

Bound ‘de re’ pronouns and the LFs of attitude reports*

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Abstract An empirical argument is given in support of Percus & Sauerland’s (2003) theory of ‘de re’ ascription, according to which the internal argument of *believe* is a function from concept-generators to propositions. The argument concerns pronouns in the scope of attitude verbs that are interpreted both ‘de re’ and as bound variables. It is argued that more traditional theories of ‘de re’ ascription — specifically, theories that take the ‘res’ to be an internal argument of *believe* — fail to account for such pronouns, as they predict that a pronoun cannot simultaneously be an argument of *believe* and bound by a quantifier in the scope of *believe*.

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1 The main claim

This paper is concerned with attitude reports in which the clausal complement of the attitude verb contains a quantifier and a pronoun bound by

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the quantifier. An example is given in (1), where *every female student* is the embedded subject and binds a pronoun — *her*.

- (1) John believes that **every female student**_{*i*} likes **her**_{*i*} mother.

We make two claims regarding (1). Firstly, when (1) is judged against a multiple-guise scenario, it has a reading according to which John roughly thinks the following: “*a* likes *b*’s mother, *c* likes *d*’s mother and *e* likes *f*’s mother”. An example of a multiple-guise scenario is one where John comes into contact with every actual female student more than once, and each actual female student appears each time in a different guise, but in John’s mind the mapping between women and guises is one-to-one. In other words, if the same woman appears in two different guises, John fails to recognize this and thinks he came into contact with two different women.

Our second claim is that in order to capture all the relevant readings of (1) an *in situ* theory of ‘de re’ ascription, such as the one proposed in Percus & Sauerland (2003), is needed. This theory yields (3) as one possible LF of (1) (in addition to other LFs, such as the ‘de dicto’ LF in (2)).

- (2) John believes- w_0
 $[\lambda_1 [\text{every female student-}w_1$
 $[\lambda_2 [t_2 \text{ likes-}w_1 \text{ her}_2 \text{ mother-}w_1]]]]$
- (3) John believes- w_0
 $[\lambda_8 \lambda_9 \lambda_1 [\text{every female student-}w_0$
 $[\lambda_2 [[G_8 t_2]-w_1 \text{ likes-}w_1 [G_9 \text{ her}_2]-w_1 \text{ mother-}w_1]]]]$

We spell out our assumptions about the syntax-semantics interface in §2 (e.g. the assumptions regarding traces and world-denoting pronouns). For now, it suffices to note that in (3), the trace of *every female student* and the pronoun co-indexed with it are embedded inside a complex noun phrase whose head is a pronominal element — G_n — which denotes a *concept-generator*, i.e. a function from individuals to individual concepts. In other words, a concept-generator supplies a guise. Since G_8 and G_9 in (3) may potentially supply different guises for the co-indexed (and co-valued) t_2 and her_2 , the resulting reading is such that, “in John’s mind”, the liker and the likee’s daughter are not necessarily the same (though “in the speaker’s mind” they are). The semantics assumed for *believe*, where the clausal complement is the only internal argument, yields the following interpretation: “There is a pair of guises $\langle G_1, G_2 \rangle$ such that for every actual woman x , John believes that x -under- G_1 likes the mother of x -under- G_2 ”. We refer to her_2 in (3), which

is a bound variable but “understood” by John as not co-valued with t_2 , as a ‘bound de re’ pronoun.

In §2 we motivate the existence of ‘bound de re’ pronouns on empirical grounds and explain in detail why standard theories cannot account for such pronouns. In §3 we present a version of the ‘de re’ theory of Percus & Sauerland (2003) that predicts the existence of ‘bound de re’ pronouns. In §4 we show that intuitions regarding attitude reports with downward-entailing quantifiers in the clausal complement of the attitude verb (such as *John believes that only Mary is French*), judged against multiple-guise scenarios, suggest that *believe* is at least sometimes a universal — rather than existential — quantifier over guises.

2 What are ‘bound de re’ pronouns?

2.1 The problem and a first attempt at solving it

Our point of departure is (1), repeated below.

- (4) John believes that **every female student_{*i*}** likes **her_{*i*}** mother.

We ask readers to ignore any reading where *female student* is interpreted ‘de dicto’ (i.e., any reading that implies that John’s thought is roughly of the form: “Every female student likes...”) and any reading where *her* is interpreted referentially (i.e., any reading that implies that John’s thought is roughly of the form: “...likes this woman”). Ignoring those ‘de dicto’ and referential readings, (1) is felicitous in two types of scenarios, corresponding to two different readings — the ‘simple bound’ reading and the ‘bound de re’ reading. The ‘simple bound’ reading is illustrated by a scenario where John is looking at the set of actual female students, saying to himself something like the following (without necessarily acknowledging that the individuals in question are students, or even female): “for each x such that x is one of these individuals here, x likes x ’s mother”.

However, (1) is felicitous in other, stranger, scenarios. Imagine the set of actual female students is {Mary, Sally, Betty} and that John is looking at pairs of pictures of them (i.e., two pictures of Mary, two pictures of Sally, and two pictures of Betty). Again, he may not be aware that Mary, Sally, or Betty are students, or even female. For each pair, he mistakenly thinks its members are distinct from each other. That is to say, pointing first at the first member of the pair (Mary, Mary) and then at its second member, he says to himself something along the following lines: “This person likes that person’s mother

[this person ≠ that person]”; pointing at the first member of the pair (Sally, Sally) and then at its second, he says to himself the same thing: “This person likes that person’s mother [this person ≠ that person]”; likewise for Betty. We call this reading (first observed in [Sharvit 2011](#)) ‘bound de re’.¹

The bound ‘de re’ reading is not accounted for by most standard theories of attitude reports. Before we show this, let us first elaborate briefly on a data point brought to our attention by Ezra Keshet. The ‘bound de re’ reading, as we have described it, implies that the predicate *mother* is interpreted ‘de dicto’. For Keshet and two of our consultants, the interpretation of the pronoun *her* in *her mother* as a ‘de re’ pronoun biases *mother* towards a ‘de re’ interpretation. This observation does not alter our claim. Examples like (5a) and (5b), where the ‘de re’ pronoun isn’t embedded inside a DP, as well as examples like (5c), where the ‘de re’ pronoun is embedded inside a ‘de dicto’ DP, all have ‘bound de re’ readings.

- (5) a. John believes that **every female student_i** thinks that **she_i** is smart.
 b. John believes that **every female student_i** likes **herself_i**.
 c. John believes that **every female student_i** likes **her_i** unicorn.

This means that the existence of the ‘bound de re’ reading is independent of whether the embedding noun phrase — if there is one — is interpreted ‘de re’ or ‘de dicto’, and of whether the pronoun is embedded in another noun phrase at all. For this reason, and because most speakers still accept the reading of (1) where *mother* is interpreted ‘de dicto’, unless otherwise noted we use the term ‘bound de re’ reading to refer to the reading where *her* in *her mother* is interpreted ‘de re’ and *mother* is interpreted ‘de dicto’.

To see that standard theories of attitude reports struggle with ‘bound de re’ readings, it is necessary to take a little excursion into the syntax and semantics of ‘de re’ ascription. We look at [Russellian](#) theories as well as “relational” theories, starting with the former.

First, let us lay out our assumptions about the syntax-semantics interface. (Nothing important hinges on these; our arguments are compatible with a wide range of assumptions about syntax and interpretation.) Following [Heim & Kratzer \(1998\)](#), we assume the rules of functional application and

¹ Though, unsurprisingly, the ‘simple de re’ reading is more salient, we have yet to find an informant who rejects (1) in this sort of scenario while accepting standard [Quine \(1956\)](#) cases (see §2.2.1).

predicate modification (as shown in (6a) and (6b), where $\llbracket \cdot \rrbracket^g$ is an assignment-parametrized function from pieces of syntax to their interpretations).

- (6) a. **Functional application:** For any branching node α with daughters β, γ and any assignment g , if $\llbracket \beta \rrbracket^g(\llbracket \gamma \rrbracket^g)$ is defined, $\llbracket \alpha \rrbracket^g = \llbracket \beta \rrbracket^g(\llbracket \gamma \rrbracket^g)$.
- b. **Predicate modification:** For any branching node α with daughters β, γ and any assignment g , if $\llbracket \beta \rrbracket^g$ and $\llbracket \gamma \rrbracket^g$ are type $\langle e, t \rangle$, $\llbracket \alpha \rrbracket^g = (\lambda x. \llbracket \beta \rrbracket^g(x) = \llbracket \gamma \rrbracket^g(x) = 1)$.

We also assume that quantificational DPs (type $\langle et, t \rangle$) in the object position of transitive verbs aren’t interpretable *in situ*. (This follows from our assumptions about the typing of quantificational DPs and transitive verbs, and the operations available for interpreting branching nodes.) To yield an interpretable structure, quantificational DPs undergo LF movement (i.e. Quantifier Raising or QR) to a position of sentential scope. QR leaves behind a trace t_n and inserts an operator λ_n below the movement target such that λ_n c-commands the co-indexed trace t_n . For example, the LF of *John saw every man* is as in (7).

- (7) [every man] [λ_1 [John saw t_1]]

Phrases headed by λ -operators are interpreted as in (8), yielding (9), of type $\langle e, t \rangle$, which is the proper type to combine with the quantificational DP, and yielding the truth conditions in (10).

- (8) **Abstraction:** For any node α ,

$$\llbracket \lambda_n \alpha \rrbracket^g = \lambda \gamma. \llbracket \alpha \rrbracket^{g[n \rightarrow \gamma]},$$

where $g[n \rightarrow \gamma]$ is the assignment g' differing at most from g in that g' maps n to γ .

- (9) $\llbracket \lambda_1 \llbracket \text{John saw } t_1 \rrbracket \rrbracket^g = \lambda \gamma. \text{John saw } \gamma$
- (10) $\llbracket (7) \rrbracket^g = \llbracket \text{every man} \rrbracket^g(\llbracket \lambda_1 \llbracket \text{John saw } t_1 \rrbracket \rrbracket^g) = 1$
iff $\llbracket \text{every man} \rrbracket^g(\lambda \gamma. \text{John saw } \gamma) = 1$
iff $\{x: x \text{ is a man}\} \subseteq \{x: \text{John saw } x\}$.

Next, our assumptions about intensionality. To simplify matters, we assume that predicates take pronominal world arguments. Like traces and individual-denoting pronouns, world pronouns can be abstracted over. We adopt the convention that all world pronouns free in the matrix (i.e. not bound

by a co-indexed, c-commanding λ -operator) denote the world of utterance.² Also for simplicity (and temporarily), we assume that *believe* has the Hintikka-style (Hintikka 1962, 1969) semantics in (11), where $\text{Dox}_{x,w}$ is the set of x 's doxastic alternatives in w — the set of worlds compatible with what x believes in w .³

- (11) For any x in D_e , any w in D_s , any p in $D_{\langle s,t \rangle}$ and any assignment g ,
- $$\llbracket \text{believe} \rrbracket^g(w)(p)(x) = 1 \text{ iff } \text{Dox}_{x,w} \subseteq \{w' \in D_s : p(w') = 1\}.$$

Syntactically, we assume intensional verbs like *believe* trigger λ -abstraction over world pronouns (so we may have λ -operators without QR). Thus, *John believes it's raining* receives the LF in (12a) and the interpretation in (12b).

- (12) a. John believes- w_0 [λ_3 [raining- w_3]]
 b. $\text{Dox}_{\text{John},@} \subseteq \{w \in D_s : \text{it's raining in } w\}$

We now return to the interpretation of quantificational phrases in the scope of attitude reports, beginning with Russellian approaches (approaches that roughly follow Russell 1905). Notice first that the Russellian theory is not expressly built to handle the kind of 'de re' reading we are concerned with; the question is whether this sort of analysis can be extended to deal with 'bound de re' readings.

On the Russellian approach, the interpretation of a noun phrase in the scope of an attitude verb has to do with the noun phrase and the attitude verb's relative scope. For example, when *some female student* remains *in situ*, as in (13), the 'de dicto' reading of *John believes that some female student is a fool* arises. The 'de re' reading arises as a result of *some female student* QR-ing above *believe*, as in (14).

- (13) a. John believes- w_0
 [λ_2 [some female student- w_2
 [λ_1 [t_1 is a fool- w_2]]]]]

² For further constraints on the distribution and interpretation of world pronouns, see e.g. Percus (2000). For criticisms of the world-pronoun approach to transparent readings (discussed below, cf. (15)), see Schwager (2010).

³ This is a simplified lexical entry, which doesn't take into account beliefs 'de se' (Lewis 1979). A more adequate entry is (i); a *centered world* $\langle w', x' \rangle$ is a doxastic alternative for x at w just in case for all x knows in w , w' is a world she might be living in and x' is who she might be in w' :

(i) $\llbracket \text{believe} \rrbracket^g(w)(p_{\langle s, \langle e,t \rangle \rangle})(x) = 1$ iff $\text{Dox}_{x,w} \subseteq \{\langle w', x' \rangle \in D_s \times D_e : p(w')(x') = 1\}$.

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- b. $\text{DOX}_{\text{John},@} \subseteq \{w \in D_s : \{y \in D_e : y \text{ is a female student in } w\} \cap \{y \in D_e : y \text{ is a fool in } w\} \neq \emptyset\}$

(For each of John’s actual doxastic alternatives w , there is a female student in w who’s a fool in w .)

- (14) a. [some female student- w_0]
 $[\lambda_1 [\text{John believes-}w_0$
 $[\lambda_2 [t_1 \text{ is a fool-}w_2]]]]$
- b. $\{y \in D_e : y \text{ is a female student in } @\} \cap \{y \in D_e : \text{DOX}_{\text{John},@} \subseteq \{w \in D_s : y \text{ is a fool in } w\}\} \neq \emptyset$
 (There is an actual female student y such that, in each of John’s actual doxastic alternatives w , y is a fool in w .)

Since we are assuming that predicates take overt pronominal world arguments, another LF is predicted — one where *some female student* remains *in situ* but its world argument is co-indexed with that of *believe*.

- (15) a. John believes- w_0
 $[\lambda_2 [\text{some female student-}w_0$
 $[\lambda_1 [t_1 \text{ is a fool-}w_2]]]]$
- b. $\text{DOX}_{\text{John},@} \subseteq \{w \in D_s : \{y \in D_e : y \text{ is a female student in } @\} \cap \{y \in D_e : y \text{ is a fool in } w\} \neq \emptyset\}$
 (For each of John’s actual doxastic alternatives w , there is an actual female student who’s a fool in w .)

The reading in (15) is the so-called ‘intermediate’ reading, first observed in Fodor (1970), according to which John’s belief is roughly “One of these individuals — I’m not sure who — is a fool” while he is pointing at the actual female students. With universal quantifiers, however, the ‘de re’ and intermediate readings are indistinguishable:

- (16) John believes that every female student is a fool.

Whenever *every female student* and *believe* have the same world argument, it does not matter whether we scope *every female student* above *believe* — itself a universal quantifier — or not. Both LFs — the Russellian (17a) and the non-Russellian (17b) — yield truth conditions equivalent to (17c).

- (17) a. [every female student- w_0]
 $[\lambda_1 [\text{John believes-}w_0$
 $[\lambda_2 [t_1 \text{ is a fool-}w_2]]]]$

- b. John believes- w_0
 $[\lambda_2 [\text{every female student-}w_0$
 $[\lambda_1 [t_1 \text{ is a fool-}w_2]]]]]$
- c. $\text{DOX}_{\text{John,@}} \subseteq \{w \in D_s : \{y \in D_e : y \text{ is a female student in @}\} \subseteq$
 $\{y \in D_e : y \text{ is a fool in } w\}\}$
 (For each of John's actual doxastic alternatives w , every actual female student is a fool in w .)

With similar assumptions, and with the LFs in (18b) and (18a) for *John believes that every female student likes her mother*, we get (18c) as its 'de re' truth conditions.

- (18) a. [every female student- w_0]
 $[\lambda_2 [\text{John believes-}w_0$
 $[\lambda_1 [t_2 \text{ likes-}w_1 \text{ her}_2 \text{ mother-}w_1]]]]]$
- b. John believes- w_0
 $[\lambda_1 [\text{every female student-}w_0$
 $[\lambda_2 [t_2 \text{ likes-}w_1 \text{ her}_2 \text{ mother-}w_1]]]]]$
- c. $\text{DOX}_{\text{John,@}} \subseteq \{w \in D_s : \{y \in D_e : y \text{ is a female student in @}\} \subseteq$
 $\{y \in D_e : y \text{ likes MOTHER}(w)(y) \text{ in } w\}\}$
 (For each of John's actual doxastic alternatives w , every actual female student x likes in w x 's mother in w .)

Can we account for 'bound de re' readings with this mechanism? No: (18c) certainly captures the 'simple bound' reading of (1), but crucially not its 'bound de re' reading, according to which "in John's mind" the liker and the likee's daughter are different individuals. Still, it *feels* like we want to scope the quantifier above *believe*, the Russellian way, along with the pronoun, as in (19): here t_2 — corresponding to the liker, and t_3 — corresponding to the likee's daughter are not co-indexed. The problem is, of course, that (19) yields the exact same interpretation as in (18c).

- (19) [every female student- w_0]
 $[\lambda_2 [\text{her}_2$
 $[\lambda_3 [\text{John believes-}w_0$
 $[\lambda_1 [t_2 \text{ likes-}w_1 t_3 \text{'s mother-}w_1]]]]]]]$

The reason we get the exact same truth conditions as in (18c) is that in both (19) and (18a,18b) the movement-index λ_2 binds both the trace t_2 and the

pronoun her_2 . Movement of a type- e expression which doesn't result in variables becoming unbound is in general semantically vacuous.

2.2 A second attempt

2.2.1 'Res'-movement as an alternative to scoping

As we will now see, the [Russellian](#) approach has problems independent of 'bound de re' cases. Although the [Russellian](#) theory of 'de re' ascription we have just entertained does not distinguish between the case where *every female student* in (1) — on its 'de re' reading — scopes above *believe* and the case where it doesn't, there are cases where wide-scoping the quantificational phrase gives rise to unattested truth conditions. This happens when the quantifier is downward-entailing. For example, the intuitive truth conditions of (20) on its 'de re' reading are given in (20a); the truth conditions predicted by scoping are given in (20b). The latter are not attested. (We are using *certain* instead of *believe* because the latter is Neg-raising, cf. e.g. [Fillmore \(1963\)](#), [Horn \(1978\)](#).)

- (20) John is certain that no female student passed the exam.
- a. **Actual reading; *no female student* interpreted *in situ*:** John says to himself, with certainty, pointing at the actual female students: "None of these individuals passed the exam".
 - b. **Non-existent reading; *no female student* scoped out:** No actual female student x is such that John says to himself, with certainty: " x passed the exam".

Notice now that (21), with a downward-entailing quantifier, has a 'bound de re' reading, on which John thinks "this woman doesn't like that woman's mother", for every actual female student.

- (21) John is certain that no female student $_i$ likes her $_i$ mother.

In fact, (21) has a stronger reading than the one just described, which implies that for each pair $\langle x, y \rangle$ in John's mind (i.e., a pair corresponding to a single female), he thinks: " x doesn't like y 's mother and y doesn't like x 's mother". We come back to examples such as (21), and their stronger readings, in §4. In the meantime, it suffices to note that (21) has a 'bound de re' reading. Scoping the quantifier above *believe* would, again, result in incorrect truth conditions, as in (20b). The conclusion is that 'de re' ascription is not a simple matter of scope, and it is preferable to derive 'de re' readings of quantifiers

or expressions with quantificational binding of a ‘de re’ trace or pronoun, without scoping.⁴

In fact, using non-quantificational expressions, Quine (1956) already showed that ‘de re’ ascription is not a simple matter of scope, arguing instead for a “relational” sense of attitude verbs like *believe*. Quine made his point by evaluating examples similar to those in (22) against multiple-guise scenarios.

- (22) a. Ralph believes that **Ortcutt** is a spy and, at the same time, he believes that **Ortcutt** is not a spy.
 b. John believes that **Mary** is French and, at the same time, he believes that **Mary** is German.

The point is this. While (22a) has a reading that attributes contradictory beliefs to Ralph, it also has a reading that *does not*: imagine a situation where Ralph sees Ortcutt on two different occasions, but fails to acknowledge that the individual he saw on the first occasion is the same one he saw on the second occasion. (22a) can be true here. But as long as we hang on to the scope theory of ‘de re’ ascription we won’t be able to capture this reading: it does not matter whether we scope *Ortcutt* above *believe* or leave it *in situ*, both options yield the truth conditions in (23c), according to which Ralph is insane:⁵

- (23) a. Ralph believes- w_0 [λ_1 [Ortcutt is- w_1 a spy]] and
 Ralph believes- w_0 [λ_1 [Ortcutt is- w_1 not a spy]]
 b. [Ortcutt [λ_2 [Ralph believes- w_0 [λ_1 [t_2 is- w_1 a spy]]]]] and
 [Ortcutt [λ_2 [Ralph believes- w_0 [λ_1 [t_2 is- w_1 not a spy]]]]]
 c. $\text{DOX}_{\text{Ralph},@} \subseteq \{w \in D_s : \text{Ortcutt is a spy and not a spy in } w\}$

Likewise, (22b) certainly has a reading according to which John thinks that a single individual, namely Mary, is both French and German. But it also has a reading — the Quine reading — according to which, in John’s mind, one woman that he came into contact with is French, and another woman, a different one that he also came into contact with, is German. (The speaker, of

⁴ To derive the ‘de re’ reading of *John believes that some female student is a fool* (represented by (14)) without scoping, at least two strategies have been suggested: the choice-function strategy (Reinhart 1997, Kratzer 1998, 2003), and the singleton-indefinite strategy (Schwarzschild 2002). The choice-function strategy does not treat *some female student* as a quantifier at all, and the singleton-indefinite strategy treats it as a quantifier with a singleton set restrictor.

⁵ Nor does simply making names non-rigid designators help matters since multiple-guise scenarios require multiple “Ortcutts” at each of Ralph’s belief-alternatives.

course, knows that these women are one and the same.) Scoping only gives us the former reading.

Quine’s point is, of course, applicable to quantifiers as well. For example, *John believes that every female student is French and, at the same time, he believes that every female student is German* has a reading according to which John sees the same women on different occasions, and regarding every woman, he holds a pair of beliefs just like the pair he holds regarding Mary in (22b). Scoping, as we just saw, would not help us arrive at the relevant reading.

Yet it still feels like the ‘bound de re’ reading of (1) “needs” a wide-scoping LF à la (19), where the trace and the pronoun are *contra-indexed*. In §3 we will see that a specific solution to Quine’s problem (namely, the solution due to Percus & Sauerland 2003) also solves the ‘bound de re’ problem posed by (1), by providing an LF that is not quite like (19), but which nevertheless leads to the reading where the liker and the daughter of the likee are not necessarily the same in John’s mind (though they remain identical in the speaker’s mind). Before introducing that solution, let us look at some traditional solutions to Quine’s problem and convince ourselves that they, too, cannot solve the ‘bound de re’ pronouns problem posed by (1).

Cresswell & von Stechow (1982) (following Kaplan 1968 and Lewis 1979) propose that *believe*^{re}, defined in (24), is the main verb in ‘de re’ ascriptions such as *John believes that Mary is French*.⁶ This verb is “relational”: it takes the ‘res’ — the individual about whom John holds his belief (here Mary) — as its first internal argument, and a property-denoting expression of type $\langle e, \langle s, t \rangle \rangle$ as its second internal argument. It requires an acquaintance relation to hold uniquely between the believer and the ‘res’ in the actual world, and between the believer and some individual in the believer’s doxastic alternatives. Since the acquaintance relation only ever relates the attitude holder to a single individual at each relevant world, we’ll speak, equivalently, of “acquaintance

6 We are again simplifying (see fn. 3). A more adequate version of *believe*^{re} is this:

- (i) $\llbracket \text{believe}^{\text{re}} \rrbracket^g(w)(z)(P_{\langle e, \langle s, \langle e, t \rangle \rangle \rangle})(x) = 1$ iff there is a suitable acquaintance function F such that
- a. $F(w)(x) = z$, and
 - b. $\text{Dox}_{x,w} \subseteq \{ \langle w', x' \rangle \in D_s \times D_e : P(F(w')(x'))(w')(x') = 1 \}$.

functions” as defined in (25). Doing so allows us to considerably simplify the metalanguage.⁷

- (24) For any x and z in D_e , any w in D_s , any P in $D_{\langle e, \langle s, t \rangle \rangle}$ and any assignment g ,

$$\llbracket \text{believe}^{\text{re}} \rrbracket^g(w)(z)(P)(x) = 1$$

iff there’s a suitable acquaintance function F such that

- i. $F(w) = z$, and
- ii. $\text{Dox}_{x,w} \subseteq \{w' \in D_s : P(F(w'))(w') = 1\}$.

This second condition can be paraphrased thus: “For all doxastic alternatives w' of x in w , $F(w')$ has property P in w' .”

- (25) **Acquaintance functions:** Given a suitable acquaintance relation R , attitude holder x , and world w , F is a suitable acquaintance function iff $F(w)$ is the unique y such that $R(w, x, y)$.

For a case like (22b), an acquaintance relation like

$$\lambda w \lambda y \lambda x . x \text{ saw } y \text{ wearing a gray coat in } w$$

might underlie F — which might in turn be something like

$$\lambda w . \text{ the } y \text{ such that John saw } y \text{ wearing a gray coat in } w$$

— thereby supplying what we have been calling a guise. Thus, if the ‘res’ is Mary, John can ascribe French-ness to her under one acquaintance function, or guise (“the woman John saw wearing a red dress is French”), and German-ness under another acquaintance function, or guise (“the woman John saw wearing a gray coat is German”). The truth conditions of the ‘de re’ reading of *John believes that Mary is French* are then as in (26).

- (26) There is a suitable acquaintance function F such that
- i. $F(@) = \text{Mary}$, and
 - ii. $\text{Dox}_{\text{John},@} \subseteq \{w \in D_s : F(w) \text{ is French in } w\}$.

⁷ Two notes: (i) The definition refers to an acquaintance function’s suitability. We intend that an acquaintance function is ‘suitable’ only if the corresponding acquaintance relation is ‘vivid’ in the sense of Kaplan (1968). The restriction to vivid acquaintance functions is designed to avoid the so-called ‘shortest-spy problem’. Aloni (2005) argues that vividness is actually the wrong notion: the relevant acquaintance functions (relations) should instead be *non-trivializing*. We are happy to adopt this; near as we can see, it’s orthogonal to our arguments. (ii) We are modeling all the interesting entailments here as non-presuppositional. We intend this only as a simplifying assumption.

To account for the ‘de re’ truth conditions of *John believes that every female student is French*, (28), assume that a plurality or set, such as the set of actual female students, can be a ‘res’. (We assume, following Schwarzschild (1996), that both singularities and pluralities are sets of individuals, of type e .) Example (27) gives the revised semantics for *believe*, and (28) gives ‘de re’ truth conditions for *John believes that every female student is French*. Note that F in (27) and (28) is a “parametrized” acquaintance function; this effectively means that for every individual in the ‘res’ a potentially different acquaintance function is introduced.⁸

- (27) For any (singular or plural) γ in D_e , any singular x in D_e , any w in D_s , any P in $D_{\langle e, \langle s, t \rangle \rangle}$ and any assignment g ,

$$\llbracket \text{believe}^{\text{re}} \rrbracket^g(w)(\gamma)(P)(x) = 1$$

iff there is a function F from members of D_e to suitable acquaintance functions such that

i. for all z in γ , $F_z(w) = z$, and

ii. $\text{Dox}_{x,w} \subseteq \{w' \in D_s :$

$$P(\{z' : \text{there is a } z'' \text{ in } \gamma \text{ such that } z' = F_{z''}(w')\})(w') = 1\}.$$

- (28) There is a function F from individuals to suitable acquaintance functions, such that

$$\{x \in D_e : x \text{ is a female student in } @\} \subseteq$$

$$\{z \in D_e : \quad \text{i. } F_z(@) = z, \text{ and}$$

$$\text{ii. } \text{Dox}_{\text{John},@} \subseteq \{w \in D_s : F_z(w) \text{ is French in } w\}.$$

(For each actual female student z , for each of John’s actual doxastic alternatives w , $F_z(w)$ is French in w .)

But what is the LF which these truth conditions are read off? Various answers have been suggested in the literature. For example, the LF in (29) follows Heim’s (1994) version of the Kaplan/Lewis/Cresswell & von Stechow idea, called ‘res’-movement: the ‘res’ is not just a semantic argument of $\text{believe}^{\text{re}}$, but also a syntactic argument, as it moves out of the clausal complement, leaving behind an abstracted-over trace. (t_3 in (29a) is a trace of type e , and T_3 in (29b) is a trace of type $\langle e, t \rangle$.)⁹

⁸ To keep things readable, (28) is given without the redundant lower universal quantifier.

⁹ Here ‘ $\langle e, t \rangle$ ’ designates the type of sets of atomic individuals. The ‘de re’ LFs of *John believes that some female student is French* are (see fn. 4):

- (29) a. John [believe^{re}- w_0 Mary]
 $[\lambda_3 \lambda_1 [t_3 \text{ is French-}w_1]]$
 b. John [believe^{re}- w_0 female-student- w_0]
 $[\lambda_3 \lambda_1 [[\text{every } T_3] \text{ is French-}w_1]]$

Clearly, this theory involves unorthodox movement. One obvious concern is that the moved ‘res’ does not c-command its trace. Furthermore, in some cases such as (30), where *Mary* (construed ‘de re’) is inside a conjoined noun phrase, ‘res’-movement violates one of the island constraints that seems the least violable, namely the Coordinate Structure Constraint (cf. Ross 1967).

- (30) John mistakenly believes he has a unicorn, and furthermore, he believes that his unicorn and Mary are fools.

Other theories have similar problems, and we will not review them here; we take ‘res’-movement to be representative of this type of theories. Importantly, ‘bound de re’ readings are not captured by ‘res’-movement. Let us elaborate on this point.

2.2.2 ‘Res’-movement and ‘bound de re’ pronouns

Making *her* an argument of *believe* as in (31) indeed creates an LF for (1) where the embedded traces are not co-indexed, but it takes *her* outside the scope of *every*, with the result that *her* can only be interpreted referentially. Notice that (31) requires us to say that *believe* is type-flexible and can take more than one ‘res’-argument (something we need to assume anyway, because of examples such as *John believes that Mary introduced Bill to Sue*).¹⁰

-
- (i) a. John [believes- w_0 $f^{\text{CH}}(\text{female-student-}w_0)$]
 $[\lambda_3 \lambda_1 [t_3 \text{ is French-}w_1]]$
 b. John [believes- w_0 female-student- w_0]
 $[\lambda_3 \lambda_1 [\text{some } T_3$
 $[\lambda_2 [t_2 \text{ is French-}w_1]]]]]$

Since the ‘res’ argument in (i) is a singular individual, that LF doesn’t require John to be acquainted with the entire set of female students.

¹⁰ $[[\text{believe}^{\text{re}}]^g(w)(z_1, z_2, \dots, z_n)(P)(x) = 1$ iff there is a function F from individuals to suitable acquaintance functions such that

- i. $F_{z_1}(w) = z_1, F_{z_2}(w) = z_2, \dots, F_{z_n}(w) = z_n$; and
 ii. $\text{Dox}_{x,w} \subseteq \{w' \in D_s : P(F_{z_1}(w'))(F_{z_2}(w')) \dots (F_{z_n}(w'))(w') = 1\}$.

- (31) John [[believe^{re}- w_0 her₃] female-student- w_0]
 [[$\lambda_3 \lambda_4 \lambda_1$ [[every T_4]
 [λ_2 [t_2 likes- w_1 t_3 ’s mother- w_1]]]]]

Moreover, if we ‘res’-move *female student* but leave the pronoun *in situ*, we run into the same problem that afflicted the Russellian LFs — namely that the pronoun is still bound “in John’s mind.”

Notice now that we *would* get the right reading if we scoped *every female student* all the way up, letting it bind both a trace-‘res’ and a pronoun-‘res’, which are co-indexed with each other.

- (32) [every female-student- w_0]
 [λ_2 [John [[believe^{re}- w_0 t_2] her₂]
 [$\lambda_4 \lambda_3 \lambda_1$ [t_4 likes- w_1 t_3 ’s mother- w_1]]]]]

But this option is excluded in view of the problems discussed in connection with (20)-(21) (see §2.2.1).

A more promising attempt might be (33), on the assumption that $\llbracket \text{her} \rrbracket^g$ is the identity function (i.e. $f: f$ is of type $\langle e, e \rangle$ and for every $x \in \text{Dom}(f)$, $f(x) = x$).¹¹ Then t_3 is a trace of type $\langle e, e \rangle$. This yields the (simplified) truth conditions in (34). Informally, the idea is that the identity function is replaced in John’s doxastic alternatives; very roughly, his confusion about the identity of the identity function “destroys the binding” in his mind. To make this work, we’d have to assume that *her* occurs with a silent type- e pronominal complement pro_n ; in normal, non-‘res’-movement cases, the fact that $\llbracket \text{her} \rrbracket^g = \text{IDENT}$ ensures that $\llbracket \text{her } \text{pro}_n \rrbracket^g = \llbracket \text{pro}_n \rrbracket^g$.

- (33) John [[believe^{re}- w_0 her] female-student- w_0]
 [[$\lambda_3 \lambda_4 \lambda_1$ [[every T_4]
 [λ_2 [t_2 likes- w_1 [t_3 pro_2]’s mother- w_1]]]]]

- (34) There is a suitable acquaintance function F (of type $\langle s, \langle e, e \rangle \rangle$) and a suitable parametrized acquaintance function H (of type $\langle e, \langle s, e \rangle \rangle$), such that
 a. $F(@) = \text{IDENT}$; and

¹¹ See Jacobson (1999) for a proposal (albeit one *quite* different from the one we’re considering here) where pronouns denote identity functions. See Elbourne (2005) for a proposal that treats pronouns as morphologically complex in a rather similar way — i.e. with silent reference-fixing content.

- b. $\{\mathcal{Y} \in D_e: \mathcal{Y} \text{ is a female student in } @\} \subseteq$
 $\{x \in D_e: \quad \text{i. } H_x(@) = x, \text{ and}$
 $\quad \text{ii. } \text{Dox}_{\text{John},@} \subseteq \{w \in D_s: H_x(w) \text{ likes in } w$
 $\quad \text{MOTHER}(w)(F(w)(H_x(w)))\}$.

F is a suitable acquaintance function that picks out an $\langle e, e \rangle$ function for each w in its domain, and H supplies, for every x in its domain, a suitable acquaintance function that picks out an individual at each w in its domain (cf. (28)).

This would require us to say that John is acquainted with the identity function (and we would have to adapt the semantics of *believe*^{ee} accordingly). The idea is that John can fail to recognize the identity function and mistake it for some other function, with the result that, in his mind, John is pointing at two different individuals, for every pair of the form $\langle x, x \rangle$ that he is actually pointing at.

Suppose, for instance, that the set of actual female students is $\{a, b, c\}$ and that John is looking at the pairs $\langle a, a \rangle$, $\langle b, b \rangle$, $\langle c, c \rangle$ (more accurately, pairs of the corresponding pictures), but he thinks the pairs are $\langle a, b \rangle$, $\langle b, c \rangle$, $\langle c, a \rangle$ (and he doesn't know that a , b , and c are students). In addition, the values for F and H in (34) are as in (35), and (36) gives more information about what goes on "in John's mind".

- (35) a. $F = \lambda w$. the $\langle e, e \rangle$ -function indirectly presented to John in w via the pairs he's looking at in w .
 b. $H = \{\langle a, \lambda w$. the z such that John sees z in a red suit in $w \rangle$,
 $\langle b, \lambda w$. the z such that John sees z in a blue suit in $w \rangle$,
 $\langle c, \lambda w$. the z such that John sees z in a green suit in $w \rangle\}$

- (36) For every w' in $\text{Dox}_{\text{John},@}$
 a. $F(w')$ agrees with IDENT on every x in its domain, except that

$$F(w')(a) = b,$$

$$F(w')(b) = c, \quad \text{and}$$

$$F(w')(c) = a;$$

 b. For every actual female student x , it is not the case that $H_x(w')$ is a student in w' ; and

$$\begin{aligned}
 \text{c.} \quad & H_a(w') = a, \\
 & H_b(w') = b, \quad \text{and} \\
 & H_c(w') = c.
 \end{aligned}$$

It then follows from (34) that in every w' in $\text{Dox}_{\text{John},@}$, a likes b 's mother, b likes c 's mother, and c likes a 's mother (instead of believing that a likes a 's mother, b likes b 's mother, and c likes c 's mother — a belief which would be more faithful to the actual pairs he is looking at). This correctly predicts that *John believes that every female student likes her mother* is felicitous even without binding “in John’s mind”.

Clearly, any proposal along these lines should motivate the assumption that individuals can be acquainted with functions. Since we’ll ultimately reject this idea, we don’t attempt to provide this foundation ourselves. Rather, we’ll briefly explore the ramifications of this approach, should an independent motivation be adduced.

But here is a problem: if we do assume that acquaintance with functions is as described above, we predict, counter-intuitively, that (1) is felicitous in a situation where John sees every actual female student once, identifies each student correctly and says “for each x such that x is one of these individuals, x likes the mother of x 's aunt”. According to the LF in (33), this can happen, for example, when John confuses the identity function with the aunt-of function (even if he doesn’t have any confusion regarding the identity of the individuals themselves). If this problem cannot be overcome, the generation of (33) must somehow be blocked, in which case the ‘bound de re’ reading would remain unaccounted for.

Gennaro Chierchia (p.c.) suggests a way to block this undesired reading, without blocking the generation of (33). Suppose there is a constraint on the kind of acquaintance functions which can possibly figure in ‘de re’ construals of $\langle e, e \rangle$ -functions. Specifically, suppose an individual y can be acquainted in the actual world with a function f (of type $\langle e, e \rangle$) through an acquaintance function F only if F is appropriate for y and f in the actual world — that is to say, only if there is a pair $\langle J, K \rangle$ such that for each x in $\text{Dom}(f)$,

- i. J_x is a suitable acquaintance function which delivers x in the actual world (though it may deliver someone else in y 's doxastic alternatives), and

- ii. K_x is a suitable acquaintance function which delivers $f(x)$ in the actual world (though it may deliver someone else in y 's doxastic alternatives).

Furthermore, for any $w \in \text{Dox}_{y,@}$ and any $\langle z, z' \rangle$, it will be the case that $\langle z, z' \rangle$ is in $F(w)$ if and only if there is a z'' such that

$$\begin{aligned} \langle z'', f(z'') \rangle &= \langle J_{z''}(@), K_{z''}(@) \rangle, \quad \text{and} \\ \langle z, z' \rangle &= \langle J_{z''}(w), K_{z''}(w) \rangle. \end{aligned}$$

Table 1 illustrates such a state of affairs: f is some $\langle e, e \rangle$ -function that John's acquainted with in the actual world — say, the function from {Mary, Sally, Betty} into {Mary, Sally, Betty} such that

$$\begin{aligned} f(\text{Mary}) &= \text{Sally}, \\ f(\text{Sally}) &= \text{Betty}, \quad \text{and} \\ f(\text{Betty}) &= \text{Mary}. \end{aligned}$$

Also, w_1 is a doxastic alternative of John's at @; and each cell shows which individuals are picked out by J_x and K_x , for every x in $\text{Dom}(f)$. For example, suppose that

$$\begin{aligned} J_{\text{Mary}} &= \lambda w . \iota x . \text{John likes-}w \ x, \quad \text{and} \\ K_{\text{Mary}} &= \lambda w . \iota x . \text{John hates-}w \ x. \end{aligned}$$

So the presence of $\langle J_{\text{Mary}}(@) = \text{Mary}, K_{\text{Mary}}(@) = f(\text{Mary}) \rangle$ in the “original function” won't license the presence of any $\langle a, b \rangle$ in the “mistaken function” at w_1 unless

$$\begin{aligned} a &= \iota x . \text{John likes-}w_1 \ x, \quad \text{and} \\ b &= \iota x . \text{John hates-}w_1 \ x. \end{aligned}$$

Likewise, the presence of $\langle \text{Betty}, f(\text{Mary}) \rangle$ in the “mistaken function” at w_1 is not licensed (by virtue of J and K) unless there is a pair $\langle a, b \rangle$ in the “original

@	w ₁
$\langle J_{\text{Mary}}(@) = \text{Mary}, K_{\text{Mary}}(@) = f(\text{Mary}) \rangle$	$\langle J_{\text{Mary}}(w_1) = \text{Betty}, K_{\text{Mary}}(w_1) = f(\text{Mary}) \rangle$
$\langle J_{\text{Sally}}(@) = \text{Sally}, K_{\text{Sally}}(@) = f(\text{Sally}) \rangle$	$\langle J_{\text{Sally}}(w_1) = \text{Sally}, K_{\text{Sally}}(w_1) = f(\text{Sally}) \rangle$
$\langle J_{\text{Betty}}(@) = \text{Betty}, K_{\text{Betty}}(@) = f(\text{Betty}) \rangle$	$\langle J_{\text{Betty}}(w_1) = \text{Mary}, K_{\text{Betty}}(w_1) = f(\text{Mary}) \rangle$

Table 1 Illustration of “extensional acquaintance”

function” such that

$$\begin{aligned} a &= J_a(@) , \\ b &= K_a(@) , \\ \text{Betty} &= J_a(w_1), \quad \text{and} \\ f(\text{Mary}) &= K_a(w_1). \end{aligned}$$

For convenience, we call this suggested constraint on acquaintance with functions “extensional acquaintance”.

Given that the identity function is of type $\langle e, e \rangle$, this constraint holds of it as well, with the result that John cannot simply mistake the identity function for the aunt-of function (this also means that John is acquainted with some sub-function of IDENT). The reason is that the identity function is the set of pairs $\langle x, x \rangle$, and the aunt-of function is a set of pairs $\langle x, y \rangle$ such that, presumably, $x \neq y$. So the only way for John to be confused about IDENT is for John to be confused about (some of) the individuals related to themselves by it. Put simply, if he isn't mistaken about the individuals, he cannot be mistaken about the function. This blocks the undesired reading of (33), where John does not misidentify the individuals themselves, but rather the identity function itself. If this solution is on the right track, we can account for the 'bound de re' reading with (33) without generating unattested readings.

But this conclusion is incorrect. Here is a scenario in which the attitude holder is acquainted with the function but where *John thinks every female student likes her mother* nevertheless cannot be truthfully uttered. Suppose the set of actual female students is as before. In addition, the set of actual female professors is $\{d_1, d_2, d_3\}$. John is looking at the following three sets of pictures, each consisting of three pairs: the first three pairs are $\langle a, a \rangle, \langle b, b \rangle, \langle c, c \rangle$, the second three pairs are also $\langle a, a \rangle, \langle b, b \rangle, \langle c, c \rangle$, and the third three pairs are $\langle d_1, d_1 \rangle, \langle d_2, d_2 \rangle, \langle d_3, d_3 \rangle$. Suppose the values for F and H in (34) are as in (37) and (38).

- (37) $F = \lambda w$. the $\langle e, e \rangle$ function indirectly presented to John via the
 $1^{st}, 2^{nd}, 3^{rd}, 7^{th}, 8^{th}$ and 9^{th} pairs he is looking at in w
 (e.g. in @ the pairs $\langle a, a \rangle, \langle b, b \rangle, \langle c, c \rangle, \langle d_1, d_1 \rangle, \langle d_2, d_2 \rangle, \langle d_3, d_3 \rangle$)

- (38) $H = \{ \langle a, \lambda w . \text{the woman } z \text{ s.t. John sees } z \text{ in a red suit in } w \rangle,$
 $\langle b, \lambda w . \text{the woman } z \text{ s.t. John sees } z \text{ in a blue suit in } w \rangle,$
 $\langle c, \lambda w . \text{the woman } z \text{ s.t. John sees } z \text{ in a green suit in } w \rangle,$
 $\langle d_1, \lambda w . \text{the woman } z \text{ s.t. John sees } z \text{ in a yellow suit in } w \rangle,$
 $\langle d_2, \lambda w . \text{the woman } z \text{ s.t. John sees } z \text{ in a purple suit in } w \rangle,$
 $\langle d_3, \lambda w . \text{the woman } z \text{ s.t. John sees } z \text{ in a pink suit in } w \rangle \}$

Suppose John thinks: (i) the first three pairs are $\langle d_1, d_1 \rangle, \langle d_2, d_2 \rangle, \langle d_3, d_3 \rangle$, the second three pairs are $\langle a, a \rangle, \langle b, b \rangle, \langle c, c \rangle$, and the third three pairs are $\langle a, d_1 \rangle, \langle b, d_2 \rangle, \langle c, d_3 \rangle$; and (ii) for each pair in the first and second threesomes of pairs, the first member hates the second member's mother, and for each pair in the third threesome of pairs, the first member likes the second member's mother. (39) gives more information about what goes on in the actual world and "in John's mind".

- (39) a. $F(@) = \{ \langle a, a \rangle, \langle b, b \rangle, \langle c, c \rangle, \langle d_1, d_1 \rangle, \langle d_2, d_2 \rangle, \langle d_3, d_3 \rangle \};$
 b. For every w' in $\text{Dox}_{\text{John}, @}$,
 i. $F(w')(a) = d_1, \quad F(w')(b) = d_2, \quad F(w')(c) = d_3,$
 $F(w')(d_1) = d_1, \quad F(w')(d_2) = d_2, \quad F(w')(d_3) = d_3;$
 ii. For every x such that x is a female student in $@$, $H_x(w')$ is not a female student in w' ; and
 iii. $H_a(w') = a, \quad H_b(w') = b, \quad H_c(w') = c.$

It follows from (34) that in every w' in $\text{Dox}_{\text{John}, @}$, a likes d_1 's mother, b likes d_2 's mother, and c likes d_3 's mother. Importantly, the "mistaken function" — $\{ \langle d_1, d_1 \rangle, \langle d_2, d_2 \rangle, \langle d_3, d_3 \rangle, \langle a, d_1 \rangle, \langle b, d_2 \rangle, \langle c, d_3 \rangle \}$ — obeys "extensional acquaintance" since each "mistaken" pair corresponds to a pair in IDENT. For instance, $\langle a, d_1 \rangle$ is in the mistaken function since, looking at $\langle d_1, d_1 \rangle$ (which is in IDENT), John thinks he is looking at $\langle a, d_1 \rangle$. Similarly for the remaining pairs.¹²

¹² Here are possible values for $F(@)$ and $F(w)$, for any $w \in \text{Dox}_{\text{John}, @}$ (notice that John can be acquainted with each individual by more than one acquaintance relation):

- (i) IDENT (= $F(@)$):
 $\{ \langle \text{"the 1}^{\text{st}} \mathcal{Y} \text{ to John's left in } @ \rangle (= a), \langle \text{"the 1}^{\text{st}} \mathcal{Y} \text{ to John's right in } @ \rangle (= a) \rangle,$
 $\langle \text{"the 2}^{\text{nd}} \mathcal{Y} \text{ to John's left in } @ \rangle (= b), \langle \text{"the 2}^{\text{nd}} \mathcal{Y} \text{ to John's right in } @ \rangle (= b) \rangle,$
 $\langle \text{"the 3}^{\text{rd}} \mathcal{Y} \text{ to John's left in } @ \rangle (= c), \langle \text{"the 3}^{\text{rd}} \mathcal{Y} \text{ to John's right in } @ \rangle (= c) \rangle,$
 $\langle \text{"the 7}^{\text{th}} \mathcal{Y} \text{ to John's left in } @ \rangle (= d_1), \langle \text{"the 7}^{\text{th}} \mathcal{Y} \text{ to John's right in } @ \rangle (= d_1) \rangle,$
 $\langle \text{"the 8}^{\text{th}} \mathcal{Y} \text{ to John's left in } @ \rangle (= d_2), \langle \text{"the 8}^{\text{th}} \mathcal{Y} \text{ to John's right in } @ \rangle (= d_2) \rangle,$
 $\langle \text{"the 9}^{\text{th}} \mathcal{Y} \text{ to John's left in } @ \rangle (= d_3), \langle \text{"the 9}^{\text{th}} \mathcal{Y} \text{ to John's right in } @ \rangle (= d_3) \rangle \}$

So once again, F picks out IDENT in @, and we predict *John believes that every female student likes her mother* to be felicitous. But this prediction is wrong; the sentence *cannot* report the state of affairs just described. In a sense, the confusion required by extensional acquaintance has happened “at the wrong place” — since only the female students matter for the ‘bound de re’ reading, the sub-function of IDENT which we, the theorists, want to inform extensional acquaintance is $\{\langle a, a \rangle, \langle b, b \rangle, \langle c, c \rangle\}$; but instead, extensional acquaintance lets pass the “mistaken sub-function” $\{\langle a, d_1 \rangle, \langle b, d_2 \rangle, \langle c, d_3 \rangle\}$ in virtue of a *different* sub-function of IDENT — namely, $\{\langle d_1, d_1 \rangle, \langle d_2, d_2 \rangle, \langle d_3, d_3 \rangle\}$. Absent an ad hoc appeal to context, it is not clear how this worry can be remedied; doing so clearly requires tools beyond the notion of extensional acquaintance (especially in view of the fact that *John believes every female student likes her mother* can be uttered felicitously in a similar scenario, where John makes the same identification mistakes, but also thinks that every first member in the second threesome likes the mother of the corresponding second member, and every first member in the third threesome hates the mother of the corresponding second member).

We conclude that (33) should not be generated. The reason for this, we’ve argued, is not that acquaintance with functions is constrained by “extensional acquaintance”. Rather, (33) must violate some grammatical constraint. We do not commit ourselves to what that constraint is, though the following possibility comes to mind: suppose pronouns are always of type e , even when they are complex (i.e., composed of a function element of type $\langle e, e \rangle$ and an argument element of type e , as is the case in (33)), and can be interpreted ‘de re’ only as a single unit of type e . Such a constraint blocks the generation of (33), but still generates (31), which does not yield the ‘bound de re’ reading (as we saw).¹³

-
- (ii) $F(w)$, for every $w \in \text{Dox}_{\text{John}, @}$,
 $\{\langle \text{“the } 1^{\text{st}} \gamma \text{ to John’s left in } w \text{”} (= d_1), \text{“the } 1^{\text{st}} \gamma \text{ to John’s right in } w \text{”} (= d_1) \rangle,$
 $\langle \text{“the } 2^{\text{nd}} \gamma \text{ to John’s left in } w \text{”} (= d_2), \text{“the } 2^{\text{nd}} \gamma \text{ to John’s right in } w \text{”} (= d_2) \rangle,$
 $\langle \text{“the } 3^{\text{rd}} \gamma \text{ to John’s left in } w \text{”} (= d_3), \text{“the } 3^{\text{rd}} \gamma \text{ to John’s right in } w \text{”} (= d_3) \rangle,$
 $\langle \text{“the } 7^{\text{th}} \gamma \text{ to John’s left in } w \text{”} (= a), \text{“the } 7^{\text{th}} \gamma \text{ to John’s right in } w \text{”} (= d_1) \rangle,$
 $\langle \text{“the } 8^{\text{th}} \gamma \text{ to John’s left in } w \text{”} (= b), \text{“the } 8^{\text{th}} \gamma \text{ to John’s right in } w \text{”} (= d_2) \rangle,$
 $\langle \text{“the } 9^{\text{th}} \gamma \text{ to John’s left in } w \text{”} (= c), \text{“the } 9^{\text{th}} \gamma \text{ to John’s right in } w \text{”} (= d_3) \rangle\}$

¹³ We also correctly predict that (5b) (*John believes that every female student likes herself*) can have the reading where John mistakes the individuals comprising pairs of the form $\langle x, x \rangle$, but *cannot* have a reading where John correctly identifies the individuals, but is mistaken about the identity function. In other words, (5b) cannot mean that John’s thought is “Each of these individuals likes her aunt”.

To sum up, we have blocked the unattested reading of *John believes that every female student likes her mother*, but we are left with a theory that does not predict ‘bound de re’ pronouns.

We conclude that no ‘de re’ theory that relies solely on movement — of the scoping type or of the ‘res’-movement type — can explain the ‘bound de re’ reading of (1).¹⁴ This is based on

- i. the fact that LFs like (33) must be blocked so as to avoid over-generation (and as a result only (31) is available as a ‘res’-movement LF of (1)), and
- ii. our conclusions from §2.1.

We therefore explore an alternative that makes no use of movement, of the scoping kind or of the ‘res’-movement kind, but rather encodes guises — or acquaintance functions/relations — in the syntax. Since we won’t be making any use of acquaintance with functions, from now on we make the simplifying assumption that individuals are only acquainted with individuals.

3 The solution: concept-generator pronouns

3.1 Belief ‘de re’ without movement

Percus & Sauerland’s (2003) concept-generator theory obviates the need for ‘res’-movement: a ‘de re’ expression, according to that theory, is embedded in a larger noun phrase — as an argument of a pronominal element that denotes a concept-generator (to be defined below). For example, the ‘de re’

¹⁴ It is worth pointing out that there actually is a way to account for ‘bound de re’ readings within ‘res’-movement (see Sharvit 2011), but it requires some questionable assumptions and stipulations. Sharvit’s (2011) analysis posits lexical items (*OP*, *every**) that are not independently motivated. Translated to ‘res’-movement, Sharvit’s analysis works only if: (a) *OP* in (i) applies to *female-student-w₀* to yield a set of ordered pairs (whose first and second members are the same); (b) the trace *T₅* in (i) is a variable over sets of ordered pairs; and (c) *every** in (i) (as opposed to the standard *every*) applies to a set of pairs to yield something of type $\langle\langle e, \langle e, t \rangle \rangle, t \rangle$.

- (i) John [believes-*w₀* [fem-student-*w₀* OP]]
 [$\lambda_5 \lambda_1$ [every* *T₅*
 [$\lambda_2 \lambda_3$ [*t₃* likes-*w₁* her₂ mother-*w₁*]]]]]

These assumptions are clearly ad-hoc, with the result that such a theory lacks any explanatory force.

reading of *John believes that Mary is French* has the LF in (40), where the concept-generator is abstracted over in the scope of the attitude verb.

$$(40) \text{ John believe}^{\text{GC}}-w_0 \\ [\lambda_8 \lambda_1 [[G_8 \text{ Mary}]-w_1 \text{ is French}-w_1]]$$

This implies that the attitude verb takes only one internal argument — the argument corresponding to the embedded clause. As we now show, the theory provides an elegant solution to the problem of ‘bound de re’ readings.

The theory relies on the definition of ‘suitable concept-generator’ given in (42) (cf. Percus & Sauerland 2003, fn. 16); the new semantics for *believe* is in (43).^{15, 16}

- (41) **Concept-generators:** G is a concept-generator for individual x in w iff
- a. G is a function from individuals to individual concepts; and
 - b. $\text{Dom}(G) = \{z \in D_e : x \text{ is acquainted with } z \text{ in } w\}$.
- (42) **Suitable concept-generators:** A function G of type $\langle e, \langle s, e \rangle \rangle$ is a suitable concept-generator for individual x in w iff
- a. G is a concept-generator for x in w ; and

¹⁵ This, too, is a simplification (see fns. 3 and 6). Percus & Sauerland’s definition of concept-generators (see their fn. 16) is closer to that in (i) (but see their fn. 2). Likewise, a more adequate semantics for *believe*^{GC}, one which captures ‘de se’ belief, is (ii).

- (i) A function G of type $\langle e, \langle s, \langle e, e \rangle \rangle \rangle$ is a suitable concept-generator for individual x in w only if there is a function F from individuals to suitable acquaintance functions, such that

$$\text{Dom}(G) \subseteq \{z \in D_e : \begin{array}{l} \text{(a) } F_z(w)(x) = z, \text{ and} \\ \text{(b) } \text{Dox}_{x,w} \subseteq \{\langle w', x' \rangle \in D_s \times D_e : F_z(w')(x') = G(z)(w')(x')\} \end{array} \}.$$

- (ii) $\llbracket \text{believe}^{\text{GC}} \rrbracket^g(w)(p_{\langle \langle e, \langle s, \langle e, e \rangle \rangle \rangle, \langle s, \langle e, t \rangle \rangle \rangle})(x) = 1$ iff there is a suitable concept-generator G for x in w such that

$$\text{Dox}_{x,w} \subseteq \{\langle w', x' \rangle \in D_s \times D_e : p(G)(w')(x') = 1\}.$$

¹⁶ Concept-generators are bijections between the individuals an attitude holder is acquainted with and descriptions (i.e. individual concepts) the attitude holder has for those individuals. Accordingly, as Anand (2007) notes, they’re similar to conceptual covers in the sense of Aloni (2005) (cf. also Aloni 2001). Pace Anand, there are differences. For instance, concept generators needn’t return a value at the actual world. Another difference is the concept-generator theory is given an explicitly compositional formulation, the conceptual covers apparatus is not.

- b. there is a function F from individuals to suitable acquaintance functions such that

$$\text{Dom}(G) \subseteq \{z \in D_e : F_z(w) = z, \text{ and} \\ \text{Dox}_{x,w} \subseteq \{w' \in D_s : F_z(w') = G(z)(w')\}\}.$$

- (43) For any x in D_e , any w in D_s , and any p in $D_{\langle\langle e, \langle s, e \rangle \rangle, \langle s, t \rangle\rangle}$,

$$\llbracket \text{believe}^{\text{GC}} \rrbracket^g(w)(p)(x)$$

is defined only if for all (relevant) concept-generators G suitable for x in w

$$\text{Dox}_{x,w} \subseteq \{w' \in D_s : p(G)(w') \text{ is defined}\}.$$

When defined, $\llbracket \text{believe}^{\text{GC}} \rrbracket^g(w)(p)(x) = 1$ iff there is a (relevant) concept-generator G suitable for x in w such that

$$\text{Dox}_{x,w} \subseteq \{w' \in D_s : p(G)(w') = 1\}.$$

In other words, concept-generators are functions that *supply acquaintance functions*, or guises, to the individuals in their domain. Since they are represented in the syntax, there is no need to make the ‘res’ a semantic argument of the attitude verb. Accordingly, ‘de re’ readings of *John believes that Mary is French* and *John believes that every female student is French* are generated as follows.

- (44) a. John believe^{GC}- w_0
 $[\lambda_8 \lambda_1 \llbracket [G_8 \text{ Mary}] - w_1 \text{ is French} - w_1 \rrbracket]$
 b. When defined, $\llbracket 44a \rrbracket^g = 1$ iff there is a suitable concept-generator G for John in @ such that

$$\text{Dox}_{\text{John},@} \subseteq \{w \in D_s : G(\text{Mary})(w) \text{ is French in } w\}.$$

- (45) a. John believe^{GC}- w_0
 $[\lambda_8 \lambda_1 [\text{every female student} - w_0 \\ [\lambda_2 \llbracket [G_8 t_2] - w_1 \text{ is French} - w_1 \rrbracket]]]$
 b. When defined, $\llbracket 45a \rrbracket^g = 1$ iff there is a suitable concept-generator G for John in @ such that

$$\text{Dox}_{\text{John},@} \subseteq \{w \in D_s : \{\gamma \in D_e : \gamma \text{ is a female student in } @\} \subseteq \\ \{\gamma \in D_e : G(\gamma)(w) \text{ is French in } w\}\}.$$

(There is a concept-generator G suitable for John in @, such that at each of John’s doxastic alternatives w in @, every actual female student γ is such that $G(\gamma)(w)$ is French in w .)

Crucially, for any x , any relevant concept-generator G such that $x \in \text{Dom}(G)$, and any of John’s doxastic alternatives w , it is possible that $\llbracket G_8 \rrbracket^{g[8-G]}(x)(w) \neq x$.

To account for ‘bound de re’ pronouns, we also assume: (a) that bound pronouns as well as traces can be arguments of concept-generator pronouns, as in (45a);¹⁷ and (b) that the semantics of *believe* is the type-flexible semantics in (46) (which allows LFs to contain as many concept-generator pronouns as there are ‘res-es’), rather than the type-rigid semantics in (43). In (46), n is the number of arguments of type $\langle e, \langle s, e \rangle \rangle$ that p takes.¹⁸ In addition, $\text{CON}(c)_{x,w,n}$ is a non-empty set of n -long sequences of concept-generators supplied by context c that are suitable for x in w (a sequence of concept-generators S is suitable for x in w when each member of S is suitable for x in w).

(46) $\llbracket \text{believe}^{\text{FGC}} \rrbracket^{c,g}(w)(p)(x)$ is defined only if for all $S (= \langle G_1^S, \dots, G_n^S \rangle)$ in $\text{CON}(c)_{x,w,n}$ such that

$$\text{Dox}_{x,w} \subseteq \{w' \in D_s : p(G_1^S) \dots (G_n^S)(w') \text{ is defined}\}.$$

When defined, $\llbracket \text{believe}^{\text{FGC}} \rrbracket^{c,g}(w)(p)(x) = 1$ iff there is an $S (= \langle G_1^S, \dots, G_n^S \rangle)$ in $\text{CON}(c)_{x,w,n}$ such that

$$\text{Dox}_{x,w} \subseteq \{w' \in D_s : p(G_1^S) \dots (G_n^S)(w') = 1\}.$$

Accordingly, the ‘simple bound’ reading of (1) (with *mother* construed ‘de dicto’) can be obtained as in (47), where the two concept-generator pronouns are co-indexed; and the ‘bound de re’ reading (again, with *mother* construed ‘de dicto’) is obtained as in (48), where the two concept-generator-pronouns are not co-indexed.

(47) **‘Simple bound’ reading; the two concept-generators are co-indexed:**

- a. John believe^{FGC}- w_0
 $[\lambda_8 \lambda_1 [\text{every female student-}w_0$
 $[\text{AP } \lambda_2 [\llbracket G_8 t_2 \rrbracket -w_1 \text{ likes-}w_1 [G_8 \text{ her}_2] -w_1 \text{ mother-}w_1]]]]]$

¹⁷ Allowing concept generators to adjoin to ‘de dicto’ traces risks over-generation. See the appendix for discussion.

¹⁸ This is determined by the number of concept-generator abstractors in the LF:

- i. if $n = 0$, p is of type $\langle s, t \rangle$;
- ii. if $n > 0$, then for any sequence of concept-generators $\langle X_1, X_2, \dots, X_n \rangle$, $p(X_1)(X_2) \dots (X_n)$ is of type $\langle s, t \rangle$

- b. For any concept generator G and any world w ,

$$\llbracket \Delta P \rrbracket^{c,g[8 \rightarrow G, 1 \rightarrow w]} = \lambda x. G(x)(w) \text{ likes MOTHER}(w)(G(x)(w)) \text{ in } w.$$

- c. When defined, $\llbracket (47a) \rrbracket^{c,g} = 1$ iff there is a $\langle G \rangle \in \text{CON}(c)_{\text{John},@,1}$ such that

$$\text{Dox}_{\text{John},@} \subseteq \{w \in D_s : \{y \in D_e : y \text{ is a female student in } @\} \subseteq \{y \in D_e : G(y)(w) \text{ likes MOTHER}(w)(G(y)(w)) \text{ in } w\}\}.$$

(48) **‘Bound de re’ reading; the two concept-generators are not co-indexed:**

- a. John believe^{FGC}- w_0

$$[\lambda_8 \lambda_9 \lambda_1 [\text{every female student-}w_0 \\ \llbracket \Delta P \rrbracket \lambda_2 \llbracket [G_8 t_2]-w_1 \text{ likes-}w_1 [G_9 \text{ her}_2]-w_1 \text{ mother-}w_1 \rrbracket]]$$

- b. For any concept generators G, H and any world w ,

$$\llbracket \Delta P \rrbracket^{c,g[8 \rightarrow G, 9 \rightarrow H, 1 \rightarrow w]} = \lambda x. G(x)(w) \text{ likes MOTHER}(w)(H(x)(w)) \text{ in } w.$$

- c. When defined, $\llbracket (48a) \rrbracket^{c,g} = 1$ iff there is a $\langle G, H \rangle \in \text{CON}(c)_{\text{John},@,2}$ such that

$$\text{Dox}_{\text{John},@} \subseteq \{w \in D_s : \{y \in D_e : y \text{ is a female student in } @\} \subseteq \{y \in D_e : G(y)(w) \text{ likes MOTHER}(w)(H(y)(w)) \text{ in } w\}\}.$$

For the ‘de re’ ascription in (48) to be true, John needn’t think anything of the form, “ x likes x ’s mother” (since t_2 and her_2 , though co-indexed, are arguments of distinct concept-generators).

Previous work already provides the essential ingredients of our proposal. However, to our knowledge, no one till now has shown that there are readings that only the concept-generator theory can generate. Let us elaborate on this point.

3.2 What is borrowed, what is new

First, notice an interesting technical difference between the ‘res’-movement theory and the concept-generator theory. In practice, the number of ‘res’-denoting expressions can be bigger than one (as in *John believed that Mary introduced Bill to Sue*). On the ‘res’-movement theory, we have to move all three ‘res-es’ (and ensure the type-flexibility of *believe*^{re}). On the concept-generator theory, we can work with one type-fixed *believe*^{GC} (the one in (43))

as long as the ‘res’-denoting expressions are not coreferential. This is because the domain of the concept-generator may already include all the individuals that the “subject” of the ascription is acquainted with.

(49) John [[[believe^{re}- w_0 Mary] Bill] Sue]
 $[\lambda_4 \lambda_3 \lambda_2 \lambda_1 [t_2 \text{ introduced-}w_1 t_3 \text{ to } t_4]]$

(50) John believe^{GC}- w_0
 $[\lambda_8 \lambda_1 [[G_8 \text{ Mary}]-w_1 \text{ introduced-}w_1 [G_8 \text{ Bill}]-w_1 \text{ to } [G_8 \text{ Sue}]-w_1]]$

However, as noted in Anand (2006) (see also Percus 2010), if the ‘res-es’ are co-referential, even the concept-generator analysis requires a type-flexible *believe*. (51) has a reading according to which the hurter and hurtee are not the same, in Ralph’s mind.

(51) Ralph believes that Ortcutt hurt himself.

(52) Ralph believe^{FGC}- w_0
 $[\lambda_8 \lambda_9 \lambda_1 [[G_8 \text{ Ortcutt}]-w_1 \text{ hurt-}w_1 [G_9 \text{ himself}_3]-w_1]]$

(where $[[\text{himself}_3]^\theta] = \text{Ortcutt}$)

But since (51) doesn’t necessarily contain a bound variable, all it shows is that if we are to adopt the concept-generator theory, we have to adopt a type-flexible version of *believe*. It doesn’t show that the concept-generator theory has any *semantic* advantage over ‘res’-movement, as the relevant reading of (51) is easily accounted for with ‘res’-movement:

(53) Ralph [[believe^{re}- w_0 himself₃] Ortcutt]
 $[\lambda_2 \lambda_3 \lambda_1 [t_3 \text{ hurt-}w_1 t_2]]$

Percus & Sauerland (2003), on the other hand, make the point that bound pronouns can be arguments of concept-generator variables. But the examples they discuss involve pronouns bound by quantifiers that appear above the attitude verb, as in (54).

(54) Every candidate believes that he will win.

(Every candidate x , pointing at a picture of x , without necessarily realizing that it is a picture of x : “This guy will win”)

Again, (54) only shows that if the concept-generator theory is to be adopted, it needs to allow concept-generators to apply to bound pronouns. What (54) crucially does *not* show is that the concept-generator theory has any advantage over ‘res’-movement.

- (55) a. **Concept-generator analysis:**
 every candidate- w_0
 $[\lambda_4 [t_4 \text{ believe}^{\text{GC}}-w_0$
 $[\lambda_9 \lambda_1 [[G_9 \text{ he}_4]-w_1 \text{ win}-w_1]]]]$
- b. **‘Res’-movement analysis**
 every candidate- w_0
 $[\lambda_4 [t_4 [\text{believe}^{\text{re}}-w_0 \text{ he}_4]$
 $[\lambda_4 \lambda_1 [t_4 \text{ win}-w_1]]]]$

Crucially, only those examples where the pronoun is bound by an operator situated “below” *believe* show the superiority of the concept-generator theory (from a semantic point of view): as we saw, these cases are not covered by ‘res’-movement.

It is worth pointing out that the concept-generator theory is not the only theory that offers a compositional semantics of ‘de re’ ascriptions without movement. In fact, within Lewis’s counterpart theory (Lewis 1979), a simple LF such as (56) (for *John believes that Mary is French*) can yield the desired reading ((56) itself is, of course, not taken directly from Lewis’s work, but is rather an attempt to implement his ideas within a syntactic framework).

- (56) John- w_0 believes- w_0 [λ_2 [Mary- w_2 is French- w_2]]

Mary- w_2 does not denote the “real” Mary, but rather a counterpart of Mary in $[[w_2]]^{\mathcal{G}[2 \rightarrow w]}$, for any w in $\text{Dox}_{\text{John},@}$. In attitude reports, the counterpart relation is mediated by a contextually-supplied acquaintance relation — in Lewis’s terms, “counterpart by acquaintance”. On this view, the ‘res’ is not a syntactic argument of *believe*, and no movement is necessary. Importantly, the counterpart-based LFs, unless augmented with a counterpart-selecting mechanism, fail with multiple co-referential ‘res-es’ in general, and ‘bound de re’ pronouns in particular. It is possible that counterpart selection is done in the semantics, rather than the syntax (in which case our claim that the syntax must be “transparent” — i.e., that counterpart selection is done by pronominal elements — might be too strong). We do not consider this option to be radically different from what we are proposing, or, for that matter, from what Percus & Sauerland propose.¹⁹

This concludes the discussion of our main claim regarding ‘bound de re’ pronouns. In the next section we try to think more seriously about the quantificational force of *believe*. This issue raises more problems than solutions,

¹⁹ We thank Angelika Kratzer and Paolo Santorio for their input on this issue.

but we think that it is nevertheless worth discussing, because it is intimately tied to how ascriptions with quantificational binders in the embedded clause are interpreted in multiple-guise scenarios (which constructions motivate the existence of ‘bound de re’ pronouns in the first place).

4 Believe as a universal quantifier over concept-generators

4.1 The problem of negative quantifiers

Let us go back to the examples that motivated the Kaplan/Lewis/Cresswell & von Stechow view of “relational” *believe*.

- (57) a. Ralph believes that Orcutt is a spy and, at the same time, he believes that Orcutt is not a spy.
 b. John believes that Mary is French and, at the same time, he believes that Mary is German.

These examples are predicted to be well-formed both by the “relational” theories of *believe* and by the concept-generator theory, because the acquaintance functions/concept-generators are introduced *existentially*. The type-flexible semantics for *believe* is repeated in (58).

- (58) If defined, $\llbracket \text{believe}^{\text{FGC}} \rrbracket^{c,g}(w)(p)(x) = 1$ iff **there is an S**
 (= $\langle G_1^S, \dots, G_n^S \rangle$) in $\text{CON}(c)_{x,w,n}$ such that

$$\text{Dox}_{x,w} \subseteq \{w' \in D_s : p(G_1^S) \dots (G_n^S)(w') = 1\}.$$

But there is reason to believe that “existential” *believe* is sometimes too weak.²⁰ Let us discuss in more detail the possibility that *believe* sometimes quantifies universally over acquaintance functions/concept-generators. Specifically, universal quantification seems to be invoked when the quantifier binding a ‘de re’ pronoun/trace is downward-entailing. Consider in this regard (59a) and (59b): the former is acceptable in scenario (60a) as well as (60b); the latter is acceptable only in (60c).

- (59) a. John believes that every female student is French.

²⁰ Our criticism of the “existential” theory will also apply to Aloni’s (2005) quantifier-less theory of ‘de re’ ascription. As mentioned in fn. 16, concept-generators can be thought of as conceptual covers. So a quantifier-less concept-generator theory will be equivalent to Aloni’s quantifier-less conceptual-covers theory. We show that you often need to derive stronger truth conditions than either a wide-scoping existential-style analysis or a quantifier-less analysis can produce. For simplicity, we limit our remarks to “traditional” existential theories.

- b. John believes that no female student is French.
- (60) John looks at three pairs of pictures of actual female students — two pictures of Mary, two pictures of Sally, two pictures of Betty — and doesn't realize
- i. that they're students (in fact, he thinks they're professors), and
 - ii. that the same person is depicted in each pair.

He says:

- a. “The professor in red [who happens to be Mary], the professor in yellow [who happens to be Sally] and the professor in green [who happens to be Betty] are all **French**.

The other three — including the professor in blue [who also happens to be Mary], the professor in gray [who also happens to be Sally] and the professor in pink [who also happens to be Betty] — are **Italian**.”

- b. “The professor in red [who happens to be Mary], the professor in yellow [who happens to be Sally] and the professor in green [who happens to be Betty] are all **French**.

The other three — including the professor in blue [who also happens to be Mary], the professor in gray [who also happens to be Sally] and the professor in pink [who also happens to be Betty] — are **also French**.”

- c. “The professor in red [who happens to be Mary], the professor in yellow [who happens to be Sally] and the professor in green [who happens to be Betty] are all **Italian**.

The other three — including the professor in blue [who also happens to be Mary], the professor in gray [who also happens to be Sally] and the professor in pink [who also happens to be Betty] — are **also Italian**.”

However, given (58) we expect (59b) to be acceptable in (60a) as well (see (62b)). That this fails to obtain (that is to say, that the right predictions are made only regarding (59a); see (61b)) suggests that *believe* has a “universal” reading, as in (63).

- (61) a. John believe^{FGC}- w_0
 $[\lambda_8 \lambda_1$ [every female-student- w_0
 $[\lambda_2$ [[G_8 t_2]- w_1 is French- w_1]]]]]

Bound ‘de re’ pronouns and the LFs of attitude reports

- b. When defined, $\llbracket (61a) \rrbracket^{c,g} = 1$ iff **there is a** relevant concept-generator G such that

$$\text{Dox}_{\text{John},@} \subseteq \{w \in D_s : \{y \in D_e : y \text{ is a female student in } @\} \subseteq \{y \in D_e : G(y)(w) \text{ is French in } w\}\}.$$

- (62) a. John believe^{FGC}- w_0

$$[\lambda_8 \lambda_1 [\text{no female-student-}w_0 \\ [\lambda_2 \llbracket [G_8 t_2]-w_1 \text{ is French-}w_1 \rrbracket]]]$$

- b. When defined, $\llbracket (62a) \rrbracket^{c,g} = 1$ iff **there is a** relevant concept-generator G such that

$$\text{Dox}_{\text{John},@} \subseteq \{w \in D_s : \{y \in D_e : y \text{ is a female student in } @\} \cap \{y \in D_e : G(y)(w) \text{ is French in } w\} = \emptyset\}.$$

- (63) $\llbracket \text{believe}^U \rrbracket^{c,g}(w)(p)(x)$ is defined only if for all $S (= \langle G_1^S, \dots, G_n^S \rangle)$ in $\text{CON}(c)_{x,w,n}$,

$$\text{Dox}_{x,w} \subseteq \{w' \in D_s : p(G_1^S) \dots (G_n^S)(w') \text{ is defined}\}.$$

When defined, $\llbracket \text{believe}^U \rrbracket^{c,g}(w)(p)(x) = 1$ iff **for all** $S (= \langle G_1^S, \dots, G_n^S \rangle)$ in $\text{CON}(c)_{x,w,n}$,

$$\text{Dox}_{x,w} \subseteq \{w' \in D_s : p(G_1^S) \dots (G_n^S)(w') = 1\}.$$

Suppose σ_1 is a concept-generator that yields “the professor in red” for Mary, “the professor in yellow” for Sally and “the professor in green” for Betty; and σ_2 is a concept-generator that yields “the professor in blue” for Mary, “the professor in gray” for Sally and “the professor in pink” for Betty (so $\text{CON}(c)_{\text{John},@,1} = \{\sigma_1, \sigma_2\}$). The judgments reported for (59b) are predicted by (63):

- (64) a. John believes^U- w_0

$$[\lambda_8 \lambda_1 [\text{no-female-student-}w_0 \\ [\lambda_2 \llbracket [G_8 t_2]-w_1 \text{ is French-}w_1 \rrbracket]]]$$

- b. When defined, $\llbracket (64a) \rrbracket^{c,g} = 1$ iff

$$\text{Dox}_{\text{John},@} \subseteq \{w \in D_s : \{y \in D_e : y \text{ is a female student in } @\} \cap \{y \in D_e : \sigma_1(y)(w) \text{ or } \sigma_2(y)(w) \text{ is French in } w\} = \emptyset\}.$$

(For every concept generator $G \in \text{CON}(c)_{\text{John},@,1}$ and all of John’s doxastic alternatives w in $@$, no actual female student y is such that $G(y)(w)$ is French in w .)

On the other hand, if $\text{CON}(c)_{\text{John},@,1} = \{\sigma_1, \sigma_2\}$, the judgments reported for (59a) are predicted by (58); (63) imposes truth conditions that are too strong for a scenario like (60a): since for each female student x , each of John's doxastic alternatives w' is such that $\sigma_2(x)(w')$ fails in w' to be French, believe^U plus $\text{CON}(c)_{\text{John},@,1} = \{\sigma_1, \sigma_2\}$ incorrectly predicts that (59a) should be false.

An anonymous reviewer calls our attention to another case where universal *believe* makes predictions that are not quite right. Suppose there are three American students who like to dress up as men and walk around town playing tricks on people. On day 1, the three students meet John and pretend (successfully) to be Italian. On day 2, they dress in another disguise and again meet John, but this time they pretend (again successfully) to be French. John doesn't realize that the students are students or American, nor does he identify the people he met on day 1 with the people he met on day 2. Then the following ascriptions both seem to be true:

- (65) a. On day 1, John believed that none of the three female students was French.
 b. On day 2, John believed that none of the three female students was Italian.

This case shows that if universal quantification is invoked to explain 'de re' readings with negative quantifiers, it needs to be restricted to *salient* sets of concept generators. In example (65a), the salient concept generator(s) will map the female students to the people that John met on day 1, and in example (65b) the salient concept generator(s) will map the female students, naturally, to the people that John met on day 2.

Let us therefore assume that both versions of *believe* are available — or, alternatively, that the grammar contains only believe^U , but $\text{CON}(c)_{x,w,n}$ can be "shrunk" to a set possibly containing just one sequence of concept-generators. For some reason (that we do not understand) the universal semantics is often preferred when the 'de re' quantifier is downward-entailing. Alternatively, the singleton shrinking of $\text{CON}(c)_{x,w,n}$ only happens when the concept-generator's argument isn't bound by a downward-entailing quantifier. (Note that this isn't simply a matter of the bound 'de re' pronoun being in a downward-entailing environment; e.g. a natural reading of *no one believes Ralph is smart* entails that no one believes of Ralph *under any guise* that he is smart.) The asymmetry is further evidenced by the contrast between the following sentences, which contain 'bound de re' pronouns. As before, John is

looking at the pairs ⟨Mary, Mary⟩, ⟨Sally, Sally⟩, and ⟨Betty, Betty⟩ — i.e. pairs of photographs.

- (66) a. John believes that every female student likes her friend.
 b. John believes that no female student likes her friend.

As we already saw, intuitions regarding (66a) are explained by “existential” *believe*^{FGC}. But notice that intuitions regarding (66b) are not: the truth of (66b) requires that, in John’s “mind”, it isn’t just the case that one member of each pair doesn’t like the friend of the other member, but rather, it must be that *neither of them likes the friend of the other*. This is predicted by *believe*^U, assuming $\text{CON}(c)_{\text{John},@,2} = \{\langle\sigma_1, \sigma_2\rangle, \langle\sigma_2, \sigma_1\rangle\}$.

- (67) a. John *believe*^U- w_0
 $[\lambda_8 \lambda_9 \lambda_1 [\text{no female student-}w_0$
 $[\lambda_2 [[G_8 t_2]-w_1 \text{ likes-}w_1 [G_9 \text{ her}_2]-w_1 \text{ friend-}w_1]]]]$
 b. When defined, $\llbracket (67a) \rrbracket^{c,\mathcal{G}} = 1$ iff for every pair of concept-generators $\langle G, H \rangle$ in $\text{CON}(c)_{\text{John},@,2}$,

$$\text{DOX}_{\text{John},@} \subseteq \{w \in D_s : \{\mathcal{Y} \in D_e : \mathcal{Y} \text{ is a female student in } @\} \cap \{\mathcal{Y} \in D_e : G(\mathcal{Y})(w) \text{ likes FRIEND}(w)(H(\mathcal{Y})(w)) \text{ in } w\} = \emptyset\}.$$

(For every pair of concept-generators $\langle G, H \rangle$ in $\text{CON}(c)_{\text{John},@,2}$, and all of John’s doxastic alternatives w in $@$, no actual female student \mathcal{Y} is such that $G(\mathcal{Y})(w)$ likes in w $H(\mathcal{Y})(w)$ ’s friend in w .)

It should be noted that even when the ‘de re’ quantifier is downward-entailing, the existential version of *believe* is sometimes chosen. One case is when the context imposes (lexical or non-lexical) presuppositions that make it impossible to implement “universal” *believe*. An example that comes to mind is *John believes that no female student voted for her opponent*: if, in John’s mind, not every relevant individual is a candidate, then he cannot entertain the “reciprocal” belief predicted by “universal” *believe*^U, but he may still be able to entertain the “non-reciprocal” belief predicted by “existential” *believe*^{FGC} (though again, this could result from coupling “universal” *believe* with an appropriately restricted $\text{CON}(c)_{x,w,n}$, i.e. one whose second member only ever outputs candidates).

4.2 Additional data

More evidence for universal quantification is provided by *only*-constructions, as in (68), in a scenario where John is looking at pairs of pictures of all relevant women.

(68) John believes that only Mary is French.

The first thing to note for this case is that the predictions of existential *believe* are spectacularly wrong. Say the relevant domain of individuals is {Mary, Sally}. Then, given a standard semantics for *only* (and assuming that the presuppositions triggered by *only* can be accommodated in the scope of the attitude à la Heim 1992), (68) is predicted to be true if John believes ‘de re’ of Mary that she is French, and John believes ‘de re’ of Sally that she isn’t. These truth conditions are satisfied even in a multiple-guise scenario where John has *totally parallel* beliefs about Mary and Sally — i.e. he believes that Mary (qua A) is French, Mary (qua B) isn’t French, Sally (qua C) is French, and Sally (qua D) isn’t French.

- (69) a. John believe^{FGC}- w_0
 $[\lambda_8 \lambda_1 [\text{only MARY}_F$
 $[\lambda_2 [[G_8 t_2]-w_1 \text{ is French-}w_1]]]]$
 b. When defined, $[(69a)]^{c,g} = 1$ iff there is a relevant concept-generator G such that

$$\text{Dox}_{\text{John},@} \subseteq \{w \in D_s : \\ \{y \in D_e : G(y)(w) \text{ is French in } w\} = \{\text{Mary}\}\}.$$

Relative to our scenario, the truth of (69) is witnessed by a G such that for any w in $\text{Dox}_{\text{John},@}$,

$$G(\text{Mary})(w) = A$$

(French, in John’s mind, though Mary-under-guise-B isn’t), and

$$G(\text{Sally})(w) = D$$

(Not French, in John’s mind, though Sally-under-guise-C is). But certainly (68) isn’t true here!

This out of the way, we return to motivating the usefulness of existential quantification over concept-generators. That (68) is false in a parallel multiple-guise scenario is an extremely robust judgment, but what exactly are its truth conditions? This turns out to be a far subtler matter. Our consultants require that for every x distinct from Mary, all the relevant guises under

which x appears must be non-French; but for Mary herself, it suffices that *just one* of the “Mary’s” be French. In other words, the sentence is judged true in scenario (70a) and false in scenario (70b) by all speakers, as predicted by universal *believe*^U. However, our consultants still judge it true in the scenario described in (70c), which suggests that the presupposition contributed by *only* is evaluated relative to existential *believe*, suggesting the lexical entry in (71).²¹

(70) John looks at two pairs of pictures — two pictures of Mary and two pictures of Sally — and doesn’t realize that the same person is depicted in each pair. He says:

- a. “The woman in red [who happens to be Mary] is French and the woman in blue [who also happens to be Mary] is French. The other two are Italian.”
- b. “The woman in gray [who happens to be Sally] is Italian. The other three — including the woman in yellow [who also happens to be Sally] — are French.”
- c. “The woman in red [who happens to be Mary] is French. The other three — including the woman in blue [who also happens to be Mary] — are Italian.”

(71) $\llbracket \text{believe}^U \rrbracket^{c,g}(w)(p)(x)$ is defined only if **there is an** $S (= \langle G_1^S, \dots, G_n^S \rangle)$ in $\text{CON}(c)_{x,w,n}$ such that

$$\text{Dox}_{x,w} \subseteq \{w' \in D_s : p(G_1^S) \dots (G_n^S)(w') \text{ is defined}\}.$$

²¹ Even if we could derive satisfactory truth conditions without universal quantification, by making certain assumptions about the interaction of concept-generators with focus (cf. (i) below, which embeds a concept-generator under an F-mark), (a) we’d still need to somehow avoid generating the incorrect truth conditions in (69), and (b) ‘bound de re’ readings of constructions like *John believes that only Mary likes her friend* would remain problematic. An LF like (ii) doesn’t have the focused material binding *her*₂ (nor *could* it, cf. the appendix), so its truth conditions are necessarily not those of the ‘bound de re’ reading.

- (i) John believe^{FGC}- w_0
 $[\lambda_8 \lambda_1 [\text{only } [G_8 \text{ Mary}]_{\text{F}}-w_1 \text{ is French-}w_1]]$
- (ii) John believe^{FGC}- w_0
 $[\lambda_9 \lambda_8 \lambda_1 [\text{only } [\text{Mary}$
 $[\lambda_2 [G_8 t_2]_{\text{F}}-w_1 \text{ likes-}w_1 [G_9 \text{ her}_2]_{\text{F}}-w_1 \text{ friend-}w_1]]]]]$

When defined, $\llbracket \text{believe}^U \rrbracket^{c,g}(w)(p)(x) = 1$ iff **for all** $S (= \langle G_1^S, \dots, G_n^S \rangle)$ in $\text{CON}(c)_{x,w,n}$,

$$\text{Dox}_{x,w} \subseteq \{w' \in D_s : p(G_1^S) \dots (G_n^S)(w') = 1\}.$$

On the other hand, for other cases the existentially quantified definedness condition is arguably too weak. Consider *Mary thinks only John remembers Steve*. Even on the ‘de re’ reading, it should presuppose that Mary thinks of each alternative to John that he is alive. But the definedness condition is consistent with Mary failing to think so. We have to leave this issue open.

We’ve argued that the facts may motivate a (partially) “universal” instantiation of *believe*. Another conceivable proposal allows the existential quantifier over sequences of concept-generators to take non-maximal scope (i.e., below *no female student* in (59b) or *only Mary* in (68)).²² This is an appealing account in some respects, but it faces a major difficulty: belief in a singular proposition (speaking loosely) is usually considered a necessary feature of ‘de re’ belief. In other words, for John to have a ‘de re’ belief about someone, there must be some x of whom John believes so-and-so. But if concept-generators can vary across belief alternatives, ‘de re’ belief is dissociated from singular belief: a sentence like *John believes Ortcutt killed Ralph* is mapped to True if, for each of John’s belief alternatives w , there is some concept-generator G such that $G(\text{Ortcutt})(w)$ killed Ralph in w . This seems to be an undesirable outcome: if John thinks, “it was either A or B who killed Ralph”, where A, B, and C are guises under which John knows Ortcutt, and where John incorrectly believes A, B, and C to be different people, speakers hesitate to judge *John believes Ortcutt killed Ralph* true (similarly for the singular-belief-ascribing *there’s someone who John believes killed Ralph*).

On the other hand, consider (72a) in a context where John sees Mary on three different occasions (and fails to recognize her each time): there is one person who admires her on the first occasion, and there is another person who admires her on the other two occasions. Relative to this scenario, (72a) seems relatively well-formed, which may suggest that our semantics should allow acquaintance functions/concept-generators to vary under *exactly two people*. But if narrow existential closure over (sequences of) concept-generators is out, how are the correct truth conditions derived? One option is admitting parameterized concept-generators (cf. Skolemized choice functions) as in (72b). This move allows acquaintance functions/concept-generators to vary with admirers while avoiding the over-generation associated with free exis-

²² Thanks to Nicholas Fleisher and Ezra Keshet for discussion of this and related points.

tential closure over concept-generators. (Note that $\text{CON}(c)_{x,w,n}$ is now a set of parametrized concept generators.)

- (72) a. John believes that Mary is admired by exactly two people.
 b. For every $\mathfrak{G}_{\langle e, \langle e, \langle s, e \rangle \rangle \rangle}$ in $\text{CON}(c)_{\text{John}, @, 1}$,

$$\text{DOX}_{\text{John}, @} \subseteq \{w \in D_s : |\{z \in D_e : z \text{ admires } \mathfrak{G}_z(\text{Mary})(w) \text{ in } w\}| = 2\}.$$

But a familiar problem from the Skolemized choice functions literature bedevils us here. The original problem, noticed by Chierchia (2001) and discussed by Kratzer (2003), Schlenker (2006), Solomon (2011), a.o., is that unattested readings arise when a Skolemized choice function is bound by a non-distributive quantifier such as *no one* or *exactly two students*. Take the LF in (73), corresponding to *no student read a (certain) book*. If f is resolved to the function mapping each student x to (a function from the set of books to) the single book x didn’t read, then *no student read a (certain) book* is predicted to have truth conditions to the effect that no student read every book, a meaning it lacks (though see Kratzer 2003 for another view).

- (73) No student _{x} read $f_x(\text{book})$

Let’s see how this makes trouble for our proposal. Suppose, for instance, that at each of John’s doxastic alternatives, there’s 2 individuals A and B corresponding to the actual Mary (i.e., assume a classic double-vision scenario). Now assume that at each of John’s doxastic alternatives there’s 5 relevant individuals in the denotation of *people*. If John thinks each of those 5 individuals admires A and that each of them doesn’t admire B, then (72a) is intuitively quite false. Yet if $\text{CON}(c)_{\text{John}, @, 1}$ contains just one Skolemized concept-generator \mathfrak{G} such that at each of John’s doxastic alternatives w ,

$$\begin{aligned} |\{x : \mathfrak{G}_x(\text{Mary})(w) = A\}| &= 2, \quad \text{and} \\ |\{x : \mathfrak{G}_x(\text{Mary})(w) = B\}| &= 3. \end{aligned}$$

(assuming that $\text{Dom}(\mathfrak{G})$ is just the relevant 5 individuals), the truth conditions in (72b) will be satisfied. Now, for this to really trouble us, we’d have to get a grip on why this sort of Skolemized concept-generator would make it into $\text{CON}(c)_{\text{John}, @, 1}$ in the first place (cf. e.g. Kratzer’s 2003 reply to Chierchia 2001 or Schlenker 2006 on “natural functions”). Yet insofar as recent work (Solomon 2011) seems to suggest that natural, empirically successful constraints on Skolemized choice functions are difficult to formulate, the

Skolemized concept-generator theory must be seen as a very preliminary proposal.

5 Summary

‘Bound de re’ readings of pronouns support a non-relational semantics for *believe*, one which has a single, “clausal”, internal argument and which quantifies over concept-generators. In addition, the kinds of scenarios required to evaluate ‘bound de re’ readings — scenarios involving beliefs about individuals in the domain of an attitude-embedded quantifier whom the attitude holder knows in multiple ways (possibly without identifying that these guises actually correspond to a single individual) — lead to the conclusion that *believe* at least sometimes quantifies universally, rather than existentially, over concept-generators.

6 Appendix: ‘De dicto/de re’ and iterated belief reports

An area of potential over-generation in the concept-generator theory bears mentioning. We must somehow rule out configurations where (in simple, non-iterated belief reports) concept-generators are adjoined to traces/pronouns bound by ‘de dicto’ expressions; e.g. the system shouldn’t generate ‘de re’ ascriptions about unicorns or whoever a misinformed attitude holder takes the king of France to be (though we’ll refine this characterization shortly). The first of these (unicorns) might follow from how concept-generators are defined — in particular the stipulation that the attitude holder be acquainted with each ‘res’ in the domain of the concept-generator. However, the second (the king of France) certainly does not. After all, a deranged William Daley (Barack Obama’s chief of staff) might come to believe that Barack Obama, whom he works for and is very much acquainted with, is (‘de dicto’) the king of France. But Daley might also unwittingly know Obama under two guises A and B; he might think that A is the upstanding Barack Obama (for Daley, the king of France), and that B is a notorious spy. *Daley thinks there’s a unique king of France and that the king of France is a spy* doesn’t have any true readings here, but so long as there’s a $G \in \text{CON}(c)_{\text{Daley},@,1}$ such that for any

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$w \in \text{Dox}_{\text{Daley},@}, G(\text{Obama})(w)^{23} = \text{the (relevant) spy in } w$, (74) evaluates to True.²⁴

$$(74) \quad \llbracket \text{Daley believe-}w_0 \quad \llbracket \lambda_8 \lambda_1 \llbracket [G_8 \text{ KoF-}w_1]-w_1 \text{ is a spy-}w_1 \rrbracket \rrbracket^{c,g} = 1 \text{ iff} \\ \exists G \in \text{CON}(c)_{\text{Daley},@,1} : \text{Dox}_{\text{Daley},@} \subseteq \{w : G(\text{Obama})(w) \text{ is a spy in } w\}.$$

Iterated belief reports show that this is a somewhat subtle problem. Say Daley still thinks there’s a unique king of France (Obama), but that he believes *Hillary Clinton* is in a [Quinean](#) double-vision scenario — i.e. Daley thinks Clinton knows the king of France (i.e. Obama) under two different guises: A and B. Daley thinks Clinton believes A is a spy and B isn’t. Then, for instance, *Daley believes there’s a unique king of France and that Clinton thinks the king of France is a spy* is true, presumably due to the following LF and truth conditions:²⁵

²³ Equivalent, given what we know about Daley’s beliefs, to $G(\text{KoF}(w))(w)$.

²⁴ We should also rule out some configurations where concept-generators are sisters of syntactically ‘de se’ traces/pronouns (that is, traces/pronouns bound by the ‘de se’ abstractor, cf. fn. 3). Say Sue thinks she’s Mary. Then for any $\langle w, x \rangle \in \text{Dox}_{\text{Sue},@}$, $x = \text{Mary}$. So a concept generator adjoined to a ‘de se’ pronoun (like in (i) below, with λ_i a ‘de se’ abstractor operator which allows the complement clause to denote something in the domain of the ‘de se’ attitude verb, cf. fns. 1 and 5) supplies a guise for Mary rather than one for Sue. Now say an actual description of Mary is *the woman living at 17 Quincy*, and, moreover, that Sue is acquainted with Mary and that she believes ‘de dicto’ that the woman living at 17 Quincy is a total bore — though, naturally, Sue thinks, “Unlike the woman living at 17 Quincy, I’m the life of the party”. In other words, Sue *doesn’t* think “I/Mary live(s) at 17 Quincy”. Does *Sue_i believes she_i’s a bore* have any true readings here? Though the answer seems to be no, the LF in (i) (where λ_i is a ‘de se’ abstractor operator which allows the complement clause to denote something in the domain of the attitude verb, cf. fns. 3 and 6) is mapped to True.

(i) $\llbracket \text{Sue believes-}w_0 \quad \llbracket \lambda_8 \lambda_1 \lambda_i \llbracket [G_8 \text{ she}_i]-w_1]-x_i \text{ is a bore-}w_1 \rrbracket \rrbracket^{c,g} = 1 \text{ iff}$

$$\exists G \in \text{CON}(c)_{\text{Sue},@,1} : \text{Dox}_{\text{Sue},@} \subseteq \{\langle w, x \rangle : G(x)(w)(x) \text{ is a bore in } w\}.$$

²⁵ Similarly, *Sue thinks John believes she’s a total bore* has a reading where Sue’s belief is ‘de se’, but she’s ascribing a ‘de re’ belief about herself to John — i.e. she might think John knows her under two guises. Presumably the LF underlying this reading has to look something like (ii). So ruling out problematic ‘de se/de re’ LFs can’t simply be a matter of forbidding concept-generators from being adjoined to ‘de se’ pronouns/traces:

- (75) $\llbracket \text{Daley believes-}w_0$
 $[\lambda_1 [\text{Clinton thinks-}w_1$
 $[\lambda_8 \lambda_2 [\llbracket G_8 \text{ KoF-}w_1 \rrbracket \text{-}w_2 \text{ is a spy-}w_2 \rrbracket]]] \rrbracket]^{c,g} = 1$ iff
 $\text{DOX}_{\text{Daley,@}} \subseteq \{w : \exists G \in \text{CON}(c)_{\text{Clinton},w,1} :$
 $\text{DOX}_{\text{Clinton},w} \subseteq \{w' : G(\text{Obama})(w') \text{ is a spy in } w'\}\}$.

Thus, it only makes sense to talk about the ‘de dicto’/‘de re’ distinction in relative terms. In (76), *the king of France* is ‘de dicto’ with respect to one attitude operator (namely, *believe*) but ‘de re’ with respect to another (namely, *think*). The relevant generalization for our cases seems to be that a DP cannot be construed ‘de re’ and ‘de dicto’ *relative to the same attitude operator*. More formally:

- (76) A concept generator G_n cannot adjoin to any node that dominates a world-pronoun bound by the world-binder of G_n , or to a trace bound by such a node (where the world-binder of G_n is the highest world-binding lambda c-commanded by λ_n).

Interestingly, ‘res’-movement avoids some of these issues. Moving the ‘res’ term up to the attitude verb, as in (77a), places it above the world abstraction operator λ_1 . Given the convention that all world pronouns free in the matrix denote the world of evaluation, the truth conditions for (77a) nonsensically require Daley to have a ‘de re’ belief about the (nonexistent) actual king of France. Iterated cases, on the other hand, work just fine, cf. (77b); *the king of France* is scoped high enough to be ‘de re’ in the scope of *think*, but not so high that it ceases being ‘de dicto’ in the scope of *believe*.

- (77) a. Daley [believes- w_0 [the king of France- w_1]]
 $[\lambda_3 \lambda_1 [t_3 \text{ is a spy-}w_1]]$
 b. Daley believes- w_0
 $[\lambda_1 [\text{Clinton} [\text{thinks-}w_1 [\text{the king of France-}w_1]]$
 $[\lambda_3 \lambda_2 [t_3 \text{ is a spy-}w_2]]]]]$

Unsurprisingly, though, given the arguments we developed in this paper, the scoping solution rules out too much — namely ‘bound de dicto/de re’

-
- (i) $\llbracket \text{Sue thinks-}w_0 [\lambda_1 \lambda_i [\llbracket \text{John believes-}w_1 [\lambda_8 \lambda_2 \lambda_j [\llbracket G_8 \text{ she}_i \rrbracket \text{-}w_2 \rrbracket \text{-}x_j \text{ is a bore-}w_2 \rrbracket]]] \rrbracket] \rrbracket]^{c,g} = 1$ iff

$$\text{DOX}_{\text{Sue,@}} \subseteq \{\langle w, x \rangle : \exists G \in \text{CON}(c)_{\text{John},w,1} :$$

$$\text{DOX}_{\text{John},w} \subseteq \{\langle w', x' \rangle : G(x)(w')(x') \text{ is a bore in } w'\}\}.$$

constructions. To show this we embed our original ‘bound de re’ scenario inside an attitude, as it were. Say Sally believes there’s three unicorns and that she thinks Bill’s in a Quinean double-vision scenario with respect to them — i.e. she thinks Bill believes *of Unicorn 1* and its mother that the former likes the latter, and so on, which is to say she thinks Bill’s thought is “a likes b’s mother, . . .”. Then *Sally believes in unicorns, and she believes that Bill thinks every unicorn_i likes its_i mother* is true, but it requires an LF that ‘res’-movement can’t give it: *every unicorn* needs to stay inside its tensed clause (cf. §2.2.1), but the pronoun it binds needs to go higher to pair up with relational *thinks*. The concept-generator theory, of course, readily generates a working LF:

$$(78) \quad \llbracket \text{Sally believes-}w_0 [\lambda_1 \text{ Bill thinks-}w_1 \\ [\lambda_8 \lambda_9 \lambda_2 [\text{every unicorn-}w_1 \\ [\lambda_3 \llbracket [G_8 t_3]\text{-}w_2 \text{ likes-}w_2 [G_9 \text{ its}_3]\text{-}w_2 \text{ mother-}w_2 \rrbracket]]]] \rrbracket^{c,g} = 1 \text{ iff} \\ \text{Dox}_{\text{Sally,@}} \subseteq \{w : \exists \langle G, H \rangle \in \text{CON}(c)_{\text{Bill},w,2} : \\ \text{Dox}_{\text{Bill},w} \subseteq \{w' : \{x : x \text{ is a unicorn in } w\} \subseteq \\ \{y : G(y)(w') \text{ likes MOM}(w')(H(y)(w'))\}\} \}.$$

So while scoping theories of ‘de re’ ascription (e.g. ‘res’-movement) do predict some of the data we’ve considered in this appendix — this explanation isn’t consistent with the full range of ‘de dicto/de re’ data.

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