A Choice-Functional Semantics for *De Re* Attitude Reports

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1. Introduction

In this paper, I present a relatively simple syntax and semantics for *de re* attitude reports, one that builds heavily upon the approaches developed by Percus & Sauerland (2003), Charlow & Sharvit (2014), and Sauerland (2014). The principle innovation of this account is that such readings involve quantification over choice-functions, rather than direct quantification over accessibility relations (Cresswell & von Stechow 1982), concept generators (Percus & Sauerland 2003, Charlow & Sharvit 2014), or counterpart functions (Sauerland 2014). I show that the proposed system accounts for the same range of complex data and judgments as prior approaches, particularly (i) the behavior of bound *de re* pronouns (Charlow & Sharvit 2014), (ii) interactions between *de re* readings and non-upward monotone operators (Charlow & Sharvit 2014), (iii) constraints on *de re* readings of complex DPs (Sauerland 2014), and (iv) the inability for DPs to be construed *de re* when they contain opaquely interpreted NPs (Charlow & Sharvit 2014). Despite this equivalent empirical coverage, the proposed system offers a relatively simple compositional semantics for *de* re attitude reports, one where (i) the object-language quantification at play is of a type independently observed in natural language, (ii) attitude verbs do not require a 'type-flexible' denotation, (iii) the intensional argument of an attitude verb is simply a proposition (or property of entities), (iv) there is no lexical ambiguity between 'existential' and 'universal' readings of such verbs. I show that the facts which motivated the complexities found in prior accounts – particularly the interactions between *de re* readings and quantificational DPs – can follow from independently known properties of choice-functional quantification.

The structure of this paper is as follows. In the next two subsections, I present some key background assumptions concerning the ontology of possible worlds and individuals (Section 2.1), and concerning the syntax/semantics interface and choice-functional quantification (Section 2.2). In Section 3, I present the proposed compositional semantics for attitude reports, and illustrate it with some basic cases. Section 4 discusses more complex cases where attitude reports contain bound pronouns (Charlow & Sharvit 2014). In Section 5, I briefly compare the proposed account to prior treatments. Section 6 explores the interactions between *de re* readings and non-upward-monotone operators such as sentential negation and quantificational DPs like *only Bill* and *no female student*. I show that under the proposed account, the key facts follow from a certain independently observed property of choice-functional quantification, the so-called 'Integrity Condition' (Chierchia 2001, Schwarz 2001a,b). Finally, Section 7 discusses two other predictions of the proposed account, the limits on *de re* readings of complex DPs (Sauerland 2014) and the inability for DPs to be construed *de re* when they contain opaquely interpreted NPs (Charlow & Sharvit 2014).

2. Central Background Assumptions

2.1 Assumptions Concerning Possible Worlds and Individuals

Following Sauerland (2014) and Heim (2001), I assume a Lewisian theory of trans-word identity between objects (Lewis 1968, 1986). That is, I assume every individual occupies exactly one possible world, and that no individual can exist in multiple worlds. Throughout this paper, I will employ the following abbreviatory notation (adapted from Sauerland 2014).

(1) For any individual x, w_x is the (unique) world that x occupies.

Individuals in different possible worlds, however, can be 'counterparts' of one another. Moreover, it is possible for an individual in world w to have more than one counterpart in w', or to have no counterparts in w'. Within the world w_x, however, x has exactly one counterpart, itself (Lewis 1968, 1986).

As noted by Heim (2001) and Sauerland (2014), such counterpart relations holding between entities can be represented in our semantic metalanguage by means of 'counterpart functions', defined as follows.

(2) C_x is a counterpart function for an entity x if (i) C_x is a function from worlds to entities, and (ii) for any world w, $C_x(w)$ is a counterpart of x at w.

Of course, since an entity needn't have counterparts at a given world, counterpart functions are partial functions. Furthermore, since an entity can have more than one counterpart at a given world, there is a great multiplicity (perhaps infinity) of counterpart functions C_x for any entity x. Finally, not every function fitting the formal definition in (2) will be 'cognitively accessible' to human minds. Often, the counterpart functions that factor into our semantic judgments are ones that can be finitely expressed by natural language definite descriptions, such as "the person named 'Barack Obama'" or "the person who wrote *Dreams from My Father*" or "the 44th president of the United States". However, perhaps just as often, there are contexts where our criteria for identifying individuals across worlds are much less effable. It would be well beyond the scope of this paper to offer a theory of exactly which functions meeting the definition in (2) will actually be 'cognitively accessible' to speakers, and thereby factor into our judgments of truth and felicity for specific attitude sentences. However, this issue is one that – in one form or another – infects all semantic treatments of *de re* readings, including those of attitude sentences.

Interestingly, counterpart functions as defined in (2) can be constructed through a formal device that has enjoyed broad popularity in natural language semantics: choice functions. As defined in (3), a choice function is one that maps a set to some element from that set.

(3) f is a choice function if (i) the domain of f is a set of non-empty sets, and (ii) for all S in the domain of f, $f(S) \in S$

To see how such functions can be used to construct counterpart functions, let us first introduce the following metalanguage notation.

(4) $\text{CTPT}(x,w) = \{ y : y \text{ is a counterpart of x in world w} \}$

Let us briefly observe that for any entity x, CTPT(x,w_x) = {x}. With this notation at hand, consider the function defined in (5) below, where *f* is a choice function.

(5) $[\ \lambda w' : f(\text{CTPT}(x,w'))\ ]$

Note that this function fits the definition in (2) for 'counterpart function'. Let us also note that such functions will again be partial functions, due to the fact that for some w', CTPT(x,w') will be the empty set. Moreover, since CTPT(x) will generally map a world w' to a non-singleton set, it follows that for any entity x, there is a great multiplicity (perhaps infinity) of distinct choice functions *f, g* such that $[\ \lambda w' : f(\text{CTPT}(x,w'))\ ] \neq [\ \lambda w' : g(\text{CTPT}(x,w'))\ ]$. Furthermore, let us observe that for any entity x, $[\ \lambda w' : f(\text{CTPT}(x,w'))\ ](w_x) = x$. For these reasons, I will throughout this paper often refer to functions of the form in (5) as 'counterpart functions'.

Finally, it has often been noted that not all functions fitting the formal definition of a choice function in (3) are 'cognitively accessible' or 'contextually relevant' to human speakers (Chierchia 2001; Kratzer 1998, 2003). Similar to what we noted earlier for counterpart functions, it is often the case that the choice functions factoring into our semantic judgments are ones that can be finitely expressed via definite descriptions, such as "the member who will die next" (Kratzer 1998, 2003) or "the member that intrigued him" (Chierchia 2001). However, there are also contexts where our 'method' for selecting members from a set is perhaps less effable. Again, as with counterpart functions, it is arguably beyond the scope of a semantic theory to provide an account of exactly which functions fitting the definition in (3) will be cognitively accessible or contextually relevant, thereby factoring into our judgments of truth and felicity for natural language sentences. Nevertheless, functions of the form in (5) will of course inherit those cognitive/contextual restrictions. Consequently, if we construct counterpart functions via formulae like that in (5), we can recast the aforementioned cognitive/contextual restrictions on counterpart functions as a specific instance of the ones that govern choice functions. That is, due to the independently observed fact that the domain of choice functions is cognitively / contextually restricted, it follows that counterpart functions as constructed in (5) will similarly be restricted, which fits with long-known facts about the scope and limits of *de re* readings.

2.2 Assumptions Concerning the Syntax/Semantics Interface and Choice Functions

I assume that interpretation of natural language expressions is relative to a world of evaluation *w*, an assignment function *g*, and a context *c*. Contexts are tuples consisting of at least a world c_w and an individual $c_{speaker}$. In general, the evaluation world *w* can differ from the context world c_w, but at the root node these two must be identical.

(6) If XP is the root node of a tree-structure, then $[[\text{XP}]]^{w,g,c}$ is only defined if $w = c_w$

Following Sauerland (2014), I assume that names in natural language only ever denote entities existing in the context world (*i.e.*, the actual world).

(7) If α is a name, then $[[\alpha]]^{w,g,c}$ = the individual named 'α' in c_w (Sauerland 2014)

Following Heim (2001) and Sauerland (2014), I assume that natural language predicates and relations cannot hold in a world w' of an entity that exists in a distinct world w''. Also following

Heim (2001) and Sauerland (2014), I will capture this via a presupposition (domain restriction) on natural language predicates and relations. That is, an intransitive verb like *smokes* and a transitive verb like *likes* will have denotations like that in (8), where the domain of their denotations is restricted to entities existing in the local evaluation world.

(8) a. $[[\ \textit{smokes}\ ]]^{w,g,c} = [\ \lambda x\ .\ w_x = w : x \text{ smokes in } w\ ]$
b. $[[\ \textit{likes}\ ]]^{w,g,c} = [\ \lambda x\ .\ w_x = w : [\ \lambda y\ .\ w_y = w : y \text{ likes } x \text{ in } w\ ]$

I will now introduce the only original technical devise used in this paper, the natural language operator *CTPT*, which assumed to be phonologically covert. As stated in (9) below, its semantics is defined in terms of the metalanguage 'CTPT' function in (4).

(9) $[[\ \textit{CTPT}\ ]]^{w,g,c} = [\ \lambda x : \text{CTPT}(x,w)\ ]$

That is, *CTPT* serves to 'lift' the denotation x of a type-e expression – such as a proper name – to the set of counterparts that x has at the local evaluation world. Consequently, the equivalences in (10) follow.

(10) $[[\ \textit{CTPT}\ \text{Barack Obama}\ ]]^{w,g,c}$ =
CTPT(the person named 'Barack Obama in c_W , w) =
CTPT(Barack Obama, w)

Note that if the local evaluation world w is c_w, then $[[\ \textit{CTPT}\ \text{Barack Obama}\ ]]^{w,g,c}$ will be the singleton {Barack Obama}.

Following Reinhart (1997), Winter (1997), Kratzer (1998), and many others, I assume that natural languages possess a phonologically covert pronoun over choice functions *F*.[1] Qua pronoun, *F* must bear an index, and thus obtains its semantic value via the variable assignment *g*.

(11) $[[\ F_i\ ]]^{w,g,c}$ is defined only if g(i) is a choice function
when defined, it is equal to g(i).

I assume that *F* can in principle be attached to any set-denoting expression. Consequently, syntactic structures like that in (12) can be generated for natural language sentences.

(12) [F_2 [*CTPT* Barack Obama]] (pronounced as 'Barack Obama')

Furthermore, following Reinhart (1997), Winter (1997), and Chierchia (2001), I assume that the pronoun *F* in natural language must be bound by a special existential closure operator, '$\exists F_i$'. This operator is given the syncategorematic semantic entry in (13) below.

(13) $[[\ \exists F_i\ \ XP\ ]]^{w,g,c} = \exists f\ .\ [[XP]]^{w,g(i/f),c} = T$

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[1] Following the work of Kratzer (1998), it is generally held that *F* can (or must) denote a 'skolemized' choice function, and thus its denotation can (or must) have an additional entity argument (Chierchia 2001). My discussion in this paper simply abstracts away from this further detail; the reader can confirm that 'skolemizing' the choice functions will not have any effect upon the proposed treatment of *de re* readings.

A major controversy within the literature on choice functional indefinites is the allowable scope positions for this existential closure operator '$\exists F_i$' – and indeed whether it actually exists at all (Kratzer 1998; Chierchia 2001; Schwarz 2001a,b). Although this issue remains far from settled, I will here follow Chierchia (2001) and Schwarz (2001a,b) in assuming that the scope of '$\exists F_i$' is governed by (at least) the following condition, dubbed the 'Integrity Condition' by Schwarz (2001a,b).[2,3]

(14) **Integrity Condition (Chierchia 2001; Schwarz 2001a,b)**
The operator '$\exists F_i$' must appear at the highest possible position in the sentence, modulo the following constraint: there cannot be a non-upward-monotone quantifier in the scope of '$\exists F_i$' that binds into the sister of 'F_i'.

* [$\exists F_i$ … [OP_j … [F_i [… X_j …] …] (where OP is non-upward monotone)
✔ [… OP_j [$\exists F_i$ [… [F_i [… X_j …] …] (where OP is non-upward monotone)

The Integrity Condition in (14) states that a non-upward monotone operator cannot scope below '$\exists F_i$' if it binds into the argument of the choice-function pronoun F_i. As first observed by Chierchia (2001), if such scope configurations were allowed, then sentences like (15a) below would be able to get extremely weak readings, ones that would hold true in scenarios like (15bi). Intuitively, however, (15a) is false in scenarios like (15bi), but true in ones like (15bii).

(15) a. Only $Dave_2$ saw a dog that he_2 liked.

b. (i) *Falsifying Scenario:*
Dave saw the dogs Sparky and Rex. Dave likes the dogs Sparky and Max.
Sue saw the dogs Fido and Max. Sue likes the dogs Fido and Rex.

(ii) *Verifying Scenario:*
Dave saw the dogs Sparky and Rex. Dave likes the dogs Sparky and Max.
Sue saw the dogs Fido and Jojo. Sue likes the dogs Sparky and Rex.

Without the Integrity Condition in (14), sentence (15a) could receive the LF in (16ai) below, and thereby get the truth-conditions in (16aii). Those truth-conditions hold in scenario (15bi), since there exists a choice function that will map the dogs Dave likes to Sparky (which he saw), but

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2 It should be noted that the first half of the condition in (14) – requiring '$\exists F_i$' to scope as high as possible – is usually stated as a separate generalization from the second half (Chierchia 2001), and that only the second half is referred to by Schwarz (2001a,b) as the 'Integrity Condition'. For reasons of space, I choose here to collect these two generalizations into the single complex statement in (14), and I dub the entirety 'the Integrity Condition'.

3 Properly speaking, Schwarz (2001a,b) argues that *if the operator* '$\exists F_i$' *exists,* then its scope must be regulated by the Integrity Condition in (14). However, for Schwarz (2001a,b), the complexity and *sui generis* character of (14) is sufficient reason for concluding (via *modus tollens*) against any analysis appealing to that operator. Consequently, Schwarz (2001a,b) is lead to a theory where quantifier raising of indefinites is exceptionally permitted to cross syntactic islands. I therefore conclude that should we wish to avoid that latter consequence, we must (via *modus ponens*) conclude that (i) the operator '$\exists F_i$' exists and (ii) is subject to (14).

Kratzer (2003) proposes that certain data motivating the constraint in (14) can be understood instead in purely pragmatic terms. I leave open here whether such a pragmatic approach could be similarly developed for the facts that I account for in terms of this constraint.

map the dogs Sue likes to Rex (which she didn't see).[4] Thus, the LF in (16ai) must somehow be ruled out, and this is accomplished by the condition in (14).

(16) a. (i) Unallowable LF for (15a):
[$\exists F_1$ [Only Dave [2 [t_2 saw [F_1 [dog that he$_2$ liked] …] [5]

(ii) Predicted Truth-Conditions of LF (15ai)
$\exists f$. Dave saw f({x : x is a dog that Dave liked}) &
$\forall$y . y $\neq$ Dave $\rightarrow$ $\neg$(y saw f({x : x is a dog that y liked})

b. (i) Allowable LF for (15a):
[Only Dave [2 [$\exists F_1$ [t_2 saw [F_1 [dog that he$_2$ liked] …]

(ii) Predicted Truth-Conditions of LF (15bi)
$\exists f$. Dave saw f({x : x is a dog that Dave liked}) &
$\forall$y . y $\neq$ Dave $\rightarrow$ $\neg\exists f$. (y saw f({x : x is a dog that y liked})

That condition, though, would not rule out the LF in (16bi), which receives the truth-conditions in (16bii). As the reader can confirm, those truth-conditions rightly hold only in scenario (15bii). The reader is referred to the aforementioned works for more detailed discussion of this point (Chierchia 2001, Schwarz 2001a,b; *cf.* Kratzer 2003).

In addition to limiting the scope interactions between '$\exists F_i$' and non-monotone quantifiers, the condition in (14) requires the operator '$\exists F_i$' to take the highest possible scope in the sentence. This reflects the fact that – modulo the observations in (15)-(16) – choice-functional quantification seems unable to take scope at intermediate positions within the sentence (Fodor & Sag 1982, Kratzer 1998, Chierchia 2001). Taking these observations together, it appears that the existential closure of the choice-function pronoun 'F_i' must be at the highest possible position where there is not an intervening non-upward monotone operator binding into the argument of 'F_i', as stated in (14).

Let us now briefly examine how the ingredients introduced in this section yield accurate truth-conditions for simple sentences like those in (17).

(17) a. Barack Obama smokes.
b. Barack Obama likes Joe Biden.

Under the system proposed thus far, sentence (17a) can receive either the LF in (18ai) or that in (18bi). Although the LF in (18bi) contains the operator *CTPT* and choice-functional quantification, in a matrix environment like that of (17a), the resulting truth-conditions are

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[4] Kratzer (2003) observes, however, that while such a choice-function is formally definable, it may not be cognitively natural or ever contextually relevant. Consequently, the truth-conditions in (16aii) could still end up false in scenario (15bi) if the domain of choice-functional quantification is restricted to those that are cognitively accessible / contextually relevant. It may thus be possible to dispense with the condition in (14). As stated earlier in Footnote 3, I leave open here whether such a 'pragmatic' account of the judgments in (15) could be extended to the cases I discuss in Section 6, where I make crucial use of the condition in (14).

[5] Throughout this paper, I assume a syntax and semantics for binding and movement like that originally proposed by Heim & Kratzer (1998).

logically equivalent to the simple LF in (18ai). Similarly, sentence (17b) can receive either the LF in (19ai) or that in (19bi), which have logically equivalent truth-conditions (19aii)-(19bii).

(18) a. (i) Possible LF for (17a): [Barack Obama smokes]

(ii) Predicted Truth-Conditions:
The person named 'Barack Obama' in c_w smokes in c_w
(*iff* Barack Obama smokes in c_w)

b. (i) Possible LF for (17a): [$\exists F_1$ [F_1 [*CTPT* Barack Obama]] smokes]

(ii) Predicted Truth-Conditions
$\exists f$. f(CTPT(the person named 'Barack Obama' in c_w , c_w)) smokes in c_w
(*iff* $\exists f$. f({Barack Obama} smokes in c_w)
(*iff* Barack Obama smokes in c_w)

(19) a. (i) Possible LF for (17a): [Barack Obama [likes Joe Biden]]

(ii) Predicted Truth-Conditions:
The person named 'Barack Obama' in in c_w likes in c_w the person named 'Joe Biden' in c_w
(*iff* Barack Obama likes Joe Biden in c_w)

b. (i) Possible LF for (17a): [$\exists F_1$ [$\exists F_2$ [F_1 [*CTPT* Barack Obama]]
[likes [F_2 [*CTPT* Joe Biden]]

(ii) Predicted Truth-Conditions
$\exists f$. $\exists f'$. f (CTPT(the person named 'Barack Obama' in c_w , c_w)) likes in c_w
f' (CTPT(the person named 'Joe Biden' in c_w , c_w))
(*iff* $\exists f$. $\exists f'$. f ({Barack Obama}) likes in c_w f' ({Joe Biden})
(*iff* Barack Obama likes Joe Biden in c_w)

3. The Syntax and Semantics of Attitude Sentences

I will assume a rather elementary lexical semantics for attitude verbs like *believes* and *thinks*, whereby they are simply functions from propositions to predicates (type <st,et>). Thus, both *believes* and *thinks* will receive the fairly simple lexical entry in (20), where 'Bel(x,w)' stands for the worlds that are consistent with the beliefs of x in world w.[6] Note that given the limitations of human minds, there is no individual such that exactly one possible world is consistent with

[6] The general theory of *de re* readings offered here would also be compatible with the view that attitude verbs take *properties* (type <s,et>) as their first argument, and quantify over so-called 'doxastic alternatives' (Lewis 1979, Chierchia 1989, Percus & Sauerland 2003). That is, the general theory offered here could just as well employ the lexical entry in (i) below:

(i) $[[$ *believes / thinks* $]]^{w,g,c}$ = $[\lambda P_{<s,et>} : \lambda x : \forall <y,w'> \in \text{DoxAlt}(x,w) . P(w')(y) = T]$

Since we will not be concerned here with so-called *de se* readings of attitude sentences, I abstract away from this additional complication in my discussion, and employ the simpler lexical semantics in (20).

their beliefs. Consequently, I assume that the range of 'Bel(x,w)' is strictly limited to non-singleton sets.

(20) [[*believes / thinks*]]^{w,g,c} = [$\lambda p_{<st>}$: λx : $\forall$w' $\in$ Bel(x,w) . p(w') = T]

I also assume the object-language up-operator '^' of Keshet (2011). As stated in (21) below, the '^'-operator serves to lambda-abstract over the evaluation world.

(21) [[^ XP]]$^{w,\, g,\, c}$ = [λw' : [[XP]]$^{w',\, g,\, c}$]

With all these ingredients in place, let us consider the treatment of a simple attitude sentence like the following.

(22) John believes that Barack Obama smokes.

Given the assumptions from Section 2, the sentence in (22) could in principle receive either of the LFs in (23).

(23) a. [John [believes [^ [Barack Obama smokes] …]
b. [$\exists F_1$ [John [believes [^ [F_1 [*CTPT* Barack Obama]] smokes] …]

Let us first observe that the truth-conditions generated for the LF in (23a) – stated in (24) below – will be pathological (effectively contradictory).

(24) $\forall$w' $\in$ Bel(John,w) : the person named 'Barack Obama' in c_w smokes in w'

Recall that natural language predicates like *smokes* bear a presupposition that their arguments occupy their local evaluation world (8). Consequently, the truth-conditions in (24) can only hold if every world in Bel(John,w) is equal to c_w, the world that Barack Obama inhabits. Given that, as mentioned earlier, the range of Bel(x,w) must be non-singleton sets, it follows that the truth-conditions in (24) can never be satisfied, and thus are logically contradictory.[7]Assuming that logically contradictory LFs are grammatically blocked (Gajewski 2002), we may conclude that the LF in (23a) is not actually an allowable reading/parse of sentence (22).

Now let us consider the LF in (23b), where *Barack Obama* forms a constituent with the operator *CTPT*, which in turn is complement to a choice function pronoun bound by matrix '$\exists F_1$'. As the reader can confirm, the LF in (23b) will receive the truth-conditions in (25a) below.

[7] I also assume that attitude verbs in natural language do not permit trivial quantification over possible worlds, and thus (23) cannot end up true via 'Bel(John,w)' returning the empty set. Note that if such trivial quantification were permitted, then from (i) and (ii) below, the statement in (iii) should logically follow, but intuitively it does not.

(i) Trump believes that the Russians interfered with the 2016 election.
(ii) Trump believes that the Russians didn't interfere with the 2016 election.
(iii) Trump believes that choice functional indefinites are never existentially closed.

Thus, though individuals can hold logically inconsistent beliefs, the function 'Bel(x,w)' at play in the semantics of attitude verbs never seems to return the empty set of worlds. This, of course, raises important questions regarding the nature of 'inconsistent belief states', but such matters fall well outside the scope of this paper.

(25) a. $\exists f\,.\ \forall w' \in Bel(John,w): f(CTPT(Barack\ Obama,\ w'))$ smokes in w'
b. $\exists f\,.\ \forall w' \in Bel(John,w): [\lambda w'' : f(CTPT(Barack\ Obama,\ w''))](w')$ smokes in w'
c. There is a counterpart function $C_{BarackObama}$ such that in all the worlds w' consistent with John's beliefs in w, $C_{BarackObama}(w')$ smokes in w'.

Furthermore, let us note that the formula in (25a) is equivalent to that in (25b). Thus, recalling our discussion from Section 2.1, these truth-conditions are equivalent to the statement in (25c). All the statements in (25) assert that there is a counterpart function for Barack Obama – $C_{BarackObama}$ or $[\lambda w'' : f(CTPT(Barack\ Obama,\ w''))]$ – that maps each of John's belief worlds w' to some smoker in w'. Put more informally, these truth-condition state that there is a conception of Barack Obama – say "the 44th president of the United States" – such that in all John's belief worlds, the entity satisfying that conception smokes. Thus, (25a,b,c) will hold in a scenario where John has the *de dicto* belief that "the 44th president of the United States smokes", and so we correctly predict that sentence (22) will receive a true *de re* reading in such a scenario.

One might worry, however, whether our putative *de re* truth-conditions in (25a,b,c) are too weak. Beginning with Sleigh (1967) and Kaplan (1968), it has long been noted in the literature on *de re* attitude ascriptions that the 'conceptions' or 'counterpart functions' at play in such ascriptions are typically grounded in some form of 'epistemic accessibility relation' holding between the attitude holder and the entity named in the complement to the attitude verb (a.k.a, the 'object' or '*res*' of the attitude). In the semantic literature on *de re* readings of attitude sentences, this fact has often been captured by simply 'hardwiring' it into the semantics of the *de re* reading, typically via stipulating in the lexical entries for the attitude verbs themselves the need for there to be such an 'accessibility relation' between the attitude holder and the *res* (Cresswell & von Stechow 1982, Percus & Sauerland 2003, Sauerland 2014). However, as first noted by Sosa (1970), such an approach would wrongly predict that the truth of a *de re* reading *always* requires that there be such an accessibility relation. Indeed, philosophers of language have observed a rather sizeable number of contexts where sentences can allow true *de re* readings without there being any identifiable accessibility relation between the attitude holder and the entity named in the subordinate clause (Sosa 1970, Fodor 1970, Partee 1970, Bonomi 1995, Aloni 2005, Hawthorne & Manley 2012). Many of these cases are reviewed by Yalcin (2015), who defends the claim – originally proposed by Schiffer (1977) – that while the quantification over 'conceptions' / 'counterpart functions' at play in *de re* readings must be restricted, it would be far too strong to restrict it only to concepts based in 'epistemic accessibility relations'. Instead, the most a semantic theory of *de re* attitudes should state is simply that the quantification over conceptions / counterpart functions is contextually determined. The nature of that contextual restriction – why certain imaginable or logically definable conceptions / functions are not allowable in certain contexts – is an independent (and quite difficult) problem, which should be approached from a more general theory of reference fixation, trans-world identity, and perhaps the social pragmatics of belief ascriptions. I will follow Yalcin (2015) and many others in this view. Note that, as we've already observed, quantification over choice-functions such as that in (25a,b) is subject to complex – and currently ill-understood – pragmatic and cognitive limitations. It would be quite natural, then, to view the long-observed limits on the allowable conceptions / counterpart functions in *de re* readings to be of a piece. At the very least, our choice functional semantics in (25a) indeed predicts that *de re* readings will be affected by which conceptions / counterpart functions are contextually (and cognitively) accessible.

In the structure in (23b), the existential binder of the choice function pronoun scopes above the attitude predicate. Importantly, our system would not permit an LF like that in (26a) below, where the existential binder occupies a position inside the subordinate clause.

(26) a. [John [believes [^ [$\exists F_1$ [F_1 [*CTPT* Barack Obama]] smokes] …]

b. $\forall$w' $\in$ Bel(John,w): $\exists f$. f(CTPT(Barack Obama, w')) smokes in w'

The structure in (26a) would run afoul of the Integrity Condition in (14), since it is possible for '$\exists F_1$' to take higher scope without also scoping over an intervening non-upward monotone operator. Consequently, we predict that sentence (22) cannot receive the reading / parse in (26a), whose truth-conditions would be as in (26b). As noted by Charlow & Sharvit (2014), this appears to be a correct prediction, as the truth-conditions in (26b) are quite weak. Note that they permit the counterpart function (conception) for Barack Obama to co-vary with the belief-worlds. As a result, the truth-conditions in (26b) will hold even if John holds the *de dicto* belief "either the 44th president smokes, or the author of *Dreams from My Father* smokes" but does not know that those two individuals are one-and-the-same. However, as Charlow & Sharvit (2014) observe, sentences like (22) do not seem to allow for a true reading in such contexts. Thus, we can conclude that the LF in (26a) is not a permissible parse for (22), as predicted by the Integrity Condition in (14). On the other hand, we will later see in Section 6 that there are sentences where the Integrity Condition will require the operator '$\exists F_i$' to appear within the complement to the attitude verb; however, we will also see that in such cases, our system will still derive accurate truth-conditions for the sentences in question.

Finally, let us briefly consider a sentence like (27a) below, where the complement to the attitude verb contains multiple names.

(27) a. Sentence: John believes that Barack Obama likes Joe Biden.

b. Permissible LF:
[$\exists F_1$ [$\exists F_2$ [John [believes [^ [F_1 [*CTPT* Barack Obama]]
[likes [F_1 [*CTPT* Joe Biden]]

c. Predicted Truth-Conditions:
$\exists f$. $\exists f'$. $\forall$w' $\in$ Bel(John,w): f(CTPT(Barack Obama, w'))
likes in w' f' (CTPT(Joe Biden, w'))

Given what we've already seen for sentence (22), it follows that (27b) is the only permissible LF for (27a). Under this LF, both the names *Barack Obama* and *Joe Biden* are complement to the *CTPT* operator, and the resulting phrase is complement to a choice function pronoun. Furthermore, both choice function pronouns are existentially bound within the matrix clause. The truth-conditions our system assigns to this LF are those in (27c), which state that there is a counterpart function (conception) for Barack Obama and one for Joe Biden, such that in all of John's belief worlds, the entity satisfying the former likes the entity satisfying the latter. Thus, the truth-conditions in (27c) will hold in a situation where John has the *de dicto* belief "The 44th president likes the 47th vice president," and so we correctly predict that sentence (27a) has a true *de re* reading in such a scenario.

4. *De Re* Readings and Bound Pronouns

Under the system proposed in Section 2, it should be perfectly possible for a bound pronoun or movement-trace to be complement to the *CTPT* operator. Thus, a sentence like (28a) below should allow for either the LF in (28b) or the one in (28c).

(28) a. Sentence: John believes that Barack Obama likes himself.

b. Permissible LF:
[$\exists F_1$ [John [believes [^ [F_1 [*CTPT* Barack Obama]]
[2 [t_2 [likes himself$_2$] …]

c. Permissible LF:
[$\exists F_1$ [$\exists F_3$ [John [believes [^ [Barack Obama
[2 [F_1 [*CTPT* t_2]] likes [F_3 [*CTPT* himself$_2$] …]

Under the LF in (28b), the phrase '[F_1 [*CTPT* Barack Obama]]' binds the anaphor *himself*. Under the LF in (28c), however, the name *Barack Obama* has undergone movement above the *CTPT* operator, to a position where it can directly bind the anaphor *himself*. Furthermore, that anaphor is itself complement to *CTPT*, and that phrase is complement to a separate (existentially bound) choice function pronoun F_3. Under our semantics, the LF in (28b) will receive the truth-conditions in (29a), while the LF in (28c) will receive those in (29b).

(29) a. Truth-Conditions of LF (28b):
$\exists f . \forall w' \in \text{Bel}(\text{John},w): f(\text{CTPT}(\text{Barack Obama}, w'))$
likes in w' $f(\text{CTPT}(\text{Barack Obama}, w'))$

b. Truth-Conditions of LF (28c)
$\exists f . \exists f'. \forall w' \in \text{Bel}(\text{John},w): f(\text{CTPT}(\text{Barack Obama}, w'))$
likes in w' $f'(\text{CTPT}(\text{Barack Obama}, w'))$

The truth-conditions in (29a) state that there is a conception of Barack such that in all of John's belief worlds, the entity fitting that conception likes the entity fitting that conception. Thus, (29a) will hold in a scenario where John has the *de dicto* belief "The 44th president likes himself", and so we correctly predict that (28a) will allow for a true *de re* reading in such a scenario. The truth-conditions in (29b), however, are more complex. They state that there are *two* conceptions of Barack Obama such that in all of John's belief worlds, the entity fitting the first conception likes the entity fitting the second conception. Thus, (29b) will hold in a scenario where John holds a *de dicto* belief like "The 44th president likes the author of *Dreams from My Father*", and so our account predicts that sentence (28a) should allow a true *de re* reading in such a scenario. While it may not be immediately obvious whether this prediction is accurate, plausible examples of such 'bound *de re*' readings have been amassed in the literature (Anand 2006, Percus 2010, Charlow & Sharvit 2014). We may therefore conclude that our theory correctly predicts that sentence (28a) will allow for a reading like that in (29b), though the plausibility of such readings may (again) rely upon poorly-understood contextual factors.

The structure in (28c) differs from that in (28b) in two respects: (i) the name *Barack Obama* has undergone movement above the *CTPT* operator, directly binding the anaphor *himself*, and (ii) a second *CTPT* operator takes the anaphor *himself* as argument. Importantly, our account predicts that the first feature of (28b) cannot occur without the second. That is, our account will rule out the LF in (30a) below, where the name *Barack Obama* directly binds *himself* and there is no second *CTPT* operator above the anaphor.

(30) a. Impermissible LF for (28a): [$\exists F_1$ [John [believes [^ [Barack Obama [2 [F_1 [*CTPT* t_2]] likes himself$_2$] …]

b. Predicted Truth-Conditions for (30a)
$\exists f$. $\forall$w' $\in$ Bel(John,w): f(CTPT(Barack Obama, w')) likes Barack Obama in w'

Given our semantics from Section 2, the LF in (30a) will receive the truth-conditions in (30b). Crucially, like the truth-conditions in (24), the truth-conditons in (30b) will require Barack Obama to exist at all of John's belief worlds, and so therefore entail that the set of John's belief worlds is the singleton set $\{c_w\}$. Because the function 'Bel' only returns non-singleton sets as values, it follows that the truth-conditions in (30b) will never hold, and so the LF in (30a) may thereby be grammatically blocked (Gajewski 2002). Thus, (30a) is not a permissible parse / reading for sentence (28a).

Let us now consider the much more complex case of sentence (31a) below, first discussed by Charlow & Sharvit (2014). As Charlow & Sharvit observe, sentence (31a) can be construed as true in both scenario (31b) and scenario (31c).

(31) a. John believes that every student likes their mother.

b. Simple '*De Re* + Binding' Scenario:
John is shown pictures of all the students in our class. He doesn't know that they are students. However, (for whatever reason) he thinks each person he looks at likes their mother. That is, he goes through the pictures of our students saying (*e.g.*) "This person likes their mother. And this person likes their mother. And this person too likes their mother…" *etc.*

c. 'Bound *De Re*' Scenario:
John is shown two sets of pictures of all the students in our class. There's a set of pictures on his left, and a different set on his right. John doesn't know that these people are students. *He also (for whatever reason) doesn't recognize that the people on the left are the same as the people on the right*. But, for each pair of pictures of the same person, he thinks that the person depicted on the left likes the mother of the person depicted on the right. That is, he goes through the pairs of pictures saying (*e.g.*) "This person like the mother of this person. And, this person likes the mother of this person. And this person too likes the mother of this other person…", each time pointing at two pictures of the same individual.

Charlow & Sharvit (2014) demonstrate that many prior theories of *de re* readings are unable to predict that sentence (31a) can be interpreted as true in scenario (31c). However, they also show that the 'concept generator'-based approach of Percus & Sauerland (2003) is able to predict a reading of (31a) that is true in (31c). Given that our own account borrows very heavily from that of Percus & Sauerland, it is perhaps not surprising that we also correctly predict such a reading of (31a). Under our account, the sentence in (31a) can receive either of the LFs in (32).

(32) a. Permissible LF for (31a):
[$\exists F_1$ [John [believes [[every student] [2 [^ [F_1 [*CTPT* t_2]]
[3 [t_3 [likes their$_3$ mother] …]

b. Permissible LF for (31a):
[$\exists F_1$ [$\exists F_3$ [John [believes [[every student] [2 [^ [F_1 [*CTPT* t_2]]
[likes [[F_3 [*CTPT their*$_2$]] mother] …]

In both the LFs above, the quantificational subject *every student* undergoes movement to a position above the '^'-operator; this results in the NP *student* receiving a transparent reading, where it is interpreted relative to c_w (Keshet 2011). The LFs differ, however, with respect to the binder of the possessive pronoun *their*. In (32a), the pronoun is bound by the subject remnant ('[F_1 [*CTPT* t_2]'). In (32b), however, the pronoun is directly bound by the quantificational DP *every student*. For reasons that we've just seen (30), the pronoun in (32b) must therefore also be complement to the operator *CTPT*, and the resulting phrase complement to a separate choice function pronoun 'F_3'.

Our semantics predicts that LF (32a) will receive the truth-conditions in (33a), while the LF in (32b) will receive those in (33b)

(33) a. Truth-Conditions Predicted for LF (32a):
$\exists f$. $\forall$w' $\in$ Bel(John,w):
$\forall$x . x is a student in c_w $\rightarrow$ f(CTPT(x, w')) likes the mother of f(CTPT(x, w'))

b. Truth-Conditions Predicted for LF (32b):
$\exists f$. $\exists f'$ $\forall$w' $\in$ Bel(John,w):
$\forall$x . x is a student in c_w $\rightarrow$ f(CTPT(x, w')) likes the mother of f' (CTPT(x, w'))

The truth-conditions in (33a) hold if there is a way of choosing counterparts f such that for every student x and every belief world of John w', f applied to the counterparts of x in w' likes their own mother in w'. Importantly, the counterparts selected by such a function f could in principle vary in their nature from student to student. That is, it could be that across John's belief worlds w', f(CTPT(student$_1$, w') is whatever entity is depicted in the first picture John saw in w', while f(CTPT(student$_2$, w') is whatever entity is depicted in the second picture John saw in w', *etc.*[8] Consequently, the truth-conditions in (33a) will hold in a scenario like (31b), where for each actual student x, there is a conception of x whereby in John's belief worlds, the entity satisfying that conception likes their own mother.

Let us now consider the more complex truth-conditions in (33b). These will hold if there are *two* ways of choosing counterparts – f and f' – such that for every student x and belief world of John w', f applied to the counterparts of x in w' likes the mother of f' applied to the

[8] That is, as readers familiar with concept generator-based analyses of *de re* readings may observe, while a function of the form '[λw': f(CTPT(x,w')]' is equivalent to a counterpart function for x (Section 2), a function of the form '[λx : [λw': f(CTPT(x,w')]' is equivalent to a *concept generator*, in the sense of Percus & Sauerland (2002). Consequently, when the entity argument of CTPT is quantificationally bound, existential quantification over the choice function f is effectively quantification over concept generators taking that entity as argument.

counterparts of x. Crucially, since *f* and *f'* are distinct choice functions, their 'method' of selecting the counterparts of x can differ. That is, it could be that across John's belief worlds w', *f*(student$_1$, w') is whatever entity is depicted in the *left-hand* picture from the first pair John saw in w', while *f'*(student$_1$, w') is whatever entity is depicted in the *right-hand* picture from the first pair John saw in w'. Similarly, it could be that in every belief world w' of John, *f*(student$_2$, w') is whatever entity is depicted in the *left-hand* picture from the *second* pair John saw in w', while *f'*(student$_2$, w') is whatever entity is depicted in the *right-hand* picture from the *second* pair John saw in w', *etc.* Consequently, the truth-conditions in (33b) will hold in a scenario like (31c), where for each actual student x, there are *two* conceptions of x, whereby in all of John's belief worlds, the entity satisfying the first conception likes the mother of the entity satisfying the second conception.

In summary, we have seen in this section that the relatively simple syntax and semantics for attitude ascriptions presented in Sections 2 and 3 can scale up to the complex cases of 'bound *de re*' readings famously discussed by Charlow & Sharvit (2014). Again, it should be acknowledged that this should not be a surprise, given how heavily the proposed account borrows from the 'concept generator'-based semantics of Percus & Sauerland (2003).

5. Some Brief Comparisons to Prior Approaches

For reasons of space, I will not review here in detail prior compositional semantic analyses of *de re* attitude ascriptions. Knowledgeable readers, however, will surely observe the strong parallels between the account offered above and the concept generator-based analyses of Percus & Sauerland (2003) and Charlow & Sharvit (2014). Both these accounts are also very similar in spirit to Sauerland's (2014) analysis employing quantification over counterpart functions (Heim 2001). There are, however, some important differences between those prior analyses and the account offered here.

One relatively minor – but not insignificant – feature of the system in Sections 2 and 3 is that the object-language quantification hypothesized for *de re* readings is of a sort that is independently motivated for natural language. Under the concept generator-based theories of Percus & Sauerland (2003) and Charlow & Sharvit (2014), the LF structure of a *de re* attitude ascription involves object-language quantification over so-called 'concept generators', functions from entities to type-<se> functions. Consequently, these accounts entail the existence of object-language pronouns and operators ranging over concept generators. Unfortunately, such objects don't appear to have any independent empirical motivation, outside of the generation of *de re* readings. Similarly, the system proposed by Sauerland (2014) postulates object-language pronouns and operators ranging over counterpart functions, again a device that seems not to have an independent empirical motivation. Our proposed account, however, employs object-language quantification over choice functions, a hypothesis that – while not uncontroversial – has enjoyed rather broad applications and acceptance within natural language semantics. Of course, our account does also postulate a covert *CTPT*-operator, an entity that seems to be needed only for the generation of *de re* readings. However, one could argue that the postulation of a single *sui generis* covert operator is somewhat more conservative than the postulation of both covert pronouns and covert operators of a *sui generis* type. Furthermore, within a Lewisian ontology of the kind presented in Section 2.1, natural language would require some means for 'lifting' an entity into its set of counterparts, otherwise referring expressions would be entirely impossible in modal contexts. Crucially, the *CTPT*-operator performs exactly this role and no more. Thus, its existence is a 'virtual conceptual necessity' for any natural language semantics making use of a Lewisian theory of trans-world identity.

A more significant difference between the present account and previous ones concerns the existential quantification at play in *de re* attitude ascriptions. With perhaps the exception of Yalcin (2015), all previous compositional semantic treatments of *de re* readings have (to my knowledge) proposed that the existential quantification involved in such readings is contributed by the attitude verb itself. Under our proposed account, however, that quantification is the result of independent existential closure operators (over choice functions) adjoined in the sentence. A major consequence of this difference is that the present account is able to employ a rather simple lexical semantics for attitude verbs, one where their intensional argument is simply a proposition (20). Under prior approaches, the lexical semantics of attitude verbs additionally involves existential quantification over either 'accessibility relations' (Cresswell & von Stechow 1982), concept generators (Percus & Sauerland 2003), or counterpart functions (Sauerland 2014). Consequently, under such approaches, the intensional argument of the attitude verb must be a function from such objects to propositions. Thus, under the concept generator-based approach (Percus & Sauerland 2003), the complement of an attitude verb must be a function from concept generators to propositions; similarly, under the analysis of Sauerland (2014), such clausal complements must denote functions from counterpart concepts to propositions. This, of course, is a striking deviation from the intuitive notion that attitude verbs are relations between entities and propositions. Under the account proposed here, however, by separating out the existential quantification in the *de re* reading from the lexical semantics of the attitude verb, we are able to adhere to the simple, intuitive picture of attitude verbs being propositional operators.

A further consequence of our separating out the existential quantification in *de re* readings from the attitude verbs themselves is that our account needn't postulate a 'type-flexible' semantics for those verbs. Note that in 'bound *de re*' readings of pronouns – like in (29b) and (33b) – there must be two existential quantifiers in the *de re* reading (Anand 2006, Percus 2010, Charlow & Sharvit 2014, Sauerland 2014). Clearly, one can thereby imagine more complicated examples where there must be three, four, five, or any number of existential quantifiers in the 'bound *de re*' reading. Under a system where that existential quantification arises from the lexical semantics of the attitude verb, it would follow that every such verb must allow for an unbounded number of readings. Thus, within such systems, it is widely recognized that a type-flexible semantics for attitude verbs must be employed, one that would allow such verbs to productively take on any one of these infinite number of meanings (Anand 2006, Percus 2010, Charlow & Sharvit 2014, Sauerland 2014). Unfortunately, to my knowledge, there is no way to recursively define this infinite number of possible readings that attitude verbs are postulated to allow for. Thus, besides being an additional complication to the analysis, the type-flexibility proposed in prior accounts of *de re* readings is rather different in kind from the more well known and widely accepted instances of type-flexibility, which can be recursively defined. There also arise difficult questions regarding exactly how this postulated type-flexibility is finitely represented in the linguistic system. For these reasons, I conclude that the type-flexibility required for attitude verbs in previous accounts is a rather unfortunate feature of those accounts, and so its absence from the account proposed here is a compelling argument in its favor.

On the other hand, it is not for nothing that previous treatments of *de re* readings attributed the existential quantification of those readings to the attitude verbs. In particular, Percus & Sauerland (2003) and Sauerland (2014) observe that there are limitations on the scope of that existential quantification, ones that would easily follow from it being lexically encoded in the attitude verb. In the following section, we will examine those facts, and we will see that our choice functional approach offers its own unique perspective upon them.

6. Interactions Between *De Re* Readings and Non-Upward Monotone Operators

All the *de re* attitude sentences we have discussed thus far have been assigned truth-conditions where the existential operator '$\exists F_i$' takes highest scope, over the matrix subject. However, as first observed by Percus & Sauerland (2003), there are sentences where it seems the existential quantification in the *de re* reading must scope below the matrix subject. For example, let us observe that sentence (34a) is intuitively false in scenario (34b).

(34) a. Only Bill_1 believes he_1 will win.

b. Falsifying Scenario:
Bill, Tom, and Frank are local politicians running for office. However, all three of them expect to lose and so have gone to a local bar to drown their sorrows. They have become so drunk that when their campaign ads play on the TV and the radio in the bar, they don't recognize themselves. Bill sees his ad on the TV and says "I'm going to lose, but whoever that guy is – he's going to win!" Tom isn't impressed by his own TV ad, but is instead struck by his own radio ad. He says, pointing to the radio, "I'm going to lose, but whoever that guy is – he's going to win." Finally, Tom is impressed by neither his own TV ad nor his own radio ad. He says despondently, "none of us and none of those guys are going to win."

Intuitively, sentence (34a) is false in scenario (34b) because both Bill and Tom believe *de re* about themselves that they are going to win. Note, however, that the LF in (35a) will receive the truth-conditions in (35b), which actually hold in scenario (34b).

(35) a. Impermissible LF for (34a):
[$\exists F_1$ [[Only Bill] [2 [t_2 believes [^ [F_1 [*CTPT* he_2]] will win] …]

b. Unavailable Reading for (34a):
$\exists f\ .\ \forall w' \in \text{Bel(Bill,w)}: f(\text{CTPT(Bill, w')})$ will win in w' & $\forall y\ .\ y \neq \text{Bill} \rightarrow$
$\neg(\forall w' \in \text{Bel(y,w)}: f(\text{CTPT(y, w')})$ will win in w'

The truth-conditions in (35b) state that there is a way of selecting counterparts *f* such that in all Bill's belief worlds w', the counterpart of Bill that *f* picks out wins in w', but for anyone else, it isn't true that in all their belief worlds, the counterpart of themselves that *f* picks out wins in w'. These truth-conditions hold in scenario (34b), since they are verified by the function that maps all Bill's counterparts to the entity whose TV ad played (at such-and-such a time), and maps all Tom's counterparts to the entity whose TV ad played (at such-and-such a later time). Since only Bill believes of his 'TV-counterpart' that he will win – Tom thinks that the person in his TV ad won't win – it follows that this function *f* witnesses the truth of (35b) in scenario (34b). For this reason, the LF in (35a) cannot represent a grammatically possible parse / reading for sentence (34a). Instead, it seems that the LF in (36a) – which receives the truth-conditions in (36b) – represents the intuitive meaning of sentence (34a).

(36) a. Permissible LF for (34a):

[[Only Bill] [2 [$\exists F_1$ [t_2 believes [^ [F_1 [*CTPT* he_2]] will win] …]

b. Permissible Reading for (34a):

$\exists f$. $\forall$w' $\in$ Bel(Bill,w): f (CTPT(Bill, w')) will win in w' & $\forall$y . y $\neq$ Bill $\rightarrow$
¬($\exists f$. $\forall$w' $\in$ Bel(y,w): f (CTPT(y, w')) will win in w'

The truth-conditions in (36b) state that there is there is a way of selecting counterparts *f* such that in all Bill's belief worlds w', the counterpart of Bill that *f* picks out wins in w', but for anyone else, *there is no such way of selecting counterparts.* These truth-conditions fail to hold in (34b); after all, there is the function that will map all of Tom's counterparts across his belief worlds to the entity whose radio ad played (at such and such a time). Since Tom believes of his 'radio counterpart' that he will win, it follows that the formula '[$\exists f$. $\forall$w' $\in$ Bel(Tom,w): f (CTPT(Tom, w')) will win in w']' does hold in scenario (34b), and so the LF in (36a) would be false in that scenario.

It seems then that the sentence in (34a) can only receive the truth-conditions in (36b), and not those in (35b). For this reason, Percus & Sauerland (2003) and Sauerland (2014) attribute the existential quantification of the *de re* reading to the lexical semantics of the attitude verb itself, as that would correctly predict that the existential quantification must scope below the subject in sentences like (34a). Happily, however, our own account can also capture this range of facts. Note that the LF in (35a) would violate the Integrity Condition (14), since the non-upward monotone operator *Only Bill* scopes below '$\exists F_1$' and binds into the complement of 'F_1'. Such a violation does not occur in (36a); furthermore '$\exists F_1$' in (36a) occupies the highest scope position that obviates such a violation. Consequently, the Integrity Condition would entail that (36a) is the only allowable LF for sentence (34a), and so (36b) is correctly predicted to be its only allowable reading.

As just noted, the LF in (36a) obviates the Integrity Condition violation of (35a) by adjusting the scope of '$\exists F_1$'. Of course, there would also be no violation of (14) if the quantificational subject *Only Bill* didn't bind into the argument of 'F_1'. With this in mind, let us observe that sentence (37a) is naturally construed as true in scenario (37b).

(37) a. Sentence: Only Tom thinks Bill will win.

b. Verifying Scenario:

Tom has a lot of confidence that Bill will win the election. He tells everyone "Bill is definitely going to win." Nobody else shares his confidence, however. Even Bill expects to lose. Consequently, Bill is a bar drowning his sorrows. Bill has become so drunk that he doesn't recognize his own campaign ads on TV. He's impressed with those ads, though, and says "I'm going to lose, but whoever that guy is – he's going to win!"

Our Integrity Condition in (14) now predicts that the LF for (37a) must be the structure in (38a), rather than the one in (38b).

(38) a. Permissible LF for (37a):

[$\exists F_1$ [[Only Tom] [2 [t_2 believes [^ [F_1 [*CTPT* Bill]] will win] …]

b. Impermissible LF for (37b):
[[Only Tom] [2 [$\exists F_1$ [t_2 believes [^ [F_1 [*CTPT* Bill]] will win] …]

Under our semantics, the LF in (38a) will receive the truth-conditions in (39a) below, while the LF in (38b) will be interpreted as in (39b).

(39) a. Truth-Conditions for (38a):
$\exists f \,.\, \forall w' \in \text{Bel}(\text{Tom},w){:}\, f(\text{CTPT}(\text{Bill}, w'))$ will win in w' & $\forall y \,.\, y \neq \text{Tom} \rightarrow$
$\neg(\forall w' \in \text{Bel}(y,w){:}\, f(\text{CTPT}(\text{Bill}, w'))$ will win in w'

b. Truth-Conditions for (38b):
$\exists f \,.\, \forall w' \in \text{Bel}(\text{Tom},w){:}\, f(\text{CTPT}(\text{Bill}, w'))$ will win in w' & $\forall y \,.\, y \neq \text{Tom} \rightarrow$
$\neg(\exists f \,.\, \forall w' \in \text{Bel}(y,w){:}\, f(\text{CTPT}(\text{Bill}, w'))$ will win in w'

Importantly, the truth-conditions in (39a) hold in scenario (37b), while those in (39b) do not. The truth of (39a) in (37b) is witnessed by the counterpart function that maps every belief world w' to the entity named "Bill" in that belief world. In scenario (37b), only Tom is such that in all of his belief worlds w', the entity named "Bill" in w' will win in w'. The truth-conditions in (39b), however, are falsified by the fact that there is a separate conception of Bill – namely, "the person whose ad played on the TV in the bar" – such that in all of Bill's belief worlds w', the entity fitting that conception in w' wins in w'.

We find then that the intuitive truth of (37a) in scenario (37b) demonstrates that it is in principle possible for the existential quantification in a *de re* reading to scope over a quantificational subject like *Only Bill*, just so long as the subject doesn't bind the *res* of the attitude. This is as predicted by our proposed choice-functional account; however, it is difficult to see how an analysis where the existential quantification is part of the lexical semantics of the attitude verb can predict the truth of (37a) in scenarios like (37b).

Charlow & Sharvit (2014) observe a variety of other cases that pose problems for the view that the existential quantification in a *de re* reading is 'hardwired' into the semantics of the attitude verb. The first are cases where the attitude verb occupies a downward-monotonic environment, such as sentential negation. Note that as famously observed by Quine (1956), the two sentences in (40a,b) can be simultaneously true under so-called 'double vision scenarios' like (40c).

(40) a. John thinks that Mary is a burglar.
b. John doesn't think that Mary is a burglar.

c. Scenario Verifying Both (40a) and (40b)
Mary is John's teacher, who he greatly respects, and who he would never suspect of burglary. One day, however, Mary forgets the keys to her classroom, and so must squeeze in through the open window. John witnesses this from a far, and failing to recognize Mary, thinks to himself "Oh no! That's a burglar!"

As the reader can confirm, our system predicts that (40a,b) will receive the readings in (41a,b), both of which hold in scenario (40c). After all, there are two conceptions of Mary that John has – "the person named Mary who is a teacher" and "the person squeezing through the school's window" – and for one conception, John thinks that that individual is a burglar, while under the other conception, he does not.

(41) a. Predicted Truth-Conditions for (40a):
$\exists f$. $\forall$w' $\in$ Bel(John,w): f(CTPT(Mary, w')) is a burglar in w'

b. Predicted Truth-Conditions for (40b):
$\exists f$. $\neg$($\forall$w' $\in$ Bel(John,w): f(CTPT(Mary, w')) is a burglar in w')

However, under any analysis where the existential quantification of the *de re* reading is part of the lexical semantics of the verb, that existential quantification will necessarily scope below sentential negation. Thus, such accounts predict that (40a) and (40b) will get the truth-conditions in (42a,b); those truth-conditions are, of course, contradictory and so could not simultaneously hold in scenario (40c).

(42) a. Truth-Conditions Predicted for (40a), If '$\exists$' is Contributed by Attitude Verb
$\exists f$. $\forall$w' $\in$ Bel(John,w): f(CTPT(Mary, w')) is a burglar in w'

b. Truth-Conditions Predicted for (40b), If '$\exists$' is Contributed by Attitude Verb
$\neg\exists f$. $\forall$w' $\in$ Bel(John,w): f(CTPT(Mary, w')) is a burglar in w'

To obviate this and related problems, Charlow & Sharvit (2014) propose that all attitude verbs additionally allow for 'universal readings'.[9] That is, every attitude verb has a second lexical entry where it *universally* quantifies over concept generators / counterpart functions. Consequently, sentence (40b) would allow for a reading like that in (43) below, which would be logically equivalent to the wide-scope existential truth-conditions in (41b).

(43) Truth-Conditions for (40b), If Attitude Verbs Also Have 'Universal' Readings
$\neg\forall f$. $\forall$w' $\in$ Bel(John,w): f(CTPT(Mary, w')) is a burglar in w'

However, in addition to further complicating the lexical semantics of attitude verbs, this approach would raise quite difficult questions regarding the distribution of these 'universal readings' of attitude verbs, an issue explicitly acknowledged by Charlow & Sharvit (2014). For these reasons, the intuitive consistency of pairs like (40a,b) in 'double vision scenarios' seems to pose a very difficult challenge to any analysis where the existential quantification in a *de re* reading is encoded within the lexical semantics of the attitude verb.

A related set of problems also arise when a non-monotonic operator appears within the attitude complement, as originally observed by Charlow & Sharvit (2014). Consider, for example, the sentence in (44a) below, which is felt to be false in a scenario like (44b).

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[9] Another imaginable means for obviating the issue in (40)-(42) would be to suppose that the main clause negation in (40b) undergoes a syntactic operation of 'negation lowering' to the subordinate clause. However, such syntactic approaches to so-called 'NEG-raising' have been persuasively challenged in recent years, and the overall evidence appears to favor a pragmatic/semantic account like that of Gajewski (2007).

(44) a. Sentence: John believes that no student is French.

b. Falsifying Scenario:
John is given two pictures of each of our students. In one picture, the student is dressed like a fireman; in the other picture, the student is dressed like a doctor. John doesn't realize that (i) these individuals are students, or (ii) each pair of pictures depicts the same individual. For whatever reason, in each pair, he points to the fireman and says "This person is French", but points to the doctor and says "This person is Italian."

As noted by Charlow & Sharvit (2014), the truth-conditions in (45) – where the existential quantification of the *de re* reading scopes over the attitude verb – would actually be satisfied in scenario (44b).

(45) Truth-Conditions Holding in Scenario (44b):
$\exists f\,.\ \forall w' \in$ Bel(John,w): $\neg$ ($\exists$x : x is a student in c_w & f(CTPT(x, w')) is French in w')

The truth-conditions in (45) state that there is a counterpart function C such that in all John's belief worlds w', there is no actual student x that C maps in w' to a French person. In scenario (45), such a counterpart function exists. Consider a function *f* which for every world w', maps CTPT($student_1$, w') to the person depicted in the first 'doctor-picture' in w', maps CTPT($student_2$, w') to the person depicted in the second 'doctor-picture' in w', maps CTPT($student_3$, w') to the person depicted in the third 'doctor-picture' in w', *etc.* As detailed by Charlow & Sharvit (2014), such a function would witness the truth of (45) in scenario (44b), and so (45) cannot represent a possible reading of sentence (44a). Unfortunately, (45) is the only reading for (44a) predicted by an account where the existential quantification in a *de re* reading is directly hardwired into the lexical semantics of the attitude verb.

Charlow & Sharvit (2014) demonstrate that this problem can again be obviated if we assume that attitude verbs also allow for 'universal readings', where they universally quantify over concept generators / counterpart functions. Let us observe here, however, that our choice functional semantics for *de re* readings also avoids this problem. First, given the Integrity Condition in (14), the sentence in (44a) could not receive the LF in (46a) below. In that structure, the non-upward monotone operator *no student* scopes below '$\exists F_1$' and binds into the complement of 'F_1'.

(46) a Impermissible LF for (44a):
[$\exists F_1$ [John [believes [[no student] [2 [^ [F_1 [$CTPT\ t_2$]] is French …]

b. Permissible LF for (44a):
[John [believes [[no student] [2 [^ [$\exists F_1$ [F_1 [$CTPT\ t_2$]] is French …]

Interestingly, the Integrity Condition in (14) predicts that the only allowable LF for (44a) will be that in (46b), where the existential operator '$\exists F_1$' appears within the subordinate clause, scoping below the DP *no student.* This LF will receive the truth-conditions in (47a) below, which the reader can confirm are logically equivalent to the 'universal' truth-conditions in (47b).

(47) a. Truth-Conditions Predicted for LF (46b):

$$\forall w' \in \text{Bel}(\text{John},w): \neg(\exists x : x \text{ is a student in } c_w \ \&\ \exists f. f(\text{CTPT}(x, w')) \text{ is French in } w')$$

b. Logically Equivalent 'Universal' Truth-Conditions:

$$\forall f.\ \forall w' \in \text{Bel}(\text{John},w): \neg(\exists x : x \text{ is a student in } c_w \ \&\ f(\text{CTPT}(x, w')) \text{ is French in } w')$$

The truth-conditions in (47a,b) state that for every actual student x, in all of John's belief worlds w', there is no counterpart of x in w' that is French. This clearly fails to hold in a scenario like (44b); after all, there is for student_1 the counterpart function "the person in the first 'fireman-picture' in w'", which in all of John's belief worlds will yield someone who is French.

We therefore find that the only reading our semantics generates for sentence (44a) is correctly predicted to be false in scenario (44b). Finally, let us note that this reading is correctly predicted to be true in scenarios like the following.

(48) Verifying Scenario for Sentence (44a):
John is given two pictures of each of our students. In one picture, the student is dressed like a fireman; in the other picture, the student is dressed like a doctor. John doesn't realize that (i) these individuals are students, or (ii) each pair of pictures depicts the same individual. For whatever reason, in each pair, he points to the fireman and says "This person is Italian", and then points to the doctor and says "This person is also Italian."

In summary, our choice functional semantics for *de re* readings is able to capture the meanings of attitude sentences where a non-upward monotonic operator c-commands an expression receiving a *de re* construal. Moreover, these results ultimately follow from the Integrity Condition in (14), a constraint that receives independent empirical support in the literature on choice-functional indefinites. Within previous treatments of *de re* readings – where the quantification over concept generators or counterpart functions is encoded in the lexical semantics of the attitude verb – the only way to capture the facts in (40)-(48) is to assume that every attitude verb is systematically ambiguous between an 'existential' and a 'universal' reading (Charlow & Sharvit 2014). Given that such previous accounts must also assume a concomitant (infinite) 'type flexibility' for such verbs (Section 5), the choice-functional semantics proposed here offers a radically simpler picture of the compositional semantics of attitude ascriptions.

7. Further Consequences of the Lewisian Ontology

The semantics proposed here assumes a Lewisian ontology for possible worlds and individuals, a feature it shares with the account developed by Sauerland (2014). Consequently, the present account inherits those results that Sauerland (2014) shows to follow from that assumed ontology. That is, like Sauerland's (2014) system, the analysis proposed here predicts the following constraints on *de re* interpretations: (i) the Main Predicate Constraint (Percus 2000), (ii) the Intersective Predicate Constraint (Romoli & Sudo 2009), and (iii) the Nested DP constraint (Romoli & Sudo 2009).

For reasons of space, let us consider here only the Nested DP constraint; the account of the other two constraints is similar in spirit (Sauerland 2014). As noted by Romoli & Sudo (2009) and Keshet (2011), the sentence in (49a) cannot be construed as true in scenario (49b).

(49) a. Sentence: John thinks that the husband of the president is nice.

b. Falsifying Scenario:
John sees Hillary Clinton on TV with her husband Bill, who he thinks is nice. John wrongly thinks that Hillary is president, and that Bill is her vice president.

Within a non-Lewisian ontology, entities can exist at more than one possible world, and so predicates and relations can hold at a world w' of entities existing at distinct worlds w''. Consequently, in a semantics assuming such an ontology, it could be possible to assign to (49a) an LF that receives the truth-conditions in (50) below, where the relation 'husband of' is predicated of an entity in c_w and the president in John's belief worlds w'.

(50) Truth-Conditions that Hold in Scenario (49b):
$\exists f. \forall w' \in \text{Bel(John,w)}: f(\text{CTPT(the husband in } c_w \text{ of the president in w', w') is nice in w'}$

Furthermore, note that in a scenario like (49b), a non-Lewisian ontology would assume that in all of John's belief worlds w', the president in w' is Hillary Clinton – the same Hillary Clinton that exists in our world. Consequently, the formula [$\lambda w'$: f(CTPT(the husband in c_w of the president in w', w')] would be a counterpart function for Bill Clinton, the husband in c_w of Hillary Clinton. Thus, in scenario (49b), the truth-conditions in (50) would be equivalent to those in (51), which simply state that John believes *de re* of Bill Clinton that he is nice.

(51) Truth-Conditions Equivalent to (50) in Scenario (49b):
$\exists f. \forall w' \in \text{Bel(John,w)}: f(\text{CTPT(Bill Clinton, w') is nice in w'}$

Since the truth-conditions in (51) clearly hold in scenario (49b), it follows that under a non-Lewisian ontology, it is in principle possible for (49a) to receive a reading that is true in such a scenario. Therefore, some additional grammatical principles must serve to rule out an LF that would yield truth-conditions like those in (50) (Romoli & Sudo 2009, Keshet 2011).

As Sauerland (2014) observes, however, a Lewisian ontology provides a principled explanation for the absence of the reading in (50). Again, such a reading would require the relation 'husband of' to be predicated of some actual individual (*i.e.* Bill Clinton) and whoever is president in John's belief worlds. Since natural language relations cannot hold of entities in distinct worlds, it follows that such truth-conditions are paradoxical within a Lewisian ontology. Furthermore, in that ontology, the president in John's belief worlds is not the same individual as the one named "Hilary Clinton" in our world, even in a scenario like (49b). Consequently, even if our ontology somehow countenanced a formula like "CTPT(the husband in c_w of the president in w', w')", it would not be equivalent to "CTPT(Bill Clinton, w')", and so there would be no equivalence between the truth-conditional statements in (50) and (51).

We therefore find that like the account of Sauerland (2014), our semantics for *de re* attitudes correctly predicts certain observed constraints on such readings, namely the ones that will independently follow from a Lewisian ontology. I will conclude this paper by observing that this ontology also correctly predicts a further effect, first observed by Charlow & Sharvit (2014). Note that sentence (52a) cannot be construed as true in the complex *de re* scenario in (52b).

(52) a. Sentence: John thinks that the king of the U.S. is a genius.

b. Scenario:
John is under the mistaken belief that Donald Trump is the king of the United States. He also has a very low opinion of Donald Trump (*qua* king of the U.S.). Unbeknownst to John, however, Donald Trump is the author of one of his favorite books, *The Art of the Deal*. John regularly praises the author of this book, saying "Whoever wrote this book is a real genius."

Charlow & Sharvit (2014) observe that it is possible within a non-Lewisian ontology to assign truth-conditions to sentence (52a) that will end up holding in scenario (52b). Again, under such an ontology, it would be assumed that in scenarios like (52b), all of John's belief worlds w' are such that the king of the U.S. at w' is Donald Trump – the real Donald Trump who inhabits c_w and who is the author of *The Art of the Deal.* Consequently, the truth-conditions in (53a) below would be equivalent to those in (53b).

(53) a. Non-Lewisian Truth-Conditions that Hold in Scenario (52b)
$\exists f.\ \forall w' \in \text{Bel(John,w)}$: f(CTPT(the king of the U.S. in w', w')) is a genius in w'

b. Truth-Conditional Statement Equivalent to (53a).
$\exists f.\ \forall w' \in \text{Bel(John,w)}$: f(CTPT(Donald Trump, w')) is a genius in w'

The truth-conditions in (53a,b) will therefore hold as long as John believes *de re* of Donald Trump that he is a genius. Given that he does hold such a belief in (52b) – *i.e.,* through his *de dicto* belief that "The author of *The Art of the Deal* is a genius" – it follows that these truth-conditions will hold of that scenario. Finally, since sentence (52a) cannot be construed as true in scenario (52b), a semantics for *de re* readings that does not employ a Lewisian ontology must find some means for ruling out an LF for (52a) which receives the truth-conditions in (53a) (Charlow & Sharvit 2014).

Under our Lewisian ontology, however, this issue does not arise. After all, under that ontology, it could never be that the entity satisfying the description "the king of the U.S." in John's belief worlds is the actual Donald Trump, resident of c_w. Furthermore, as the reader can confirm, under our proposed system, the truth-conditions in (53a) are actually equivalent to the *de dicto* truth-conditions in (54) below.

(54) a. Formula Equivalent to (53a) in Our Lewisian Ontology
$\exists f.\ \forall w' \in \text{Bel(John,w)}$: f({the king of the U.S. in w'}) is a genius in w'

b. Formula Equivalent to (54a):
$\forall w' \in \text{Bel(John,w)}$: the king of the U.S. in w' is a genius in w'

Therefore, any LF for sentence (52a) that would receive the truth-conditions in (53a) would, under our Lewisian ontology, simply possess a *de dicto* reading, one that would be false in scenario (52b). We find, then, that a further benefit of this ontology is that no special puzzles arise regarding the judgments of sentences like (52a) in scenarios like (52b).

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