Relative clauses

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Do we face von Stechow's problem for pied-piping in relatives?

1 Null operator theory

Let's start by defining a new type constructor:

(1)   R a := e → a

The relative operators is an inhabitant of R e (an identity function):

(2) Op_{Rel} := λx . x   R e

We can shift a relative operator into a scope taker via a shifter we can call Q_{Rel}.[1]

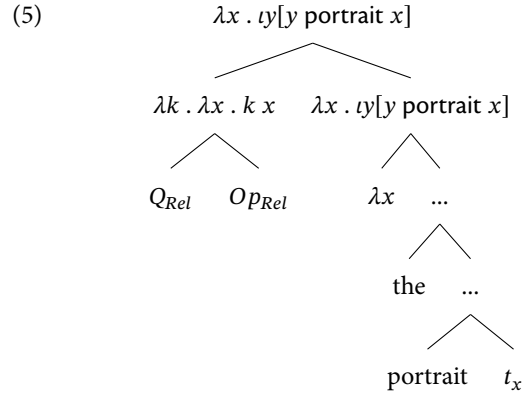[1] This is a flipped version of the fmap of the Reader functor.

(3) Q_{Rel} m := λk . λx . k (m x)   R a → (a → b) → R b
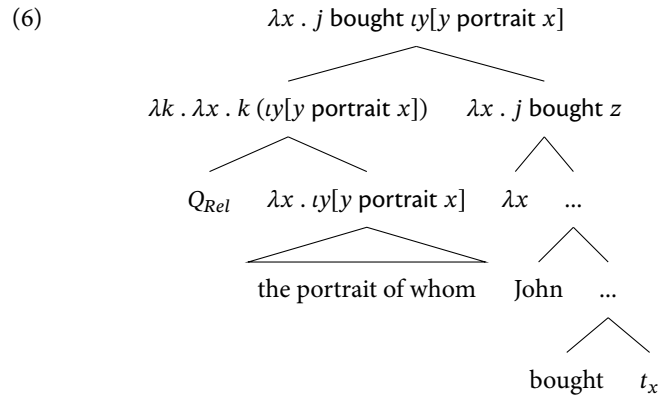
Now we have everything we need to get simple pied-piping:

(4)   Mary met the man [[the portrait of whom] John bought].

1.1 Composition via QR

Let's start with the composition of the pied-piped DP – we shift the relative operator to a scope-taker via Q_{Rel}, and scope it to the edge:

(5)

$$\lambda x \,.\, \iota y[y \text{ portrait } x]$$

Tree:
- $\lambda x \,.\, \iota y[y \text{ portrait } x]$
  - $\lambda k \,.\, \lambda x \,.\, k\ x$
    - Q_{Rel}
    - Op_{Rel}
  - $\lambda x \,.\, \iota y[y \text{ portrait } x]$
    - λx
      - the
        - portrait
        - t_x
      - ...
    - ...

Now we shift the result into a scope-taker via Q_{Rel}, and scope it to the edge of the relative clause, returning a derived predicate:

(6)

$$\lambda x \,.\, j \text{ bought } \iota y[y \text{ portrait } x]$$

Tree:
- $\lambda x \,.\, j \text{ bought } \iota y[y \text{ portrait } x]$
  - $\lambda k \,.\, \lambda x \,.\, k\ (\iota y[y \text{ portrait } x])$
    - Q_{Rel}
    - $\lambda x \,.\, \iota y[y \text{ portrait } x]$
      - the portrait of whom
  - $\lambda x \,.\, j \text{ bought } z$
    - λx
      - John
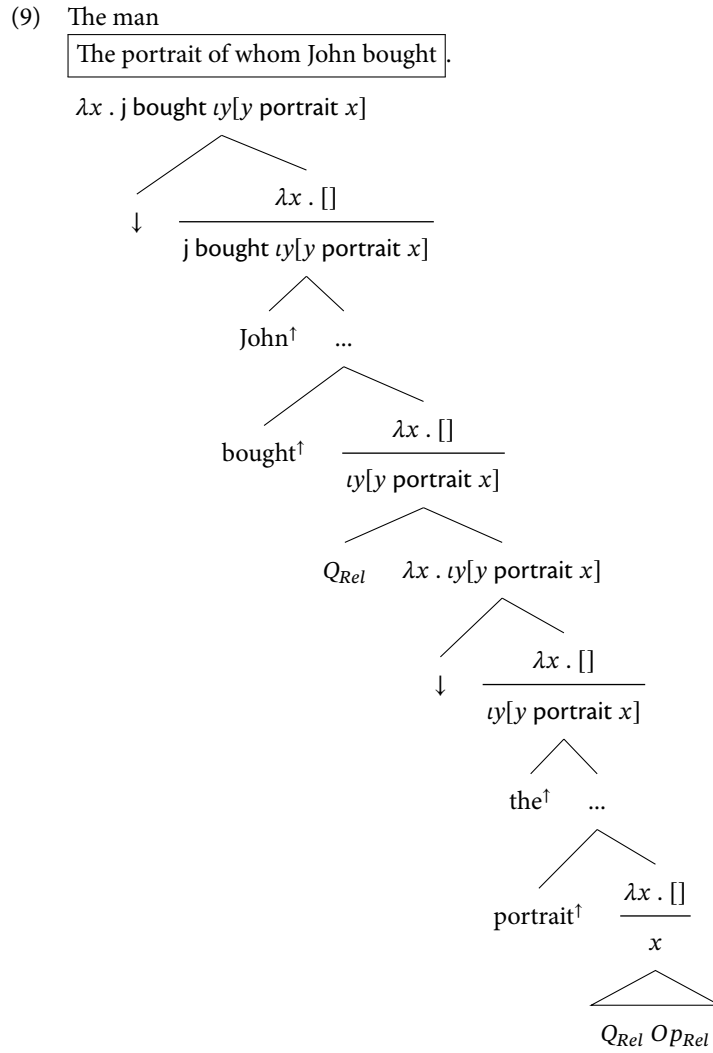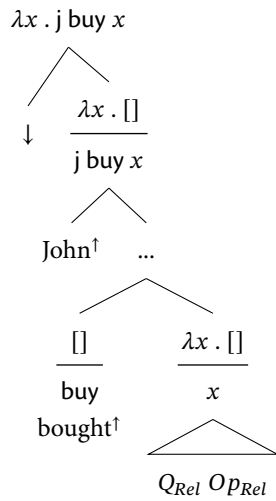   - bought
        - t_x
      - ...
    - ...

1.2   Composition via (indexed) continuations

We can think of the result of applying Q_{Rel} as a tower, in Barker & Shan's (2014) terms.

(7) $Q_{Rel}\ Q_{Op} = \dfrac{\lambda x \,.\, []}{x}$ $\qquad\qquad\qquad\qquad\qquad$ $\dfrac{R\ b \mid b}{e}$

Composition may now proceed *in-situ* via *lift* and *scopal function application*.

(8)   the book $\boxed{\text{that John bought}}$.

$\lambda x \,.\, j \text{ buy } x$

$\lambda x \,.\, []$
$\downarrow$ —————
j buy x

John$^{\uparrow}$ …

[] $\lambda x \,.\, []$
——   —————
buy x
bought$^{\uparrow}$

$Q_{Rel}\ Op_{Rel}$

(9)   The man
| The portrait of whom John bought | .

$\lambda x \,.\, j \text{ bought } \iota y[y \text{ portrait } x]$

$\lambda x \,.\, []$
$\downarrow$ ——————————
j bought $\iota y[y \text{ portrait } x]$

John$^{\uparrow}$ …

bought$^{\uparrow}$ $\lambda x \,.\, []$
——————————
$\iota y[y \text{ portrait } x]$

Q_{Rel} $\lambda x \,.\, \iota y[y \text{ portrait } x]$

$\lambda x \,.\, []$
$\downarrow$ ——————————
$\iota y[y \text{ portrait } x]$

the$^{\uparrow}$ …

portrait$^{\uparrow}$ $\lambda x \,.\, []$
——————
x

$Q_{Rel}\ Op_{Rel}$

References

Barker, Chris & Chung-chieh Shan. 2014. *Continuations and natural language* (Oxford studies in theoretical linguistics 53). Oxford University Press. 228 pp.