Alternative-based semantics combined with movement:
the role of presupposition

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1. Introduction

■ The following scoping mechanisms (among others) have been proposed in the literature:
- Syntactic movement
- Sets of alternatives

■ Syntactic movement:
In the syntax, a constituent is displaced and leaves a trace behind.
In the semantics, the trace is interpreted as a variable and its λ-binder is introduced by the Predicate Abstraction rule.

(1) a. Alice saw nobody.
b. LF: Nobody 5 [Alice saw t_5]

(2) Predicate Abstraction (PA):

$\lambda x_e.\ [\![\gamma]\!]^{M,g x/\mathbf{i}}$
$\langle e,\tau\rangle$

i $\qquad [\![\gamma]\!]^{M,g}$
$\qquad\quad \tau$

(3) a. $[\![t_5]\!]^{M,g} \quad = \quad g(5)$
b. $[\![saw]\!]^{M,g} \quad = \quad \lambda x.\lambda y.\text{see}(y,x)$
c. $[\![Alice]\!]^{M,g} \quad = \quad a$
d. $[\![Alice\ saw\ t_5]\!]^{M,g} = 1$ iff see(a,g(5))
e. $[\![1\ Alice\ saw\ t_5]\!]^{M,g} = \lambda x.\text{see}(a,g^{x/5}(5))$
$= \lambda x.\text{see}(a,x)$
f. $[\![nobody]\!]^{M,g} = \lambda P.\neg\exists z[P(z)]$
g. $[\![$ nobody $1\ Alice\ saw\ t_5]\!]^{M,g} = 1$ iff
$\neg\exists z\ [\text{see}(a,z)]$

■ Syntactic movement is sensitive to islands: (4).
A c-commanding index of movement i binds the trace t_i even if another c-commanding index of movement j intervenes (provided that $i \neq j$): (5).

(4) a. * Who$_1$ did Taro eat the rice cakes that t_1 bought?
b. * Who$_1$ did Taro leave because t_1 came?

(5) a. Who$_1$ did Taro send every postcard to t_1?
b. LF: Who 1 [did [every postcard] 2 [Taro send t_2 to t_1]]

✓

■ Sets of alternatives:
In the syntax, there is no movement and no trace.
In the semantics, sets of alternative denotations are used, so that the type of expressions is raised from σ to $<\sigma,t>$ (Hamblin 1973). Alternatives are combined by point-wise Functional Application until the intended scope is reached. At that point, alternatives may be "bound" or closed off by an associated operator.

(6) Alice saw whom$_{\text{in-situ}}$.

(7) Point-wise functional application:

$$\{ f(x): f \in [\![\alpha]\!]^{M,g} \wedge x \in [\![\beta]\!]^{M,g} \}$$
$$<\tau,t>$$

$[\![\alpha]\!]^{M,g}$ $<<\sigma,\tau>,t>$ $[\![\beta]\!]^{M,g}$ $<\sigma,t>$

(8) a. $[\![\textit{whom}]\!]^{M,g}$ = { xavier, yves, zack }
b. $[\![\textit{saw}]\!]^{M,g}$ = { $\lambda x.\lambda y.\text{see}(y,x)$ }
c. $[\![\textit{saw whom}]\!]^{M,g}$ = { $\lambda y.\text{see}(y,\text{xavier})$, $\lambda y.\text{see}(y,\text{yves})$, $\lambda y.\text{see}(y,\text{zack})$ }
d. $[\![\textit{Alice}]\!]^{M,g}$ = { a }
e. $[\![\textit{Alice saw whom}]\!]^{M,g}$ = { see(a,xavier), see(a,yves), see(a,zack) }

■ Scope via sets of alternatives is insensitive to islands: (9)-(10). (Shimoyama 2006)
But it does not tolerate an intervening operator that associates with sets of alternatives: a c-commanding operator cannot associate with a set of alternatives if another c-commanding operator that associates with sets of alternatives intervenes: (11)-(12).

(9) Taro-wa [[dare-ga katta] mochi]-o tabemasita ka?
Taro-Top who-NOM bought rice cake-ACC ate Q
'Who$_x$ did Taro eat rice cakes that x bought?'

(10) Taro-wa [[dare-ga kita-kara] kaerimasita ka?
Taro-TOP who-NOM came-because left Q
'Who$_x$ did Taro leave because x came?'

(11) Yoko-wa [[Taro-ga nan-nen-ni nani-nituite kaita ronbun]-mo yuu-datta ka]
Yoko-Top [[Taro-Nom what-year-in what-about wrote paper]-MO A-was Q]
siritagatteiru.
want to know}
a. 'Yoko wonders whether for every topic x, every year y, the paper that Taro wrote on x in y got an A.'
b. * 'Yoko wonders for which year y, for every topic x, the paper that Taro wrote on x in y got an A.'

(12) [[what ... what]-mo$_{\forall}$ ...] Q

- These two scoping mechanisms are often assumed to co-exist in the same language.
  - Syntactic movement: wh-movement, Quantifier Raising (QR), A-movement, etc.
  - Sets of alternatives: indeterminate phrases in Japanese, focus, free choice and epistemic indefinites, etc.

- The question arises, how we can interpret compositionally structures that involve, at the same time, movement and binding of variables and sets of alternatives.

(14) a. Who saw nobody?
b. LF: Nobody 1 [$\text{who}_{\text{in-situ}}$ saw t_1]

(15) a. $[\![\textit{who}]\!]^{M,g}$ = { a, b, c}
b. $[\![\textit{who saw } t_1]\!]^{M,g}$ = { see(a,g(1)), see(b,g(1)), see(c,g(1)) }
c. $[\![\textit{1 who saw } t_1]\!]^{M,g}$ = ???
c'. $[\![\textit{1 who saw } t_1]\!]^{M,g}$ = λx. {see(a,x), see(b,x), see(c,x)} By PA rule (2)
d. $[\![\textit{nobody}]\!]^{M,g}$ = { $\lambda P_{<e,t>}.\neg\exists z[P(z)]$ }
e. ???

- To combine movement with sets of alternatives, an alternative-friendly Predicate Abstraction (PA) rule needs to be defined. Shan (2004) claims that it is not possible to define such a PA rule. Three problems:

PROBLEM ①: Over-generation of functional and pair-list readings (Shan 2004).
PROBLEM ②: Binding into the "generator" of the set of alternatives (e.g. into an in-situ *wh*-phrase, into a free choice indefinite) by an XP that combines point-wise with that set of alternatives (Shan 2004).
PROBLEM ③: Binding into the "generator" of the set of alternatives by an XP that does not combine point-wise with that set of alternatives (Shan, p.c.).

- The GOAL of this talk is to show that these three problems can be circumvented if certain (reasonable) assumptions are made. The solution to problem ① is to assume the general type <<a,τ>,t> from Poesio (1996). The key idea to solve problems ② and ③ is that the "generator" of the set of alternatives has the semantics of a definite description, its presupposition playing a central role.

- Plot of the rest of the talk:
  §2. PROBLEM ① and Poesio's (1996) solution.
  §3. PROBLEM ②:
    §3.1. Problem: Binding into a *wh*-phrase from inside the set of alternatives.
    §3.2. Solution: In-situ *wh*-phrases as definite descriptions (Novel & Romero 2009).
    §3.3. Extension of the proposed solution to free choice indefinites.
  §4. PROBLEM ③: Binding into a *wh*-phrase from outside the set of alternatives.
  §5. Conclusion.

2. PROBLEM ① and Poesio's (1996) solution.

■ Consider (16) again (repeated from (14)): instead of (17), we would need the result in (19) for it to properly combine with $[\![nobody]\!]^{M,g}$.

(16) a. Who saw nobody?
b. LF: Nobody 1 [who$_{\text{in-situ}}$ saw t_1]

(17) $[\![1\ who_{in\text{-}situ}\ saw\ t_1]\!]^{M,g} = \lambda x.\ \{see(a,x), see(b,x), see(c,x)\}$ By PA rule (2)

(18) $[\![nobody]\!]^{M,g} = \{\lambda P_{<e,t>}.\neg\exists z[P(z)]\}$

(19) $[\![1\ who_{in\text{-}situ}\ saw\ t_1]\!]^{M,g} = \{\ \lambda x.see(a,x), \lambda x.see(b,x), \lambda x.see(c,x)\ \}$

■ A type shifting rule can be defined: (20). But there is a caveat. As Shan notes, a function into sets (type <e,<τ,t>>) carries less information with respect to ordering compared to a set of functions (type <e,τ>,t>). If we transpose (17) using the shifting rule in (20), the resulting set will contain uniform <e,t>-functions like the ones in (21), but also non-uniform <e,t>-functions like the ones in (22) with different values for the subject.

(20) $\lambda Q_{<e,<\tau,t>>}.\ \{\ f_{<e,\tau>}: \forall x_e[f(x) \in Q(x)]\ \}$

(21) $\begin{bmatrix} x_1 \rightarrow saw(a,x_1) \\ x_2 \rightarrow saw(a,x_2) \\ x_3 \rightarrow saw(a,x_3) \end{bmatrix}$ $\begin{bmatrix} x_1 \rightarrow saw(b,x_1) \\ x_2 \rightarrow saw(b,x_2) \\ x_3 \rightarrow saw(b,x_3) \end{bmatrix}$ $\begin{bmatrix} x_1 \rightarrow saw(c,x_1) \\ x_2 \rightarrow saw(c,x_2) \\ x_3 \rightarrow saw(c,x_3) \end{bmatrix}$

(22) $\begin{bmatrix} x_1 \rightarrow saw(a,x_1) \\ x_2 \rightarrow saw(c,x_2) \\ x_3 \rightarrow saw(b,x_3) \end{bmatrix}$ $\begin{bmatrix} x_1 \rightarrow saw(a,x_1) \\ x_2 \rightarrow saw(b,x_2) \\ x_3 \rightarrow saw(c,x_3) \end{bmatrix}$ $\begin{bmatrix} x_1 \rightarrow saw(a,x_1) \\ x_2 \rightarrow saw(a,x_2) \\ x_3 \rightarrow saw(c,x_3) \end{bmatrix}$

■ In the literature, an alternative-friendly PA-rule exists that incorporates this transposing (Hagstrom 1998, Kratzer and Shimoyama 2002).

(23) $\{\ f_{<e,\tau>}: \forall x_e\ [\ f(x) \in [\![\gamma]\!]^{M,gx/i}\ ]\ \}$
<<e,τ>,t>

i $[\![\gamma]\!]^{M,g}$
<τ,t>

■ PROBLEM ①: Shan (2004) shows that including non-uniform functions leads to an empirical problem: unwanted functional and pair-list readings in e.g. (24).

(24) Q: Who saw nobody?
A: # His$_1$ mother saw nobody$_1$.
A': # Alice didn't see Xavier, Caroll didn't see Yves, and Barbara didn't see Zack.

■ Poesio's (1996) general type $\langle\langle a,\tau\rangle,t\rangle$.

Poesio proposes that, when using set of alternatives, we use assignment-sensitive denotations like (25). This way, it is possible to have the general type $\langle\langle a,\tau\rangle,t\rangle$ with the set layer as the outermost and the assignment layer inside. With this general type template, the Funtional Application rule (26) is used and the PA-rule (27) can be defined.

(25) a. $[\![t_{1,\,\langle a,e\rangle}]\!]^{M} \quad = \quad \lambda g_a.\ g(1)$
b. $[\![saw_{\langle a,\langle e,\langle e,t\rangle\rangle\rangle}]\!]^{M} \quad = \quad \lambda g_a.\lambda x_e.\lambda y_e.\ see(y,x)$

(26) Point-wise, assignment-sensitive Functional Application rule:
$\{\ \lambda g.f(g)(x(g)) :\ f \in [\![\beta]\!]^{M} \wedge x \in [\![\gamma]\!]^{M}\ \}$
$\langle\langle a,\tau\rangle,t\rangle$

$[\![\beta]\!]^{M,}$ $\qquad$ $[\![\gamma]\!]^{M,g}$
$\langle\langle a,\langle\sigma,\tau\rangle\rangle,t\rangle$ $\qquad$ $\langle\langle a,\sigma\rangle,t\rangle$

(27) Poesio's alternative-friendly PA-rule:
$\{\ \lambda g.\lambda x.f(g^{x/i}) : f \in [\![\gamma]\!]^{M}\ \}$
$\langle\langle a,\langle e,\tau\rangle\rangle,t\rangle$

i $\qquad$ $[\![\gamma]\!]^{M,g}$
$\langle\langle a,\tau\rangle,t\rangle$

(28) a. LF: Nobody 1 [who$_{\text{in-situ}}$ saw t_1]
b. $[\![\textit{who saw } t_1]\!]^{M} = \{\ \lambda g.see(a,g(1)),\ \lambda g.see(b,g(1)),\ \lambda g.see(c,g(1))\ \}$
c. $[\![\textit{1 who saw } t_1]\!]^{M} = \{\ \lambda g.\lambda x.see(a,g^{x/1}(1)),\ \lambda g.\lambda x.see(b,g^{x/1}(1)),\ \lambda g.\lambda x.see(c,g^{x/1}(1))\ \}$
$= \{\ \lambda g.\lambda x.see(a,x),\ \lambda g.\lambda x.see(b,x),\ \lambda g.\lambda x.see(c,x)\ \}$
d. $[\![\textit{nobody}]\!]^{M} = \{\ \lambda g.\lambda P_{\langle e,t\rangle}.\neg\exists z[P(z)]\ \}$
e. $[\![\textit{nobody 1 who saw } t_1]\!]^{M} =$
$\{\ \lambda g.\neg\exists z[see(a,z)],\ \lambda g.\neg\exists z[see(b,z)],\ \lambda g.\neg\exists z[see(c,z)]\ \}$

⇨ (28c) contains only uniform functions, hence PROBLEM ① is solved.

3. PROBLEM ②.

3.1. Problem: Binding into a *wh*-phrase from inside the set of alternatives

■ Shan (2004) points out a second problem for Kratzer and Shimoyama's PA-rule which also applies to Poesio's. The problem arises when we need to bind a variable inside the phrase generating the non-singleton set of alternatives, e.g. the in-situ *wh*-phrase in (29):

(29) a. Which man$_1$ sold which of his$_1$ paintings?
b. LF: Which man 1 [t_1 sold which of his$_1$ paintings]?

■ In (29), for each man, the set of paintings is different. Intuitively (and leaving assignments aside for the moment), we would need (30). But this gives us (31), which has the problematic $\langle e,\langle\tau,t\rangle\rangle$ again.

(30) $[\![1\ [t_1\ sold$ which of $his_1\ paintings]]\!]^M =_{e.g.}$

$$\left[\begin{array}{lll} \text{Velázquez} & \rightarrow & \{\text{Velázquez sold Las Meninas, Velázquez sold The Surrender of Breda}\} \\ \text{Picasso} & \rightarrow & \{\text{Picasso sold Guernica, Picasso sold Three Musicians}\} \\ \ldots & & \end{array}\right]$$

(31) $[\![1\ [t_1\ sold$ which of $his_1\ paintings]]\!]^M = \quad \lambda x.\ \{x \text{ sold } y\text{: } y \text{ is a painting of } x\}$

- Additionally, binding into the *wh*-phrase and QR can take place in the same sentence, as in (32). This means that the type <<e,τ>,t> needed for QR and the problematic type <e,<τ,t>> needed for binding into the *wh*-phrase would have to be interleaved.

(32) a. Which man_1 told nobody about which of his_1 paintings?
b. LF: Which man 1 nobody [2 t_1 told t_2 about which of his_1 paintings $]_{<<e,\tau>,t>}$
c. $\{\ \lambda y.\ g(1)$ told y about z: z is a painting of $g(1)\ \}$
d. LF: Which man [1 nobody 2 t_1 told t_2 about which of his_1 paintings $]_{<e,<\tau,t>>}$
e. $\lambda x.\ \{$ x told nobody about z: z is a painting of x $\}$

3.2. Proposed solution: in-situ *wh*-phrases as definite descriptions.

- Rullmann and Beck (1997) note that *wh*-phrases project existence presuppositions the way definite descriptions do: (33)-(34). They propose to leave *wh*-phrases in their base position and treat them semantically as definites, as in (35b).

(33) a. Bill $\text{knows}_{\text{HOLE}}$ he caught the unicorn.
b. Bill $\text{thinks}_{\text{PLUG}}$ he caught the unicorn.

(34) a. Which unicorn did Bill $\text{know}_{\text{HOLE}}$ he caught?
b. Which unicorn did Bill $\text{think}_{\text{PLUG}}$ he caught?

(35) a. $[\![the\ man\ Sam]\!]^{M,g} = \quad \text{the } (\lambda y.\ \text{man}(y,w) \wedge y=\text{Sam})$
b. $[\![which\ man_i]\!]^{M,g} = \quad \text{the } (\lambda y.\ \text{man}(y,w) \wedge y=x_i)$

- Solution to PROBLEM ② (already proposed in Novel and Romero 2009).
We combine Poesio's general type <<a,τ>,t> and PA-rule with Rullmann and Beck's treatment of *wh*-phrases as definites. That is, a *wh*-phrase does not denote a set of assignment-sensitive name-like denotations anymore, as in (36), but a set of assignment-sensitive definite description-like denotations, as in (37).

(36) $[\![who]\!]^M = \quad \{\ \lambda g.x : x \in D_e\ \}$
$=_{e.g.} \quad \{\ \lambda g.a(lice),\ \ \lambda g.b(arbara),\ \ \lambda g.c(aroll)\ \}$

(37) $[\![who]\!]^M = \quad \{\ \lambda g.\iota v[\text{person}(v) \wedge v=x] : x \in D_e\ \}$
$=_{e.g.} \quad \{\ \lambda g.\iota v[\text{person}(v) \wedge v=a],\ \ \lambda g.\iota v[\text{person}(v) \wedge v=b],\ \ \lambda g.\iota v[\text{person}(v) \wedge v=c]\ \}$

■ *Wh*-phrases as introducing sets of potentially partial functions:

When the *wh*-phrase contains a pronoun bound from the outside, the <a,e>-functions in the set of alternatives will be partial. Consider (38), where G stands for Guernica and LM for Las Meninas. The first <a,e>-function in (38b) will map an assignment g to Guernica if g(1)=Picasso, and it will be undefined otherwise. That is, the set of alternatives will contain as many <a,e>-functions as there are individuals in D_e. But those functions will be partial: they will output an individual d only when d is a painting of g(1)'s.

(38) $[\![\textit{which of his}_1\textit{ paintings}]\!]^M$

a. = $\{\ \lambda g.\iota v[\text{painting-of}(v,g(1)) \wedge v{=}x] : x \in D_e\ \}$

b. $=_{\text{e.g.}}$ $\{\ \lambda g.\iota v[\text{painting-of}(v,g(1)) \wedge v{=}G],\ \ \lambda g.\iota v[\text{painting-of}(v,g(1)) \wedge v{=}LM],\ \ \ldots\ \}$

■ Full semantic computation of first problematic example:

(39) a. Which man_1 sold which of his_1 paintings? (=(29))

b. LF: Which man 1 [t_1 sold which of his_1 paintings]?

(40) Poesio's alternative-friendly PA-rule: (=(27))

$\{\ \lambda g.\lambda x.f(g^{x/i}) : f \in [\![\gamma]\!]^M\ \}$

$<<a,<e,\tau>>,t>$

i $\qquad [\![\gamma]\!]^{M,g}$

$<<a,\tau>,t>$

(41) a. $[\![\textit{sold}]\!]^M$ $= \{\ \lambda g.\lambda x.\lambda y.\ y \text{ sold } x\ \}$

b. $[\![\textit{sold which of his}_1\textit{ paintings}]\!]^M$ $= \{\ \lambda g.\lambda y.\ y \text{ sold } \iota v[\text{paint-of}(v,g(1)) \wedge v{=}G],$
$\lambda g.\lambda y.\ y \text{ sold } \iota v[\text{paint-of}(v,g(1)) \wedge v{=}LM]\ \}$

c. $[\![t_1]\!]^M$ $= \{\ \lambda g.g(1)\}$

d. $[\![t_1\textit{ sold which of his}_1\textit{ paintings}]\!]^M$ $= \{\ \lambda g.\ g(1) \text{ sold } \iota v[\text{paint-of}(v,g(1)) \wedge v{=}G],$
$\lambda g.\ g(1) \text{ sold } \iota v[\text{paint-of}(v,g(1)) \wedge v{=}LM]\ \}$

e. $[\![\textit{1 } t_1\textit{ sold which of his}_1\textit{ paintings}]\!]^M$

$= \{\ \lambda g.\lambda x.\ g^{x/1}(1) \text{ sold } \iota v[\text{paint-of}(v,g^{x/1}(1)) \wedge v{=}G],$
$\lambda g.\lambda x.\ g^{x/1}(1) \text{ sold } \iota v[\text{paint-of}(v,g^{x/1}(1)) \wedge v{=}LM]\ \}$

$= \{\ \lambda g.\lambda x.\ x \text{ sold } \iota v[\text{paint-of}(v,x) \wedge v{=}G],$
$\lambda g.\lambda x.\ x \text{ sold } \iota v[\text{paint-of}(v,x) \wedge v{=}LM]\ \}$

f. $[\![\textit{which man}]\!]^M$ $= \{\ \lambda g.\iota z[\text{man}(z) \wedge z{=}\text{Picasso}],$
$\lambda g.\iota z[\text{man}(z) \wedge z{=}\text{Velázquez}]\ \}$

g. $[\![\textit{which man 1 } t_1\textit{ sold which of his}_1\textit{ paintings}]\!]^M$ =

$\{\ \lambda g.\ \iota z[\text{man}(z) \wedge z{=}\text{Picasso}] \text{ sold } \iota v[\text{paint-of}(v,\iota z[\text{man}(z) \wedge z{=}\text{Picasso}]) \wedge v{=}G],$
$\lambda g.\ \iota z[\text{man}(z) \wedge z{=}\text{Picasso}] \text{ sold } \iota v[\text{paint-of}(v,\iota z[\text{man}(z) \wedge z{=}\text{Picasso}]) \wedge v{=}LM],$ #
$\lambda g.\ \iota z[\text{man}(z) \wedge z{=}\text{Velázquez}] \text{ sold } \iota v[\text{paint-of}(v,\iota z[\text{man}(z) \wedge z{=}\text{Velázquez}]) \wedge v{=}G],$ #
$\lambda g.\ \iota z[\text{man}(z) \wedge z{=}\text{Velázquez}] \text{ sold } \iota v[\text{paint-of}(v,\iota z[\text{man}(z) \wedge z{=}\text{Velázquez}]) \wedge v{=}LM]\ \}$

⇨ Some of alternatives in (41g) are presupposition failures (marked as #). (41g) captures Shan's intuition that, for a man x, we can only felicitously choose among x's paintings, and it does so while avoiding the problematic type <e,<τ,t>>. PROBLEM ② is solved.

■ Full semantic computation of problematic example allegedly with interleaving types:

(42) a. Which man_1 told nobody about which of his_1 paintings? (=(32))
b. LF: Which man 1 [nobody 2 [t_1 told t_2 about which of his_1 paintings]]

(43) a. $[\![\textit{told}]\!]^M$ = { λg.λx.λy.λz. z told x about y }
b. $[\![t_2]\!]^M$ = { λg. g(2) }
c. $[\![\textit{told } t_2]\!]^M$ = { λg.λy.λz. z tells g(2) about y }
d. $[\![\textit{which of his}_1\textit{ paintings}]\!]^M$ = { λg.ιv[painting-of(v,g(1)) ∧ v=x] : x ∈ D_e }
e. $[\![\textit{tell } t_2 \textit{ about which of his}_1\textit{ paintings}]\!]^M$ =
= { λg.λz. z tells g(2) about ιv[paint-of(v,g(1)) ∧ v=x] : x ∈ D_e }
f. $[\![t_1 \textit{ tell } t_2 \textit{ about which of his}_1\textit{ paintings}]\!]^M$ =
= { λg. g(1) tells g(2) about ιv[paint-of(v,g(1)) ∧ v=x] : x ∈ D_e }
g. $[\![2\ t_1 \textit{ tell } t_2 \textit{ about which of his}_1\textit{ paintings}]\!]^M$ =
= { $\lambda g.\lambda u_e.\ g^{u/2}(1)$ tells $g^{u/2}(2)$ about ιv[paint-of(v,$g^{u/2}(1)$) ∧ v=x] : x ∈ D_e }
= { $\lambda g.\lambda u_e.\ g^{u/2}(1)$ tells u about ιv[paint-of(v,$g^{u/2}(1)$) ∧ v=x] : x ∈ D_e }
h. $[\![\textit{nobody}]\!]^M$ = { $\lambda g.\lambda P_{<e,t>}.\neg\exists u[P(u)]$ }
i. $[\![\textit{nobody } 2\ t_1 \textit{ tell } t_2 \textit{ about which of his}_1\textit{ paintings}]\!]^M$ =
= { λg. ¬∃u [$g^{u/2}(1)$ tells u about ιv[paint-of(v,$g^{u/2}(1)$) ∧ v=x]] : x ∈ D_e }
j. $[\![1 \textit{ nobody } 2\ t_1 \textit{ tell } t_2 \textit{ about which of his}_1\textit{ paintings}]\!]^M$ =
= { $\lambda g.\lambda w_e$. ¬∃u [$g^{w/1\ u/2}(1)$ tells u about ιv[paint-of(v,$g^{w/1\ u/2}(1)$) ∧ v=x]] : x ∈ D_e }
= { $\lambda g.\lambda w_e$. ¬∃u [w tells u about ιv[paint-of(v,w) ∧ v=x]] : x ∈ D_e }
k. $[\![\textit{which man}]\!]^M$ = { λg. ιy[man(y) ∧ y=z] : z ∈ D_e }
l. $[\![\textit{which man } 1 \textit{ nobody } 2\ t_1 \textit{ tell } t_2 \textit{ about which of his}_1\textit{ paintings}]\!]^M$ =
= { λg. ¬∃u [ιy[man(y) ∧ y=z] tells u about ιv[paint-of(v, ιy[man(y) ∧ y=z]) ∧ v=x]] : x ∈ D_e ∧ z ∈ D_e }

3.3. Extension of the proposed solution to free choice indefinites.

■ Kratzer and Shimoyama (2002) propose that free choice NPs like German *irgendeinen Studenten* in (44) are interpreted as introducing a (widened) set of students: (45). The set of alternatives is closed off when the relevant operator is encountered, e.g. *kann* 'can'.

(44) Hans kann irgendeinen Studenten besuchen.
Hans can anyone student visit. 'Hans can visit any student.'

(45) $[\![\textit{irgendein Student}]\!]^{M,g}$ = {x: x is a student in w}

■ There exist examples where we need to bind into a free choice indefinite, that is, examples with the problematic configuration described in PROBLEM 2: (46). To circumvent the problem, one would need to treat free choice indefinites as underlying *definites*: (47).

(46) a. John can introduce any student_1 to any professor of his_1.
b. LF: Can [any student 1 John introduces t_1 to any professor of his_1]

(47) $[\![\textit{any professor of his}_1]\!]^M$ = { λg.ιv[prof-of(v,g(1)) ∧ v=x] : x ∈ D_e }

■ In fact, Rullmann and Beck's diagnosis applies to free choice indefinites as well:

(48) a. John is $\text{looking}_{\text{PLUG}}$ for the whitest unicorn.
b. John can $\text{look}_{\text{PLUG}}$ for any unicorn.

4. PROBLEM 3: Binding into a *wh*-phrase from outside the set of alternatives.

■ Shan (p.c.) wonders how the proposed analysis fares when binding into the "generator" of the set of alternatives is done by an XP that does not combine point-wise with that set of alternatives. PROBLEM ③: he asks how we analyse (49) and predict the infelicity of (50).

(49) Every man_1 wonders / knows which of his_1 paintings is good.

(50) #Every man_1 wonders / knows which of his_1 hearts is good.

■ Abridged computation of (49) under the proposed analysis:

(51) a. ⟦*which of his_1 paintings is good* $⟧^M$
= { λg. ιx[x=v & x ≤ σy[*paint-of(y,g(1))]] is good : v ∈ D_e }
$=_{e.g.}$ { λg. ιx[x=A & x ≤ σy[*paint-of(y,g(1))]] is good,
λg. ιx[x=B & x ≤ σy[*paint-of(y,g(1))]] is good,
λg. ιx[x=C & x ≤ σy[*paint-of(y,g(1))]] is good,
λg. ιx[x=D & x ≤ σy[*paint-of(y,g(1))]] is good }

b. ⟦*t_1 knows which of his_1 paintings is good*⟧
= λg. g(1) knows { ιx[x=v & x ≤ σy[*paint-of(y,g(1))]] is good : v ∈ D_e }

c. ⟦1 t_1 knows which of his_1 paintings is good $⟧^M$
= λg.λz. z knows { ιx[x=v & x ≤ σy[*paint-of(y,z)]] is good : v ∈ D_e }
=e.g. λg.λz. z knows { ιx[x=A & x ≤ σy[*paint-of(y,z)]] is good ,
ιx[x=B & x ≤ σy[*paint-of(y,z)]] is good ,
ιx[x=C & x ≤ σy[*paint-of(y,z)]] is good ,
ιx[x=D & x ≤ σy[*paint-of(y,z)]] is good }

⇨ Note that, for any value of g(1) in (51a), each of the functions in the embedded set shares the presupposition that g(1) has more than one painting. Projecting up to λz and *everyone*, the sentence presupposes that everyone relevant has more than one painting, as in (52). This explains #(50).

(52) λg.λz: $\exists_{>1}$y[*paint-of(y,z)]. z knows ...

⇨ Note that, for any value of of g(1) in (51a), each of the embedded functions raises a *different* presupposition about the identity of the ιx element.

How should these non-shared presuppositions project?

■ Towards a solution: We could make these non-shared atomic presuppositions project as a disjunctive presupposition, as in (53). The overall presupposition and assertion of (49) would then be as in (54)-(55).

(53) λg.λz: (A≤σy[*paint-of(y,z)] ∨ B≤σy[*paint-of(y,z)] ∨
C≤σy[*paint-of(y,z)] ∨ D≤σy[*paint-of(y,z)]).
z knows ...

(54) Presupposition of (49):

$\lambda g.\ \forall z\ [man(z) \rightarrow \exists_{>1} y[*paint\text{-}of(y,z)] \wedge$
$[\ A \leq \sigma y[*paint\text{-}of(y,z)] \vee B \leq \sigma y[*paint\text{-}of(y,z)] \vee$
$C \leq \sigma y[*paint\text{-}of(y,z)] \vee D \leq \sigma y[*paint\text{-}of(y,z)]\ ]\ ]$

This boils down to:

$\lambda g.\ \forall z\ [man(z) \rightarrow \exists_{>1} y[*paint\text{-}of(y,z)]\ ]$

(55) Assertion of (49):

$\lambda g.\ \forall z\ [man(z) \rightarrow$ z knows { $\iota x[\ x{=}A\ \&\ x \leq \sigma y[*paint\text{-}of(y,z)]\ ]$ is good ,
$\iota x[\ x{=}B\ \&\ x \leq \sigma y[*paint\text{-}of(y,z)]\ ]$ is good ,
$\iota x[\ x{=}C\ \&\ x \leq \sigma y[*paint\text{-}of(y,z)]\ ]$ is good ,
$\iota x[\ x{=}D\ \&\ x \leq \sigma y[*paint\text{-}of(y,z)]\ ]$ is good }

- This type of disjunctive projection seems possible in other constructions claimed to involve sets of alternatives, e.g. *or*.

(56) Every boy$_1$ (either) brought his$_1$ dog or his$_1$ cat.
a. Potential presupposition 1: Every relevant boy has a dog and a cat.
b. Potential presupposition 2: Every relevant boy has a dog or a cat.

- More empirical research is needed to assess what projection patterns exist for non-shared presuppositions in a set of alternatives.

5. Conclusion.

Shan's three problems can be avoided if we make certain assumptions, in particular:

PROBLEM ①: Overgeneration of functional and pair-list readings.
⇨ Solution: Poesio's (1996) general type $<<a,\tau>,t>$.

PROBLEM ②: Binding into the *wh*-phrase from inside the set of alternatives.
⇨ Solution: *wh*-phrases (Rullmann and Beck 1997) as well as other alternative "generators" as definite descriptions.

PROBLEM ③: Binding into the *wh*-phrase from outside the set of alternatives.
⇨ Solution, to be further tested empirically: non-shared presuppositions in a set of alternatives (can) project disjuntively.

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