On the Plurality of Indices

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Abstract. On modern accounts descending from the work of Quine and Kaplan, *de re* attitude reports have descriptive truth conditions involving quantification over modes of presentation. The most popular implementation of this view, namely Percus and Sauerland's, generates these truth conditions using covert variables over concept generators (roughly, functions from individuals to modes of presentations) in the syntax. This theory lives side by side with a Chierchia-style theory of *de se* reports, on which attitude verbs systematically bind *de se* pronouns. This general picture of *de re* and *de se* reports has a number of shortcomings: it overgenerates; it fits poorly with standard assumptions about syntax; it gives rise to unexpected binding-theoretic effects. I argue that these difficulties can be overcome by using indices wherever Percus and Sauerland use variables. I assume that all *e*-type expressions in attitude reports are endowed with a second layer of syntactic indices, which I call 'elevated indices'. Roughly, these indices are used to track what modes of presentations are associated to each *e*-type expression. The semantics of these indices is controlled by a new dedicated assignment, which is systematically shifted by attitude verbs. The resulting picture solves the problems affecting Percus and Sauerland's theory, while managing to predict some key data, including the 'bound *de re*' reading of some attitude reports recently pointed out by Charlow and Sharvit. In addition, all *de re* and *de se* reports turn out to share the same kind of LF; the only difference is the presence of a logophoric feature (semantically cashed out as a presupposition) on *de se* pronouns.

1 Introduction

This paper concerns two categories of attitude reports that have gathered much attention in philosophy and semantics, namely *de re* and *de se* reports. *De re* reports are, on a first pass, reports that involve reference to a specific individual in the complement clause. *De se* reports are, on a first pass, reports of attitudes that the subject would typically express in the first person. Here are two examples of, respectively, a *de re* and a *de se* report:

(1) Ramona believes that Ralph is a nice guy.

(2) Ramona expects to be treated nicely.

Accounts of *de re* and *de se* reports in semantics have different theoretical ancestries, tracing to Quine and Kaplan in one case, and to Lewis in the other. Accordingly, *de re* and *de se* reports are taken to function in different ways, syntactically and semantically.

The dominant account of *de re* reports in semantics is a form of descriptivism: the truth conditions of a *de re* report involve reference to modes of presentation that the attitude holder uses to think of the subject. In particular, following the blueprint of the account given by Kaplan (1968), attitude verbs like *believe* are assumed to involve existential quantification over some suitable modes of presentation. The truth conditions assigned to (1) are:

(3) There is a suitable individual concept *C* such that (a) Ralph satisfies *C* in the actual world and (b) for all possible worlds *w* compatible with what Ramona believes, the individual satisfying *C* in *w* is a nice guy in *w*.

Descriptivist accounts in this tradition are not immune from problems[1], but there is wide agreement that the truth conditions in (3) are at least on the right track.

While the truth conditions of *de re* reports are relatively uncontroversial, the compositional derivation of these truth conditions has been the subject of much debate. Here I take as my benchmark account Percus and Sauerland's (2003) concept generator theory. On Percus and Sauerland's theory, the LFs of attitude reports involve covert variables ranging over *concept generators*—roughly, functions from individuals to individual concepts. The LF of a sentence like (3) is taken to be:

(4) Ramona believes that [λ_6 G_6(Ralph) is a nice guy]

'G_6' is a variable ranging over concept generators. Percus and Sauerland's theory has a number of desirable features; in particular, as Charlow and Sharvit (2014) have recently pointed out, it manages to account for *de re* readings of bound pronouns and traces, something that none of its existing competitors accomplishes.

The standard account of *de se* reports like (2) is based on the general view of *de se* attitudes outlined by Lewis (1979). On Lewis's proposal, the content of a *de se* attitude is a set of individual predicaments, which can be formally modeled as a set of individual-time-world triples (or centered worlds). An ascription like (2), repeated below,

(2) Ramona expects to be treated nicely.

says that all predicaments compatible with Ramona's expectations are such that the relevant individual (i.e. the individual 'at the center' of that predicament) is treated nicely. Compositional implementations of Lewis's view are descendants of Chierchia's (1989) work on the semantics of infinitival complements. Chierchia postulates that reports like (2) involve a covert pronominal element, dubbed 'PRO', in the subject position of the infinitival clause. PRO is obligatorily bound by an abstractor over individuals. Hence (ignoring, for simplicity, reference to times) the LF of (2) is:

(5) Ramona expects [$\lambda_5 \lambda_1$. PRO_1 be treated nicely w_5]

As a result, PRO is semantically bound by the attitude verb and ranges over the individuals that are at the center of the predicaments compatible with Ramona's expectations.

This paper starts by rehearsing a number of difficulties, some new and some already known, for this general picture of attitude reports. First, I argue that Percus and Sauerland's semantics for the *de re* is too flexible and hence prone to overgeneration. Moreover, some routine syntactic tests seem to disconfirm the presence of variables ranging over concept generators in the syntax. Finally, I rehearse some puzzling binding-theoretic effects that are generated by *de se* reports, which were first pointed out by Heim (1994b). Taken together, these problems motivate searching for a different account.

The core of the paper consists in suggesting a new theory covering both *de re* and *de se* reports. Conceptually, the theory builds on the idea that attitude verbs work as assignment shifters, i.e. are able to manipulate the assignment parameter (for implementations of this view, see Cumming 2008, Santorio 2011 and 2012, Ninan 2012). The key innovation is this: all *e*-type expressions appearing in the complement clause of an attitude verb carry,

[1] See Ninan 2008 and 2012, among many.

in addition to standard indices used for syntactic and semantic binding, a second order of indices. These indices—which I call *elevated indices* and represent in superscript position as Greek letters—track the modes of presentation associated to the *e*-type expression. For example, the LF of (1), at the relevant level of abstraction, is:

Ramona believes that [Ralph$^{\beta}$ is a nice guy].

Loosely speaking, the index β is used to track what modes of presentation Ramona associates to Ralph. Semantically, these indices are interpreted via a second assignment. Attitude verbs shift systematically this second assignment, thus ensuring that the modes of presentation are suitably related to the subject of attitude.

The theory proposed can be seen as a variant of Percus & Sauerland's. In fact, it incorporates the main insight of that theory: association to modes of presentation happens *in situ*, rather than via some kind of syntactic movement. But there is an important difference. Rather than using variables ranging over modes of presentation in the object language, it uses indices, which are handled semantically via a dedicated assignment. The resulting theory avoids the overgeneration that affects Percus and Sauerland's, comports much better with default assumptions about syntax, and suggests an easy account of the *prima facie* puzzling BT effects noticed by Heim. In addition to this, the new theory yields a simple and unified picture of the LFs of attitude reports. All attitude reports, *de re* and *de se*, share a unique kind of LF. The only difference between *de se* and *de re* readings of pronouns is the presence of a logophoric feature +*log*, which is semantically interpreted as a presupposition.

I start by introducing Percus and Sauerland's concept generator theory (section 2) and outlining some worries about it (section 3). In section 4, I sketch Chierchia-style semantics for the *de se* and rehearse Heim's BT puzzle about *de se* reports. The new theory is stated in section 5 in outline, and section 6 in detail. Finally, in section 7, I focus on the question of the LFs of attitude reports and show how my theory accommodates data that has been used to defend the existence of multiple kinds of LFs.

2 *De re* reports: the state of play

This section contains an overview of semantic work on attitude reports in the descriptivist tradition. It's useful to start from a basic view and recapitulate the arguments that have led to the current state of the debate.

2.1 The beginnings: double vision and descriptivism

On a first, naïve view, referential expressions in attitude reports denote individuals exactly as they do in other environments. On this view, a sentence like (1) simply ascribes to Ramona a belief about a specific individual, which figures in all the worlds compatible with Ramona's beliefs:[2]

$[\![(1)]\!]^w$ = true iff, for all worlds w' compatible with what Ramona believes in w, Ralph is a nice guy in w'

It is common ground, at least within formal semantics, that the naïve view fails. The classical argument against it is provided by cases of double vision, which were originally pointed out

[2] I take for granted a Hintikka-style semantics for attitudes (1962, 1969), on which attitude verbs quantify over worlds compatible with the subject's attitude state.

by Quine (1956), and were taken as the starting point of Kaplan's (1968) original attempt at a semantics for attitude reports. Here is a standard example:

> *Ortcutt.* On Wednesday, Ralph sees mayor Ortcutt give an official speech in front of City Hall. Ralph is bored by lengthy speeches and thinks to himself "That guy is not fly". On Thursday, Ralph goes to the city parade, where he sees Ortcutt perform as a virtuoso drummer with his fusion jazz band. Ralph doesn't recognize the mayor, but is most impressed by his performance, and thinks to himself "That guy is fly".

Given this scenario, both (6) and (7) have true readings:

(6) Ralph thinks that Ortcutt is not a fly guy.

(7) Ralph thinks that Ortcutt is a fly guy.

On the naïve view, we are able to capture at most one of (6) and (7) (at least, as long as we represent Ralph's beliefs as consistent). Hence the data in (6) and (7) suggest that we should move to a more sophisticated theory.

The solution was provided, at least in outline, by Kaplan 1968. Kaplan's theory of *de re* reports is rooted in a theory of *de re* belief that appeals to a notion of acquaintance. On this theory, Ralph's beliefs about Ortcutt exploit a specific kind of epistemic relationship, which Ralph dubs 'acquaintance'. It's controversial exactly what acquaintance amounts to[3]. But there is agreement that some paradigmatic epistemic connections, for example being or having been in direct perceptual contact with an individual, are sufficient for acquaintance. In our example, Ralph is acquainted with Ortcutt in (at least) two different ways: i.e. as the man that he has seen give a speech and as the man he has seen perform fusion jazz in the parade. Kaplan's claim is that reports like (6) and (7) involve covert reference to acquaintance relations. In particular, the truth conditions of (6) and (7) involve existential quantification over relations of this sort. For example, the truth conditions of (7) are stated in (8):[4]

(8) There is an acquaintance relation R such that (a) Ralph is related to Ortcutt via R and (b) for all worlds w' compatible with Ralph's beliefs, the individual that Ralph is related to by R in w' is a fly guy in w'.

Notice that acquaintance relations play a double role in the truth conditions in (8). First, they are used to link subjects of belief to objects that they have beliefs about in the actual world. Second, they enter the content of the belief itself. I.e., the reported belief is supposed to involve, in its content, reference to the way that Ralph is acquainted with Ortcutt. As I will point out shortly, this double role is at the origin of some of the main difficulties in providing a compositional implementation of the view.

For the purposes of this paper, I take for granted that Kaplan's predicted truth conditions are, at least in broad outline, correct. This involves making a number of nontrivial assumptions. Let me highlight two of them. The first is that there is indeed a suitable notion of acquaintance that figures in the truth conditions of attitude reports. The second is that attitude reports involve existential quantification over relations of acquaintance, rather than

[3]For an overview of recent philosophical literature on acquaintance, as well as some reasons to be skeptical about it, see Hawthorne & Manley 2012, chapter 1.5.

[4]This is a modernized version of Kaplan's truth conditions. In his original (1968), Kaplan employed substitutional quantification; the relevant variables range over what he calls 'standard names'—roughly, names that necessarily denote their objects. As the course of subsequent literature has showed, the idea of quantifying over acquaintance relations can be disentangled from the rest of Kaplan's apparatus.

a different quantificational force, or rather than containing a covert free variable ranging over them (this latter option can be traced back to Heim 1994a). Both these assumptions are probably false as stated; at the very least, they need some degree of fine-tuning.[5,6] But, so far as I can see, they are orthogonal to the problems and the main claims discussed in this paper. How modes of presentation are implemented in compositional processes seems independent of exactly what modes of presentation are relevant, and whether the final truth conditions of a report involve existential quantification over them. So I feel free to set these questions aside and run with the assumptions that seem most popular in the literature. In addition, I set aside the idea that existential quantification over modes of presentation might come with a contextually restricted domain. This assumption is plausible (see Ninan 2008 for discussion), but I ignore it for the sake of simplicity.

The descriptivist view that I have been sketching just concerns the truth conditions of attitude reports. So far, I have been silent about issues concerning compositional implementation. As I anticipated, this has turned out to be the main difficulty for a semantics of *de re* reports.

2.2 *Res*-movement and the bound *de re*

Let me highlight again the main difficulty. We need acquaintance to play a double role in Kaplan-style descriptivist truth conditions. Consider again (7), repeated below:

(7) Ralph thinks that Ortcutt is a fly guy.

On the one hand, (7) states that Ralph, the subject of belief, is acquainted with Ortcutt *in the actual world* via a certain acquaintance relation. On the other, (7) also states that Ralph is related to a certain object via the relevant acquaintance relation *in Ralph's belief worlds*. To derive this compositionally, we need to be able to check that the individual denoted by *Ortcutt* is indeed an individual that Ralph is acquainted with. This is not easy to implement.

[5] It is known that the notion of acquaintance needs some stretching to accommodate some recalcitrant cases: see, for discussion, Kaplan 1989b, as well as Hawthorne & Manley 2012, section 1.5, and references therein. But I believe that the problems of acquaintance have been underestimated. Consider the following scenario:

> John is taking a tour of my department. While walking by my office, the person showing him around tells him that what he's seeing, including the person in the scene (i.e. me) is a clever hologram produced by computer animators; the room is an empty janitor closet. John, who is very gullible, is immediately convinced. While staring at me, he says "I can't believe there is nothing there; I really seem to see a person!"

It seems that I can truly report John's attitudes by saying:

(i) John thinks that I don't exist.

So far as I can see, it's impossible to find an acquaintance relation that can be used to generate plausible truth conditions for John's beliefs (i.e., one that doesn't end up ascribing him some insane belief, like the belief that the man he saw doesn't exist). Cases like (i) show that Kaplan's notion of acquaintance is too restrictive to account for the full range of belief reports in natural languages. As I say in the main text, I take it that this topic is orthogonal to the main problems discussed in this paper. Even if we relaxed the constraints about what counts as a suitable relation to be invoked by a semantics for attitude reports, the basic structure of the semantics would still remain the same.

[6] Arguments that existential quantification yields the wrong truth conditions are provided by belief reports involving negative quantifiers like *no female student*:

(i) John believes that no female student likes her mother.

As Charlow and Sharvit point out (2014), it looks like in reports like (i) *believe* induces universal, rather than existential, quantification over modes of presentation. This is a major problem for existing descriptivist theories, though one I have to set aside for the purposes of this paper.

To see this, it's useful to consider a quick-and-dirty way of inserting acquaintance relations in the semantics. On a first pass, we may just assume that the syntax of (7) contains a covert pronoun *D* picking out a function from individuals to acquaintance relations that takes *Ortcutt* as an argument. On this view, the LF of (7) would be:

(9) Ralph thinks that [*D*(Ortcutt) is a fly guy]

where *D* denotes a function mapping Ortcutt into some acquaintance relation (type $\langle e, se\rangle$). On this proposal, we have no way of making sure that the acquaintance relation is one that connects Ralph to Ortcutt in the actual world. Hence this simple proposal misses a key element of Kaplan's truth conditions, and should be discarded.

The first serious attempt at deriving compositionally Kaplan-style truth conditions can be traced back to Cresswell & von Stechow 1982.[7] This attempt is what has become known under the label of '*res*-movement' account. The key idea is to introduce an apposite operation of syntactic movement that 'feeds' the relevant *e*-type expression as a separate argument to the attitude verb. More precisely, here is how the idea is implemented. Attitude verbs have an extra *e*-type argument for the object that the subject's belief is about. The relevant *e*-type expression is moved out of the complement clause, leaving a trace, and is fed as an argument of the attitude verb. Hence, for example, the LF of (7) on this approach is:

Ralph [[[believes Ortcutt$_4$] that] [t_4 is a fly guy]]

Since I won't be working with *res*-movement theories, I relegate the entry for attitude verbs to a footnote.[8]

Res-movement theories have always seemed stipulative on the syntactic score, since they involve a kind of movement that is unusual and unattested on independent grounds. (For relevant criticism, see for example Anand (2006: pages 25-29) and Charlow & Sharvit (2014: page 13). But, until recently, they have resisted scrutiny, mostly for lack of less stipulative attempts, and for lack of definitive arguments against them. It is only very recently that a strong semantic argument has been put forward against them—specifically, by Charlow & Sharvit 2014. This argument is, to my mind, decisive, and it leads directly to the main theory I'll be considering, so it's helpful to review it in some detail.

Charlow and Sharvit claim that the *res*-movement view crucially undergenerates, since it's unable to account for a certain reading of attitude reports involving quantifiers and (semantically) bound pronouns in the complement clause. Charlow and Sharvit's main example is the following:

(10) John believes that every female student$_i$ likes her$_i$ mother.

[7] Cresswell and von Stecchow's original formulation of the semantics involved a special composition rule; I am presenting the version that subsequent literature has distilled from their work, and which fits better with standard compositional constraints. See also von Stechow & Zimmermann 2005 for an alternative approach, deriving from some of Kaplan's own remarks in Kaplan 1989a.

[8] As in the rest of the paper, I assume an extensional treatment of modality (see e.g. Percus 2000): the object language include variables ranging over possible worlds; attitude verbs are quantifiers over these variables. For simplicity, here I disregard all issues pertaining to belief *de se*.

$[\![\text{believe}]\!]^g = \lambda y_e.\ \lambda P_{\langle e,\langle s,t\rangle\rangle}.\ \lambda x_e.\ \lambda w_s.$ there is a suitable individual concept C such that:

(i) $C(w) = y$ and

(ii) For all worlds w' compatible with what x believes, $P(C(w'))(w') = 1$.

The relevant reading of (10) is the one that they call 'bound *de re*', and is first discussed by Sharvit in her (2011). This reading is something like an analog of double vision cases for bound variables. Here is Charlow and Sharvit's scenario:

> John is looking at a series of pictures of students. He says to himself something like: "That girl likes that girl's mother; and that girl likes that girl's mother; and that girl likes that girl's mother . . .". Unbeknownst to John, every time he utters a sentence, he's pointing to two different pictures of the same girl.

Charlow and Sharvit's empirical claim is that, in this scenario, (10) is true. They show that no version of the *res*-movement theory can yield this prediction. Discussing the details of their argument would take me far from my main focus. But the basic point can be illustrated quickly. First, consider a sentence where a pronoun appearing in an attitude report is bound by something that is outside the scope of the attitude verb:

(11) Every female student$_i$ believes that she$_i$ is tall.

The *res*-movement theory can get the right predictions for (11). It does this, in the usual way, by moving the pronoun outside the complement clause, where it gets fed as an argument of *believe*. Notice that, despite the movement, *she* is still in the scope of the quantifier, hence the bound reading is still available.

Every female student [λ_1[[[believes she$_1$] that][t_1 is tall]]]

But this strategy cannot be applied for the case of (10). If we move the pronoun outside the scope of the quantifier, the bound reading becomes unavailable:

(12) John [[[believes her$_k$] that] [every female student$_i$ likes t$_k$ mother.]]

As Charlow and Sharvit point out, we could get the right truth conditions if we could move the whole determiner phrase *every female student* out of the scope of the belief verb. But there is independent evidence that this kind of movement is unavailable.[9] One may try a number of fixes and alternative strategies; but none of them seems promising. (The reader is referred to Charlow and Sharvit's paper for a very exhaustive discussion.)

The upshot is that the *res*-movement theory is unsatisfactory. We need a theory that manages to pair objects of belief with the right acquaintance relations, but we need to keep the relevant *e*-type expressions *in situ*.

2.3 Preliminaries: basic setup of the semantics

Before moving on to Percus and Sauerland's theory, it is useful to spell out some background assumptions that I will use throughout my discussion. So far as I can see, none of my choices is strictly needed to run my arguments; but it will help to have a basic system in place.

First, I assume a system where the compositional rules are those given in Heim & Kratzer (1998). In particular, the rule for evaluating abstractors is syncategorematic and involves shift to a new assignment differing with respect to the relevant index:

[9] The evidence has to do with examples like 9:

(i) John is certain that no female student passed the exam.

If we were able to scope DPs out of the complement clause, (i) would have a reading on which it says that, for no female student, John is certain that that student passed the exam. But that reading is not available.

Abstraction rule
For any node α,

$$[\![\lambda_i \alpha]\!]^g = \lambda x.\ [\![\alpha]\!]^{g[i \to x]}$$

where $g[i \to x]$ is an assignment that differs from g at most in that the value assigned to i is x.

Second, I assume an extensional treatment of modality, opting for a system that involves overt reference to modal entities in the object language.[10] These intensional entities are not worlds, but, following a large strand of literature on attitudes, centered worlds. Centered worlds can be thought of as locations within a world. At the formal level, they are usually represented as triples of an individual, a time, and a world.[11] Since I'll be ignoring issues concerning tense throughout this paper, I will be treating them simply as pairs of a world and an individual. The basic denotation of clauses is a *centered worlds proposition* (or, for short: *centered proposition*), i.e. a function from world-individual pairs to a truth-value:

(13) $[\![\text{Ortcutt is a fly guy}]\!]^g = \lambda\langle x, w\rangle$. Ortcutt is a fly guy in w

(Notice that abstraction over individuals may be vacuous, as it happens just in (13).) Hence the type of basic clauses is $\langle es, t\rangle$.[12] Following common usage (see e.g. Anand 2006) for convenience I will shorten the type of centered worlds as 'i', and hence the type of centered propositions as '$\langle i, t\rangle$'. Accordingly, I will use 'i'-type variables in the syntax.[13]

Finally, I assume a syntax in which all determiner phrases undergo an operation of syntactic movement at LF (so-called Quantifier Raising) that takes them to have sentential scope. The moved DP leaves behind a trace and the movement operation generates a lambda-abstractor that is coindexed with the trace. Hence the LF of e.g. (14) is given by (15):

(14) Every girl likes her mother.

(15) Every girl [λ_1. t_1 likes her$_1$ mother]

2.4 Percus and Sauerland's concept generator theory

The main idea behind Percus & Sauerland's concept generator theory is simple: reference to acquaintance relation is implemented locally via covert variables in the syntax. Similarly to the quick-and-dirty variable theory I sketched above, this theory exploits covert variables of type $\langle e, ie\rangle$. But there is one crucial difference: on Percus and Sauerland's theory, these variables are bound by the attitude verb.[14] This gives a way of checking that the acquaintance

[10] For a basic introduction to modal semantics and to the extensional version of it, see von Fintel & Heim 2011. Percus 2000 raises some problems and proposes some constraints on the handling of object language variables ranging over worlds. See, among others, Keshet (2008) and (2011) for criticism and discussion.

[11] This is the 'modern' conception of centered worlds; see Egan 2004. Lewis 1979 construed centered worlds as pairs of a world and a time-slice of an individual.

[12] Assuming, as seems common in the literature (see e.g. Schlenker 1999), that lambda-abstraction over a pair of a world and an individual is equivalent to lambda abstraction over both a world and an individual:

$$\lambda\langle x, w\rangle.\ \ldots \alpha \ldots = \lambda x.\ \lambda w.\ \ldots \alpha \ldots$$

[13] One *caveat*: binders over centered worlds variables will still be able to bind e-type variables (this will happen, in particular, in *de se* construction).

[14] This is loose talk: as usual, variables over concept generator are bound by an abstractor; the resulting function is fed an argument to the attitude verb.

relations paired to each object do capture ways in which the subject is indeed related to the relevant objects.

Let me go into some more detail. The starting notion is that of a *concept generator*. A concept generator is a function from individuals to individual concepts, i.e. functions from centered worlds to possible individuals. Informally, a concept generator can be thought of as a way of pairing individuals with relations or properties that are true of those individuals. Percus & Sauerland (henceforth, P&S) focus specifically on one particular kind of concept generator, i.e. so-called acquaintance-based concept generators. Informally, and roughly, acquaintance-based concept generators are concept generators mapping individuals to acquaintance relations. More rigorously: a concept generator G is acquaintance-based for a subject x at a centered world i just in case G maps all the objects that x is acquainted with to a relevant acquaintance relation.

Here is a full definition:

> A function G of type $\langle e, ie\rangle$ is an *acquaintance-based concept generator for x at i* iff:
>
> (i) $Dom(G) = \{y$: x is acquainted with y at $i\}$
>
> (ii) For all y in $Dom(G)$, if $G(y) = R$, then:
>
> – R is an acquaintance relation;
> – x bears R uniquely to y in i;
> – for all centered worlds i' in x's doxastic set at i, the center of i' bears R to $G(y)(i')$ in i'.

It's useful to go through an example. Suppose that Ralph is acquainted with three individuals: Ortcutt, David Kaplan, and Ringo Starr. Then a function G is as an acquaintance-based concept generator for Ralph at i just in case:

(a) G is defined over the domain $D = \{$Ortcutt, David Kaplan, Ringo Starr$\}$;

(b) G maps Orcutt to a relation R such that:

- R is an acquaintance relation;
- Ralph bears R to Ortcutt at i;
- in all centered worlds i' in Ralph's doxastic state at i, the center is R-related to the individual that is the value of G(Ortcutt)(i').

(c) The conditions in (b) hold, *mutatis mutandis*, for David Kaplan and Ringo Starr.

Here is how the view works from a compositional point of view. First, all e-type expressions appearing in attitude reports are 'wrapped' by a variable ranging over concept generators. Then, all embedded clauses in attitude reports involve an abstractor over concept generator variables: hence they are of a higher type than standard clauses ($\langle\langle e, ie\rangle, it\rangle$). As an example: the LF of (7), repeated below, is in (16) (I use 'G_i' for concept generator variables):

(7) Ralph thinks that Ortcutt is a fly guy.

(16) Ralph thinks $i_0[\lambda_4.\ \lambda_1.\ G_4$(Ortcutt) is a fly guy $i_1]$

Attitude verbs quantify existentially over acquaintance-based concept generators. Some refinements are necessary, but here is a first syncategorematic entry for *think*:[15]

(17) $[\![S \text{ thinks } p]\!]^g = 1$ iff there is an acquaintance-based concept generator G such that, for all i' compatible with what S believes at i, $[\![p]\!]^g(G)(i') = 1$

On this picture, the truth conditions associated to (7) are the following:

> $[\![(7)]\!]^g$ = true iff there is an acquaintance-based concept-generator G for Ralph at @ such that, for all i' in $\text{DOX}_{Ralph,@}$, $G(\text{Ortcutt})(i')$ is a fly guy in w'

Notice one feature of this theory: the relevant *e*-type expressions don't need to be separate arguments of the attitude verb. This removes the need for *res*-movement.

This simple version of P&S's theory needs refinement in a way that is important for our purposes. In some cases, *e*-type expressions that denote the same individual might be connected to different modes of presentation. As an example, consider the following variant on the *Ortcutt* scenario:

> *Ortcutt and Tuc Trot.* As in the *Ortcutt* scenario, Ralph is acquainted with Ortcutt under two guises, as the mayor and as a virtuoso fusion drummer. When appearing as a drummer, Ortcutt goes under the pseudonym 'Tuc Trot'.

The following has a true reading in this scenario:

(18) Ralph thinks that Ortcutt is not Tuc Trot.

The simple version of the P&S theory predicts that (18) ascribes to Ralph an inconsistent belief, since the same individual is fed as argument of the relevant concept generator variable. The (quite obvious) solution is to allow that different concept generator variables may be present in a report like (18). Hence the LF of (18) will look as follows:

(19) Ralph thinks $w_0[\lambda_8.\ \lambda_4.\ \lambda_1.\ G_4(\text{Ortcutt})$ is not $G_8(\text{Tuc Trot})\ i_1]$

Accordingly, attitude verbs like *think* quantify existentially not over single concept generators, but over sequences thereof. As a result, the same individual, namely Ortcutt, can be linked to different concept generators in the context of the same sentence, as is illustrated by a schematic statement of the truth conditions of (18):

> $[\![(7)]\!]^g$ = true iff there is a sequence of acquaintance-based concept-generators $\langle G_1, G_2, G_3, G_4, \dots \rangle$ for Ralph at @ such that, for all i' in $\text{DOX}_{Ralph,@}$, $G_1(\text{Ortcutt})(i')$ is not $G_2(\text{Tuc Trot})(i')$ in w'

Charlow & Sharvit 2014 implement this by adopting a type-flexible semantics for attitude verbs like *think*. In their system, attitude verbs take as argument a contextually provided set of sequences of concept generators. Their semantics involves a definedness condition that ensures that all sequences in the set involve suitable concept generators; on top of this, the denotation of an attitude verb like *thinks* involves existential quantification over sequences in the set. To reduce clutter, I choose a simpler solution: I generalize to the worst case and

[15] Here is a full entry. 'Π' is a metalanguage variable ranging over functions from concept generators to centered propositions.

(i) $[\![\text{think}]\!]^g = \lambda\Pi_{\langle\langle e,ie\rangle,\langle i,t\rangle\rangle}.\ \lambda x.\ \lambda i.$ there is some acquaintance-based concept generator G such that, for all $\langle i'\rangle \in \text{DOX}_{x,world(i)}$, $\Pi(G)(i') = 1$

assume that attitude verbs quantify over infinite sequences of concept generators. Nothing hangs on this particular choice; I just make it to keep things more readable. Both my arguments and my proposal can be recast by making use of Charlow and Sharvit's apparatus.[16]

Here is how the P&S view, appropriately supplemented in this way, predicts the existence of bound *de re* readings. Consider again (10), repeated below:

(10) John believes that every female student$_i$ likes her$_i$ mother.

(10) contains two coindexed *e*-type items: one is the overt pronoun *her*, the other a trace resulting from the movement of *every female student*. The truth conditions for the bound *de re* reading are obtained by pairing two different variables over concept generators with the two pronouns:

> John believes w_o[λ_8. λ_4. λ_3. [every female student [λ_1. [$G_4(t_1)$ likes G_8(her$_1$) mother i_3]]]]

The resulting truth conditions are:

> $[\![(10)]\!]^g$ = true iff there is a sequence of acquaintance-based concept-generators $\langle G_1, G_2, G_3, G_4, \ldots \rangle$ for John at @ such that, for all i' in $\mathrm{DOX}_{John,@}$, for every girl x: $G_1(x)(i')$ likes $G_2(x)(i')$'s mother in i'

Notice that this mechanism manages to accomplish, at the same time, two things. First, it pairs different modes of presentation with two occurrences of the same variable. Second, it maps each individual in the domain of *every female student* to acquaintance relations that are specific to that individual. In this way, we can accommodate the fact that John is acquainted to female student 1 via relations R_1 and R_2, to female student 2 via relations R_3 and R_4, and so on.

2.5 Summary

Let me take stock. Kaplan-style descriptivism about attitude reports is the general view that *e*-type expressions appearing in attitude reports involve quantification over modes of presentation that capture relations of acquaintance. The classical evidence for this view is the availability of double vision scenarios, i.e. cases where ascriptions of beliefs in contradictory proposition can both get true readings.

While there has been significant agreement that this general view generates correct truth conditions, the compositional implementation of the view has always been problematic. The lesson of bound *de re* reading is, arguably at least, that modes of presentation need to be paired with the relevant *e*-type expressions *in situ*. The classical *res*-movement theory fails to accomplish this, and is disconfirmed. By contrast, P&S's concept generator theory is able to accommodate these readings.

[16]Notice also that using infinite sequences of concept generators doesn't commit me to the (implausible) assumption that actual believers have infinite guises to think of objects. The same concept generator can appear at multiple places in the sequence, hence we can build an infinite sequence out of a finite number of concept generators.

3 *De re* reports: two problems

In this section, I present two empirical difficulties for P&S's concept generator view. Taken by itself, none of the difficulties is fatal. In each case, we might be able to rescue P&S's view by adding appropriate stipulations. But, taken together, and in combination with the difficulties about *de se* reports that I raise in the next section, these maneuvers produce a view that is complex and rife with *ad hoc* adjustments, to the point of appearing undesirable. The core of my argument will consist in showing that a system with elevated indices produces a view that is simpler and more explanatory.

3.1 Problem #1: overgeneration

The first problem is very simple. P&S's view makes use of overt variables over concept generators in the syntax. By doing this, it predicts that, in principle, we should have readings based on long-distance binding. But these readings are unattested, hence P&S's view overgenerates.[17]

To make things concrete, consider the following example:

(20) Ralph believes that Ramona believes that Ortcutt is a fly guy.

At the relevant level of abstraction, the LF of (20) can be represented as:

(21) Ralph believes that [λG_0. G_0(Ramona) believes that [λG_1. $\underline{G_k}$(Ortcutt) is a fly guy]]

Consider the underlined variable G_k. Given that there are two abstractors over concept generators in the structure, there are two possibilities for coindexing it. We can coindex it with the local abstractor, hence we can let $k = 1$; or we can coindex it with the higher abstractor, hence we can let $k = 0$. Option (b), i.e. the one involving long-distance coindexing, is the one causing trouble. On the reading generated in that way, the truth conditions of (20) are, on a rough gloss: *Ralph believes that Ramona believes that some individual that Ramona thinks about under the acquaintance relation that Ralph uses to think of Ortcutt is a fly guy*. But (20) can't have this reading.

The point is hard to see in abstract, but easy to appreciate when we consider an example. Take the following scenario:

> *Ortcutt and Shortcutt.* Ralph and Ramona see Ortcutt perform. Ralph is impressed and says "That guy is a fly guy"; Ramona is unimpressed and says "That guy is not a fly guy". Ralph also thinks that Ortcutt, who is exceptionally short, is the shortest fusion drummer that they have ever seen. Ramona disagrees: "You're wrong. *Shortcutt* is the shortest fusion drummer we've ever seen, and *he*, differently from that guy, is fly."

In this scenario, (20) is predicted to have a true reading. (The reason is that, roughly speaking, long distance binding allows us to take some acquaintance relation that Ralph pairs with Ortcutt, and build into the content of the belief that Ralph ascribes to Ramona.) But the prediction is wrong.

Before moving on, let me consider one potential way to fix the problem.[18] The idea is to add a definedness condition on the acquaintance relations in the range of concept generators. A concept generator for individual x at i will map objects to acquaintance relations

[17] This problem is not new; it is already discussed in Santorio 2011.

[18] Thanks here to Orin Percus for discussion.

that are only defined at the doxastic alternatives of x at i. If we make this maneuver, the LF involving long distance binding in (21) will force us to use Ralph's acquaintance relations within Ramona's doxastic alternatives. Hence the relevant acquaintance relations might not be defined and we will get a kind of presupposition failure. Thus the LF involving long distance coindexing is ruled out, and the theory is rescued.

But the fix won't work. The problem can be replicated when individuals have the very same doxastic alternatives. In this case, the relevant acquaintance relations will be defined at both (or neither) the relevant doxastic states. To see an example, consider the following scenario:

> Ralph and Ramona both wake up in full darkness in a hospital bed. Their memories have been wiped out and have been replaced by a single belief: that they are the greatest drummer on Earth. As they're coming to their senses, they both say, at the same time "I am the greatest drummer on Earth!" After this, they both lie in the dark, wondering what to do about the impostor that's lying in the dark next to them.

In this situation, Ralph and Ramona have exactly analogous doxastic alternatives.[19] Moreover, each of them plausibly employs the same acquaintance relation to think of the other: namely, *the person lying in the dark in this room*. Now, consider the report:

(22) Ralph believes that Ramona believes that she is not the best drummer on Earth.

P&S's theory, even when supplemented with the fix described above, predicts that (22) has a true reading in the scenario. This because, on the (now available) long distance binding reading, (22) can be roughly synonymous with:

(23) Ralph believes that Ramona believes that *the other person lying in the dark in the room* is not the best drummer on Earth.

But, contrary to the prediction, it seems obvious that (22) doesn't have a true reading. So the definedness condition fix doesn't work; the problem persists.

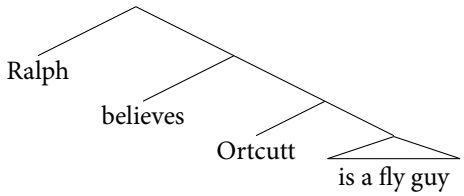
There is, obviously, one other fix that is available to P&S: this is just to stipulate that concept generator variables have to be coindexed with the most local abstractor. (This idea seems in the spirit of Percus's (2000) claim that there are pretty stringent constraints on the indexing of variables.) This solves the problem, but at the cost of introducing an extra explicit stipulation in the view.

3.2 Problem #2: undetected Binding Theory predictions

The second problem I want to raise is that the presence of concept generators at the LF level produces a number of Binding Theory predictions that are unattested. The problems are connected to the position of the overt *e*-type expressions at LF. If we do not postulate the presence of concept generator variables, some of these expressions will be in a c-command position with respect to other items. For example, a 'naïve' LF for (7) has the form:

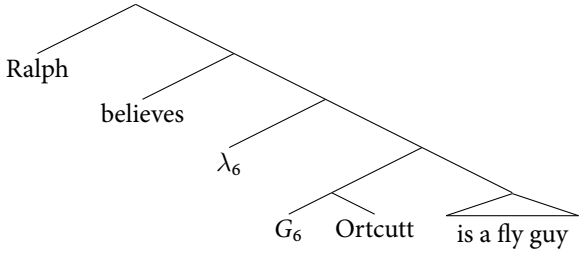
[19] Someone might worry that there is still a way to ascribe different doxastic states to Ralph and Ramona. For example, by hearing each other's voice, they will learn that their voices sound different. (Hence Ralph will think of himself as, say, *the person in the room with the low pitch voice*, and of Ramona as *the person in the room with the high pitch voice*.) Complications of this sort can be dealt with by recurring to more elaborate scenarios. One of the lessons of the literature on *de se* attitudes is that there are conceivable scenarios where different agents have analogous doxastic alternatives.

(24)



By contrast, by 'wrapping' *Ortcutt* with a concept generator variable, this c-command relation is broken, as showed by (25):

(25)



The problem is that binding-theoretic facts exhibit the typical pattern one would expect if the relevant relations of c-command were in place, as in (24). For simplicity, I will illustrate this by using Condition C effects, but the point holds generally.

Start by recalling the contrast between:

(26) *He$_1$ likes Ortcutt$_1$.

(27) His$_1$ mother likes Ortcutt$_1$.

The standard explanation for this contrast invokes Condition C of Binding Theory, which, at least on a first pass, requires that a nonpronominal NP (like *Ortcutt*) must not be covalued with a c-commanding NP. Hence (26), but not (27) is ruled out.

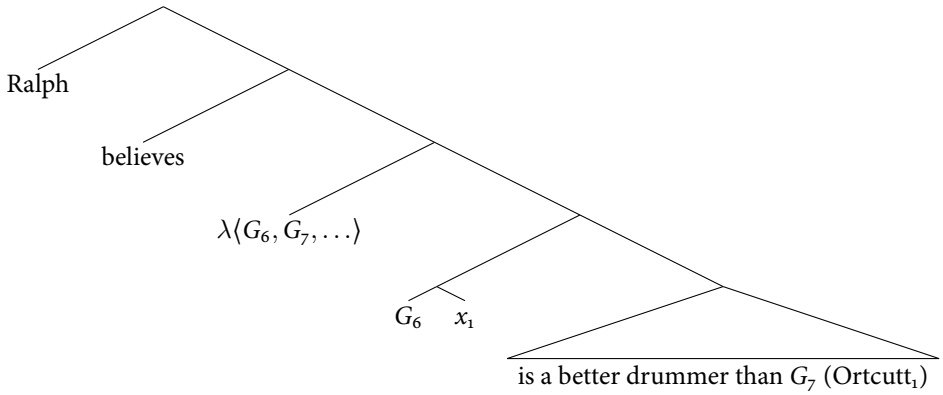
In a nutshell, the problem is this: given the presence of concept generator variables in the syntax, we expect sentences that look overtly like (26) to be ruled in. But this prediction is not borne out. For concreteness, consider the following scenario:

> Ralph sees Ortcutt perform twice in an evening with two different bands, without realizing that the same drummer is playing for both bands. As a result, Ralph forms the belief that the first band has a better drummer than the second band.

Now consider (28), whose LF is represented in full in (29):

(28) *Ralph believes that he$_1$ is a better drummer than Ortcutt$_1$.

(29)



Given this LF, we expect (28) to be ruled *in*, contrary to fact. (This will hold both on basic formulations of Binding Theory and on formulations that rely on a notion of covaluation that is sensitive to speakers' ignorance, as e.g. suggested by Heim 2009.)

I hasten to say that this argument should be taken with a grain of salt. It is an established observation in the syntax literature (see e.g. Jackendoff 1990)) that some binding theoretic effects seem to obtain in absence of relations of c-command. One classical example involves verbs with double PP complements, as in (30):

(30) *I talked to him$_1$ about Ortcutt$_1$.

(30) is infelicitous, presumably for Condition C-type reasons, despite the fact that, at least on some standard analyses of the sentence, *him* doesn't c-command Ortcutt.

Even if the argument is not definitive, it still puts pressure on P&S's theory. The proponent of that theory needs to explain why binding-theoretic facts exhibit the kind of pattern that ordinarily requires c-command. At the very least, she should come up with revised versions of binding-theoretic principles that make the correct predictions.

4 *De se* reports

In this section, I introduce some basic assumptions about semantics for *de se* reports and then go on to illustrate a well-known problem for the standard semantics. I close with a recapitulation of all the main worries surrounding standard approaches in section 4.3.

4.1 Semantics for the *de se*: basics

On a first pass, *de se* attitudes are attitudes whose content is normally reported in the first person by the attitude holder. Suppose that John has a *de se* belief that he is in London. Then, all else being equal, and barring exceptional circumstances, he will report the content of this belief by uttering "I am in London", rather than "John is in London", "This man is in London" (pointing at his own reflection in the mirror), or in some other third-personal way. The philosophical literature is rife with more theoretically loaded characterizations of *de se* attitudes, but for current purposes, we need not worry about these issues.[20] What matters

[20]For some classical arguments for signaling out *de se* attitudes as a special class, see Lewis 1979 and Perry 1979; Perry, in particular, emphasizes (correctly, to my mind) the connection between *de se* attitudes and action. See also Perry 2006, Stalnaker 2006, and Stalnaker 2008 for more recent discussions of similar points. For a recent dissenting opinion on the need for a special treatment of *de se* attitudes, see Cappelen & Dever 2013.

is that, within possible worlds semantics, *de se* attitudes call for a shift in the way we model content. As I anticipated in section 2.3, possible worlds are replaced by centered worlds, which are used to model locations within a world. On this extended model, having a belief is understood as locating oneself in a space of possible spatio-temporal locations in logical space.

While the original discussion of *de se* phenomena concerned attitudes, Chierchia 1989 first pointed out that some reports in natural language seem to ascribe specifically *de se* attitudes. One classical example in English involves attitude reports with infinitival clausal complement, such as (31):

(31) John expects to be elected.

(31) is true just in case John has an attitude that he would naturally report as 'I will be elected'. It is false if, perhaps because of amnesia or some other kind of cognitive mishap, John would report his own attitude as 'John will be elected', or (pointing to a picture of himself) 'He will be elected'.

Standard semantics for *de se* reports make crucial use of centered propositions. Syntactically, infinitival clauses like the one in (31) are taken to involve a covert pronominal element, conventionally dubbed 'PRO'. PRO is obligatorily bound by an abstractor over individuals. For example, the LF of (31) is:

(32) John expects $[\lambda_5 \lambda_1$. PRO_1 be elected $w_5]$

As a result, semantically, the complement clause in (31) denotes a centered proposition and PRO works as a bound variable ranging over centers:

(33) $[\![\lambda_5 \lambda_1$. PRO_1 be elected $w_5]\!]^g = \lambda\langle x, w\rangle$. x is elected in w.

Combined with an appropriate semantics for attitude verbs like *expects*, this results in ascribing to John an attitude with *de se* truth conditions. It's useful to look at the details. In line with the centered worlds account of attitudes, attitude verbs are taken to quantify over a set of centered worlds—intuitively, the centered worlds compatible with the content of the attitude at stake. For example, here is a toy entry for *expect*:

(34) $[\![\text{expect}]\!]^g = \lambda p_{\langle i,t\rangle}$. λx_e. λi_i. for all i' compatible with what x expects at i, $[\![p]\!]^g(i') = 1$

Combined with the denotation in (33), (34) yields the following truth conditions:

(35) $[\![(31)]\!]^g = \lambda i$. for all centered worlds i' compatible with John's expectations at i, the center of i' is elected at i'

Notice that LFs involving PRO (or other similar logophoric pronouns) are not the only way to derive the truth conditions of *de se* reports in the system I introduced in section 2.3. *De se* truth conditions can also be be derived, as a special case, from the *de re* LFs involving concept generators. All we need is the assumption that quantification over concept generators may involve a domain restriction to concept generators that always yield the *de se* acquaintance relationship (i.e., the acquaintance relationship that maps each centered world to its center). Hence, on standard accounts, we have (at least) two routes to reports with *de se* truth conditions: on the one hand, simpler LFs involving PRO; on the other, *de re* LFs involving concept generator variables.

I will come back to the question how *de se* readings are generated, and to *de se* LFs, in

section 7. Now let me rehearse a well-known problem for standard views of *de se* reports.

4.2 *De se* reports and Binding Theory

Since Heim 1994b, it is known that *de se* reports raise problems for Conditions A and B in Binding Theory (henceforth, BT). Consider the following scenario, which is borrowed from Sharvit 2011:

> Sarah Palin, who is running for president, wakes up from a coma and suffers from severe memory loss … McCain visits her in the hospital, and she says to him: 'I don't know who to vote for'. While the two of them look at a picture of her in the newspaper, he says to her: 'You must vote for this woman'. Palin, who does not recognize herself in the picture, says: 'You are right; I will vote for this woman. She seems reliable'. (2011, page 56)

The following report is true (and grammatical) in Sharvit's scenario:

(36) McCain convinced Palin to vote for herself.

The problem posed by (36) can be put as a dilemma. Consider the LF of (36) (for simplicity, I omit concept generators, which are not crucial here):

(37) McCain convinced Palin_2 $[\lambda_1[\text{PRO}_1$ vote for $\underline{\text{herself}_k}]]$

We have two (salient) options for the index of *herself*, which is underlined above.

(a) We may coindex *herself* with PRO. In this case, the sentence is ruled in by BT, since the reflexive does have a local antecedent. But, by doing this, we force an unwanted *de se* reading of *herself*. Palin should be reporting her attitude as 'I will vote for myself'.

(b) We may coindex *herself* with *Palin*. In this case, we are able to derive the right truth conditions, at least in principle. But the sentence is declared ungrammatical by BT, and in particular by Condition A (which states that reflexive pronouns must be covalued with a c-commanding NP in their local domain).

As Sharvit points out, the problem is not restricted to object control verbs like *convince*, but generalizes to subject control verbs like *promise*, as in

(38) Palin promised McCain to vote for herself.

It is also reproduced when the controller of PRO is a trace, as in

(39) McCain convinced every candidate to vote for herself.

Moreover, symmetric difficulties arise in connection with Condition B. Condition B states that nonreflexive pronouns must not be covalued with an NP within their local domain. By the lights of Condition B, the following variant on (36) (assuming the LF in (41)) should be ruled in:

(40) *McCain convinced Palin to vote for her.

(41) McCain convinced Palin_2 $[\lambda_1[\text{PRO}_1$ vote for $\text{her}_2]]$

But, of course, (40) is ungrammatical.

The only solution that I'm aware of has been provided by Sharvit herself (2011). Sharvit's proposal is, in essence, to reformulate the relevant principles of BT to make room for the

particular effects detected in *de se* reports. The statement of Conditions A and B is unaltered, but the definition of covaluation is disjunctive and makes reference to two different subtypes of covaluation, Type-I and Type-II. Type-I covaluation is the usual kind and, with some approximation, amounts to sharing an index. Type-II covaluation, on a very rough gloss, holds between NPs such that one of them denotes a subject of attitude, and the other picks out the center in the subject's attitude. The actual definition is pretty complex and the reader is referred to Sharvit's paper for the details. Here I limit myself to giving a quick example of how it works. Consider again (36) and suppose that we follow option (b) above. Hence *herself* is coindexed with *Palin*, which is not in its local domain:

(42) McCain convinced Palin$_2$ [λ_1[PRO$_1$ vote for herself$_2$]]

On Sharvit's proposal, despite the fact that PRO and *herself* do not share syntactic indices, they do count as covalued. Informally stated, the reason is that PRO picks out the center of the doxastic worlds of the individual denoted by *herself*. This is sufficient for the two pronouns to count as Type-II covalued.

Providing an evaluation of Sharvit's proposal goes beyond my purposes here. I just want to note that this solution introduces some nontrivial complications in BT. In particular, it might seem problematic that we must use a new kind of covaluation specifically for the case of anaphoric links with PRO in *de se* attitude contexts. Of course, as long as we have no alternative, we should take Sharvit's solution very seriously. In the following sections, though, I hope to convince you that there is a simpler solution that is fully conservative as far as BT is concerned, and derives the relevant data via independently motivated changes to the semantics.

4.3 Summary: the problems for the orthodox picture

Before proceeding, it's useful to recapitulate the state of play after sections 2–4. With regard to semantics for the *de re*, I have taken for granted a Kaplan-style descriptivist approach to truth conditions. Within this approach, the state-of-the-art compositional implementation, especially in light of the arguments given by Charlow & Sharvit 2014, is P&S's concept generator theory. On this theory, *e*-type expressions appearing in attitude reports are invariably wrapped by variables ranging over concept generators, i.e. functions from individuals to acquaintance relations. Attitude verbs quantify over concept generators, thus binding the relevant variables. With regard to semantics for *de se* reports, the orthodox approach involves postulating that there are at least two routes to *de se* truth conditions. On the one hand, *de se* truth conditions might be obtained as a special case of *de re* truth conditions, i.e. via an appropriate choice of concept generator. On the other, in some environments *de se* truth conditions are generated via the presence of PRO, a covert pronominal element which works semantically as a bound variable ranging over attitude centers.

Throughout my discussion, I have rehearsed a number of difficulties for the standard approach. As I pointed out, these difficulties can be overcome by adding some extra stipulations to the theory. It's useful to list them.

(a) We need to stipulate that concept generator variables cannot be bound long distance and must be rather coindexed with the most local abstractor.

(b) We must stipulate that variables over concept generators are somehow invisible to Binding Theory: the c-command relations that are used for determining binding-theoretic facts are the ones we would have if those variables were not there.

(c) We need to modify Binding Theory and introduce a second kind of covaluation alongside the standard one. This second kind of covaluation is meant to capture specifically some kind of semantic connection holding in the case of *de se* reports.

In addition to (a)–(c), let me remind you of a further feature of the standard picture:

(d) There are two different routes for generating *de se* truth conditions: on the one hand, as a special case of *de re* LFs, on the other, via dedicated *de se* LFs.

While (d) is an empirical possibility, it would be obviously more economical if the two 'roads to *de se*', as they've come to be known, could be unified.

The theory that I'm going to propose is going to fare better than the standard view in all respects (a)–(d).

5 Multiple indices

This section outlines my proposal. The exposition is intentionally nontechnical and I will skirt over details at times; the main purposes is to give an overview. I present the formal system in the next section.

5.1 Diagnosis

I start with two diagnostic observations that are useful in building a positive account.

First, consider the problem with long distance binding. That problem suggests that structures that exemplify the following pattern are, for some reason, not available:

(43) $^{*}\lambda_{G_i} \ldots \lambda_{G_k}\ G_i \ldots$

This kind of problem is familiar from a different strand of literature on modality. In semantics, we have two fundamental ways of tracking parameters like world or time of evaluation. One is the extensional way, which involves postulating directly object language variables that range over these entities. Modality and tense, for example, are treated along these lines on most contemporary frameworks. The other is the intensional way, which involves relativizing interpretation to a metalanguage parameter whose value is affected by operators in the sentence. Modality and tense were treated in this way in the past. More recently, the intensional route has proven fruitful elsewhere. For example, in the literature on predicates of personal taste (see, among many, Lasersohn 2005 and Stephenson 2007), several theorists have treated parameters like standards of taste along these lines.

Now, one standard argument for treating a parameter extensionally or intensionally relies just on the availability or the unavailability of long distance influence. For example, Stephenson (2007) observes that, in a report like

(44) John believes that the rollercoaster is fun.

(44) ascribes to John the belief that the rollercoaster is fun *by his own standards*. It has no reading on which the belief ascribed is that the rollercoaster is fun by the speaker's (or some other salient individual's) standards. Stephenson points out that the lack of these readings is unexpected on a view on which *fun* contains a covert variable ranging over standards of taste or assessors. But we can predict it if we assume that the interpretation of *fun* depends on a standard of taste or an assessor parameter that is shifted by attitude verbs like *believe*.

I want to make an analogous claim: the unavailability of long distance influence is an argument against a variable treatment of concept generators, and in favor of an intensional variant of P&S's concept generator theory. I trust that, when put this way, the point will seem clear. What might not be clear is what an intensional variant of concept generator theory looks like. I'm going to suggest that a theory involving multiple indexing of *e*-type expressions is exactly a theory of this kind.

Turn now to the problem with reflexive and nonreflexive pronouns in *de se* reports. The problem arises from sentences of the following form (where 'S' stands for an NP and 'ATT_{subj}' and 'ATT_{obj}' stand, respectively, for subject and object control attitude verbs):

(45) $S_i\ \text{ATT}_{subj}\ [\text{PRO}_j \ldots x_k]$

(46) $\ldots\ \text{ATT}_{obj}\ S_i\ [\text{PRO}_j \ldots x_k]$

Intuitively, PRO and x are connected in the following way: they pick out the same individual in the actual world, but not in the relevant attitude worlds. Given standard BT, and given the semantic assumption that PRO ranges over attitude centers of an attitude state, we would predict that x is coindexed with the nonlocal NP and realized as a nonreflexive. But the prediction is not borne out; we see a reflexive instead.

Sharvit solves the problem by altering standard BT. I suggest that the difficulty is a sign of a deeper issue with the semantics of PRO. Consider for a moment what information is carried by indices in (45) and (46). Roughly, the index of S carries information about identity and coreference facts *in the actual world*. (Talk of coreference in connection with variable indices is notoriously imprecise; but this doesn't matter for current purposes, so I'll stick with it.) The index of PRO, by contrast, carries information about identity and coreference facts *in attitude worlds*. Somewhat strikingly, the same indices are used to track these two different kinds of information.

I suggest that this is the source of the problem. In standard systems, indices that appear on pronouns are used to track, at the same time, two different kinds of information about coreference. The solution will consist in separating the syntactic elements that carry the two types of information. Also in this case, it will take some work to explain how this is done.

5.2 Multiple indexing

I will first state the main idea as it applies to PRO, and then generalize it to other pronouns. On my view, PRO is equipped with two indices. I represent the first index in the usual way, as a subscripted numerical value, and the second index as a superscripted Greek letter. Thus the syntactic representation of PRO is, picking two arbitrary indices '1' and 'α':

$$x_1^{\alpha}$$

Subscripted indices are familiar. From a semantic point of view, they work exactly in the way that ordinary indices on overt pronouns like *she* and *he* work in standard systems. Exactly what semantic information these indices carry will depend on one's view about the relationship between syntactic indices and semantic facts about coreference. This is a vexed issue that I don't need to take a stance on for the purposes of this paper. For simplicity, I adopt the convenient (but most likely false) view that syntactic indices track facts about coreference in the actual world.[21]

[21] It is acknowledged that this view runs into trouble in explaining BT effects in identity statements and statements used to provide evidence about identity, like ((i) and (ii):

(i) That man is John.

Superscripted indices—or, as I will call them, *elevated indices*—track the acquaintance relations that are associated to PRO in attitude contexts. Given that PRO obligatorily receives a *de se* reading in the class of reports I'm considering , this acquaintance relation will invariably be the *self* acquaintance relation, i.e. the acquaintance relation that maps each centered world to its center:

$$f_{self}(\langle x, w\rangle) = x$$

So, in summary: subscripted indices track facts about actual world coreference; elevated indices track facts about acquaintance relations—hence, roughly speaking at least, about coreference in attitude worlds.

So far, I have spoken informally of information being 'handled' by different indices. I haven't said anything about the compositional mechanisms behind the proposal. Let me start to fill this gap. First, I introduce a tweak. I assume that the semantic object assigned to the second index, rather than an acquaintance relation, is a function from individuals to acquaintance relations, i.e. a concept generator. In particular, for the case of PRO, the elevated index is the constant 'self' concept generator G_{self}, i.e. the concept generator that maps every individual to the 'self' acquaintance relation. Once this tweak is in place, I can state the basic mechanism by which PRO is evaluated.

Here is a first shot, to be amended in a number of ways. The two indices are evaluated separately and their values are combined via functional application. The lower index is mapped to an actual world individual, while the elevated index is mapped to the constant 'self' concept generator. Combined, these two yield simply the 'self' acquaintance relation.

$$[\![PRO^{\alpha}_{1}]\!]^{g} = [g(\alpha)](g(1)) = G_{self}(g(1)) = f_{self}$$

The first amendment has to do with relocating this information in a presupposition. (This is mostly done for compositional reasons; see section 6 for details.) This is the new meaning of PRO:

$$[\![PRO^{\alpha}_{1}]\!]^{g} \quad = \quad [g(\alpha)](g(1)).\, g(\alpha) = G_{self}$$

Notice that, on the new picture, PRO denotes an individual concept (type $\langle i, e\rangle$) rather than an individual. To get back an individual, we need to provide PRO with a centered world-type argument. I explain in section 6 how the semantics provides this argument.

At this point, it should be easy to see how the account can be generalized beyond PRO. I said that the elevated index of PRO is mapped to a function from individuals to an acquaintance relation. This, notice, is nothing else than a concept generator. The basic idea behind the generalization is that all *e*-type expressions appearing in attitude reports should be paired with elevated indices and evaluated in the same way as PRO. The only difference lies in the concept generators involved. For example, the syntactic representation of *she* and *Ortcutt* is:

$$\begin{array}{c} \text{she}^{\iota}_{4} \\ \text{Ortcutt}^{\sigma}_{9} \end{array}$$

PRO was associated, by means of a dedicated 'logophoric' presupposition, with a constant concept generator, that maps each individual to the 'self' acquaintance relation. This won't

(ii) (Was John the man in the bowler hat?) I don't know, but he put on John's coat before leaving, so it may well have been. (Heim 2009)

A more sophisticated version of this position is that syntactic indices track facts about *presupposed coreference*. For a recent articulation of this position, see Heim 2009; for a historical precedent, see Postal 1970.

be true, in general, of other *e*-type expressions. This can be implemented simply by assuming that PRO encodes the logophoric presupposition as part of its lexical meaning, while this presupposition is optional for other pronouns. (Notice that this doesn't amount to an *ad hoc* stipulation. We can just take it as part of the syntactic realization of PRO that it involves a special elevated index. At the very least, this doesn't seem any more stipulative than the standard view, on which PRO is obligatorily bound by the abstractor over individuals at the top of the clause.)

Once this maneuver is made, we can mirror P&S's main moves and reconstruct their semantics in a system that involves no variables over concept generators. Like P&S, I assume that attitude verbs quantify existentially over concept generators. Differently from them, I don't assume that they bind object language variables over concept generators. Rather, the quantification takes place only in the metalanguage and is implemented via a mechanism of assignment shift. It is useful to track separately the functioning of elevated and lower indices. Hence I assume that the two kinds of indices are handled by two different assignments. I use '*g*', as is conventional, for the lower indices assignment, and '*a*' for the elevated indices assignment. The view, then, is that attitude verbs shift the elevated assignment. Schematically, and on a first pass:

(47) $[\![x \text{ believes } [\phi]]\!]^{g,a} = \lambda i.$ there is an assignment a' such that for all i' compatible with what x believes at i, $[\![\phi]\!]^{g,a'}(i') = \text{true}$

As in P&S's system, the clausal argument of attitude verbs is a function from sequences of concept generators to centered worlds propositions. Differently from their system, this argument is not the denotation of anything at LF. Rather, I assume a composition rule that performs abstraction on the elevated assignment. This rule is analogous to the Intensional Functional Application rule defined in Heim & Kratzer 1998. The basic denotation of the items present at LF produce a type mismatch; the composition rule fixes the mismatch by mandating abstraction on the elevated assignment. Schematically: if ϕ is the complement clause of an attitude report, the argument fed to the relevant attitude verbs is:

$$\lambda a'.\ [\![\phi]\!]^{g,a'}$$

Before discussing the empirical coverage of the system, let me acknowledge some theoretical debts. Conceptually, the view I'm sketching can be seen as the result of merging two different strands of theories of attitude reports.

On the one hand, the system results from the Quine/Kaplan line that passes through *res*-movement accounts and terminates in P&S's concept generator theory. In particular, I take from P&S an effective technique for pairing individual concepts with *e*-type expressions *in situ*. On the other hand, the system connects to a more recent strand of work that appeals to assignment shift (Cumming 2008, Santorio 2011 and 2012, Ninan 2012). The main intuition behind this approach is that the semantics for *de re* attitudes should be assimilated to the model of Chierchia's semantics for *de se* attitudes. In particular, all *e*-type expressions appearing in the scope of attitude verbs are obligatorily bound, as it happens for PRO. The main innovation of the view consists in showing how these two ways of thinking about attitude reports can be brought together, and that doing so solves a number of open puzzles.

5.3 Solution to the problems

Let me give an overview of how the system deals with the empirical difficulties for P&S's theory raised in sections 2–4, as well as with bound *de re* readings. For the case of BT-

related problems, the solution is very quick to see, since it just depends on the shape of the LFs that the system assigns to the relevant sentences. So this brief discussion will be enough. For the case of embedded attitude reports and bound *de re* readings, what I say below is just a promissory note. I show how the right truth conditions are derived in the next section.

Overgeneration in embedded reports. Differently from P&S's theory, the multiple indexing view doesn't overgenerate. The reason is that, since attitude verbs act as assignment shifters, the concept generators employed at any given stage in the computation are always determined by the most local attitude verb.

Here is an intuitive illustration. Schematically, these are the truth conditions that are associated to a simple attitude report:

(48) $[\![x \text{ believes that } [\phi]]\!]^{g,a} = \lambda i.$ there is an assignment a' such that for all i' compatible with what x believes at i, $[\![\phi]\!]^{g,a'}(i') = \text{true}$

When we embed this under a further attitude report, we get the following:

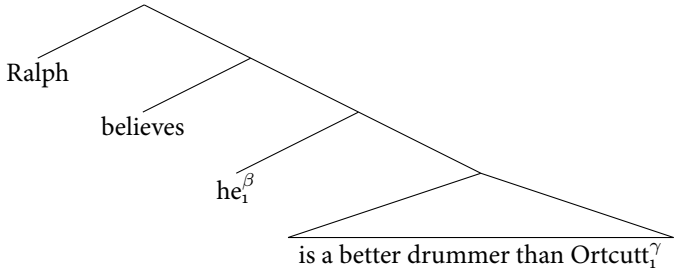
(49) $[\![y \text{ believes that } [x^{\beta} \text{ believes that } [\phi]]]\!]^{g,a} = \lambda i.$ there is an assignment a' such that for all i' compatible with what y believes at i, there is an assignment a'' such that for all i'' compatible with what $a(\beta)(x)$ believes at i', $[\![\phi]\!]^{g,a''}(i'') = \text{true}$

Because of the way composition rules work, the assignment at which the innermost clause is evaluated must be 'doubly shifted'. Again, I provide a derivation in the next section.

Undetected BT predictions. Since it avoids variables over concept generators, the multiple indexing view escapes all the problematic predictions related to c-command relations in attitude reports. For illustration, consider again (28):

(28) *Ralph believes that he_1 is a better drummer than Ortcutt_1.

In the LF of (28), *he* c-commands *Ortcutt*, hence we predict a Condition C violation and the sentence is ruled out.



BT effects in *de se* reports. (36) is ruled in by standard Condition A because, by assumption, BT only deals with basic indices.

(50) [McCain convinced Palin_1 [PRO_1^{α} vote for herself_1^{β}]]

(40) is ruled out by standard Condition B because it contains a non-reflexive coindexed with an NP in its local domain:

(51) [McCain convinced Palin_1 [PRO_1^{α} vote for her_1^{β}]]

At the same time, the coindexing of PRO and *herself* at the lower level generates no con-

straints about whether we should read *herself de re* or *de se*. That matter is determined by the elevated index. The presence of the elevated index 'β' in (50) guarantees that we use a different concept generator for the second pronoun. As a result, that pronoun can receive a *de re* reading.

The solution generalizes; it's easy to check that we get correct predictions for the case of subject control verbs, cases involving nonreflexive pronouns, and cases involving quantification.

Bound *de re* readings. Despite the fact that bound *de re* readings were discovered several years after P&S's concept generator theory was formulated, they are clearly the strongest piece of evidence in its support. So it's crucial that my system is able to replicate this prediction. Luckily, this prediction is borne out automatically and with no need for extra stipulations. In bound *de re* readings, each index appearing on pronouns is bound—hence, effectively, pronouns are bound twice. This is the LF for (10), repeated below:

(10) John believes that every female student likes her mother.

(52) John believes $w_0[\lambda_3$. [every female student $[\lambda_1$. $[t_1^\delta$ likes her$_1^\kappa$ mother $i_3]]]]$

The new variable rule guarantees that the truth conditions for (10) have the form:

> There is a sequence of concept generators $\langle G_1, G_2, \ldots\rangle$ such that: In all of John's doxastic alternatives, for every female student x, $G_1(x)$ likes $G_2(x)$'s mother.

which is exactly what we want. A compositional derivation of these truth conditions is at the end of the next section.

6 The formal system

The basic setup of the semantics was stated in section 2.3. The main change is that interpretation is relativized not only to a context and an assignment (represented respectively as 'c' and 'g'), but also to a second assignment, represented as 'a', and to a centered world parameter (essentially, an index of evaluation) 'i'. The reason for introducing an index, despite the system being extensional, is a technicality, and is explained in detail below.

6.1 Index evaluation rules

The starting point is a standard rule for the evaluation of pronouns and traces, such as the one given in Heim & Kratzer 1998:

> **Pronouns and Traces rule**
> If α is a pronoun or a trace, and k an index, $[\![\alpha_k]\!]^{c,g}$ is defined only if $k \in \mathrm{Dom}(g)$.
> When defined, $[\![\alpha_k]\!]^{c,g} = g(k)$

This rule remains in place, but it requires supplementation. In the new system, all *e*-type expressions appear in attitude reports with an elevated index. We need a second rule that tells us how to evaluate the second index.

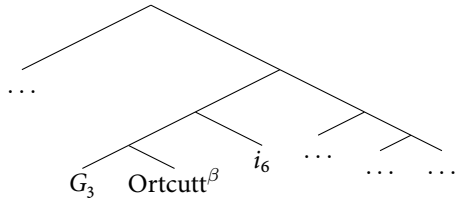
This is a first proposal that will need amendment:

> **Elevated indices rule (temporary)**
> If α is any *e*-type expression and κ an elevated index, then $[\![\alpha^\kappa]\!]^{c,g,a}$ is defined only if $\kappa \in \mathrm{Dom}(a)$. When defined, $[\![\alpha^\kappa]\!]^{c,g,a} = [a(\kappa)]([\![\alpha]\!]^{c,g,a})$

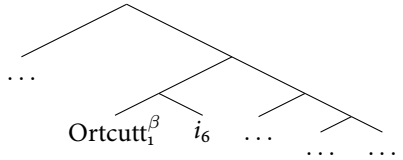
In short, the new rule instructs us to assign a denotation to the elevated index, and to combine that denotation with the denotation of the *e*-type expression via functional application.

Notice that the elevated indices rule applies not only to bindable pronouns, but to any *e*-type expression, including those with no lower index, such as proper names and indexicals. This is obviously desirable, as it allows us to handle all *e*-type expressions in one stroke. The rule is designed to not interfere at all with the basic semantics of these items; at the same time, it manages to make them bindable (at least, in the elevated position) by attitude verbs.

Now, for the complication. All we have in the syntax is an *e*-type element. But the result of evaluating the expression relative to an elevated assignment is an individual concept (type $\langle i, e \rangle$). To get back an *e*-type object, we need a way of providing an *i*-type argument to this individual concept. On P&S's account, we can do this just via a centered world variable which is the sister of the node dominating the concept generator.



But in my system there are no concept generators in the syntax. I could indeed stipulate that all *e*-type expressions have centered world variables as sisters, in the following way:



But, to do this, I would have to assume a kind of constraint on well-formedness saying that every *e*-type expression is generated with a centered-world variable as its sister. Moreover, I would also need to stipulate that that variable is appropriately coindexed (specifically, it should be coindexed with the right abstractor). These would be brute force stipulations, so I pursue a different option.

Notice that there would be no problem at all in an intensional system, in which interpretation was relativized to a centered world parameter. The right value for this parameter would be provided directly by the index of evaluation, which would be invariably shifted by the most local attitude verb. The system I'm using, though, in line with current fashion in the semantics for attitudes, is extensional. But I can still help myself to the solution afforded by intensional technology by recreating a centered world index of evaluation in an extensional system. Hence, together with the extra assignment, I assume the presence of an extra index parameter, which duplicates the information contained in the world variables. The entry for attitude verbs will shift the new assignment, as well as the centered worlds parameter—in addition to providing a centered world argument for the prejacent. Schematically (and anticipating some of the content of the next section):

> $[\![S \text{ thinks that } p]\!]^{c,g,a,i} = 1$ iff there is an appropriate a' such that, for all i' compatible with what S thinks at i, $[\![p]\!]^{c,g,a',\underline{i'}}(\underline{\underline{i'}}) = 1$

Notice the double reference to a centered world parameter (twice underlined). This is admittedly somewhat clunky, but it avoids *ad hoc* constraints about the indexing of variables or similar stipulations.

This suggestion results in the following rule:

> **Elevated indices rule (final)**
> If α is any e-type expression and κ an elevated index, then $[\![\alpha^{\kappa}]\!]^{c,g,a,i}$ is defined only if $\kappa \in \mathrm{Dom}(a)$. When defined, $[\![\alpha^{\kappa}]\!]^{c,g,a,i} = [a(\kappa)]([\![\alpha]\!]^{c,g,a,i})(i)$

Let me add a final comment. Ultimately, the complication shows that the assignment-shifting technology I'm developing might work best with an intensional theory of modality. I believe there is very much to say for an intensional theory (see, among other things, the arguments in Romoli & Sudo 2008 and Keshet 2008 and 2011). But, given the current popularity of extensional theories, I stick with this setup.

6.2 Attitude verbs

The lexical entry for attitude verbs is almost analogous to P&S's lexical entry; the only changes are due to technical issues. First, let me state again the definition of an acquaintance-based concept generator:

> A function G of type $\langle e, ie\rangle$ is an *acquaintance-based concept generator for x at i* iff:
>
> (i) $Dom(G) = \{y$: x is acquainted with y at $i\}$
> (ii) For all y in $Dom(G)$, if $G(y) = R$, then:
> - R is an acquaintance relation;
> - x bears R uniquely to y in i;
> - for all centered worlds i' in x's doxastic set at i, the center of i' bears R to $G(y)(i')$ in i'.

Then, the entry. In P&S's system, attitude verbs like *think* quantify existentially over sequences of acquaintance-based concept generators and take as their clausal argument functions from sequences of this sort to centered propositions. In the present system, there are two main differences:

- first, elevated indices (i.e. functions from elevated indices to concept generators) replace sequences of concept generators;
- second, as flagged above, attitude verbs manipulate an extra centered worlds index parameter.

As a result, the clausal argument of attitude verbs is: a function from elevated assignments to a function from centered worlds to centered propositions. Let me use 'Σ' as a metalanguage variable ranging over arguments of this sort, and 'a' as a type for elevated assignments. Below is the entry for a sample attitude verb.

(53) $[\![\text{think}]\!]^{c,g,a,i} = \lambda\Sigma_{\langle a,\langle i,it\rangle\rangle}.\ \lambda x.\ \lambda i.$ there is an assignment a' such that:

(a) the range of a' is a sequence of acquaintance-based concept generators $\langle G_1, G_2, G_3, \ldots\rangle$ for x at i;

(b) for all $i' \in \mathrm{DOX}_{x,i}$, $\Sigma(i')(i')(a') = 1$

6.3 Extra composition rule

The system that I have set up is designed to produce systematic type mismatch in the composition of attitude reports. Attitude verbs take as their clausal argument a complex function of type $\langle a, \langle i, it\rangle\rangle$; that-clauses denote simple centered propositions. Similarly to what happens in standard intensional systems, this type mismatch is fixed via a dedicated composition rule. Here it is:

> **Assignment-Shifting Functional Application (AFA)**
> If α is a branching node and $\{\beta, \gamma\}$ the set of its daughters, then for any context c, any assignments g, any elevated assignment a, and any centered world i, if $[\![\beta]\!]^{c,g,a,i}$ is a function whose domain contains $\lambda a'.\ \lambda i'.\ [\![\gamma]\!]^{c,g,a',i'}$, then $[\![\alpha]\!]^{c,g,a,i} = [\![\beta]\!]^{c,g,a,i}(\lambda a'.\ \lambda i'.\ [\![\gamma]\!]^{c,g,a',i'})$

Just the use of the AFA rule is what guarantees the absence of long distance binding of concept generators.

6.4 A basic derivation

At this stage, we have assembled the tools to give a basic derivation. Consider (7), whose LF is reported below in (54). The derivation of its truth conditions is given in (55). To reduce clutter, both in this derivation and in the following ones I omit centered world variables and the relevant abstractors in the root clause.

(54) Ralph thinks that $[\lambda_6$. Ortcutt$^{\beta}$ is a fly guy $i_6]$.

(55) $[\![(54)]\!]^{c,g,a,i} = [\![\text{thinks}]\!]^{c,g,a,i}(\lambda a'.\ \lambda i'.\ [\![\lambda_6.\ \text{Ortcutt}^{\beta}\ \text{is a fly guy}\ i_6]\!]^{c,g,a',i'})([\![\ \text{Ralph}]\!]^{c,g,a,i})$ =

$[\lambda\Sigma_{\langle a,\langle i,it\rangle\rangle}.\ \lambda x.\ \lambda i.$ there is an assignment a' such that: the range of a' is a sequence of acquaintance-based concept generators $\langle G_1, G_2, G_3, \ldots\rangle$ for x at i; for all $i' \in \text{DOX}_{x,i}$, $\Sigma(a')(i')(i') = 1]$ $(\lambda a'.\ \lambda i'.\ [\![\lambda_6.\ \text{Ortcutt}^{\beta}\ \text{is a fly guy}\ i_6]\!]^{c,g,a',i'})(\text{Ralph}) =$

$[\lambda\Sigma_{\langle a,\langle i,it\rangle\rangle}.\ \lambda x.\ \lambda i.$ there is an assignment a' such that: the range of a' is a sequence of acquaintance-based concept generators $\langle G_1, G_2, G_3, \ldots\rangle$ for x at i; for all $i' \in \text{DOX}_{x,i}$, $\Sigma(a')(i')(i') = 1]$ $(\lambda a'.\ \lambda i'.\ \lambda i''.\ [\![\text{Ortcutt}^{\beta}\ \text{is a fly guy}\ i_6]\!]^{c,g[6\to i''],a',i'})(\text{Ralph}) =$

$[\lambda\Sigma_{\langle a,\langle i,it\rangle\rangle}.\ \lambda x.\ \lambda i.$ there is an assignment a' such that: the range of a' is a sequence of acquaintance-based concept generators $\langle G_1, G_2, G_3, \ldots\rangle$ for x at i; for all $i' \in \text{DOX}_{x,i}$, $\Sigma(a')(i')(i') = 1]$ $(\lambda a'.\ \lambda i'.\ \lambda i''.\ [[\![\text{is a fly guy}\ i_6]\!]^{c,g[6\to i''],a',i'}([\![\text{Ortcutt}^{\beta}]\!]^{c,g[6\to i''],a',i'})])(\text{Ralph}) =$

$[\lambda\Sigma_{\langle a,\langle i,it\rangle\rangle}.\ \lambda x.\ \lambda i.$ there is an assignment a' such that: the range of a' is a sequence of acquaintance-based concept generators $\langle G_1, G_2, G_3, \ldots\rangle$ for x at i; for all $i' \in \text{DOX}_{x,i}$, $\Sigma(a')(i')(i') = 1]$ $(\lambda a'.\ \lambda i'.\ \lambda i''.\ [[\lambda x.\ x\ \text{is a fly guy in}\ i'']([a'(\beta)](\text{Ortcutt})(i'))])(\text{Ralph}) =$

$[\lambda\Sigma_{\langle a,\langle i,it\rangle\rangle}.\ \lambda x.\ \lambda i.$ there is an assignment a' such that: the range of a' is a sequence of acquaintance-based concept generators $\langle G_1, G_2, G_3, \ldots\rangle$ for x at i; for all $i' \in \text{DOX}_{x,i}$, $\Sigma(a')(i')(i') = 1]$ $(\lambda a'.\ \lambda i'.\ \lambda i''.\ [[a'(\beta)](\text{Ortcutt})(i')\ \text{is a fly guy in}\ i''])(\text{Ralph}) =$

λi. there is an assignment a' such that: the range of a' is a sequence of acquaintance-based concept generators $\langle G_1, G_2, G_3, \ldots \rangle$ for Ralph at i; for all $i' \in \text{DOX}_{Ralph,i}$, $[a'(\beta)](\text{Ortcutt})(i')$ is a fly guy in i'

6.5 PRO

I anticipated that the system still accommodates the fact that *PRO* is obligatorily *de se*.[22] The key to this is assuming that PRO has a dedicated upper index α as part of its lexical meaning. The upper index α is invariably mapped to the constant *self*-concept generator (referred to as 'G_{self}'), i.e. the concept generator that maps every object to the acquaintance relation f_{self}, so defined:

$$f_{self}(i) = \text{center}(i)$$

We can force the index α to be sent to the *self*-concept generator via a presupposition in the lexical entry of PRO.[23] Here is the entry (which, aside from a few details, was anticipated in section 5):

(58) $\quad [\![\text{PRO}^{\alpha}_{i}]\!]^{c,g,a,i} = \quad g(i).\ a(\alpha) = G_{self}$

As a result, PRO is always paired with the *self* concept generator, or else it generates presupposition failure.

Notice that, aside from the extra presupposition, the semantics of PRO is analogous to that of ordinary pronouns. This paves the way to a unified treatment of *de se* reports involving PRO and *de re* reports, as I explain in section 7.

6.6 Deriving embedded belief reports

Let's consider again embedded belief reports like (20), repeated below:

(20) Ralph believes that Ramona believes that Ortcutt is a fly guy.

It's easy to show that the present system doesn't overgenerate for these cases. Below is the compositional derivation of (20), whose LF is in (59). Notice that the concept generator associated with *Ortcutt*, which appears embedded under two attitude verbs, is connected semantically to the most local one.

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[22] In fact, provided that certain assumptions about the meaning of attitude verbs are in place, the system gets an even better result: it accommodates both *de se* and *de te* readings of PRO, by means of a unique lexical entry. *De te* readings are generated by object control verbs like *tell*; an example is provided by (56), which is standardly analyzed as involving PRO, as marked in (57):

(56) John told Mary to leave.

(57) John told Mary [PRO to leave].

(56) is true in a scenario where Mary is the intended addressee of John's utterance, as in "Leave!" or "You must leave!"; it is false in other circumstances—for example if John approaches someone who, unbeknownst to him, is Mary and he tells her "Mary must leave".

On the present account, *de te* readings can be derived by assuming that the elevated index α, which appears on PRO, gets invariably mapped to the constant *self* concept generator. *De te* truth conditions can be derived by assuming an appropriate entry for verbs like *tell*—roughly, *S told S′ that p* should be taken to mean "*S* intentionally produced an utterance that would produce in *S′* the belief that *p*".

[23] Just thanks to this, the present proposal avoids some of the main drawbacks of related, but less sophisticated proposal considered by Sharvit 2011, the so-called 'pure *de re*' theory. This theory has trouble explaining the fact the obligatory *de se* reading of *PRO*.

(59) Ralph believes that [λ_8. Ramona$^{\gamma}$ believes i_8 that [λ_2. Ortcutt$^{\iota}$ is a fly guy i_2]].

(60) $[\![(59)]\!]^{c,g,a,i} = [\![\text{believes}]\!]^{c,g,a,i}(\lambda a'.\ \lambda i'.\ [\![\lambda_8.\ \text{Ramona}^{\gamma}\ \text{believes}\ i_8\ \text{that}\ [\lambda_2\ \text{Ortcutt}^{\iota}\ \text{is a fly guy}\ i_2]]\!]^{c,g,a',i'})([\![\ \text{Ralph}]\!]^{c,g,a,i}) =$

$[\![\text{believes}]\!]^{c,g,a,i}(\lambda a'.\ \lambda i'.\ \lambda i''.\ [\![\text{Ramona}^{\gamma}\ \text{believes}\ i_8\ \text{that}\ [\lambda_2\ \text{Ortcutt}^{\iota}\ \text{is a fly guy}\ i_2]]\!]^{c,g[8\to i''],a',i'})([\![\ \text{Ralph}]\!]^{c,g,a,i}) =$

$[\![\text{believes}]\!]^{c,g,a,i}(\lambda a'.\ \lambda i'.\ \lambda i''.\ [[\![\text{believes}\ i_8]\!]^{c,g[8\to i''],a',i'}](\lambda a''.\ \lambda i'''.\ [\![\lambda_2\ \text{Ortcutt}^{\iota}\ \text{is a fly guy}\ i_2]\!]^{c,g[8\to i''],a'',i'''})([\![\text{Ramona}]\!]^{c,g[8\to i''],a',i'})])([\![\ \text{Ralph}]\!]^{c,g,a,i}) =$

$[\![\text{believes}]\!]^{c,g,a,i}(\lambda a'.\ \lambda i'.\ \lambda i''.\ [[\![\text{believes}\ i_8]\!]^{c,g[8\to i''],a',i'}](\lambda a''.\ \lambda i'''.\ \lambda i''''.\ [\![\text{Ortcutt}^{\iota}\ \text{is a fly guy}\ i_2]\!]^{c,g[8\to i'',2\to i''''],a'',i'''})([\![\text{Ramona}]\!]^{c,g[8\to i''],a',i'})])([\![\ \text{Ralph}]\!]^{c,g,a,i}) =$

$[\![\text{believes}]\!]^{c,g,a,i}(\lambda a'.\ \lambda i'.\ \lambda i''.\ [[\![\text{believes}\ i_8]\!]^{c,g[8\to i''],a',i'}]\ (\lambda a''.\ \lambda i'''.\ \lambda i''''.\ [\ [a''(\iota)](\text{Ortcutt})(i'''')\ \text{is a fly guy in}\ i'''']) ([a'(\gamma)](\text{Ramona})(i'))])(\text{Ralph}) =$

$[\lambda\Sigma_{\langle a,\langle i,it\rangle\rangle}.\ \lambda x.\ \lambda i.$ there is an assignment a' such that: the range of a' is a sequence of acquaintance-based concept generators $\langle G_1, G_2, G_3, \ldots\rangle$ for x at i; for all $i' \in \text{DOX}_{x,i}$, $\Sigma(a')(i')(i') = 1]\ (\lambda a'.\ \lambda i'.\ \lambda i''.\ [[\lambda\Sigma_{\langle a,\langle i,it\rangle\rangle}.\ \lambda x.\ \lambda i.$ there is an assignment a' such that: the range of a' is a sequence of acquaintance-based concept generators $\langle G_1, G_2, G_3, \ldots\rangle$ for x at i''; for all $i' \in \text{DOX}_{x,i''}$, $\Sigma(a')(i')(i') = 1](\lambda a''.\ \lambda i'''.\ \lambda i''''.\ [\ [a''(\iota)](\text{Ortcutt})(i''')$ is a fly guy in $i'''']) ($[a'(\gamma)](\text{Ramona})(i'))])(\text{Ralph})$ =

$\lambda i.$ there is an assignment a' such that: the range of a' is a sequence of acquaintance-based concept generators $\langle G_1, G_2, G_3, \ldots\rangle$ for Ralph at i; for all $i' \in \text{DOX}_{Ralph,i}$, there is an assignment a'' such that: the range of a'' is a sequence of acquaintance-based concept generators $\langle G_1, G_2, G_3, \ldots\rangle$ for $[a'(\gamma)](\text{Ramona})(i'))$ at i; for all $i'' \in \text{DOX}_{[a'(\gamma)](Ramona)(i'),i'}$, $[a''(\gamma)](\text{Ortcutt})(i'')$ is a fly guy in i''

6.7 Double binding: deriving bound *de re* readings

The existence of bound *de re* reading is the strongest empirical argument in favor of P&S's concept generator system. Hence it's important to show that this prediction can be replicated in my system. In addition, just bound *de re* readings show an interesting feature of the current system, namely that variables can be bound twice over—once for each of their indices.

I give a brief derivation of Charlow and Sharvit's primary example, namely (10) (repeated below), which I take to have the LF in (61):

(10) John believes that every female student$_i$ likes her$_i$ mother.

(61) John believes that [λ_3. [every female student i_3 [λ_1. [t_1^{σ} likes her$_1^{\omega}$ mother i_3]]]]

Here is the derivation:

(62) $[\![(61)]\!]^{c,g,a,i} = [\![\text{believes}]\!]^{c,g,a,i}(\lambda a'.\ \lambda i'.\ [\![\lambda_3.\ [\text{every female student}\ i_3\ [\lambda_1.\ [t_1^{\sigma}\ \text{likes her}_1^{\omega}\ \text{mother}\ i_3]]]]\!]^{c,g,a',i'})([\![\ \text{John}]\!]^{c,g,a,i}) =$

$[\![\text{believes}]\!]^{c,g,a,i}(\lambda a'.\ \lambda i'.\ \lambda i''.\ [\![[\text{every female student}\ i_3\ [\lambda_1.\ [t_1^{\sigma}\ \text{likes her}_1^{\omega}\ \text{mother}\ i_3]]]]\!]^{c,g[3\to i''],a',i'})([\![\ \text{John}]\!]^{c,g,a,i}) =$

$[\![\text{believes}]\!]^{c,g,a,i}(\lambda a'.\ \lambda i'.\ \lambda i''.\ [[\![\text{every female student}\ i_3\ ]\!]^{c,g[3\to i''],a',i'}([\![\lambda_1.\ [t_1^{\sigma}\ \text{likes her}_1^{\omega}\ \text{mother}\ i_3]]\!]^{c,g[3\to i''],a',i'})])([\![\ \text{John}]\!]^{c,g,a,i}) =$

$[\![\text{believes}]\!]^{c,g,a,i}$ ($\lambda a'.\ \lambda i'.\ \lambda i''.$ [$[\![\text{every female student } i_3\ ]\!]^{c,g[3\to i''],a',i'}$($\lambda x.$ $[\![[t_1^{\sigma}$ likes her$_1^{\omega}$ mother $i_3]]\!]^{c,g[3\to i'',1\to x],a',i'}$)])($[\![$ John$]\!]^{c,g,a,i}$) =

$[\![\text{believes}]\!]^{c,g,a,i}$ ($\lambda a'.\ \lambda i'.\ \lambda i''.$ [$\lambda F.$ [For all x': x' is a female student in i'', $(F(x'))$]($\lambda x.$ [$[a'(\sigma)](x)(i')$ likes $[a'(\omega)](x)(i')$'s mother in i''])(John) =

$[\lambda\Sigma_{\langle a,\langle i,it\rangle\rangle}.\ \lambda x.\ \lambda i.$ there is an assignment a' such that: the range of a' is a sequence of acquaintance-based concept generators $\langle G_1, G_2, G_3, \ldots\rangle$ for x at i; for all $i' \in \text{DOX}_{x,i}$, $\Sigma(a')(i')(i') = 1$] ($\lambda a'.\ \lambda i'.\ \lambda i''.$ For all x': x' is a female student in i'', $[a'(\sigma)](x')(i')$ likes $[a'(\omega)](x')(i')$'s mother in i'')(John) =

$\lambda i.$ there is an assignment a' such that: the range of a' is a sequence of acquaintance-based concept generators $\langle G_1, G_2, G_3, \ldots\rangle$ for John at i; for all $i' \in \text{DOX}_{John,i}$, for all x': x' is a female student in i', $[a'(\sigma)](x')(i')$ likes $[a'(\omega)](x')(i')$'s mother in i'

Notice that the relevant counterpart of the girls in John's attitude worlds are determined both by the quantification over elevated assignments and by the quantifier over objects.

6.8 Elevated indices outside attitude reports

So far, I have only explained the functioning of elevated indices in the scope of attitude reports. I have completely set aside the question whether these indices can be found outside the scope of attitude contexts, and, if so, what their semantic contribution is in those cases. To give an example: I have remained silent on whether a structure like (63) is grammatical, and, if so, how it should be interpreted:

(63) Mary$^{\delta}$ kissed Sally$^{\sigma}$

There are a number of options here; all of them seem viable, so far as I can see. I don't need to commit to any of them for current purposes, so I won't. But let me give a brief overview.

Option #1: restricted licensing

The first option is, quite simply, to restrict the presence of elevated indices to attitude contexts. This can be done via standard feature-checking mechanisms. One salient analogy is with logophoric pronouns, which are only licensed in the scope of attitude verbs. This restricted licensing is often explained by assuming that logophoric pronouns are characterized by a special feature *+log*, and that elements bearing *+log* need to be bound by an attitude verb.[24] Similarly, I could postulate that elevated indices carry a feature $[+\Gamma]$, which requires that the expressions carrying it be bound by attitude verbs. This would immediately rule out structures like (63) as ungrammatical.

Option #2: semantic vacuity

One alternative is to assume that elevated indices are indeed licensed in all syntactic positions, and that hence structures like (63) are grammatical, but that elevated indices make no difference to truth conditions. The obvious way to enforce this is to assume that the elevated assignment a, when it is not shifted by attitude verbs, defaults to mapping every elevated index to the identity concept generator, i.e. a concept generator that sends each object to itself (irrespective of its modal argument).

[24] For accounts of this sort, see (among many) Kratzer 1998, Heim 2002, von Stechow 2002, Anand 2006. See also the discussion in section 7.3.

It might seem stipulative to assume that the value for the assignment parameter simply defaults to this particular one. But notice that similar assumptions are in place, at least in intensional systems, for the values of all index parameters. For example, systems that treat modality intensionally assume that the initial value for the world parameter defaults to the actual world; similar for intensional systems for tense and the time of utterance.

Option #3: modes of presentation in the semantics

The third option is to assume that elevated indices are both syntactically licensed and semantically nonvacuous even outside attitude contexts. On this option, elevated indices and concept generators can be directly invoked to account for well-known issues concerning the cognitive significance associated to *e*-type expressions. Used in this way, elevated indices would work as an alternative to various versions of two-dimensional accounts of Frege cases, such as e.g. Stalnaker's (1978, 1981, 1988, 2006). (Notice that the theory should *not* be assimilated to fully descriptivist accounts, since syntactically names and pronouns would still be of a different type than descriptions.)

An alternative way of implementing this idea would be to adopt the assumption that all sentences involve a covert epistemic modal taking scope over the rest of the clause. This approach would comport with the syntactic assumptions spelled out in discussing the first option, but would yield the same truth conditions as those obtained via the third option.

7 Merging *De Se* with *De Re*

Over the past years, several theorists have insisted that we need multiple LFs to capture the totality of *de se* phenomena. Various arguments to this effect have been offered, over the course of time, by Percus and Sauerland (2003), Anand (2006 and 2007), Maier (2011), and Charlow (2012). In particular, since Chierchia 1989 it seems to be common ground that attitude reports involving PRO require a dedicated kind of LF. Of course, the existence of dedicated *de se* LFs also sets apart *de se* and *de re* phenomena, showing that we can't capture all *de se* reports via the LFs we use in the semantics for *de re* reports. One theoretical advantage of the theory defended in this paper is that all *de se* and *de re* phenomena can be derived via the same kind of LF. Thus there is a unified syntactic route to *de re* and *de se*.

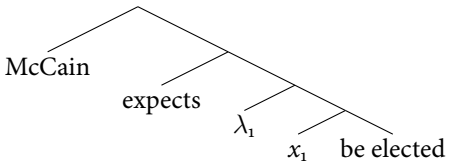
This last section is devoted to explaining in detail how this unification takes place. In particular, I discuss three arguments for the existence of dedicated *de se* LFs. Two of them are, at this point, classical arguments in the literature, while the third has been given recently by Charlow (2012). I show how all of these arguments can be accommodated on the current picture.

7.1 Infinitival complements and PRO

Let me start by recapitulating the various route to *de se*, on the picture that is more or less standard nowadays. Since Chierchia 1989, attitude reports with infinitival complements are taken to involve an LF where the *de se* pronoun is bound by a lambda-abstractor. For example, the LF of (31), repeated below, is given by (64):

(31) John expects to be elected.

(64)

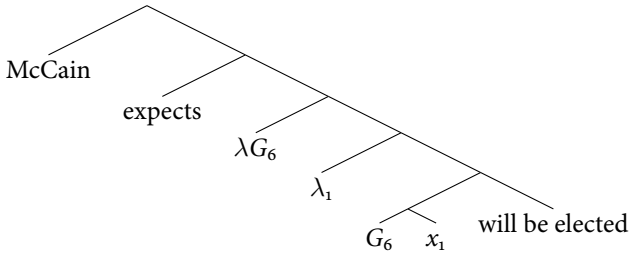


On some accounts (for example, Percus and Sauerland's 2003), also *de se* attitude reports with complements in a finite mood can have LFs of the form of (64). One example is (65), on its *de se* reading:

(65) John expects that he will be elected.

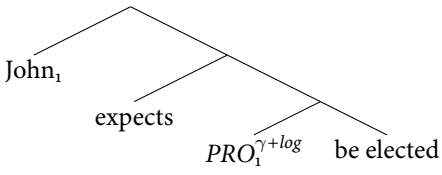
In addition, on most accounts *de se* truth conditions can also be achieved via another syntactic route—i.e., by using P&S-style *de re* LFs involving concept generators and imposing a restriction on the existential quantifier over concept generators. In this case, the LF of a report like (65) has the familiar form reproduced in (66):

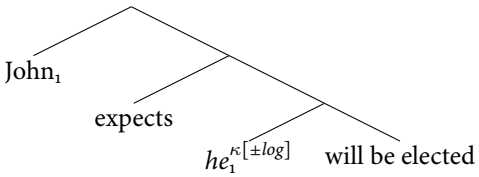
(66)



For current purposes, I skirt over the arguments for the claim that finite mood reports with *de se* truth conditions like (65) may or must have one or the other LF. What matters to me is the fact that (a) everyone in the debate agrees that at least some *de se* reports will have LFs of the form illustrated in (64) and (b) that this LF is significantly different from the LF employed for *de re* reports illustrated in (66).

As should be clear by now, the system I've presented avoids this proliferation. The difference between *de se* and non-*de se* readings is determined merely by the presence or the absence of the feature *+log* on the relevant *e*-type expressions. For the rest, at LF everything is exactly the same. For the sake of concreteness, here are the LFs that get assigned, respectively, to (31) and (65):





For the purposes of *de se* truth conditions, the main difference between PRO and *he* is that the feature *+log* (which semantically is a presupposition on the value of the elevated index) is lexically encoded in the meaning of PRO. By contrast, this feature is optional for *he*. The presence or absence of this feature is what determines whether the report gets *de se* or merely *de re* truth conditions.

One might wonder how I manage to get unified LFs so easily, while all other theories had to rely on at least two different routes to *de se* and *de re*. The reason is that, building on assignment-shifting accounts, the present theory essentially assimilates the case of the *de re* to the case of the *de se*. The basic idea is that the standard treatment of PRO—i.e. binding by attitude verbs—can provide a general model to handle the pairing of *e*-type expressions with modes of presentation. Hence it's not a coincidence that this unification takes place. The 'intensionalized' version of concept generator theory that I've defended turns out to be also a way of reducing the *de re* to the *de se*.

7.2 The argument from *only*

In their (2003), P&S give an argument to the effect that some attitude reports in the finite mood should get dedicated *de se* LFs in the style of (64). The argument has become known as 'the argument from *only*', since it involves *only*-DPs in the subject position of attitude reports. It has been heavily discussed and its upshot is controversial.[25] What matters for my purposes is showing that the current theory can get the right predictions for P&S's data without the need to postulate an additional kind of LF.

Here is a variant on P&S's central example:

> *Elections*. John, Bill, and Sam, three candidates on the election, drunkenly watch campaign speeches by themselves on TV. John doesn't recognize any of the candidates appearing on the screen; but he's a very self-confident person, and while watching thinks: "I'll win!". Bill and Sam also don't recognize themselves on the screen, but are impressed by their respective speeches, to the point that Bill thinks that Bill will win and Sam thinks Sam will win. But, being pretty insecure, they also feel unconfident about their personal prospects. Each of them thinks to himself "I will never make it; I'll lose."

P&S observe that the following claim has a true reading in the scenario:

(67) Only John thinks he will be elected.

Since all three people in the scenario have some kind of *de re* attitude towards themselves, but only John has a *de se* one, *he* must get a *de se* reading in (67). Hence, following standard assumption about the semantics of *only*, and on the assumption that John, Bill, and Sam are the relevant individuals, (67) presupposes that John has a *de se* belief that he will be elected, and asserts that neither of Bill or Sam has a *de se* belief that he will be elected.

These claims about the truth conditions of (67) seem uncontroversial. In addition, P&S also make the (much more controversial) claim that (67) shares, in relevant respects, the LF of (31). The idea is that the LF of (67) involves no concept generators. Rather, *he* works as a bound variable ranging over attitude centers, exactly as PRO in (31). This claim has been debated since, with some theorists arguing that we can still get *de se* truth conditions by other means, and some others insisting that we need dedicated *de se* LFs.

[25] According to Percus and Sauerland's (2003) original argument, (67) shows that the embedded clause must have a dedicated *de se* LFs. Anand 2006 puts forward an alternative interpretation of the data: (67) has a *de re* LF, but the concept generator supplies the 'self' mode of presentation. On this interpretation, what (67) shows is simply that the 'self' mode of presentation cannot be 'taken off the table'—it must always be available for consideration in attitude reports. Maier 2011 has a rejoinder, arguing that in some cases the 'self' mode of presentation is taken off the table after all. The way this dispute must be settled doesn't seem crucial for my purposes.

On the account I'm proposing, the question is spurious, since we only have one kind of LF. But this LF is sufficient to derive the *de se* reading of *he* in P&S-style scenarios. All we need to do is just assume that, in the relevant context, *he* has the dedicated feature +*log*:

[Only John] λ_3. t_3 thinks [he$_3^{\beta+log}$ will be elected]

Given standard facts about presupposition projection under *only*, we will get that, whenever it gets interpreted, the index β associated to *he* is presupposed to be mapped to the *self*-concept generator. This will yield exactly the truth conditions described by P&S.

7.3 Charlow's argument from *de re* anaphors

Recently, Simon Charlow (2012) has presented an argument for the claim that *de re* LFs cannot be used to generate *de se* truth conditions (cf. also Anand 2006, 2007). The argument is based on a *de re* blocking effect concerning *de re* anaphors in English, such as *herself* on a *de re* reading. In essence, the observation is that anaphors that are c-commanded by *de re* pronouns give rise to ungrammatical, or at least marked, configurations. Charlow exploits this evidence to argue that all *de se* reports must have Chierchia-style LFs, and can never have LFs exploiting concept generators. A system with elevated indices can explain the effect as well, and indeed can improve on Charlow's explanation, by reducing some of the principles used to explain the effect to more general principles.

Here is Charlow's main example:

> John comes home late one night, drunk and without his keys. Undeterred, he smashes through a back window and goes up to bed. By the morning, he has forgotten the whole incident, and is shocked to see the back window broken into pieces. Fearing that he is being robbed, he runs upstairs to check his safe. (Anand, 2006)
>
> (68) ??John hoped that he had not yet robbed himself. (Charlow, 2012)

While (68) is accepted by some speakers, some others find it ungrammatical; in any case, as Charlow emphasizes, it seems to generate a contrast in acceptability with respect to parallel examples involving nonreflexive pronouns:

(69) John hoped that he hadn't yet found his safe.

Charlow's data point suggests that the following configuration is ungrammatical/strongly dispreferred when the second pronoun is an anaphor:

(70) *[… $x_i^{de\ re}$ … [… y_i …]]

The challenge is explaining what generates this blocking effect. I don't have the space to give a full account of Charlow's explanation, but I can give a brief sketch. In part, this will be useful to set up my own account of the puzzle, since I will borrow a number of pieces from Charlow (and indirectly from Anand, from whom Charlow borrows some keys elements).

Charlow puts together two assumptions to solve the puzzle.

(a) First, following a number of theorists (Kratzer 1998, Heim 2002, von Stechow 2002, Anand 2006), he assumes that *de se* pronouns possess a syntactic feature +*log*. This feature is subject to a feature-checking mechanism that rules out as ungrammatical configurations where pronouns possessing the feature are anteceded by pronouns that don't possess it.

(b) Second, following Schlenker 2005, Charlow assumes a pragmatic principle that mandates using *de se* LFs whenever possible. Precisely, the principle is:

> ***Prefer De Se!***
> Whenever this is compatible with the situation reported, prefer a *de se* over a *de re* logical form.

In sketch, here is how the explanation proceeds. (68) may correspond to two possible configurations:

(71) a. John$_j$ hoped [λG_1. [λ_i^{+log} [[[G_1 he$_j$]$^{+log}$ i]$^{-log}$ had not yet robbed himself$_i^{+log}$]]]

b. John$_j$ hoped [λG_1. [λG_2. [λ_i [[[G_1 he$_j$] i] had not yet robbed [G_2 himself$_j$] i]]]]

Both configurations are ruled out, on different grounds. (71)-a is plainly ungrammatical, as it is ruled out by the feature-checking mechanisms attaching to the feature *+log*. (71)-b is ruled out by ***Prefer De Se!***, which mandates a preference towards (71)-a. Since both its possible LFs are ruled out, the sentence is ruled out.

As a side point, notice that, by endorsing ***Prefer De Se!***, Charlow is predicting that sentences that have P&S-style *de re* LFs with concept generators will not be interpreted as quantifying over *de se* concept generators, at least when nonquantificational subjects are at stake.[26]

This kind of explanation can be exported in full to my account; in fact, I can improve on it, since on my account ***Prefer De Se!*** (or better, a closely related principle) turns out to be directly entailed by more general principles. Let me first sketch the basic explanation.

Rather than Schlenker and Charlow's version of ***Prefer De Se!***, I will assume the following variant:

> ***Prefer logophors!***: If compatible with the situation reported, assume that a pronoun in an attitude report carries the presuppositional feature *+log*.

In addition to ***Prefer logophors!***, I assume the Heim/Anand constraints on the logophoric feature: a pronoun carrying *+log* cannot be anteceded by a pronoun that doesn't carry it.

[26]The prediction holds for the case of nonquantificational subjects like *John*. In those cases there will immediately be a *de se* LF that yields analogous truth conditions to the *de re* LF exploiting *de se* modes of presentation. Hence the following Gricen reasoning is triggered:

(P1) A *de se* LF must be used whenever it is compatible with the situation reported (by ***Prefer De Se!***).

(P2) But the speaker is not using a *de se* LF.

(P3) The speaker is knowledgeable about all relevant facts.

(C1) Hence a *de se* LF is not compatible with the situation reported.

(C2) Hence the concept generators quantified over by the attitude verb do not range over *de se* individual concepts.

Hence *de re* LFs, in the case of non quantificational subjects, carry non-*de se* implicatures.
But things are different for the case of quantificational subjects like *every girl* in

(i) Every girl thinks that she is the best soccer player in her class.

In this case, (C1) might be true, but (C2) doesn't follow. In other words, it might be that a Chierchia-style *de se* LF reports the wrong attitudes, and at the same time the attitude verb may quantify over *de se* concept generators. To see this, consider the following scenario: some of the relevant girls have the *de se* belief 'I am the best soccer player in my class', while others have only the corresponding *de re* belief about themselves ('She is the best soccer player in her class', said by each girl pointing to a picture of herself). As a result, for the case of (i), Charlow only predicts that, when a *de re* LF is used, there is an implicature that *not all* the girls have the relevant *de se* belief.

Equipped with these two assumptions, I can give an explanation of the effect that parallels Charlow's. On my system, the difference between *de se* and *de re* readings is determined simply by the presence or absence of the *+log* feature. Hence the possible LFs for (68) are:

(72) a. John$_1$ hoped that [he$_1^{\beta -log}$ hadn't yet robbed himself$_1^{\alpha +log}$]

b. John$_1$ hoped that [he$_1^{\beta -log}$ hadn't yet robbed himself$_1^{\alpha -log}$]

Both (72)-a and (72)-b are ruled out, on different grounds. (72)-a is ruled out by the grammatical constraint that *+log* elements that are syntactically bound must have an antecedent carrying *+log*. (72)-b is ruled out by ***Prefer logophors!***, since the situation is compatible with the second pronoun carrying the relevant feature.

What is the advantage of the present account over Charlow's? Thanks to the implementation of the *+log* feature as a presupposition, ***Prefer logophors!*** turns out to be a special instance of Heim's (1991) general principle **Maximize Presupposition**. Here is a formulation of the principle:

> **Maximize Presupposition**
>
> Presuppose as much as possible in your contribution to the conversation.

Given Maximize Presupposition, and given that the logophoric feature on pronouns works as a presupposition, it follows that, whenever possible, speakers should prefer LFs in which the relevant pronouns are interpreted as having *+log*. This account makes a further desirable prediction: when the *+log* feature is not present, **Maximize Presupposition** will give rise to anti-*de se* inferences, presumably via an implicature-type mechanism.[27]

Let me flag a further advantage of treating PRO as involving a logophoric presupposition. On this account, the logophoric element in PRO is treated on a par with other semantic features of pronouns, such as gender, person, and number. For the case of these features, the presuppositional treatment (initially proposed by Cooper 1983) has turned out to be fruitful. Sauerland 2008, in particular, has shown that, once we assume a presuppositional treatment of features, we can derive a number of meaning effects connected to person, gender, and number simply via **Maximize Presupposition** and a mechanism for computing implicatures. On the treatment that I'm proposing, effects relating to *de se* and *de re* readings of pronouns turn out to be just a further instance of these mechanism.

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[27]Notice that this also accounts for the case of 'mixed' *de se*/*de re* reports with quantificational subjects. Charlow discusses the following scenario:

> Gas is being spilled in three national parks. Three rangers, Olympia, Susan, and Sarah, are dispatched to find the culprit. In each case, the gas leak is coming from the ranger's golf cart—though she doesn't realize it. Eventually, Sarah discovers that she's been leaking gas the whole time. Each thinks, "The person with the least arrests this month should be the one to arrest the culprit", but in each case the person with the least arrests turns out to be her. So Sarah thinks, "The person with the least arrests this month [her] should arrest me", and Olympia and Susan each think, "The person with the least arrests this month [her] should arrest the culprit [her]." (Charlow, 2012)

(73) Each ranger believes SHE's the one who should arrest herself.

Charlow notices that (73), differently from (68), is a good sentence. This is expected on my proposal. The prediction is that, in the only acceptable LF of (73), the *+log* feature is *absent*. This doesn't give rise to anti-*de se* inferences, but only to the inference that not all of the rangers have a *de se* belief.

8 Conclusion

This paper has operated in the descriptivist tradition about attitude reports that was initiated, on the *de re* side, by Quine and Kaplan and, on the *de se* side, by David Lewis. The compositional implementation of Quine, Kaplan, and Lewis's ideas has turned out to be a substantial challenge for formal semanticists. I have taken as my starting point Percus and Sauerland's concept generator theory, combined with a standard Chierchia-style semantics for the *de se*. I have argued that this picture has a number of shortcomings. It overgenerates; it fits poorly with standard assumptions about syntax; it compels us to modify standard Binding Theory. In addition, it leads to an undesirable proliferation of LFs. I have argued that we can improve on all these aspects by switching to a different theory.

The new theory crucially builds on P&S's concept generator machinery, but introduces some key changes inspired by assignment-shifting accounts. All *e*-type expressions are endowed with an extra level of indices. Roughly, these indices determine what modes of presentation are associated to the relevant expression in the scope of an attitude verb. The semantics for these new indices exploits a dedicated assignment, which is obligatorily shifted by attitude verbs. By making these moves, we manage to solve all the problems raised for P&S's account and get a very simple picture of the LFs of attitude reports. This picture assigns only one kind of LF to all attitude reports, *de se* and *de re*, while handling data that is usually invoked to motivate the need for multiple LFs.

Of course, further work must to be done to show how, and whether, elevated indices can account for a number of other puzzles in the neighborhood. Let me mention a few: a *de re* blocking phenomenon involving counterfactual attitudes, in particular dream reports (Lakoff 1972; Heim 1994b; Anand 2007); a *de se* blocking phenomenon individuated by Sharvit (2011; section 4); asymmetries between first and third person reflexives in Free Indirect Discourse (Sharvit, 2011).[28]

[28] *[Acknowledgments suppressed for blind review.]*

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