Reconstruction is dynamic*

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Overview

Aims of this study:

• give theoretical and empirical limits to previous accounts of Reconstruction (in the generative grammar framework);

• show that Reconstruction is best analyzed within a dynamic framework where grammar and processing interact, i.e. in the spirit of Dynamic Syntax [CKM05].

Main proposal:

Reconstruction corresponds to a delay of interpretation.

1 Reconstruction: a Generative perspective

Reconstruction[1]: interaction between (syntactic) displacement structures in language (interrogation, dislocation, relativization) and interpretation procedures such as the evaluation of referential expressions (proper names, pronouns and anaphors) or scope statements.

In the generative framework, scope statements crucially rely on structural dominance (c-command) and referential expressions are evaluated through binding theory (c-command and co-indexation)[2].

(1) [Which picture of himself$_1$]$_2$ did every student$_1$ give $\_\_{}_2$ to Mary?

⇒ The anaphor *himself* can be interpreted as a variable bound by *every student*, i.e. in the scope of this quantifier, and *picture of himself* has a distributive reading (a different *picture* for *each student*). However, there is no apparent c-command of the binder on the bindee.

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[1]The word "reconstruction" comes from the first analysis of the phenomenon, based on a literal movement of the detached constituent.

[2]-Condition on bound variable anaphora (BVA): a pronoun or an anaphor α can be interpreted as a variable bound by a quantified argument β iff α is bound by β;
-Condition A: an anaphor must be bound by an argument in its local domain;
-Condition B: a pronoun must be free from any argument in its local domain;
-Condition C: an R-expression must be free from any argument.

1.1 Reconstruction, movement and cyclicity

GG account for reconstruction: the copy theory of movement. This is a syntactic mechanism given by Lebeaux [Leb90], Chomsky [Cho95], Sauerland [Sau98] among others, in order to allow interpretation of a displaced constituent in the base position:

(2) (a) [which picture of himself$_1$] did every student$_1$ give [picture of himself$_1$] to Mary?
(b) *[which picture of John$_1$] did he$_1$ give [picture of John$_1$] to Mary?

⇒ Straightforward account for grammaticality of (2a) and ungrammaticality of (2b): the copy of the displaced constituent in the original site predicts that *every student* can have scope over *picture of himself* in (2a) and condition C is violated in (2b)[3].

Prediction I ⇒ movement of an XP should lead to a reconstruction effect of that XP.

⊗ However, Prediction I, entailed by the copy theory of movement and confirmed by cyclicity effects, is falsified in English relative clauses:

(5) The picture of John$_1$ that he$_1$ prefers is on the desk.

⇒ Coreference between *John* and *he* possible. However, reconstruction would lead to ungrammaticality, as Condition C would be violated[4].

1.2 Reconstruction and resumption

Standard arguments for the absence of movement with resumption[5]: the lack of island effects in (6b) and crossover effects in (7b), as data in Breton (from [Gui06]) shows:

(6) *Island Effects:*

(a) **An den$_1$ [a anevez [$_{NP}$ an dud$_2$ [o deus ___$_2$ gwelet ___$_1$]]]*
the man *prt* you-know the people *prt* have seen
*"the man that you know the people who saw"

(b) *An den$_1$ [a anevez [$_{NP}$ an dud$_2$ [o deus ___$_2$ gwelet anezhañ$_1$]]]*
the man *prt* you-know the people *prt* have seen him
"the man that you know the people who saw him"

[3] A further argument for the copy theory of movement: cyclicity effects. Movement is cyclic (see [Cho95], [FP04] among others), and reconstruction displays cyclicity effects, as [Fox00] shows:

(3) (a) Which paper that he$_1$ wrote for Mrs Brown$_2$ did every student$_1$ get her$_2$ to grade?
⇒ Coreference (index 2) and Bound Variable reading (index 1) possible
(b) *Which book that he$_1$ asked Mrs Brown$_2$ for did she$_2$ give every student$_1$?
⇒ Coreference (index 2) and Bound Variable reading (index 1) impossible

The pattern in (3) suggests multiple intermediate sites for reconstruction, even within the IP domain, as argued in [Fox00]:

(4) [which paper that he$_1$ wrote for Mrs Brown$_2$]$_3$ did every student$_1$ _$_3$ get her$_1$ to grade *_$_3$?

[4] This relies on a head-raising analysis of relative clauses (see [Bia95]) where the NP antecedent moves in the base position (without the determiner).

[5] Only few approaches consider a movement analysis of resumption (see [Boe01] or [ACH01]).

(7) *Crossover Effects:*

(a) **Pep den$_1$ [a gare e$_1$ vamm ___$_1$]*
every man *prt* loved his mother
"Every man$_1$ that his$_1$ mother loved"

(b) *Pep den$_1$ [a lares e kare e$_1$ vamm anezhañ$_1$]*
every man *prt* you-say *prt* loved his mother him
"Every man$_1$ that you say that his$_1$ mother loved him"

Prediction II: Resumption (free of movement) should not exhibit reconstruction effects.

⊗ This prediction is falsified by data in Breton (see [Gui06]) and Lebanese Arabic (see [ACH01]):

(8) *poltred$_1$ e$_2$ verc'h [a lares [e wel pep tad$_2$ anezhañ$_1$]]*
picture his daughter *prt* you-say *prt* looks every father it
"the picture$_1$ of his$_2$ daughter that you say that every father$_2$ is looking at it$_1$"

1.3 Positive vs negative conditions

The study of Reconstruction facts with resumption leads to another paradox (data from Breton):

(9) (a) *poltred$_1$ e$_2$ verc'h [a lares [e wel pep tad$_2$ anezhañ$_1$]]* *(BVA)*
"the picture$_1$ of his$_2$ daughter that you say that every father$_2$ is looking at (it$_1$)"

(b) *poltred$_1$ Yann$_2$ [a lares en deus (pro$_2$) en$_1$ gwelet]* *(Condition C)*
picture Yann *prt* you-say *prt* has it seen
"the picture$_1$ of Yann$_2$ that you say that he$_2$ has seen (it$_1$)"

⇒ (9a) argues for **Reconstruction** in the site occupied by the resumptive pronoun, as variable binding (requiring scope of the binder on the bindee) is possible;
⇒ (9b) argues for the **absence of Reconstruction** in this site, as coreference is possible.

1.4 Scope reconstruction: definite vs indefinite antecedents

Based on Alexopoulou & Heycock [AH02]:

(10) (a) The secretary called the patient that each doctor will examine tomorrow.
(b) The secretary called the two patients that each doctor will examine tomorrow.

⇒ The definite antecedent, as in (10a) and (10b), allows for a narrow-scope/distributive reading with respect to *each doctor*, as if part of it were 'reconstructed' in the relativized site ([Bia95]).

(11) (a) The secretary called a patient that each doctor will examine tomorrow.
(b) The secretary called two patients that each doctor will examine tomorrow.

⇒ The indefinite antecedent, as in (11a) and (11b), only allows for a wide-scope (referential or specific) reading, hence does not 'reconstruct' in the relativized site.

To account for the contrast, [AH02] argue that the definite determiner induces a functional interpretation of its restriction (based on [Löb85]).

Prediction III: a definite antecedent allows for reconstruction, an indefinite does not.

⊗ However, this distinction between definite and indefinite antecedents can not capture all the facts, as the examples in (12) show:

(12) (a) Mary saw a picture of himself$_1$ that each man$_1$ has brought.

(b) A woman that each man$_1$ invited was his$_1$ mother.

⇒ Both examples in (12) involve indefinite antecedents which certainly allow for reconstruction (narrow-scope/distributive reading).

2 Dynamic syntax

Based on the following:

- incremental (word by word) building of syntactic and semantic representations as a tree;
- underspecification in language (a kind of context dependency);
- modality, on a node n:

-$\langle\downarrow_0\rangle X$ means 'X holds at an argument-daughter node of n.'
-$\langle\downarrow_1\rangle X$ means 'X holds at a functor-daughter node of n.'
-$\langle\downarrow_*\rangle X$ means 'X holds at a node dominated by n.' (the level of embedding is underspecified)
-$\langle\uparrow_*\rangle X$ means 'X holds at a node that dominates n.' (the level of embedding is underspecified)
-$\langle L^{-1}\rangle X$ means 'X holds at a node that n is linked to.'

- requirements, written as $?X$;
- lexical representation of words as lexical actions (or programs) on the tree;

(13) *Upset'*

IF	$?Ty(e \rightarrow t)$	Trigger
THEN	go($\langle\uparrow_1\rangle ?Ty(t)$),	Go to mother node
	put($Tns(PAST)$),	Tense specification
	go($\langle\downarrow_1\rangle ?Ty(e \rightarrow t)$),	Go to functor node
	make($\langle\downarrow_1\rangle$),	Make a functor node
	go($\langle\downarrow_1\rangle$),	Go to functor node
	put($Fo(Upset'), Ty(e \rightarrow (e \rightarrow t))$);	Decorate
	go($\langle\uparrow_1\rangle$);	Go to mother node
	make($\langle\downarrow_0\rangle$);	Make an argument node
	go($\langle\downarrow_0\rangle$);	Go to argument node
	put($?Ty(e)$)	Decorate
ELSE	ABORT	

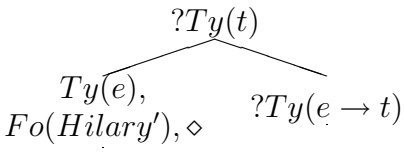
- localization of the node under process with the pointer $\diamond$.

2.1 A sketch of the process

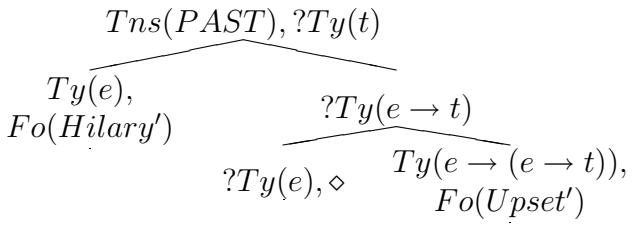
How Dynamic Syntax operates for a sentence like *Hilary upset Joan* ...

-Initial requirement $\Rightarrow ?Ty(t)$

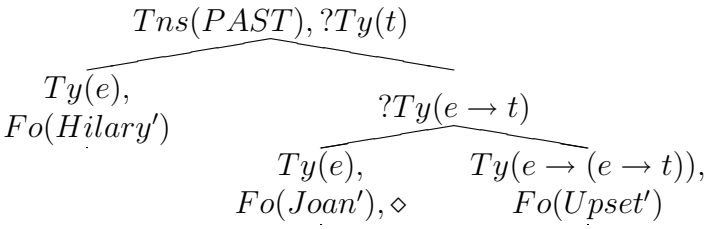
-Parsing *Hilary* $\Rightarrow$



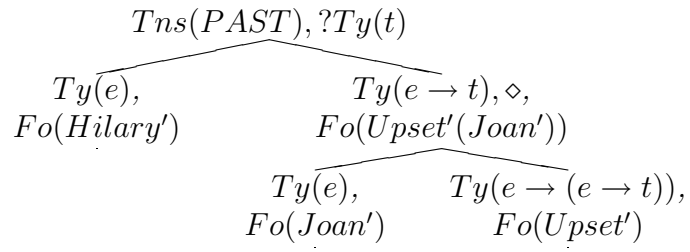
-Parsing *Upset* $\Rightarrow$



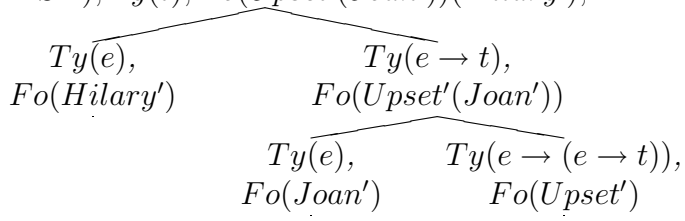
-Parsing *Joan* $\Rightarrow$



-Combination of types/formulas $\Rightarrow$



-Combination of types/formulas $\Rightarrow$ $Tns(PAST), Ty(t), Fo(Upset'(Joan'))(Hilary'), \diamond$



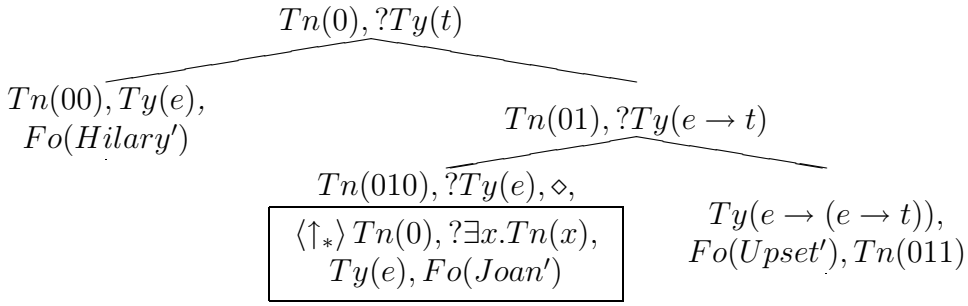
2.2 Movement: structural underspecification+update

2.2.1 Dislocation: structural underspecification

(14) $?Ty(t), \diamond \quad \Rightarrow \quad \dfrac{Tn(0), ?Ty(t)}{\boxed{\langle\uparrow_*\rangle\, Tn(0), ?Ty(e), ?\exists x.Tn(x), \diamond}}$

⇒ The modal statement $\langle\uparrow_*\rangle\, Tn(0)$ creates an unfixed node (process of *Adjunction) which follows the pointer and can then be unified with a fixed position:

(15) Parsing *Joan, Hilary upset*:

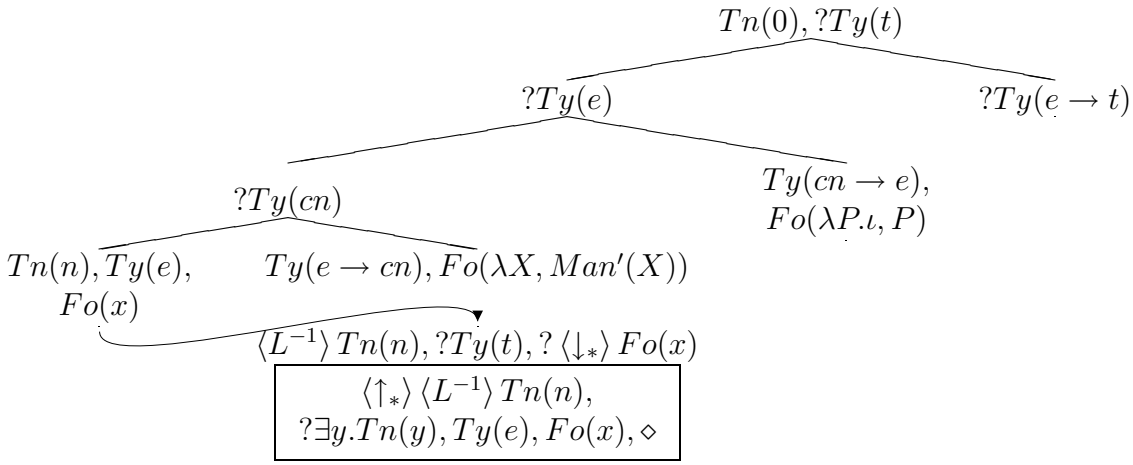


2.2.2 Relativization: LINKed trees

Relativization is designed to express two assertions about one element of type e:

(16) The man that Sue likes left.
⇒ Sue likes a man ∧ the man left.

⇒ In DS, creation of a LINKed tree, and a possible creation of an unfixed node decorated with the formula of the antecedent[6]:



2.3 Resumption

(17) ?A professor who nobody liked him finally retired.

A resumptive pronoun is treated like any pronoun: it introduces an underspecified variable.

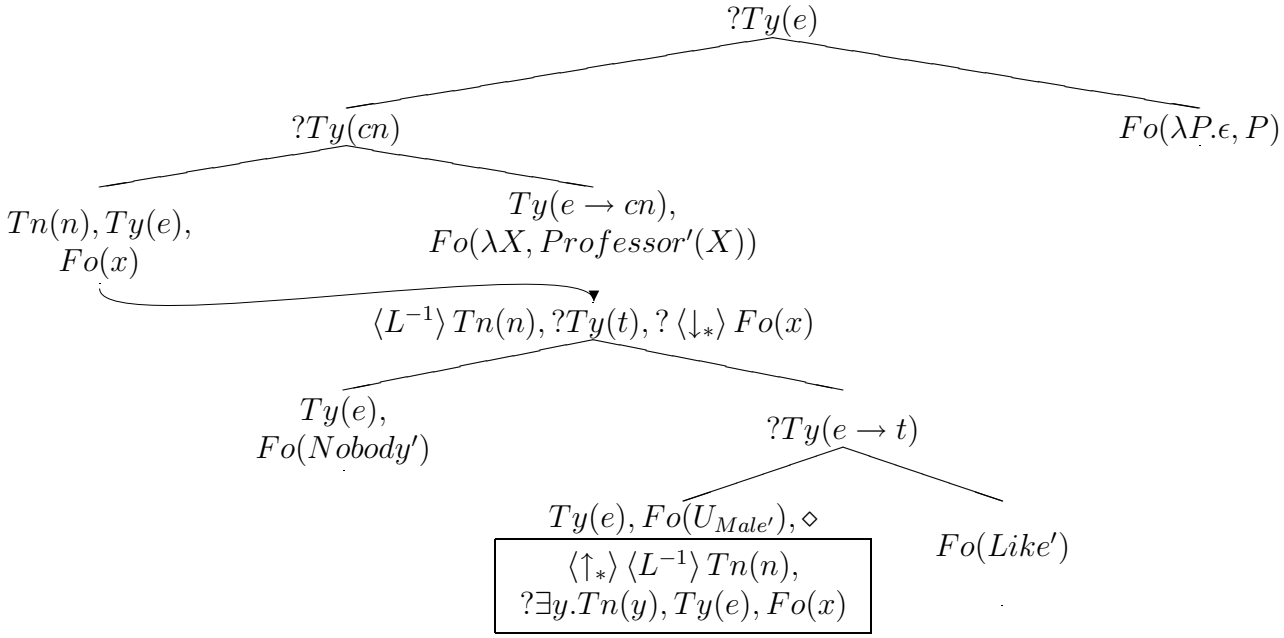
[6]Notice that, in DS, all elements of type e have a complex structure with a variable ($Ty(e)$), a resrictor ($Ty(e \rightarrow cn)$) and a determiner ($Ty(cn \rightarrow e)$).

(18) *him*

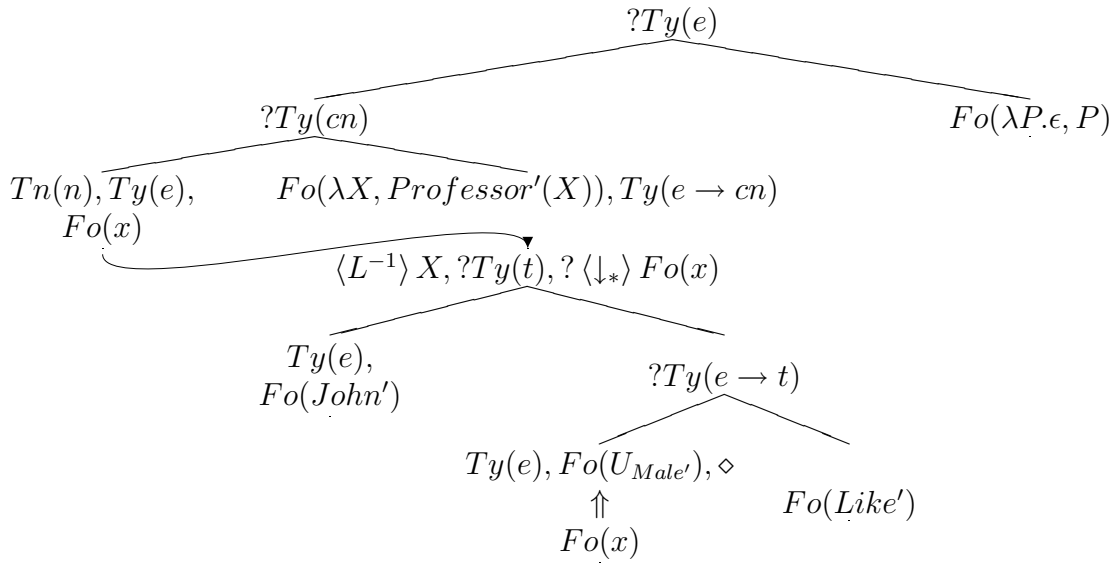
IF	$?Ty(e)$	Trigger
THEN	put($Ty(e), Fo(U_{Male'}),$	Type+Formula Decoration
	$?\exists x.Fo(x)$)	Requirement for a specified formula
ELSE	ABORT	

Technically, two possibilities for the identification of the variable:

- unification with an unfixed node created precedingly:



- substitution with a formula of the context (ex: $Fo(x)$), if no unfixed node was created[7]:



[7]For concreteness, we illustrate this strategy with English. However, notice that [CKM05] propose this alternative for other languages than English (such as Arabic).

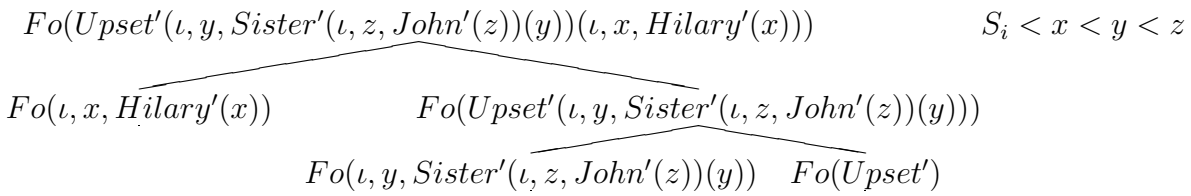
2.4 Scope statements

Scope evaluation is based on the incremental building of scope statements (ex: $x < y$):

• The variables of any element of type e feed scope statements at the local type-t-requiring node. A sequence of scope statements is thereby accumulated on that node.

• Scope ordering follows time-linear evaluation of the variables[8].

(19) Hilary upset the sister of John



3 Dynamic Reconstruction

We propose that reconstruction follows from two parameters:

• Structural or lexical underspecification prevents direct evaluation;

• Unification of an unfixed node gives rise to reconstruction[9].

3.1 Definite antecedents allow for reconstruction

Recall the example:

(20) The secretary called the patient that each doctor will examine tomorrow.
⇒ Reconstruction is possible as narrow-scope/distributive reading of *patient* is available.

Following [Bia95]'s claim that the relativized site of a restrictive is interpreted as an indefinite, we propose a rule which introduces an underspecified choice function of type ($cn \rightarrow e$), written $f_U(X)$, as Fig. 1 shows[10]:

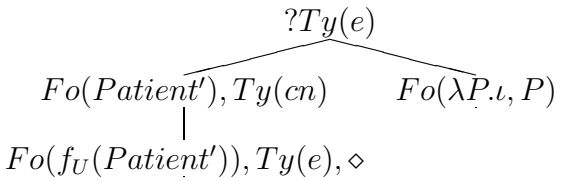


Figure 1. Choice function introduction

⇒ This choice function can be compared to [Kra98]'s parametrized choice functions for indefinites as it takes a restriction and entity as its arguments and returns an entity of type e. The underspecification can then be updated with any variable from the already defined scope statements $(S_i, x, y...)$[11].

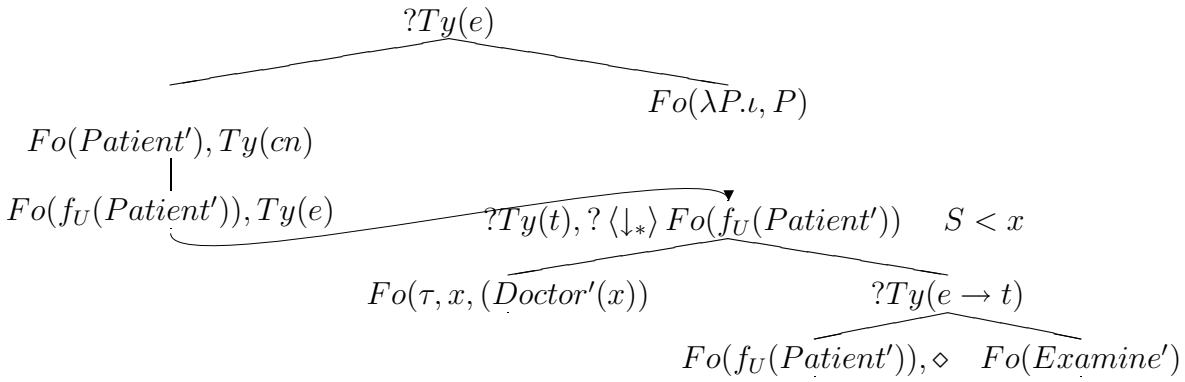
The narrow-scope reading in (20) is then expected, as the choice function can be updated with the variable x ($f_x(Patient')$):

[8] except for the indefinite which has an underspecified scope under [CKM05]'s approach.

[9] Reconstruction then corresponds to a delay in evaluation.

[10] This constitutes a slight modification of [CKM05]'s approach to terms of type e.

[11] We also argue for a generalization of this analysis for indefinites, contra [CKM05]'s approach based on epsilon terms (ϵ).



3.2 The contrast with indefinite antecedents

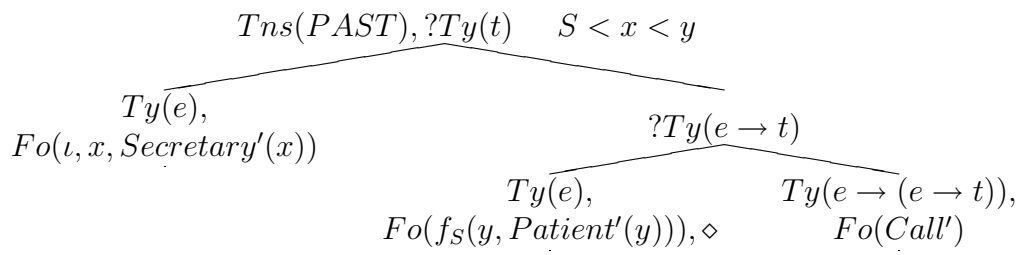
(21) (a) The secretary called a patient that each doctor will examine tomorrow.
⇒ *No reconstruction (wide-scope reading strongly preferred).*

(b) Mary saw a picture of himself$_1$ that each man$_1$ has brought.
⇒ *Reconstruction (narrow-scope reading available).*

(c) A woman that each man$_1$ invited was his$_1$ mother.
⇒ *Reconstruction (narrow-scope reading available).*

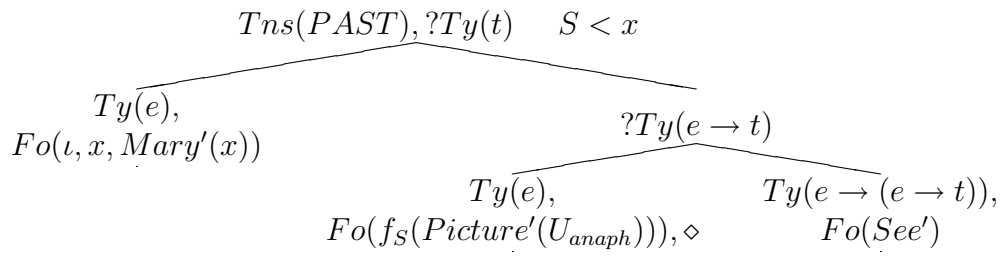
Following dynamic property of language, a string is evaluated as soon as it can be fully specified.

(22) Parsing *the secretary called a patient* in (21a):



⇒ No underspecification left: the string can be evaluated.

(23) Parsing *Mary saw a picture of himself* in (21b):



⇒ Lexical underspecification on the anaphor cannot be updated: the string cannot be evaluated. The unfixed node created in the relative clause will enable delay of evaluation (reconstruction).

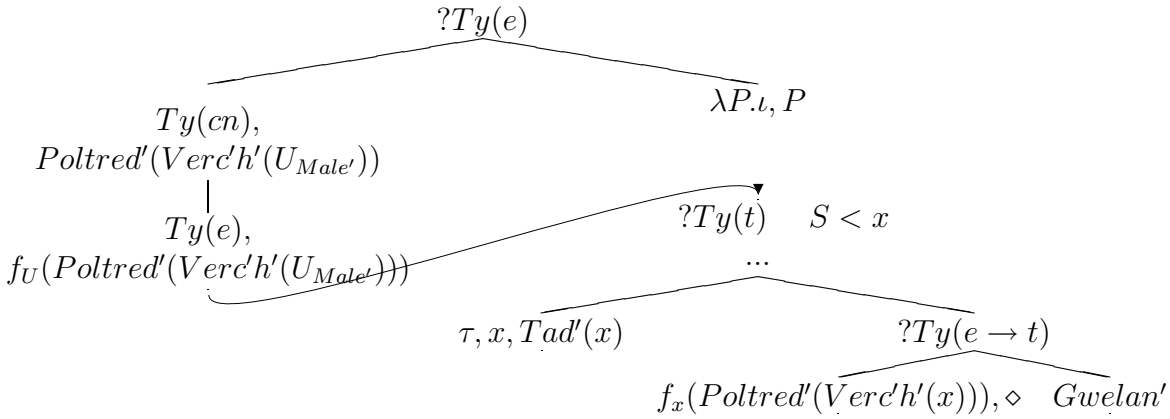
Straightforward account for (21c) too, as incremental building of semantic representation creates an equivalence between two functions:

(24) $f_U[(y, Woman'(y)) \ \wedge \ (\iota, x, Man'(x)) \rightarrow (Invite'(y)(x))] \ = \ g_x[(Mother'(z))]$

3.3 Reconstruction with resumption

How can resumption exhibit reconstruction effects?
-lexical underspecification forces a delay in evaluation: $Fo(Poltred'(Verc'h'(U_{Male'})))$.
-subsequent structural underspecification (possible unfixed node of the relative clause) enables this delay.

(25) *poltred*$_1$ *e*$_2$ *verc'h* *[a* *lares* *[e* *wel* *pep* *tad*$_2$ *anezhañ*$_1$*]]*
picture his daughter *prt* you-say *prt* looks every father it
"the picture$_1$ of his$_2$ daughter that you say that every father$_2$ is looking at it$_1$"



3.4 Positive vs negative conditions

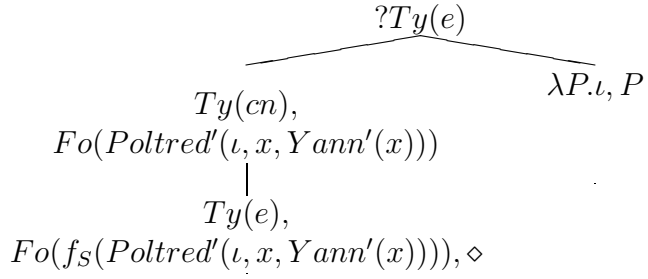
Recall the paradox:

(26) *Binding, Reconstruction and Resumption in Breton:*

(a) *poltred*$_1$ *e*$_2$ *verc'h* *a* *lares* *e* *wel* *pep* *tad*$_2$ *anezhañ*$_1$ *(BVA)*
picture his daughter *prt* you-say *prt* looks every father it
"the picture$_1$ of his$_2$ daughter that you say that every father$_2$ is looking at (it$_1$)"
⇒ *Reconstruction*

(b) *poltred*$_1$ *Yann*$_2$ *[a* *lares* *[en* *deus* *pro*$_2$ *en*$_1$ *gwelet]]* *(Condition C)*
picture Yann *prt* you-say *prt* has it seen
"the picture$_1$ of Yann$_2$ that you say that he$_2$ has seen (it$_1$)"
⇒ *Absence of reconstruction*

(27) Parsing (26b):

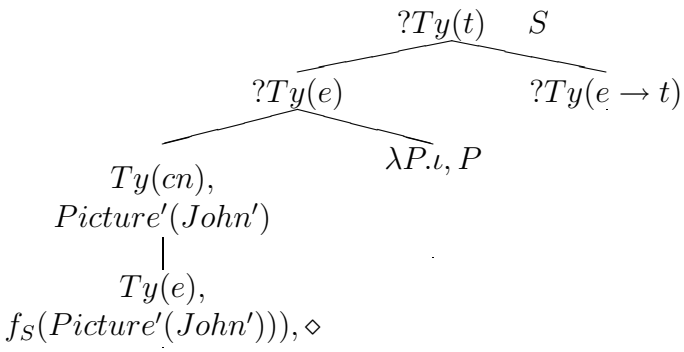


⇒ No lexical underspecification forces reconstruction.

3.5 Reconstruction and movement

(28) The picture of John$_1$ that he$_1$ prefers is on the desk.
⇒ No reconstruction (coreference between *John* and *he* possible).

Why is there no reconstruction in (28)?
⇒ Direct evaluation of the antecedent is possible as there is no underspecification (lexical or structural)[12]:



4 Further argument: English vs Breton

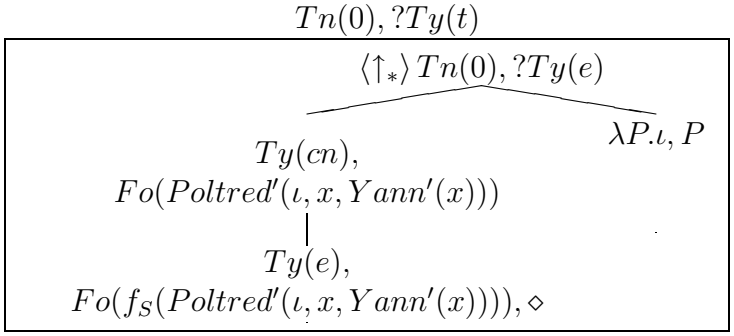
A further argument for this processing approach to reconstruction comes from the following contrast between English and Breton:

(29) (a) The picture of John$_1$ that he$_1$ prefers is on the desk.
⇒ *No reconstruction (coreference between* John *and* he *possible).*

(b) **poltred*$_1$ *Yann*$_2$ *[a gare (pro*$_2$*)]* *a zo bet drailhet.*
picture Yann *prt* loved he *prt* has been torn
"the picture of Yann$_2$ that he$_2$ loved has been torn."
⇒ *Reconstruction (coreference between* John *and* he *impossible).*

What makes Breton different from English?
⇒ Breton is often classified as a V2 language where one constituent of the sentence (anyone) occupies the first position. In DS framework, structural underspecification would be at stake. This underspecification will ban direct evaluation of the antecedent at the local *type-t* node.

(30) Parsing (29b):



[12]There will be structural underspecification only when the relative clause is parsed.

Conclusion

We provided several empirical arguments for a processing account for reconstruction data:
-Lexical underspecification forces reconstruction (as the string cannot be evaluated);
-Structural underspecification (unification of an unfixed node) embodies reconstruction.

Another possible argument for this account: reconstruction data in 'scrambling' languages, treated with structural underspecification in DS.

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