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Transparent Readings and Privileged Worlds

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I present a problem for Sauerland's [24] account of the restrictions on certain non-standard *de re* readings in propositional attitude reports. Sauerland's idea is to postulate the ontological prominence of the actual world so that no merely possible individual could have an actual counterpart. However, the problem Sauerland aims to solve extends to multiply nested attitude reports, where his prominence considerations are insufficient to explain either attested or non-attested readings. A solution I propose involves switching to tree-like possible world frames, thus creating an infinity of ontological levels. A remedy for Sauerland's problem, the approach is shown to have shortcomings as regards the definability of factivity.

Keywords: propositional attitude reports, *de dicto*, *de re*, possible worlds, counterpart semantics, tree frames

1. Restrictions on transparent readings

The received *de re* / *de dicto* distinction for propositional attitude reports has been by now challenged in multiple publications (starting from Fodor [7] and Bäuerle [3]; later in [1, 4, 28, 14] and others) where it was argued that transparent (i.e. *de re*) readings exist not only for determiner phrases (DPs) as a whole but also for restrictor predicates of several kinds of DPs, prominently for indefinites and definites.

For instance, (1) would traditionally be said to have two readings: a *de dicto* reading, which amounts to 'Charley's desire is to buy a coat similar to Bill's, whatever particular coat it is', and a *de re* reading, which can be paraphrased as 'There is a coat like Bill's s.t. Charley wants to buy it (even though maybe he does not realise that it is a coat or it is like Bill's)'. The newly recognised reading is outlined below the sentence (1).

1. Charley wants to buy a coat like Bill's. [7]
   Possible: 'Charley wants to buy some coat or other provided that it is of a particular kind, and the speaker knows Bill has a coat of that kind' (non-specific transparent).

The simplest scope theory of *de re* / *de dicto* [23], which uses only the movement[1] of whole DPs from their surface syntactic positions to the left, cannot derive the non-specific transparent reading of (1). The reason is that traditionally only full noun phrases have been assumed to move, whereas in (1) such movement of *a coat like Bill's* would result in the plain *de re* reading. What we would like to get might perhaps be derived via the movement of the predicate *coat like Bill's*, but such mechanism is either problematic from the syntactic viewpoint or semantically incorrect [26].

Therefore, the movement account was supplemented with overt possible world (or situation) variables in the syntax. The variables are bound by lambda-abstractors in subordinate clauses (such as *to buy a coat like Bill's* in (1)), and in main clauses their values are supplied by the contextual world index. Here is how the three attested readings of (1) come about on that account:[2]

- *de re*:
  [a coat_like_Bill's$_@$] λx[Charley wants λw[Charley buys$_w$ x]][3]
- *de dicto*:
  Charley wants λw[Charley buys$_w$ [a coat_like_Bill's$_w$]]
- non-specific transparent:
  Charley wants λw[Charley buys$_w$ [a coat_like_Bill's$_@$]]

[1] In generative approaches to natural language semantics, it is commonplace to assume a special level of representation, called Logical Form (LF), which may differ from surface syntax w.r.t. the positions of various scope-taking expressions.

[2] I shall uniformly designate the actual world by the index @.

[3] Many features of the syntax and semantics of attitude reports are simplified in the present paper. For instance, we completely abstract from *de se* phenomena (see [16] for a classical discussion) and represent the null subject PRO in (1) as if it were the overt subject *Charley*. Likewise, in (9a) below we abstract from indexicality and replace the denotation of *my* with the denotation of *the speaker*.

The distribution of the variables, however, needs to be constrained in the following ways [20, 19, 13, 22]:

Main Predicate Constraint = Generalisation X The main predicate is always interpreted at the index bound by the closest binder above; thus (2) cannot mean that Mary believes something of the set of *actual* Canadians:

2. Mary thinks that my brother is Canadian.

Adverb Constraint = Generalisation Y The adverb which modifies the main predicate is always interpreted at the index bound by the closest binder above; thus (3) cannot mean that Mary thinks my brother won the first 10 rounds out of 20 while actually there were only 10 rounds and he won all of them:

3. Mary thinks that my brother always won the game.

Intersective Predicate Constraint = Generalisation Z An adjectival modifier with intersective semantics has to be evaluated at the same index as its head noun phrase (NP); thus (4) cannot mean that Mary believes he is a bachelor while he is actually married, or vice versa:

4. Mary thinks that the married bachelor is confused.

Presuppositional DP Constraint Weak determiner phrases (DPs) — i.e. non-presuppositional ones, those able to occur in *there is X* construction — are always interpreted at the index bound by the closest binder above; thus (5) cannot be true if John has correctly counted the horses but mistakenly believes they are donkeys:

5. John thinks that there are two horses.

Nested DP Constraint If DP′ is embedded into DP, DP′ cannot be interpreted at a lower index than DP; thus (6) cannot mean that Mary believes of the actual wife of the actual governor that she is indeed the wife, but of someone who she believes to be the president:

6. Mary thinks the wife of the president is nice.

It is generally believed that the best way to implement such restrictions is to make them inevitable due to general syntactic or semantic reasons, for them to be "explained without any stipulated constraints" [25]. Prima facie nothing prevents multiple occurrences of world variables within a single DP (e.g. one as an argument of the determiner and one for each predicate within its restrictor) as well as next to main predicates; Schwarz [27], an example of a syntactic approach to restriction, cuts the range of such positions severely, leaving explicit overt pronouns (as providing a "resourse situation") only at determiners; other predicates get their denotations either w.r.t. such resource situations or w.r.t. the world index immediately dominating the clause (the latter being the only option for main predicates, which thus observe Generalisation X).

Schueler [25] provides another syntactic solution; he replaces our familiar λ-abstraction, canonically [10] introduced by numerical indices in the syntax, with much more restrictive β-binders in the sense of [5, 6].[4]

In contrast to Schueler and Schwarz, Romoli and Sudo [22] provide an explanation that relies upon the view that DPs trigger presuppositions, which can be resolved in several positions, yielding — as they claim — exactly the available readings. For instance, the non-specific transparent reading of (1) obtains by projecting the presupposition that there is a set of coats like Bill's up to the highest level; the content of (1) will then amount to 'there is the unique set X of coat like Bill's s.t. Charley wants to buy a member of X'.

While there may be cases where each of the theories fails and hence a radically different explanation may be in order [26, 30], in the present paper I will be dealing with yet another non-stipulative solution, this time semantic, proposed by Sauerland [24]. It hinges on the idea that the actual world @ has ontological priority over possible worlds, so there

[4]Sauerland [24] refers to Shimada [29] as presenting another purely syntactic way to derive one constraint, namely Percus's [20] Generalisation X.

can be no counterpart functions mapping merely possible individuals to actual ones. After describing Sauerland's approach in Section 2, I present a contrast with multiple embeddings I believe it cannot explain (Section 2.2). Then in Section 3 I outline my proposal; its essence is that one should restrict oneself to tree-like possible world frames, which will guarantee that Sauerland's priority condition hold at all levels. The proposal is demonstrated to suffice for the cases Sauerland cannot handle (Section 4). After that a brief conclusion follows.

2. Sauerland on counterpart functions

Sauerland describes a semantics able to handle belief contexts, which is based on counterpart semantics due to Lewis [15, 17]. In that sort of semantics, once an individual is chosen, there is no need to specify which world it belongs to, as each individual only inhabits one.[5]

Reference to counterparts is realised via counterpart functions. $f_w(y)$ is a *counterpart function* mapping an individual y (wherever it lives) to its counterpart at the world w. If y itself exists at w, then $f_w(y) = y$ (as for Lewis, my only counterpart in my own world is myself). Importantly, nothing forces the functions to be defined both ways, either from the actual world @ to worlds accessible from it or the other way round. In fact Sauerland's claim is that in order to account for (some of) the restrictions mentioned in Section 1, one has to assume that @ has *a privileged status* over all other worlds: all its inhabitants can (but of course do not have to) have counterparts "abroad", whereas "foreign" individuals are never mapped to @ citizens by any counterpart function.

Here is a preliminary semantics for attitude verbs, exemplified by belief.

7. $[\![\text{believe}]\!] = \lambda P.\lambda x.\lambda w : \forall v \in \text{dox}_w(x) : P(v)$,
   where $\text{dox}_w(x)$ is the set of x's doxastic alternatives at the world w.

[5]Similarly, once an individual is given, the domain of its world can be specified as just the set of all and only the individuals *cohabitating* a world with the individual given; there is no more need in independent means of referring to worlds. Sauerland makes extensive use of this idea, but in my paper nothing hinges on it, so I retreat to more conventional world variables.

So the world argument for the proposition P under the attitude verb is supplied by the verb itself, which functions as a quantifier over worlds; but a given predicate in the scope of an attitude verb may choose to take a different world variable, bound by a higher λ-abstractor, for that end. This is essentially how one can get *de re* readings.

Dealing with *de re* reports, Sauerland first notes that in certain cases apparently contradictory attributions are not in fact contradictory, as in Quine's [21]

8. (a) Ralph believes that Ortcutt is a spy.

   (b) Ralph believes that Ortcutt is not a spy.

For Sauerland, like essentially for many of his predecessors (since [12]), the non-contradiction means that different *acquaintance functions* are invoked in (8a) and (8b). An acquaintance function is a function from attitude holders to individuals; for a given holder, it picks up a single (if any) individual in the holder's world satisfying the definite description associated with the acquaintance relation (e.g. 'x sees y sneaking around on the docks'). All the individuals it picks up in the worlds of the holder's counterparts are considered counterparts(-via-acquaintance) for the one picked up at @:

$$\mathsf{C}_{f,v}(x) = y \text{ iff } \exists a : f_{@} = x \wedge f_v = y.$$

(This is how counterparthood and acquaintance are related.) Of course two different acquaintance relations can yield different objects of acquaintance at some possible worlds while coinciding in their values at @. This is exactly what happens in Quine's puzzle: the acquaintance relations 'x sees y as the man in the brown hat' and 'x sees y as the man on the beach' yield, for Ralph as x, the same person Ortcutt at @ but different individuals in all Ralph's doxastic alternatives.

Finally, considerations on the behaviour of negation and *only* lead Sauerland to the conclusion that in cases of *de re*, an acquaintance function and its world-identifying argument should appear in the syntax (and not, say, be supplied by the context, roughly as in [2]).

2.1. Constraints explained?

Getting eventually to restrictions on transparent readings, recall what has already been mentioned: according to Sauerland,

> counterpart relations are intuitively asymmetric because we see our actual world as privileged over other possible worlds (p. 78);

so the two individuals in Ralph's belief worlds are counterparts of the real Ortcutt (as they are "causally related" to him) while he is a counterpart of neither. Sauerland shows how this idea accounts for Generalisation X, Generalisation Z and Nested DP Constraint.

Generalisation X: Percus's example would have to have the following LF, should the transparent reading of the main predicate be intended (definites are assumed *not* to be quantifiers):

9. (a) Mary thinks that my brother is Canadian.
   (b) # Mary thinks $\lambda w[\underbrace{[\varnothing_{\text{the}}\ \text{speaker's-brother}_w]}_{\text{type } \langle s,e\rangle}\ \text{is-Canadian}_@\ ].$[6]

This requires that we find an individual in a doxastic alternative of Mary's who is the (counterpart-of-the-)speaker's brother and ensure that its counterpart is Canadian at @. This is, however, impossible since $\mathsf{C}_{f,@}(x_1)$ is undefined for any f as @ is "privileged" and no counterpart function is allowed to map from a less privileged world into a more privileged one.

Generalisation Z: Keshet's example involves Predicate Modification, which, according to Sauerland (p. 80) and contrary to the classical presentation of [10], is obligatory (i.e. it cannot be replaced with Functional Application, as suggested by Heim and Kratzer) and targets two predicates before they can apply to an argument. Therefore, in order for the sentence to be true, there has to be an individual satisfying both predicates; one cannot be content with a certain thing being a bachelor and *its counterpart* being married. This is reflected in the LF below,

[6]Here no counterpart function appears, as *my brother* is read *de dicto*; cf. also (11b) below.

where the argument is applied to the intersection of the two properties and the result is then fed to a counterpart function; thus the restriction comes for free (once Sauerland's use of Predicate Modification is acknowledged) and the readings below are the only ones possible (and of course both absurd, since nothing in any world is both a bachelor and married).

10. (a) Mary thinks that the married bachelor is confused.
    (b) Mary thinks $\lambda w[\ \mathsf{C}_{f,w}\big(\text{the [married } \cap_{@/w} \text{ bachelor]}\big)$ is-confused$_w$.

Here a counterpart function f is evoked which returns a counterpart at w of the individual who is both a bachelor and married (either actually or at w).

Nested DP Constraint: Romoli and Sudo's example forces one to look for an actual married counterpart (as required by the denotation of *wife*) of the non-actual president. Given Sauerland's assumption about the privileged status of @, this is impossible, so the reading below does not arise.

11. (a) Mary thinks that the wife of the president is nice.
    (b) # Mary thinks $\lambda w[\ \mathsf{C}_{f,w}\big(\text{the wife-of}_{@} \text{ [the pres.}_w]\big)$ is-nice$_w$].

2.2. A rejoinder

I will now show that Sauerland explanation works only insofar as he limits himself to one level of embedding; once nested reports are considered, the theory is jeopardised.

Consider (12).

12. (a) John believes that Mary thinks the wife of the president is nice.
        i. # [J. believes^w [... M. thinks^v [... [wife$_w$ ... president$_v$ ...]]]]
        ii. ✓ [J. believes^w [... M. thinks^v [... [wife$_v$ ... president$_w$ ...]]]]
    (b) Mary believes that John thinks the wife of the president is nice.

The indexing outlined in (12(a)i) — of course there are other indexings, including several acceptable ones — is banned in natural language.[7] Sauerland would have to say that's because there is no way to find a counterpart of the president-in-v in w. Assuming that counterpart functions only map from @ to other worlds (only those accessible from @ or, alternatively, just all other worlds), this is conceivable; there is just no mapping from the domain of v onto w's domain.

Such a way of explanation, however, soon falls short of explanatory power. John and Mary are both actual individuals in the domain of @, so obviously the doxastic alternatives of the former are in no way privileged over the doxastic alternatives of the latter, neither is the opposite the case. So either counterpart functions run both from Mary's worlds to John's worlds and vice versa, or they run in neither direction. But why is (12(a)ii) an *acceptable* indexing then?

The predicament concerning (12a) puts into doubt the claim that ontological priority is sufficient for the explanation of the restrictions. In what follows, I show that one could maintain a certain version of the priority view, although the changes it brings to the received possible world semantics are considerable.

3. Reflection semantics

The move that would allow to maintain Sauerland's way of explanation may be very simply put: the two attitude verbs in (12a) (and, of course, the same for (12b)) — as any two attitude verbs differing in the holder argument or in the level of embedding — must *quantify over non-overlapping domains*. In other words, no Mary's belief world can be John's belief world, even if neither of the two agents excludes the state of affairs at @ from what may be the case! Even in the limiting case where John and Mary have all and only correct beliefs (i.e. the

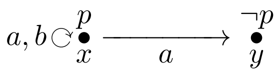
[7] The literature on transparent readings, including the first mention of the Nested DP Constraint [22], typically does not concern itself with multiple embeddings. There are sporadic exceptions though, e.g. Sudo's [30] discussion of the possible readings of (*the*) *linguist* in

(∗) Bill doubts that John thinks that the linguist was nervous (Sudo's (40), p. 455).

only complete state of affairs they consider possible is that at @), the worlds that represent their beliefs should be distinct from each other (and therefore from @, as there is no reason to prefer one of the two agents, who would be said to have direct access to @, over the other who wouldn't).

The same goes for other levels of embedding: the set of worlds Mary considers-at-@ Sue's doxastic alternatives cannot overlap with the set of worlds *John* considers-at-@ Sue's alternatives; neither with the set of Sue's actual alternatives at @.

Frames of the described kind, called *tree frames*, have been defined by [11] and put to use (with anti-reflexivity added) in [8]; [9] as a response to a problem in the semantics for multi-agent dynamic epistemic logics (the same problem is described in [18]). The problem had to do with the fact that

> arrows (and worlds) can play several roles in a Kripke model... If we remove the arrow (on the world y) from the model to model change in the information of a in x [i.e. to indicate that a has come to believe that p], also the information of b in x will change.
>
> 
>
>
> In the new model $[B_b B_a p]$ is true, while previously this was not the case. [9, p. 110]

The property of possible world structures where, for any w, v, the sets of worlds accessible from w and from v do not overlap is this: In a tree-like frame, a given possible world may be the second member of *no more than one* pair in the extension of the union of all relevant accessibility relations, although it can be the first member of any number (≥ 0) of such pairs. (A notable world with 0 preceding worlds is @.) Formally [11],

Definition 1 (tree frame). A tree frame is a frame $\langle W, R \rangle$[8] s.t.

[8]For the needs of the present paper, here R should be read as the union of all accessibility relations one is eager to define, not just a single such relation.

- there is the unique root world $w(\in W)$ s.t. $\forall v \in W : w(R\circ\ldots\circ R)v$;
- it is anti-symmetrical: $\forall w, v : (wRv \wedge vRw) \Rightarrow (w = v)$;
- it is anti-convergent: $\forall w, v : (\exists u(wRu \wedge vRu)) \Rightarrow (w = v)$.[9]

I will additionally require *anti-reflexivity* ($\neg\exists w : wRw$) and presume it in what follows.

The name *reflection semantics* conveys the intuition that the semantics reminds of Leibniz's idea that a monad (a sentient being) mentally represents the whole world (presumably, including the perceptions of other monads) but has no direct access to it; its mental space is inaccessible for other monads, nor can it directly see what they represent. (Everything is put into its mind by God.)

It will be convenient in what follows to refer to the set of all and only worlds directly accessible from a given world (and, by Definition 1 above, not from any other world) as the *foliage* of this world. Note that on this use of the term, the foliage of a world w *does not contain* w. We shall also refer to the part of a tree-like frame starting from w as the *branch* of w; w's branch *does* contain w.

3.1. Models

Let us agree to speak in terms of one common domain of individuals D, out of which a selection $D_w \subseteq D$ is made for each world w; $\forall w, v : D_w \cap D_v = \varnothing$. (We could be less strict and allow intersection for the domains of worlds belonging to the same foliage; for we are less interested here in trans-world existence *per se* but rather in "trans-attitude-holder" existence and identification. On the option we have chosen, trans-world identity within a single foliage can be provided via counterpart functions that work in both directions, as obviously the reasonable restrictions on their "backward" application do not come into play here; there is just

[9] Compared to the definition of *convergence* given in [11, p. 270], this definition of *anti-convergence* does not make reference to the world where w and v are both accessible from. It plainly states that no world is accessible from more than one world, even if the world it is accessible from is not accessible from anything (i.e. is the root).

no way to tell apart "forward" and "backward" application within a foliage — indeed this was the cause of Sauerland's lapse.)

A *model* is defined as

$$\mathcal{M} = \langle D, W, Inh \rangle,$$

where $Inh : W \mapsto \wp(D), \forall w, v \in W : w \neq v \Rightarrow Inh(w) \cap Inh(v) = \varnothing$[10] is the inhabitant function that selects for each world its exclusive domain.

As counterpart relations are defined via acquaintance functions and those, in turn, in terms of descriptions, no counterpart relation is built into the model.

3.2. Factivity in tree-like frames

A question is pending and should be answered before we present an account of the problematic (12). Namely, if no world can be literally accessible from itself, how to represent factive attitudes?

The problem I have in mind is the following. As long as only non-factive attitudes are concerned, reflection semantics poses no obvious difficulties. But as soon as we want an account of e.g. knowledge, we would like a property of reflective frames that would guarantee factivity, i.e. that all instances of the scheme **T** hold:

$$\mathbf{knows}(a, \phi) \rightarrow \phi.$$

In usual Kripke semantics, the property in question is *reflexivity* of the accessibility relation (which we have just employed all our ingenuity to rule out).

A reasonable candidate for the property in question might be the following. Among the attitudinal alternatives of an agent (i.e. of an individual in D_w for some w) there must be a world *bisimilar* to w modulo counterparts, i.e. a world v s.t. the conjunction of the following holds:

[10] $Inh(w) = D_w \subseteq D$. The non-intersection condition presumes that we have decided not to allow overlapping domains even for worlds in the same foliage. The power set $\wp(D)$ appears in our definition because to each world there corresponds some subset of the domain of individuals.

- all propositional atoms are true at v iff they are true at w;

- for any accessibility arrow connecting v to a certain world v', there is an arrow connecting w to a certain w' bisimilar to v';

- for any accessibility arrow connecting w to a certain world w', there is an arrow connecting v to a certain v' bisimilar to w'.

Bisimulation modulo counterparts means that the roles of all the inhabitants of w are played by their counterparts via some counterpart functions in v. If an agent is omniscient, all her alternatives are bisimilar to the world she inhabits, again modulo counterparts.

Now there is a problem. One can reasonably assume that no human agent is acquainted (in any way) with all individuals in her world. Thus not all individuals at @ are values of some counterpart function or other; this makes the notion of bisimilarity modulo counterparts devoid of any practical sense: there is plainly no world satisfying the requirement of being the same as @ except for the roles of actual individuals being played by their counterparts via this or that acquaintance function.[11]

So far I can do no better than just build into the denotation of *knows* the presupposition that its complement hold in the world of evaluation.[12]

13. $[\![\text{know}]\!] = \lambda P.\lambda x.\lambda w[P(w) \equiv \top] : \forall v \in \text{dox}_w(x).P(v) \equiv \top$

The point here is that the actual truth of the embedded proposition is a *presupposition* for either truth or falsity of the whole knowledge report; with the presupposition unsatisfied, the whole report gets the truth value “undefined”. Therefore knowledge turns out to be no more than true belief. One can feel free to take this as a limitation of the present approach.

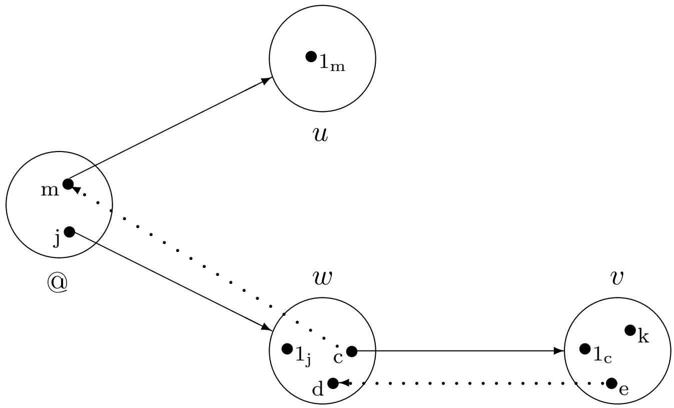


Fig. 1. The worlds for (12(a)ii). Solid lines: accessibility relations; dotted lines: counterparthood. The subscripted 1 is a counterpart of the attitude holder in her doxastic alternative, i.e. the Lewisian [16] centre of the world.

4. Sauerland's problem solved

Having settled down the framework of reflection semantics, we can now outline the solution of Sauerland's problem.

As long as an embedded belief operator forces us to leave the foliage quantified over by the embedding operator, after *thinks* in (12(a)ii) we find ourselves in a world v which is a doxastic alternative accessible from a belief world w of John's. But whose doxastic alternative is v? We are tempted to say it's Mary's; however, Mary lives only in the actual world. So we conclude that v is a doxastic alternative of a certain individual $c \in D_w$ who is a counterpart of Mary's. At v we find the individual k, who is the wife of another individual, e (of course inhabiting v as well). Now, we are told that the president, who has a wife at v, is himself

[11] Cf. a related but not the same (mine is about @) problem noted in [24]: "Orin Percus... points out that there could be acquaintance functions that the individual u forgot about and hence might not be defined for all doxastic alternatives of u" (p. 72, fn. 9).

[12] Cf. (7′) for the denotation of *believe*.

not at v; so we place the president d into w and stipulate that e is his counterpart. That is, what is literally conveyed by (12(a)ii) is that

> for all John's belief worlds w, there is an object c existing only at w:
>
> > for all c's belief worlds v, there is an object k existing only at v:
> >
> > > k is a wife of an individual e and k is nice and
> > >
> > > e is a counterpart of some $d \in D_w$ and
> >
> > d is the president and
>
> c is a counterpart of Mary.

Here is how this interpretation of (12(a)ii) comes about. The stipulated LF for (12(a)ii) is

14. John thinks $\lambda w[\ \mathsf{C}_{f,w}(\text{Mary})\ \text{thinks}_w\ \lambda v[$
$$\mathsf{C}_{g,v}\big(\text{the wife-of}_v\ [\text{the pres.}_w]\big)\ \text{is-nice}_v\ ]]$$

The interpretation of this LF (assuming that the functions f and g are contextually supplied) is as follows:

15. $\forall w \in \text{dox}_{@}(j) : \forall v \in \text{dox}_v(\mathsf{C}_{f,w}(m)) :$
$$\mathbf{nice}_v\big(\iota x(\mathbf{wife\_of}_v(x, \mathsf{C}_{g,v}(\iota y(\mathbf{president}_w(y)))))\big)$$

As one can see, (a) no counterpart function takes an argument in a world farther from @ than the individual it yields; (b) neither does a counterpart function relate two individuals out of which neither's world is accessible from the other's world via a chain of accessibility relations. Taken together, (a) and (b) amount to the world of the function's argument being the head of some branch wherein the world of the function's value is to be found. In the case of (12(a)i), (a) is violated, so we get an impossible reading, as

$$\mathsf{C}_{g,w}(\iota y(\mathbf{president}_v(y)))$$

is undefined: v is accessible from w and thus has lower ontological status than w, so nothing at w may be a counterpart of anything (e.g. the president) at v.

5. Conclusion

Sauerland's way of explaining constraints on transparent readings is not the only one on the market, and it was not the aim of the present paper to make and justify the choice, although a purely semantic explanation may be for several reasons considered welcome. The aim of the paper was to demonstrate that the simplest formulation of the ontological priority principle for the actual world @ fails to distinguish between attested and unattested indexings in doubly embedded clauses. The idea that allows to cope with this difficulty is to stipulate an infinite number of ontological priority levels, each corresponding to the number of accessibility arrows needed to get to a world from @. To make use of this idea, one has to restrict the range of possible frames to tree-like frames in the sense described above (Definition 1). However, this move complicates the computation as it uses more non-actual counterparts (as opposed to actual individuals) than the traditional approach. Another shortcoming — at least so far — is that factive attitudes are defined in a philosophically non-satisfactory way.

References

[1] Abusch, D. "The Scope of Indefinites", *Natural Language Semantics*. 1993, Vol. 2, No. 2, pp. 83–135.

[2] Aloni, M. *Quantification under Conceptual Covers*. PhD thesis, ILLC, University of Amsterdam, 2001. 204 pp.

[3] Bäuerle, R. "Pragmatisch-semantische Aspekte der NP-interpretation", *Allgemeine Sprachwissenschaft, Sprachtypologie und Textlinguistik*, 1983, pp. 121–131.

[4] Bonomi, A. Transparency and specificity in intensional contexts, in: *On Quine, New Essays*, 1995, pp. 164–185.

[5] Büring, D. "Crossover Situations", *Natural Language Semantics*, 2004, Vol. 12, No. 1, pp. 23–62.

[6] Büring, D. *Binding Theory*. Cambridge University Press, 2005. 294 pp.

[7] Fodor, J.D. *The Linguistic Description of Opaque Contexts*. Garland, 1979. 388 pp.

[8] Gerbrandy, J.D., Groeneveld, W. "Reasoning about Information Change", *Journal of Logic, Language and Information*, 1997, Vol. 6, No. 2, pp. 147–169.

[9] Gerbrandy, J.D. *Bisimulations on Planet Kripke*. ILLC Dissertation Series, 1999. 184 pp.

[10] Heim, I., Kratzer, A. *Semantics in Generative Grammar*. Oxford: Blackwell, 1998. 334 pp.

[11] Hughes, G.E., Cresswell, M.J. *A New Introduction to Modal Logic*. Routledge, 1996. 432 pp.

[12] Kaplan, D. "Quantifying in", *Synthese*, 1968, Vol. 19, pp. 178–214.

[13] Keshet, E. "Only the strong: Restricting Situation Variables", *Proceedings of SALT*, Vol. 18, 2008, pp. 483–495.

[14] Keshet, E. "Split Intensionality: A New Scope Theory of *de re* and *de dicto*", *Linguistics and Philosophy*, 2010, Vol. 33, No. 4, pp. 251–283.

[15] Lewis, D. "Counterpart Theory and Quantified Modal Logic", *The Journal of Philosophy*, 1968, Vol. 65, No. 5, pp. 113–126.

[16] Lewis, D. "Attitudes *de dicto* and *de se*", *Philosophical Review*, 1979, Vol. 88, No. 4, pp. 513–543.

[17] Lewis, D. *On the plurality of worlds*, Blackwell, 1986. 288 pp.

[18] Lomuscio, A. *Knowledge Sharing Among Ideal Agents*. PhD thesis, University of Birmingham, 1999. 170 pp.

[19] Musan, R.I. *On the Temporal Interpretation of Noun Phrases*, Garland, 1997. 208 pp.

[20] Percus, O. "Constraints on Some Other Variables in Syntax", *Natural Language Semantics*, 2000, Vol. 8, No. 3, pp. 173–229.

[21] Quine, W.V.O. "Quantifiers and Propositional Attitudes", *Journal of Philosophy*, 1956, Vol. 53, No. 5, pp. 177–187.

[22] Romoli, J., Sudo, Y. "*De re / de dicto* ambiguity and presupposition projection". In *Proceedings of Sinn und Bedeutung*, Vol. 13, 2009, pp. 425–438.

[23] Russell, B. "On Denoting", *Mind*, 1905, Vol. 14, No. 56, pp. 479–493.

[24] Sauerland, U. "Counterparts Block Some 'de re' Readings", in: L. Crnič and U. Sauerland (eds.), *The Art and Craft of Semantics: A Festschrift for Irene Heim*, MITWPL, 2014, Vol. 2, pp. 65–85.

[25] Schueler, D. "World Variable Binding and Beta-binding", *Journal of Semantics*, 2011, Vol. 28, No. 2, pp. 241–266.

[26] Schwager, M. "Speaking of Qualities", *Proceedings of SALT*, Vol. 19, 2009, pp. 395–412.

[27] Schwarz, F. "Situation Pronouns in Determiner Phrases", *Natural Language Semantics*, 2012, Vol. 20, No. 4, pp. 431–475.

[28] Sharvit, Y. "Individual Concepts and Attitude Reports", *Proceedings of SALT*, Vol. 8, 1998, pp. 233–248.

[29] Shimada, J. *Head Movement, Binding Theory, and Phrase Structure*. MIT, 2007. [http://research.nii.ac.jp/kanazawa/semantics/2007/0817/Head_Movement_Binding_Theory_Phrase_Structure.pdf, accessed on 26.01.2016].

[30] Sudo, Y. "On *de re* Predicates", *Proceedings of WCCFL* 31, 2014, pp. 447–456.