

# 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

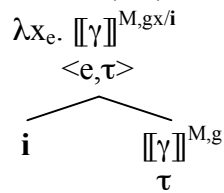
- Syntactic movement:

In the syntax, a constituent is displaced and leaves a trace behind.

In the semantics, the trace is interpreted as a variable and its  $\lambda$ -binder is introduced by the Predicate Abstraction rule.

- (1) a. Alice saw nobody.  
b. LF: Nobody <sub>5</sub> [Alice saw <sub>t<sub>5</sub></sub>]

- (2) Predicate Abstraction (PA):



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

- 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<sub>1</sub> did Taro eat the rice cakes that <sub>t<sub>1</sub></sub> bought?  
b. \* Who<sub>1</sub> did Taro leave because <sub>t<sub>1</sub></sub> came?
- (5) a. Who<sub>1</sub> did Taro send every postcard to <sub>t<sub>1</sub></sub>?  
b. LF: Who <sub>1</sub> [did [every postcard] <sub>2</sub> [Taro send <sub>t<sub>2</sub></sub> to <sub>t<sub>1</sub></sub> ] ]



■ 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  $\sigma$  to  $\langle\sigma, t\rangle$  (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<sub>in-situ</sub>.

(7) Point-wise functional application:

$$\begin{array}{c} \{ f(x): f \in \llbracket \alpha \rrbracket^{M,g} \wedge x \in \llbracket \beta \rrbracket^{M,g} \} \\ \langle \tau, t \rangle \\ \swarrow \quad \searrow \\ \llbracket \alpha \rrbracket^{M,g} \quad \llbracket \beta \rrbracket^{M,g} \\ \langle \langle \sigma, \tau \rangle, t \rangle \quad \langle \sigma, t \rangle \end{array}$$

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

■ 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<sub>x</sub> 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<sub>x</sub> 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<sub>v</sub> ... ] 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 <sub>1</sub> [ *who*<sub>in-situ</sub> saw *t*<sub>1</sub> ]

(15) a.  $\llbracket who \rrbracket^{M,g} = \{ a, b, c \}$   
 b.  $\llbracket who \text{ saw } t_I \rrbracket^{M,g} = \{ \text{see}(a,g(1)), \text{see}(b,g(1)), \text{see}(c,g(1)) \}$   
 c.  $\llbracket I \text{ who saw } t_I \rrbracket^{M,g} = ???$   
 c'.  $\llbracket I \text{ who saw } t_I \rrbracket^{M,g} = \lambda x. \{ \text{see}(a,x), \text{see}(b,x), \text{see}(c,x) \}$  By PA rule (2)  
 d.  $\llbracket nobody \rrbracket^{M,g} = \{ \lambda P_{\langle e,t \rangle}. \neg \exists z [P(z)] \}$   
 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  $\langle\langle a, \tau \rangle, t \rangle$  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  $\llbracket nobody \rrbracket^{M,g}$ .

(16) a. Who saw nobody?

b. LF: Nobody 1 [ who<sub>in-situ</sub> saw t<sub>1</sub> ]

(17)  $\llbracket I \text{ who}_{in-situ} \text{ saw } t_I \rrbracket^{M,g} = \lambda x. \{ \text{see}(a,x), \text{see}(b,x), \text{see}(c,x) \}$  By PA rule (2)

(18)  $\llbracket nobody \rrbracket^{M,g} = \{ \lambda P_{\langle e, \tau \rangle}. \neg \exists z [ P(z) ] \}$

(19)  $\llbracket I \text{ who}_{in-situ} \text{ saw } t_I \rrbracket^{M,g} = \{ \lambda x. \text{see}(a,x), \lambda x. \text{see}(b,x), \lambda x. \text{see}(c,x) \}$

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

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

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

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

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

(23)  $\{ f_{\langle e, \tau \rangle}: \forall x_e [ f(x) \in \llbracket \gamma \rrbracket^{M, g^{x/i}} ] \}$   
 $\langle \langle e, \tau \rangle, t \rangle$   
  
 $i$        $\llbracket \gamma \rrbracket^{M, g}$   
 $\langle \tau, t \rangle$

- PROBLEM ②: 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<sub>1</sub> mother saw nobody<sub>1</sub>.

A': # Alice didn't see Xavier, Carroll 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 Functional Application rule (26) is used and the PA-rule (27) can be defined.

$$(25) \quad \begin{array}{l} \text{a. } \llbracket t_1, \langle a, e \rangle \rrbracket^M = \lambda g_a. g(1) \\ \text{b. } \llbracket saw_{\langle a, \langle e, \langle e, t \rangle \rangle} \rrbracket^M = \lambda g_a. \lambda x_e. \lambda y_e. see(y, x) \end{array}$$

- (26) Point-wise, assignment-sensitive Functional Application rule:  
 $\{ \lambda g. f(g)(x(g)) : f \in \llbracket \beta \rrbracket^M \wedge x \in \llbracket \gamma \rrbracket^M \}$

$$\begin{array}{c} \langle\langle a, \tau \rangle, t \rangle \\ \wedge \\ \begin{array}{cc} \llbracket \beta \rrbracket^M, & \llbracket \gamma \rrbracket^{M, g} \\ \langle\langle a, \langle \sigma, \tau \rangle \rangle, t \rangle & \langle\langle a, \sigma \rangle, t \rangle \end{array} \end{array}$$

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

$$\{ \lambda g. \lambda x. f(g^{x/i}) : f \in \llbracket \gamma \rrbracket^M \}$$

$$\begin{array}{c} \langle\langle a, \langle e, \tau \rangle \rangle, t \rangle \\ \wedge \\ \begin{array}{cc} \mathbf{i} & \llbracket \gamma \rrbracket^{M, g} \\ & \langle\langle a, \tau \rangle, t \rangle \end{array} \end{array}$$

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

⇒ (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<sub>1</sub> sold which of his<sub>1</sub> paintings?  
 b. LF: Which man 1 [  $t_1$  sold which of his<sub>1</sub> 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.

$$(30) \quad \llbracket I [t_1 \text{ sold which of his}_1 \text{ paintings}] \rrbracket^M =_{\text{e.g.}} \left[ \begin{array}{l} \text{Velázquez} \rightarrow \{ \text{Velázquez sold Las Meninas, Velázquez sold The Surrender of Breda} \} \\ \text{Picasso} \rightarrow \{ \text{Picasso sold Guernica, Picasso sold Three Musicians} \} \\ \dots \end{array} \right]$$

$$(31) \quad \llbracket I [t_1 \text{ sold which of his}_1 \text{ paintings}] \rrbracket^M = \lambda x. \{ x \text{ sold } y: y \text{ is a painting of } x \}$$

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

- (32) a. Which man<sub>1</sub> told nobody about which of his<sub>1</sub> paintings?  
 b. LF: Which man 1 nobody [2 t<sub>1</sub> told t<sub>2</sub> about which of his<sub>1</sub> paintings ] $\langle\langle e, \tau \rangle, t \rangle$   
 c. {  $\lambda y. g(1)$  told y about z: z is a painting of g(1) }  
 d. LF: Which man [1 nobody 2 t<sub>1</sub> told t<sub>2</sub> about which of his<sub>1</sub> paintings ] $\langle e, \langle \tau, t \rangle \rangle$   
 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 knows<sub>HOLE</sub> he caught the unicorn.  
 b. Bill thinks<sub>PLUG</sub> he caught the unicorn.

- (34) a. Which unicorn did Bill know<sub>HOLE</sub> he caught?  
 b. Which unicorn did Bill think<sub>PLUG</sub> he caught?

- (35) a.  $\llbracket \text{the man Sam} \rrbracket^{M,g} = \text{the } (\lambda y. \text{man}(y,w) \wedge y=\text{Sam})$   
 b.  $\llbracket \text{which man}_i \rrbracket^{M,g} = \text{the } (\lambda y. \text{man}(y,w) \wedge y=x_i)$

- Solution to PROBLEM ② (already proposed in Novel and Romero 2009).

We combine Poesio's general type  $\langle\langle a, \tau \rangle, t \rangle$  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).

$$(36) \quad \llbracket \text{who} \rrbracket^M = \{ \lambda g.x : x \in D_e \}$$

$$=_{\text{e.g.}} \{ \lambda g.a(\text{lice}), \lambda g.b(\text{arbara}), \lambda g.c(\text{aroll}) \}$$

$$(37) \quad \llbracket \text{who} \rrbracket^M = \{ \lambda g.\iota v[\text{person}(v) \wedge v=x] : x \in D_e \}$$

$$=_{\text{e.g.}} \{ \lambda g.\iota v[\text{person}(v) \wedge v=a], \lambda g.\iota v[\text{person}(v) \wedge v=b], \lambda g.\iota v[\text{person}(v) \wedge v=c] \}$$

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

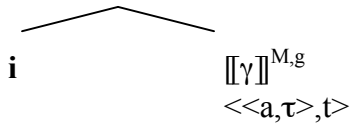
When the *wh*-phrase contains a pronoun bound from the outside, the  $\langle a, e \rangle$ -functions in the set of alternatives will be partial. Consider (38), where *G* stands for Guernica and *LM* for Las Meninas. The first  $\langle a, e \rangle$ -function in (38b) will map an assignment *g* to Guernica if  $g(1)=\text{Picasso}$ , and it will be undefined otherwise. That is, the set of alternatives will contain as many  $\langle a, e \rangle$ -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)  $\llbracket \textit{which of his}_1 \textit{ paintings} \rrbracket^M$   
 a. =  $\{ \lambda g. \iota v [\textit{painting-of}(v, g(1)) \wedge v=x] : x \in D_e \}$   
 b. =<sub>e.g.</sub>  $\{ \lambda g. \iota v [\textit{painting-of}(v, g(1)) \wedge v=G], \lambda g. \iota v [\textit{painting-of}(v, g(1)) \wedge v=LM], \dots \}$

■ Full semantic computation of first problematic example:

- (39) a. Which man<sub>1</sub> sold which of his<sub>1</sub> paintings? (= (29))  
 b. LF: Which man 1 [<sub>t<sub>1</sub></sub> sold which of his<sub>1</sub> paintings]?

- (40) Poesio's alternative-friendly PA-rule: (= (27))  
 $\{ \lambda g. \lambda x. f(g^{x/1}) : f \in \llbracket \gamma \rrbracket^M \}$   
 $\langle \langle a, \langle e, \tau \rangle \rangle, t \rangle$



- (41) a.  $\llbracket \textit{sold} \rrbracket^M = \{ \lambda g. \lambda x. \lambda y. y \textit{ sold } x \}$   
 b.  $\llbracket \textit{sold which of his}_1 \textit{ paintings} \rrbracket^M = \{ \lambda g. \lambda y. y \textit{ sold } \iota v [\textit{paint-of}(v, g(1)) \wedge v=G],$   
 $\lambda g. \lambda y. y \textit{ sold } \iota v [\textit{paint-of}(v, g(1)) \wedge v=LM] \}$   
 c.  $\llbracket t_1 \rrbracket^M = \{ \lambda g. g(1) \}$   
 d.  $\llbracket t_1 \textit{ sold which of his}_1 \textit{ paintings} \rrbracket^M = \{ \lambda g. g(1) \textit{ sold } \iota v [\textit{paint-of}(v, g(1)) \wedge v=G],$   
 $\lambda g. g(1) \textit{ sold } \iota v [\textit{paint-of}(v, g(1)) \wedge v=LM] \}$   
 e.  $\llbracket I t_1 \textit{ sold which of his}_1 \textit{ paintings} \rrbracket^M$   
 =  $\{ \lambda g. \lambda x. g^{x/1}(1) \textit{ sold } \iota v [\textit{paint-of}(v, g^{x/1}(1)) \wedge v=G],$   
 $\lambda g. \lambda x. g^{x/1}(1) \textit{ sold } \iota v [\textit{paint-of}(v, g^{x/1}(1)) \wedge v=LM] \}$   
 =  $\{ \lambda g. \lambda x. x \textit{ sold } \iota v [\textit{paint-of}(v, x) \wedge v=G],$   
 $\lambda g. \lambda x. x \textit{ sold } \iota v [\textit{paint-of}(v, x) \wedge v=LM] \}$   
 f.  $\llbracket \textit{which man} \rrbracket^M = \{ \lambda g. \iota z [\textit{man}(z) \wedge z=\text{Picasso}],$   
 $\lambda g. \iota z [\textit{man}(z) \wedge z=\text{Velázquez}] \}$   
 g.  $\llbracket \textit{which man } I t_1 \textit{ sold which of his}_1 \textit{ paintings} \rrbracket^M =$   
 $\{ \lambda g. \iota z [\textit{man}(z) \wedge z=\text{Picasso}] \textit{ sold } \iota v [\textit{paint-of}(v, \iota z [\textit{man}(z) \wedge z=\text{Picasso}]) \wedge v=G],$   
 $\lambda g. \iota z [\textit{man}(z) \wedge z=\text{Picasso}] \textit{ sold } \iota v [\textit{paint-of}(v, \iota z [\textit{man}(z) \wedge z=\text{Picasso}]) \wedge v=LM], \#$   
 $\lambda g. \iota z [\textit{man}(z) \wedge z=\text{Velázquez}] \textit{ sold } \iota v [\textit{paint-of}(v, \iota z [\textit{man}(z) \wedge z=\text{Velázquez}]) \wedge v=G], \#$   
 $\lambda g. \iota z [\textit{man}(z) \wedge z=\text{Velázquez}] \textit{ sold } \iota v [\textit{paint-of}(v, \iota z [\textit{man}(z) \wedge z=\text{Velázquez}]) \wedge v=LM] \}$

⇒ 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  $\langle e, \langle \tau, t \rangle \rangle$ . PROBLEM ② is solved.

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

- (42) a. Which man<sub>1</sub> told nobody about which of his<sub>1</sub> paintings? (= (32))  
 b. LF: Which man 1 [ nobody 2 [t<sub>1</sub> told t<sub>2</sub> about which of his<sub>1</sub> paintings] ]
- (43) a.  $\llbracket \text{told} \rrbracket^M = \{ \lambda g. \lambda x. \lambda y. \lambda z. z \text{ told } x \text{ about } y \}$   
 b.  $\llbracket t_2 \rrbracket^M = \{ \lambda g. g(2) \}$   
 c.  $\llbracket \text{told } t_2 \rrbracket^M = \{ \lambda g. \lambda y. \lambda z. z \text{ tells } g(2) \text{ about } y \}$   
 d.  $\llbracket \text{which of his}_1 \text{ paintings} \rrbracket^M = \{ \lambda g. \iota v [\text{painting-of}(v, g(1)) \wedge v=x] : x \in D_e \}$   
 e.  $\llbracket \text{tell } t_2 \text{ about which of his}_1 \text{ paintings} \rrbracket^M =$   
 $= \{ \lambda g. \lambda z. z \text{ tells } g(2) \text{ about } \iota v [\text{paint-of}(v, g(1)) \wedge v=x] : x \in D_e \}$   
 f.  $\llbracket t_1 \text{ tell } t_2 \text{ about which of his}_1 \text{ paintings} \rrbracket^M =$   
 $= \{ \lambda g. g(1) \text{ tells } g(2) \text{ about } \iota v [\text{paint-of}(v, g(1)) \wedge v=x] : x \in D_e \}$   
 g.  $\llbracket 2 t_1 \text{ tell } t_2 \text{ about which of his}_1 \text{ paintings} \rrbracket^M =$   
 $= \{ \lambda g. \lambda u_e. g^{u/2}(1) \text{ tells } g^{u/2}(2) \text{ about } \iota v [\text{paint-of}(v, g^{u/2}(1)) \wedge v=x] : x \in D_e \}$   
 $= \{ \lambda g. \lambda u_e. g^{u/2}(1) \text{ tells } u \text{ about } \iota v [\text{paint-of}(v, g^{u/2}(1)) \wedge v=x] : x \in D_e \}$   
 h.  $\llbracket \text{nobody} \rrbracket^M = \{ \lambda g. \lambda P_{\langle e, t \rangle}. \neg \exists u [P(u)] \}$   
 i.  $\llbracket \text{nobody } 2 t_1 \text{ tell } t_2 \text{ about which of his}_1 \text{ paintings} \rrbracket^M =$   
 $= \{ \lambda g. \neg \exists u [g^{u/2}(1) \text{ tells } u \text{ about } \iota v [\text{paint-of}(v, g^{u/2}(1)) \wedge v=x]] : x \in D_e \}$   
 j.  $\llbracket 1 \text{ nobody } 2 t_1 \text{ tell } t_2 \text{ about which of his}_1 \text{ paintings} \rrbracket^M =$   
 $= \{ \lambda g. \lambda w_e. \neg \exists u [g^{w/1 \ u/2}(1) \text{ tells } u \text{ about } \iota v [\text{paint-of}(v, g^{w/1 \ u/2}(1)) \wedge v=x]] : x \in D_e \}$   
 $= \{ \lambda g. \lambda w_e. \neg \exists u [w \text{ tells } u \text{ about } \iota v [\text{paint-of}(v, w) \wedge v=x]] : x \in D_e \}$   
 k.  $\llbracket \text{which man} \rrbracket^M = \{ \lambda g. \iota y [\text{man}(y) \wedge y=z] : z \in D_e \}$   
 l.  $\llbracket \text{which man } 1 \text{ nobody } 2 t_1 \text{ tell } t_2 \text{ about which of his}_1 \text{ paintings} \rrbracket^M =$   
 $= \{ \lambda g. \neg \exists u [\iota y [\text{man}(y) \wedge y=z] \text{ tells } u \text{ about } \iota v [\text{paint-of}(v, \iota y [\text{man}(y) \wedge y=z]) \wedge v=x]] : x \in D_e \wedge z \in D_e \}$

### 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)  $\llbracket \text{irgendein Student} \rrbracket^{M,g} = \{x: x \text{ is a student in } w\}$

■ 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<sub>1</sub> to any professor of his<sub>1</sub>.  
 b. LF: Can [ any student 1 John introduces t<sub>1</sub> to any professor of his<sub>1</sub> ]

(47)  $\llbracket \text{any professor of his}_1 \rrbracket^M = \{ \lambda g. \iota v [\text{prof-of}(v, g(1)) \wedge v=x] : x \in D_e \}$

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

- (48) a. John is looking<sub>PLUG</sub> for the whitest unicorn.  
 b. John can look<sub>PLUG</sub> 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<sub>1</sub> wonders / knows which of his<sub>1</sub> paintings is good.

(50) #Every man<sub>1</sub> wonders / knows which of his<sub>1</sub> hearts is good.

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

- (51) a.  $\llbracket \text{which of his}_1 \text{ paintings is good} \rrbracket^M$   
 $= \{ \lambda g. \iota x [ x=v \ \& \ x \leq \sigma y [ * \text{paint-of}(y, g(1)) ] ] \text{ is good} : v \in D_e \}$   
 $=_{\text{e.g.}} \{ \lambda g. \iota x [ x=A \ \& \ x \leq \sigma y [ * \text{paint-of}(y, g(1)) ] ] \text{ is good},$   
 $\lambda g. \iota x [ x=B \ \& \ x \leq \sigma y [ * \text{paint-of}(y, g(1)) ] ] \text{ is good},$   
 $\lambda g. \iota x [ x=C \ \& \ x \leq \sigma y [ * \text{paint-of}(y, g(1)) ] ] \text{ is good},$   
 $\lambda g. \iota x [ x=D \ \& \ x \leq \sigma y [ * \text{paint-of}(y, g(1)) ] ] \text{ is good} \}$
- b.  $\llbracket t_1 \text{ knows which of his}_1 \text{ paintings is good} \rrbracket$   
 $= \lambda g. g(1) \text{ knows } \{ \iota x [ x=v \ \& \ x \leq \sigma y [ * \text{paint-of}(y, g(1)) ] ] \text{ is good} : v \in D_e \}$
- c.  $\llbracket I \ t_1 \text{ knows which of his}_1 \text{ paintings is good} \rrbracket^M$   
 $= \lambda g. \lambda z. z \text{ knows } \{ \iota x [ x=v \ \& \ x \leq \sigma y [ * \text{paint-of}(y, z) ] ] \text{ is good} : v \in D_e \}$   
 $=_{\text{e.g.}} \lambda g. \lambda z. z \text{ knows } \{ \iota x [ x=A \ \& \ x \leq \sigma y [ * \text{paint-of}(y, z) ] ] \text{ is good},$   
 $\iota x [ x=B \ \& \ x \leq \sigma y [ * \text{paint-of}(y, z) ] ] \text{ is good},$   
 $\iota x [ x=C \ \& \ x \leq \sigma y [ * \text{paint-of}(y, z) ] ] \text{ is good},$   
 $\iota x [ x=D \ \& \ x \leq \sigma y [ * \text{paint-of}(y, z) ] ] \text{ is good} \}$

- ⇒ 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  $\lambda z$  and *everyone*, the sentence presupposes that everyone relevant has more than one painting, as in (52). This explains #(50).

(52)  $\lambda g. \lambda z. \exists_{>1} y [ * \text{paint-of}(y, z) ]. z \text{ knows} \dots$

- ⇒ Note that, for any value of  $g(1)$  in (51a), each of the embedded functions raises a *different* presupposition about the identity of the  $\iota x$  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)  $\lambda g. \lambda z. ( A \leq \sigma y [ * \text{paint-of}(y, z) ] \vee B \leq \sigma y [ * \text{paint-of}(y, z) ] \vee$   
 $C \leq \sigma y [ * \text{paint-of}(y, z) ] \vee D \leq \sigma y [ * \text{paint-of}(y, z) ] ).$   
 $z \text{ knows} \dots$

- (54) Presupposition of (49):  
 $\lambda g. \forall z [\text{man}(z) \rightarrow \exists_{>1} y [* \text{paint-of}(y,z)] \wedge$   
 $[ A \leq \sigma y [* \text{paint-of}(y,z)] \vee B \leq \sigma y [* \text{paint-of}(y,z)] \vee$   
 $C \leq \sigma y [* \text{paint-of}(y,z)] \vee D \leq \sigma y [* \text{paint-of}(y,z)] ] ]$

This boils down to:

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

- (55) Assertion of (49):  
 $\lambda g. \forall z [\text{man}(z) \rightarrow z \text{ knows } \{ \iota x [ x=A \ \& \ x \leq \sigma y [* \text{paint-of}(y,z)] ] \text{ is good ,}$   
 $\iota x [ x=B \ \& \ x \leq \sigma y [* \text{paint-of}(y,z)] ] \text{ is good ,}$   
 $\iota x [ x=C \ \& \ x \leq \sigma y [* \text{paint-of}(y,z)] ] \text{ is good ,}$   
 $\iota x [ x=D \ \& \ x \leq \sigma y [* \text{paint-of}(y,z)] ] \text{ is good } \}$

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

- (56) Every boy<sub>1</sub> (either) brought his<sub>1</sub> dog or his<sub>1</sub> 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  $\langle\langle a, \tau \rangle, t \rangle$ .

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 disjunctively.

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