pointwise.

- (26) a.  $[[TP]^o]$  undefined  
 b.  $[[TP]^f] = \left\{ \begin{array}{l} \lambda w . \text{ Alex likes Bobby in } w, \\ \lambda w . \text{ Alex likes Chris in } w, \\ \lambda w . \text{ Alex likes Dana in } w, \dots \end{array} \right\}$

C takes the alternatives in its complement ( $[[TP]^f]$ ) to form the question denotation (Beck and Kim, 2006; Kotek, 2014, a.o.). The alternatives in  $[[TP]^f]$  correspond to *possible answers* to the question.

This works for the interpretation of *wh*-question pied-piping, too.

- (27)  $[[[_{RP} \textit{whose} \text{ brother}] [ \lambda x [ \text{you like } x ] ] ]]$

- (28)  $[[\textit{whose} \text{ brother}]^f] = \text{the set of brothers} = \left\{ \begin{array}{l} \text{Andrew (= Bobby's brother),} \\ \text{Bill (= Chris's brother),} \\ \text{Fred (= Dana's brother)} \end{array} \right\}$

- (29)  $[[ (27) ]^f] = \left\{ \begin{array}{l} \lambda w . \text{ you like Andrew (= Bobby's brother) in } w, \\ \lambda w . \text{ you like Bill (= Chris's brother) in } w, \\ \lambda w . \text{ you like Fred (= Dana's brother) in } w \end{array} \right\}$

This combines the pied-piping constituent with the rest of the question to derive the correct set of possible answers.

### 3.2 Rooth-Hamblin alternative computation for RPPP: a problem

Now consider the RPPP. In order to construct the derived predicate “ $\lambda x . I \text{ met } [x's \text{ brother}] \text{ at SuB}$ ,” we need the RPPP to provide a **function from individuals to their brothers**.

(30) Mary,  $[_{RC} [_{RPPP} \textit{whose brother}] \lambda x . I \text{ met } x \text{ at SuB } ]$ ,...

☞ However, a naive attempt to interpret RPPP using Rooth-Hamblin alternative computation runs into difficulties.

(31)  $[[\textit{whose brother}]^f]$  = the set of brothers =  $\left\{ \begin{array}{l} \text{John (= Mary's brother),} \\ \text{Bill (= Chris's brother),} \\ \text{Fred (= Dana's brother)} \end{array} \right\}$

(32)  $[[RC]^f]$  =  $\left\{ \begin{array}{l} \lambda w . I \text{ met John at SuB in } w, \\ \lambda w . I \text{ met Bill at SuB in } w, \\ \lambda w . I \text{ met Fred at SuB in } w \end{array} \right\}$

**The problem:** this meaning of RC could be derived from the correct mapping: Mary → John, Chris → Bill, Dana → Fred. But it can also be obtained from other possible functions, e.g. Mary → Fred, Chris → John, Dana → Bill. Once we compute the RC, **the correct mapping between individuals and their brothers cannot be recovered**.

This problem has been observed by previous authors (Rooth 1992 fn. 15, citing Ede Zimmermann (p.c.); Sternefeld 2001; Sauerland and Heck 2003), leading them to ultimately not pursue this approach to the interpretation of RPPP.

### 3.3 The antecedent of a non-restrictive relative: towards a solution

**Important:** Non-restrictive relatives require a referential antecedent (Thorne, 1972; Karttunen, 1976; McCawley, 1988; Potts, 2002, a.o.).

The antecedent of a non-restrictive relative is an E-type anaphor (Sells, 1985; Demirdache, 1991; Del Gobbo, 2007). This is motivated through parallels between non-restrictive RCs and cross-sentential anaphora.

#### (33) Non-restrictive RCs and parallel cross-sentential anaphora:

- a. i. I saw Mary,  $[_{RC} \textit{who}$  was late].
- ii. I saw Mary<sub>i</sub>. She<sub>i/\*j</sub> was late.
- b. i. I go there [whenever I have time],  $[_{RC} \textit{which}$  isn't actually very often].
- ii. I go there [whenever I have time]<sub>i</sub>. It/<sub>that</sub><sub>i/\*j</sub> isn't actually very often. (Sells, 1985)

Non-restrictive relatives are only compatible with referring expressions. The availability of cross-sentential anaphora patterns with non-restrictive RCs:

#### (34) Limits on antecedents of non-restrictives, cross-sentential anaphora:

- a. Indefinites: (Emonds, 1979, p. 236)
  - i. [ $\checkmark$ One,  $\checkmark$ some, \*each, \*no] student at this conference,  $[_{RC} \textit{who}$  I talked to \_\_\_ on the phone], is happy.
  - ii. [ $\checkmark$ One,  $\checkmark$ some, \*each, \*no] student at this conference]; is happy. I talked to him/her<sub>i</sub> on the phone.
- b. Non-specific indefinite under neg: (Demirdache, 1991, p. 134)
  - i. \*I didn't see a donkey,  $[_{RC} \textit{who/which}$  eats too much].
  - ii. \*I didn't see a donkey<sub>i</sub>. It<sub>i</sub> eats too much.

### 3.4 The solution

Following Sells (1985); Demirdache (1991); Del Gobbo (2007), we can dynamically refer to the E-type referent denoted by the antecedent of a non-restrictive RC. For *Mary, whose brother I met at SuB*:

(35)  $\textit{antecedent}_{RC} = \text{Mary}$

We contextually restrict the alternative denotation of the relative pronoun.

(36) a.  $[[\textit{who}]^0]$  undefined  
b.  $[[\textit{who}]^f] = \{\textit{antecedent}_{RC}\} = \{\text{Mary}\}$

(37) a.  $[[\textit{whose brother}]^0]$  undefined  
b.  $[[\textit{whose brother}]^f] = \{\text{John (= M's brother)}\}$

(38) a.  $[[RC]^0]$  undefined  
b.  $[[RC]^f] = \{(\lambda x . I \text{ met } x \text{ at SuB})(\text{John})\} = \{I \text{ met John at SuB}\}$

**Notice that there is no step in this computation where we compute the property “ $\lambda x . I \text{ met } x's \text{ brother at SuB}$ .”**

An operator at the edge of the pied-piping introduces the projective meaning of the non-restrictive relative (cf Potts, 2005).

(39)  $[Op RC]$ : for  $\phi \in [[RC]^f]$ ,  $\phi$  is true

(40)  $[Op [_{RC} \textit{whose brother I met at SuB } ]]$   $\sim$  “I met Mary's brother at SuB” is true

**Q:** Are there cases where the meaning of the non-restrictive RC ranges over a set of individuals?

**A: Apparently no.** Even if a plurality is described, it is described together as a single, plural individual.

- (41) a. Every mother whose son is in the army is concerned. *restrictive*  
 $\Rightarrow$  each (relevant) mother has her own son  
b. Mary and Sue, whose son is in the army, are concerned. *non-restrictive*  
 $\Rightarrow$  Mary and Sue have a son together.

☞ Non-restrictive RCs do not “distribute” over individuals; there is always a single referent (possibly a plurality) which is described.<sup>4</sup>

Note that because we contextually restrict  $[[\textit{wh}]^f]$  to be a singleton set, this is in effect a lot like coindexation/binding.

(42) Mary<sub>i</sub>,  $[[\textit{who}_i's \text{ brother}] I \text{ met at SuB}]$ ,

☞ The crucial difference is that we are computing the RPPP using Rooth-Hamblin alternatives (albeit a singleton set), which makes it susceptible to intervention effects.

#### Non-restrictive relatives are proposition-denoting (Del Gobbo, 2007).

☞ The denotation of RC is constructed without first composing the corresponding predicate.

- This is crucially the case because we are able to restrict the denotation of the relative pronoun in the non-restrictive relative.

#### (43) In-situ interpretation of RPPP in non-restrictive RCs:

$[_{RC} [_{RPPP} \dots \textit{wh} \dots ] \lambda x . \dots x \dots ]]$

Such a solution *cannot* work for restrictive relatives, which modifies nominal domains, not entire referents.

<sup>4</sup>See also discussion of Weakest Crossover in Lasnik and Stowell (1991).

## Restrictive relatives are property-denoting.

☞ Restrictive relatives cannot use Rooth-Hamblin alternatives for their interpretation. They must use a movement strategy (Kayne, 1994).

### (44) Covert movement of *wh*-pronoun in restrictive RCs:

$[_{RC} \textit{wh} \lambda y \textit{ } [[_{RPPP} \dots y \dots ] \lambda x \dots x \dots ]]$   
↑-----↑      ↑-----↑

The current proposal brings RPPP in line with other instances of pied-piping, in questions and focus constructions.

- Pied-piping in all of these cases is interpreted through a combination of movement and Rooth-Hamblin alternative computation.
- All pied-piping constituents are sensitive to intervention effects.

## 3.5 Implications

This proposal helps explain why a *wh*-pronoun must be used with non-restrictive RCs, but a *that*/ $\emptyset$  strategy is available to restrictive RCs.

### (45) Non-restrictive relatives can't be introduced by *that*/ $\emptyset$ :

- Every semanticist [ $_{RC}$  *that*/ $\emptyset$  I met \_\_ at SuB] gave a great talk.
- \* Mary, [ $_{RC}$  *that*/ $\emptyset$  I met \_\_ at SuB], gave a great talk.

☞ Only the *wh*-pronoun strategy can lead to a propositional denotation for RC, because of the semantic contribution of the *wh*.

This proposal explains why **relative pronoun pied-piping in non-restrictive RCs can be substantially larger** than in restrictive RCs.

- ☞ This is due to the semantics of Rooth-Hamblin alternatives.
- R-H alternatives are insensitive to syntactic barriers such as islands, but they are susceptible to intervention effects.
  - Movement, used to interpret restrictive RCs, is sensitive to islands.

## 4 Conclusion

Today we investigated the structure and interpretation of **English relatives with relative pronoun pied-piping (RPPP)**.

**We argued that restrictive and non-restrictive relatives have fundamentally different semantic interpretations.**

Restrictive-relatives are property-denoting, while non-restrictive relatives are proposition-denoting (Del Gobbo, 2007).

- ☞ RPPP in **non-restrictive relatives** is interpreted via **Rooth-Hamblin alternative computation**, with the *wh* relative pronoun *in-situ*.
- ☞ RPPP in **restrictive relatives** is interpreted via **covert movement** (Kayne, 1994, a.o.).

Handouts and slides at <http://mitcho.com> and <http://hkotek.com>.

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