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# An Externalist Account of Intentional Identity

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## 1. Introduction

This paper is about the interpretation of *intentional identity* as exemplified by the following example[1]:

(1) Hob believes that a witch blighted his mare and Nob thinks that she killed his sow.

In order to fully appreciate the problem with (1), let us imagine the following (doubtlessly possible) scenario: Hob and Nob live in the same little village whose social life they both actively participate in. In particular, they have both been exposed to the recent rumour that their village, for reasons unbeknownst to anyone, has been the target of a witch's evil activities. None of the villagers has ever seen the hag or anything that would count as evidence for her existence, and nobody suspects any of the villagers or visitors to the village of witchcraft, which is to say that nobody has any *specific* suspicion. Still, about half of the village's population believe the rumour, and both Hob and Nob are among this superstitious half. Indeed, Hob has been complaining about his mare's bad health and firmly believes this to be a result of a witch spell; and Nob is bemourning his favourite sow that he also takes to be a victim of the local witch. However, due to their completely different family backgrounds, Hob and Nob never talked about the matter (or anything else); indeed, neither of them knows (or cares) about the other's attitude to the witch rumour. Needless to say, the rumour is just a product of malicious male phantasies: witches do not exist.

Let us, for ease of reference, pick out one possible situation $s^*$ which is as indicated in the last paragraph. It would then seem that, at least on one of its readings, (1) is true of $s^*$. The problem is, of course, to find an accurate and systematic account of that reading in truth-conditional terms.

To begin with, on many semantic approaches, the very fact that the pronoun *she* in (1) is anaphoric to *a witch* requires the latter to take wide scope and hence imply the existence of witches. One traditional logical analysis of (1) is roughly of the form[2]:

$(1dr)$ $\quad (\exists x)\,[\mathrm{W}(x) \,\&\, \mathrm{B}(\mathrm{h},\varphi[x]) \,\&\, \mathrm{B}(\mathrm{n},\psi[x])\,]$

Although something like $(1dr)$ may be a possible *de re* reading of (1), it certainly is incompatible with $s^*$ and hence not the reading we were looking for.

Another traditionally predicted logical form of (1) is:

$(1fv)$ $\quad [\,\mathrm{B}(\mathrm{h},(\exists y)\,[\,\mathrm{W}(y) \,\&\, \varphi[y]\,]\,) \,\&\, \mathrm{B}(\mathrm{n},\psi[x])\,],$

which contains a free variable that may be understood as corresponding to a deictic use of

1 The example and the subsequent discussion of it are inspired by Geach (1967).

2 At this point the logical notation is just informal and suggestive. We will be more specific about the interpretation of logical formulae from section 2 on.

*she*, thus yielding another legitimate reading of (1). But again it is hardly the one we are concerned with: according to (1*fv*), Nob's belief is about a specific individual pointed at by the speaker or somehow given by the context of utterance, and not about whoever Hob takes to be the witch that blighted his mare.

Of course, the underlined paraphrase is just a rough approximation of the intentional identity understanding of the anaphoric pronoun in (1). Nevertheless, it is instructive to see what happens if we take it at face value, formalizing it as:

(1*uq*) $(\forall x)\,[\,\mathrm{B}(\mathrm{h},\,[\,\mathrm{W}(x)\,\&\,\varphi[x]\,]\,)\rightarrow\mathrm{B}(\mathrm{n},\psi[x])\,]$

One reason why (1*uq*) is obviously inadequate is that it will be vacuously true if Hob does not believe in witches (and his beliefs are closed under logical consequence[3]). One way of avoiding this trivializiation is to add an existential condition (or maybe presupposition), as in:

(1*uq*$^+$) $[\,(\exists x)\,\mathrm{B}(\mathrm{h},\,[\,\mathrm{W}(x)\,\&\,\varphi[x]\,]\,)\,\&$
$(\forall x)\,[\,\mathrm{B}(\mathrm{h},\,[\,\mathrm{W}(x)\,\&\,\varphi[x]\,]\,)\rightarrow\mathrm{B}(\mathrm{n},\psi[x])\,]\,]$

Alternatively, one may shun the universal quantifier altogether and use an existential instead[4]:

(1*eq*) $(\exists x)\,[\,\mathrm{B}(\mathrm{h},\,[\,\mathrm{W}(x)\,\&\,\varphi[x]\,]\,)\,\&\,\mathrm{B}(\mathrm{n},\psi[x])\,]$

The problem with (1*eq*) is that it ascribes to Hob a belief about a specific object, one which he takes to be a witch: for (1*eq*) to be true there would have to be some object *u* satisfying the matrix:

(2) $\mathrm{B}(\mathrm{h},\,[\,\mathrm{W}(x)\,\&\,\varphi[x]\,]\,)$

However, this does not have to be the case in *s**, as an adaptation of a classical argument (cf. Buridan 1350) shows. First, Hob cannot be acquainted with *u*: according to what we have assumed about *s**, Hob believes none of the individuals he has ever come across to be a witch and thus none of them satisfies (2). So Hob is not acquainted with *u*. But then how can he have formed a belief about *u*? Moreover, how could one decide which of the many objects Hob is not acquainted with satisfy (2)? Maybe we cannot. Maybe this is just typical of unspecific (*de dicto*) belief: an (allegedly) unspecific belief is one that is about an object the subject is not acquainted with, and what is really unspecific about it is the fact that no reporter would be able to specify the object of belief. So this solution of the intentional identity problem seems to imply that any true attitude report that is not *de re* is a generalization of a principally unknowable report. This, we take it, is absurd enough to start looking for an alternative explanation.

Since (1*uq*$^+$), too, implies the existential closure of (2), it cannot be the correct reading either. Indeed, we suspect that none of the three proposals corresponds to a reading of (1); but we will not pursue the matter any further here.

One may try to save the spirit of the above quantificational approach and replace the objects of acquaintance by suitable *concepts*: instead of being acquainted with a particular individual he takes to be a witch, Hob would then have to have a special grasp of a property that he believes to be instantiated by a witch, and Nob's belief would involve the same property. Again we have three variants:

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3 The closure property actually needed is, of course, rather weak. In any case the assumption is harmless because it is certainly possible for Hob to be logically omniscient.

4 Cf. Slater (1994), whose formalization in terms of Hilbert's e boils down to (1*eq*).

(1*ac*) $(\forall D)$ [ B(h,$(\exists x)$ [$D(x)$ & W($x$) & $\varphi[x]$ ] ) $\rightarrow$ B(n, $(\exists x)[D(x)$ & $\psi[x]])$]

(1$ac^{+}$) [ $(\exists D)$ [ B(h,$(\exists x)$ [$D(x)$ & W($x$) & $\varphi[x]$ ] ) & $(\forall D)$

[ B(h,$(\exists x)$ [$D(x)$ & W($x$) & $\varphi[x]$ ] ) $\rightarrow$ B(n, $(\exists x)[D(x)$ & $\psi[x]])$ ]

(1*sc*) $(\exists D)$ [ B(h,$(\exists x)$ [$D(x)$ & W($x$) & $\varphi[x]$ ] ) & B(n,$(\exists x)[D(x)$ & $\psi[x]]$ )]

(1*ac*) is vacuously true if Hob does not believe in witches (and his beliefs are closed under logical consequence). So it is not a possible reading of (1). And (1*sc*) is not much better: it will be true if Nob believes to have slaughtered his cow, as long as Hob believes his mare to have been blighted by a witch; but (1) would be unequivocally false under such circumstances. It should be noted that this argument does not depend on the precise understanding of second-order quantification: no logic could do without the trivial property of being self-identical. So the (1*ac*) and (1*sc*) can be dismissed as possible ways to understand (1).

The fact that a property as general as self-identity renders (1*sc*) inadequate may be taken as indication that only highly specific ideas should be taken into account – concepts that uniquely identify (at most) one individual. However, a variation of Kaplan's (1969) shortest spy argument reveals that existential quantification over specific ideas delivers truth-conditions that are, in general, too weak for intentional identity: if, in addition to what we have assumed so far, both Hob and Nob believe all witches to be well-ordered by age, then the following formula will be satisfied by the specific idea of being the youngest witch:

(3*D*) [ B(h,$(\exists x)$ [$D(x)$ & W($x$)] ) & B(n, $(\exists x)[D(x)$ & W($x$)] )]

But if (1*sc*) were a correct logical form of (1), it would seem that, on an analogous reading, (3) would then have to be true – which it isn't:

(3) Hob believes that some witch is a witch and Nob believes that she is a witch, too.

Now, although this conclusion may not be entirely compelling, we do not see how to give a systematic account of (1) as (1*sc*) while at the same time blocking the existential closure of (3*sc*) as a possible reading of (3).

As to (1$ac^{+}$), it should be noted that – even given the restriction to specific ideas – it would not be true of *s**: if, for some specific idea **S**, Hob believes in *s** that there is a witch who is **S** and satisfies $\varphi[x]$, then he also believes there to be a witch that is **S*** and satisfies $\varphi[x]$ – where **S*** is the (specific) idea of being **S** and satsifying $\varphi[x]$; thus, according to (1$ac^{+}$), Nob would believe that the killer of his sow blighted Hob's mare – which he does not. Of course, one might try and exclude concepts like **S*** from the range of the universal quantifier in (1$ac^{+}$), but we doubt that there is any systematic way of doing so. Note, however, that this does not show that (1$ac^{+}$) is not a possible reading of (1) – it just isn't the one we were looking for. Whether or not it is still an adequate formalization is hard to decide; and we will ultimately leave the matter open.

There is independent evidence that (1*sc*) cannot be the only intentional identity construal (= non *de re* reading with coreferential *he*) of (1). Indeed, (1) does not necessarily imply its symmetric counterpart (4) even if both Hob's and Nob's beliefs involve witchhood:

(4) Nob thinks that a witch killed his sow and Hob believes that she blighted his mare.

However, an adaptation (and simplification) of Edelberg's (1986) mayor/commissioner scenario falsifies (1) while still making (4) true. Imagine that, contrary to our assumptions about *s**, the current (and completely absurd) rumour has it that the village is haunted by a whole tribe of witches. Now, Hob knows that Nob's sow has been stabbed, although he does not know that the poor creature died as result of that stabbing; and, for some obscure reason, Hob takes the fact that both his cow and Nob's sow were born on the same day as indication that they were victims of the very same witch. Nob, on the other hand, does not make a

connection between the fatal stabbing of his sow and Hob's cow's health problems, although he does make the witches responsible for each. It would thus seem that (1) is false. But, given this story, (4) appears to be true.

There is, of course, a straightforward way of accounting for asymmetries in anaphoric relations: the pronoun may be taken as going proxy for a description to be gleaned from the preceding discourse. Asymmetry would be guaranteed because, as a rule, different descriptions become available when antecedent and anaphor change positions. However, this strategy is of no help in the present case; for it would predict (4) to be an abbreviation of either of the following:

(4') Nob thinks that a witch killed his sow and Hob believes that the witch that killed Nob's sow blighted his mare.
(4") Nob thinks that a witch killed his sow and Hob thinks that the witch that Nob thinks killed his sow blighted his mare.

Unlike (4), neither of these sentences is true in the above scenario. So even if (4) can be understood in these ways – which we think it can – it must have yet another reading that would have to be obtained in a different fashion.

Intuitively, a descriptive understanding of the anaphoric pronoun does seem to be relevant when (4) is considered true under the given circumstances. But the description is not composed from previous discourse. Rather, the following appear to correct paraphrases:

($4^{+}$) Nob thinks that a witch killed his sow and Hob believes that the witch that stabbed Nob's sow blighted his mare.
($4^{++}$) Nob thinks that a witch killed his sow and Hob believes that the witch that Nob thinks stabbed his sow blighted his mare.

And the reason why the underlined description is an appropriate resolution of the anaphor seems to be that, according to the story, *Hob* believes that there is witch that stabbed Nob's sow and *Nob* believes that the witch that stabbed his sow also killed it. If this is right, then one may try and capture intentional identity in terms of a four-place relation *R* holding among agents *a* and *b* and specific concepts *C* and *D* if *a* believes there to be something (uniquely) satisfying *C*, *b* believes there to be something (uniquely) satisfying *D*, and *a* believes the *C* and the *D* to be identical: the anaphoric pronoun can be interpreted by a concept *D* if there is a concept *C* such that *R* holds among the the antecedent's attitude subject, the anaphor's attitude subject and the concepts *C* and *D*. Of course, this strategy and the peculiar correspondence relation *R* might appear less ad hoc if they turned out to be instances of a more general approach to anaphora; we will not pursue this matter here.

It should be noted that this *correspondence* approach to intentional identity deals with certain cases of asymmetry without invoking discourse information; we will later argue that this is not always desired. Another interesting feature of this approach is that it does not require the attitudinal subjects to be members of the same communitiy; they do not even have to be indirectly linked by a communicative chain, as in the original Hob/Nob case. That this second feature is welcome has been shown by Edelberg (1992), using the following example:

Two teams of astronomers have independently been investigating the peculiar motion of superclusters of galaxies – that is, the motion of *clusters* of clusters of galaxies, over and above that due to the Hubble expansion of the universe. Neither team knows about the work of the other, but both independently and correctly ascertain the peculiar motions of the Hydra-Centaurus supercluster, of the Local Supercluster, and of our own Local Group. Both teams attempt to explain the vectors of the peculiar motions in the same way: by postulating an "overdensity" of galaxies at roughly twice the distance between the Hydra-Centaurus supercluster and our own galaxy. The idea is that an enormous collection of galaxies, "a distant concentration of mass that appears to be larger than any proposed by existing cosmologies," lies beyond the Hydra-Centaurus supercluster, drawing it, as well as our own Local Supercluster of galaxies, toward it. The American team calls the structure "The Great Attractor", the Soviet team calls it "The Overdensity" (in Russian). Due only to certain differences

in instrumentation and atmospheric conditions at the times and locations of observations, the two teams conjecture the structure to be at "slightly" different distances. The Americans say it is twice the distance of the Hydra-Centaurus supercluster; the Soviets say it is at 2.1 time the distance. In reality, let us suppose, the Great Attractor does not exist at all: the peculiar motions of the various superclusters are each caused by independent factors.

According to Edelberg's story, the following intentional identity statement is true:

(5) The American team believes that an immense overdensity of galaxies at a certain distance causes a peculiar motion of superclusters, but the Soviet team thinks it is slightly further away.

The correspondence approach seems to deal fairly well with this example; yet we think that the relation between the corresponding (American and Soviet) concepts would have to be closer than just one of "rough similarity of explanatory rôle" (Edelberg (1992)). This becomes clear if we consider a Twin Earth variant of the above story[5], according to which the two teams live in two distinct regions of the universe that happen to be qualitatively identical. In that case (5) is clearly false. Roughly, the reason is that the two teams do not perceive the same *event* that leads them to their corresponding beliefs. If this is right, then an externalist account of intentional identity is called for.

## 2. Dynamic semantics with descriptive pronouns

We want to account for the above insights in terms of the dynamic semantics proposed by Kamp (1981) and Heim (1982) and to which we will loosely refer as 'DRT/FCS'. We believe that these dynamic approaches formalised the suggestion of Kripke (1977) and Lewis (1979) that a singular pronoun can sometimes be appropriately used because it refers to the speakers referent of an earlier mentioned indefinite, by means of the diagonalisation strategy of Stalnaker (1978). On the assumption that pronouns normally pick up referentially used indefinites, and the fact that indefinites used in distributive position are normally not used to refer to a specific individual, the specific constraints on anaphoric binding that DRT/FCS propose can be explained. We don't want to defend this view on dynamic semantics here, we only mention it because it most clearly brings out the need for descriptive pronouns. Sometimes a singular pronoun that takes an indefinite as syntactic antecedent can be appropriately used although it does not refer to the speaker's referent of the indefinite. This is most clearly the case in examples where the DRT/FCS constraints on anaphoric bindings are violated, even when no explicit modal is mentioned. We believe it is reasonable to assume that to account for these cases we need besides referential pronouns, also *descriptive pronouns* – pronouns that go proxy for a description recoverable from the sentence in which its syntactic antecedent occurs. Because singular pronouns are definite expressions, descriptive pronouns should be analysed as *definite descriptions*. To account for descriptive pronouns in DRT/FCS, we will assume that an utterance like *An S is P* introduces two kinds of objects to each possibility of the context. First, an S that is a P in the world of that possibility, and second, the property *S that is P*. Contrary to the object introduced first, the property will escape 'syntactic islands', and thus can be picked up by pronouns in unexpected ways. However, a singular pronoun can only pick up such a property, if it is presupposed that that property has only one instantiation. As in standard DRT/FCS, a possibility is represented by a set of tuples, and the tuples contain assignments by which anaphoric dependencies are accounted for. But contrary to the standard formulation, we will use two assignments in a possibility, instead of only one. The first assignment assigns properties to variables, while the second assigns ordinary objects to them. The resulting context change theory (for a formal language L) will be called *CCT*.[6]

The *syntax* for the language L need not be specified: it is quite straightforward and will be implicit in the semantic clauses anyway. *Models* are triples <D,W, I>, where D is a non-empty set of *objects*, W a non-empty set of *possible worlds*, and I is the intentensional interpretation function that maps each *n*-ary relation to a function from worlds to a subsets of

5 The method of Twin Earth *gedankenexperiments* is, of course, due to Putnam (1975).

6 The formalisation is, of course, inspired by Groenendijk & Stokhof (1991) and Dekker (1993).

the *n*-th Cartesian product of D. The following definitions are all relative to a model <D,W,I> of a language L.

The set G of of *partial assignments* is: $\cup\{[W \rightarrow \wp(D)]^X | X \subseteq VAR_L\}$. Hence, technically, variables are always assigned properties – but some of these properties represent ordinary objects: the set **D** of *rigid concepts* is defined by:

$\mathbf{D} := \{\{<w,\{\mathbf{d}\}>|w \in W\}| \mathbf{d} \in D\}$.

Moreover, we let $\Omega$ be the set of *language-dependent* properties:

$\Omega := \{\{<w,F>|w \in W \& F = I_W(P)\}| P \in PRED^1_L\}$.

An *information state* S is a relation between two assingments and a world: $S \subseteq (G \times G \times W)$. We will use the following *notational conventions* in conection with assigments g and h, objects o, variables x and y, worlds w, and information states S and S':

| | | |
|---|---|---|
| g[x]h | iff | $dom(h) = dom(g) \cup \{x\} \& \forall y \in dom(h)[y \neq x \rightarrow h(y) = g(y)]$ |
| $g[^x/_o]$ | := | $\{<y,o'>| y \in dom(g) \& g(y) = o' \& y \neq x\} \cup \{<x,o>\}$ |
| S[x] | := | $\{<g,h',w>| \exists h:<g,h,w> \in S \& h[x]h'\}$ |
| $S[x:\approx\mathbf{d}]$ | := | $\{<g,h',w>| \exists h:<g,h,w> \in S \& h[x]h' \& h'(x) = \mathbf{d}\}$ |

The elements of $(G \times G \times W)$ are ordered by $\leq$: $<g,h,w> \leq <g',h',w'>$ iff $w = w'$ and $g \subseteq g'$ and $h \subseteq h'$. And $\leq$ carries over to information states S and S': $S \leq S'$ iff for every $\alpha' \in S'$ there is an $\alpha \in S$: $\alpha \leq \alpha'$.

We are now in a position to give a recursive definition of the context change potential $[[A]]$ $[\subseteq \wp(G \times G \times W) \times \wp(G \times G \times W)]$ of formulae A of L :

(i-a) If P is an *n*-ary predicate and $x_1 ... x_n$ are variables and S is an information state, then $[[Px_1...x_n]]$ (S) is only defined if $||x_i||^\alpha$ is defined for each i between 1 and *n* and $\alpha \in S$, in which case:

$[[Px_1...x_n]]$ (S) = $\{\alpha \in S| <||x_1||^\alpha,...,||x_n||^\alpha> \in I_W(P)\}$.

(i-b) If P is an *n*-ary predicate and $x_1$ and $x_2$ are variables and S is an information state, then $[[x_1 = x_2]]$ (S) is only defined if $||x_1||^\alpha$ and $||x_2||^\alpha$ are defined for each $\alpha \in S$, in which case:

$[[x_1 = x_2]]$ (S) = $\{\alpha \in S | ||x_1||^\alpha = ||x_2||^\alpha\}$

The (static) term-evaluation used in (i-a) and (i-b) is defined by:

$$||x||^{g,h,w} = \begin{cases} \$(h(x)(w)), \text{ if } x \in dom(h); \\ \$(g(x)(w)), \text{ if } x \in dom(g) \text{ and } \$(g(x)(w)) \text{ defined}; \\ \text{undefined otherwise}, \end{cases}$$

where $\$(\{u\}) = u$ and $\$(T)$ is undefined if T is not a singleton set.

For the induction step we assume that [[A]] (S) and [[B]] (S) have already been defined (for given formulae A and B and information states S) and put:

(ii-a) $[[\sim A]](S) = \{\langle g',h,w\rangle | \exists g \subseteq g': \langle g,h,w\rangle \in S$ & & $g' = g \cup$
$\{\langle y,o\rangle |\ \exists k,h',w': \langle k,h',w'\rangle \in [[A]](\{\langle l,m,w''\rangle | l = g$ & $m = h\})$
& $y \in dom(k)/dom(g)$ & $\forall l,m,n,n': \langle l,n,w'\rangle, \langle m,n',w'\rangle \in$
$[[A]](\{\langle l,m,w''\rangle | l = g$ & $m = h\}): l(y) = m(y) = o\}$
& $\sim\exists h'' \supseteq h: \exists g'' \supseteq h: \langle g'',h'',w\rangle \in [[A]](S)\}$[7]

(ii-b) $[[A \wedge B]](S) = [[B]]([[A]](S))$

(ii-c) $[[\exists xA]](S)$ is only defined if x is a variable such that $x \notin dom(g)$ for any $g \in G(S)$, in which case:

$[[\exists x A]](S) = \{\langle g'[x / \hat{x}|A|^g_h], h', w\rangle | \langle g,h,w\rangle \in S$ and $\langle g',h',w\rangle \in \cup_{\mathbf{d} \in \mathbf{D}}[[A]](S[x:\approx \mathbf{d}])\}$.

(ii-d) $[[\forall xA]](S) = \{\langle g,h,w\rangle \in S |$ for all h' such that [h[x]h' there is an such that:
$[\langle g,h',w\rangle \leq \alpha$ and $\alpha \in [[A]](S[x])]\}$

The notation'G(S)' used in (ii-c) means:

$\{g \in G | \exists w \in W, h \in G: \langle g,h,w\rangle \in S$ or $\langle h,g,w\rangle \in S\}$;

and the abstraction $\hat{x}|A|^g_h$ is that function $f$: W –> $\wp$(D) such that:

$f(w) = \{d \in D \mid [[A]](\{\langle g,h[x/\langle w,\{d\}\rangle],w\rangle\}) \neq \emptyset\}$,

for any $w \in W$. Disjunction and implication can be treated syncategorematically, by having '$(A \vee B)$' and '$(A \rightarrow B)$'stand for '$\sim(\sim A \wedge \sim B)$' and '$\sim(A \wedge \sim B)$', respectively. We can also introduce a special notation coresponding to definite descriptions: ' $\iota xA$' is short for '$\exists xA \wedge \forall y[A[x/y] \rightarrow y = x]$', where $A[x/y]$ is A with all occurences of free x replaced by fresh y.

We can now define the most important semantic concepts. A formula A is *acceptable in S*, $S|=_d A$ iff S is a *substate* of [[A]] (S), in the sense that every $\alpha \in S$ can be extended to an $\alpha' \in [[A]](S)$: $\alpha \leq \alpha'$. A is *accepted in S*, $S|=_s A$ iff S = [[A]] (S). A is *true in* $\langle g,h,w\rangle$ – $\langle g,h,w\rangle |= A$ – iff $\{\langle g,h,w\rangle\}|=_d A$. A $|=_{d/s}$ B iff for all $S \in dom([[A]])$: $[[A]](S)|=_{d/s} B$.

Note that by our interpretation rules it is predicted to be possible that sometimes a pronoun can pick up a description that is interpreted in a world, or a more complex index, that is not an element of the set of indices of the context resulting after the interpretation of the indefinite. This is good news. Examples are easy to find where non-rigid concepts seem to be useful:

(6) This year *the president* is a Republican.
Next year *he* will be a Democrat. (Evans, 1977)

(7) *My home* once was in Maryland, but now *it*'s in Los Angeles. (Janssen, 1984)

In the above system of CCT, possibilities of a context only represent something about the subject matter of conversation and about what objects speakers have referred to by referentially

7 In this way the pronoun *it* in the second disjunct of *Either John does not own a donkey, or he keeps it very quiet* (Evans, 1977), can be interpreted as the descriptive pronoun *the donkey that John owns*. Still, this interpretation rule is a bit more complicated than one might have expected because we don't want to introduce properties by indefinites that are *dependent* on terms standing in distributive position. For instance, we don't want to introduce a property corresponding with *a woman* in *If a man buys a flower, he gives it to a woman*.

used expressions. But this is not the only thing a possibility should represent. As far as the participants of the conversation presuppose, each possibility of the context might be the representation of the actual world where a certain conversation is going on. What the participants know about this actual world is that the conversation is taking place in it, and what is presupposed by the participants of the conversation. It follows that each possibility of the context should contain the information of what is presupposed in the actual world. In a very simplistic way, we might add natural numbers as special duty variables to the formal language which are interpreted as information states. A natural language sentence is no longer simply represented by a formula A, but by something of the form "*n*:A", where *n* is the lowest natural number not yet used. This new formula is interpreted as follows:

$[[n{:}A]](S) = \{\langle g,h',w\rangle \mid \exists h{:}\langle g,h,w\rangle \in [[A]](S) \,\&\, h[n]h' \,\&\, h'(n) = [[A]](h(n-1))\}$

Note that for each $\alpha,\beta \in S$, and for each $n \in dom(\alpha) \cap dom(\beta)$: $||n||^{\alpha} = ||n||^{\beta}$. Note also that on our simplistic assumption natural numbers are only elements of the assignment functions in the main context, not of the elements of h(*n*) for any *n*. It follows that $\langle g,h,w\rangle \notin h(n)$ for any *n*[8].

## 3. Two problems of intentional identity

Intentional identity attributions come in two ways. First, there are Hob-Nob examples as discussed above with several agents involved, and secondly examples like (6) with only one agent.

(8) John believes that a woman broke into his apartment.
He believes that *she* is now hiding from the police.

We believe with Saarinen (1978) that the two cases pose different kinds of theoretical problems. For the one agent case we believe that something like what Geurts (1995) proposed is on the right track, and we will come back to this in the Appendix. The main goal of this paper, however, is to account for the two-agent case.

If we want to account for intentional identity belief attributions, we have to know how to interpret belief sentences in CCT. At first sight, it might seem that the interpretation rule of belief attributions is very simple. Pronouns in embedded clauses of belief attributions are either descriptive pronouns, or the objects introduced in earlier sentences themselves. If we say that K(a,w) denotes the belief state of *a* in *w*, represented by a set of possible worlds, the interpretation of belief sentences can be given as follows:

$[[Bel(x,A)]](S) =$

$\{\langle g',h,w\rangle \mid$ for some g and h: $\langle g,h,w\rangle \in S$ and for all $w' \in K(||x||^{g,h,w},w)$ there is some k:
$\langle g',k,w'\rangle \in [[A]](\{\langle l,m,w''\rangle \mid w'' \in K(|x||^{g,h,w},w)$ and $l = g \,\&\, m = h\})\}$

Note that in this way we seem to handle the anaphoric dependence relation for a sentence like:

(9) John believes that *the winner of the game* needs to play well,
while Mary believes *he* just must be lucky.

in the intuitively right way. The pronoun *he* is simply used as an abbreviation for *the winner of the game*. Second, it seems that in this way we can account for ordinary *de re* belief attributions. Suppose Ralph has never heard of the name 'Ortcutt', we still might truly attribute to Ralph the belief that Ortcutt is a spy. Unfortunately, as should already be clear from the discussion above, this proposal cannot be good enough. Because by the above interpretation

8 Something like what we do here is needed for a distributive analysis of epistemic *might* in CCT. For a less simplistic account, see Fernando (forthcoming).

rule, pronouns in embedded clauses of belief attributions that take indefinites used in embedded clauses of attitude attributions of another agent as syntactic antecedents always go proxy for a description recoverable from the embedded sentence in which the sentence occurs, it cannot account for those cases the E-type account cannot account for. Moreover, the analysis of *de re* attitudes attribution is problematic, too. It predicts Quine's Ralph to have inconsistent beliefs about Ortcutt, although intuitively we don't feel to attribute an inconsistency to Ralph in the well-known situation sketched by Quine (1956). It seems that the latter problem can easily be solved. You simply assume that, at least for *de re* attributions, the values of variables of the second assignment function are not necessarily *rigid* individual concepts. In these cases we don't only introduce rigid individual concepts anymore, but let those variables range over all individual concepts. Unfortunately, as Kaplan (1969) showed, *de re* belief attributions are too easily made true that way. It is counterintuitively predicted that the *de re* belief attribution *John believes that Ortcutt is the shortest spy* is true just because Ortcutt actually is the shortest spy and John (de dicto) believes that whoever is the shortest spy is the shortest spy.

We have seen above that the descriptive approach cannot account for Edelberg's *mayor/ commissioner puzzle*, it cannot explain the asymmetry between (1) and (4). We also saw that to account for the intuition that something like 'rough similarity of explanatory role' is normally not a sufficient condition for intentional identity, we have to assume that the beliefs of the two agents are *about* a single thing external to both of them. Thus, a proper account of *de re* belief attributions seems to be needed to analyse intentional identity attributions, too.

## 4. The interpretation of *de re* belief attributions

How should *de re* attributions be analysed? The puzzling examples of belief attribution, as given by Quine (1956) and others, are cases where although it might be assumed that in different conversational contexts the agent has the same beliefs, in these different conversational contexts we might truly attribute to the agent beliefs about the same object that are inconsistent with each other. In case of Quine's Ralph, in some conversational situations we might truly and appropriately say that he believes that Ortcutt is a spy, in others that he doesn't believe that Ortcutt is a spy. The puzzle that arises is that the question *Does Ralph or does he not believe that Ortcutt is a spy?* cannot be answered by a clear *yes* or *no* once the two different conversational contexts come together. To account for *de re* belief attributions, we believe four insights are essential. The first important insight was that with *de re* and *de dicto* belief attributions we do not attribute to the agent different kinds of belief. The beliefs involved are the same, it is just that in case of a *de re* belief attribution we might use an expression in the embedded sentence to refer to a particular object to characterise a belief. Even if the agent did not use that expression to refer to that relevant object, we would still be allowed to use this expression because the agent has a conception of the object referred to by this expression. This first insight was due to Quine, just as the second is. The second insight is that it is not only important to know what object the belief attribution is about (as is assumed by a Russellian account), but also *the way* the believer thinks about that object. That we can truly make mutually contradictory belief attributions to Ralph about Ortcutt, doesn't mean that Ralph really has contradictory beliefs. Third, Kaplan (1969) taught us that the way the believer thinks about that object must be due to some kind of *causal relation* between agent and object. However, this causal acquaintance relation need not be a particularly strong one. As a result it might be that an agent is acquainted with one object in different ways, and such that the agent is not aware that it is the same object that is the dominant source of these relevantly different bodies of information associated with an object. It follows that we could rightly attribute contradictory beliefs to that agent about the same object. The fourth crucial insight is that we cannot *appropriately* make these belief attributions in all conversational contexts. If *we* only know that Ortcutt is the man with the brown hat that Ralph saw, we can appropriately assert *Ralph believes that Ortcutt is a spy*. If *we* only know that Ortcutt is the man Ralph saw at the beach, we can appropriately assert *Ralph doesn't believe that Ortcutt is a spy*. But once it is presupposed that Ortcutt is the man Ralph saw with the brown hat *and* the man Ralph saw at the beach, we can no longer *appropriately* attribute to Ralph any of those two beliefs[9].

[9] In a more sophisticated account, a *de re* belief attribution is already appropriate if there is a unique most salient way in which the agent is acquainted with the object the belief attribution is about. Moreover, what this most salient acquaintance relation is might be determined via the Gricean reasoning known as

Moreover, once *Ralph believes that Ortcutt is a spy* can be appropriately asserted, *what* is asserted by the sentence depends crucially on the conversational context. The fourth insight is due to Van Fraassen (1979) and Stalnaker (1988).

We try to implement the first three ideas in an almost Lewisean (1979a) way[10]. We assume that we can assign to each agent in a world a set of tuples <d,R>, meaning that the agent in that world is acquainted in way *R* with *d* in that world. Thus $\langle d,R\rangle \in Acq(a,w)$ iff $\{d' | \langle a,d'\rangle \in I_w(R)\} = \{d\}$ & $\forall w' \in K(a,w): \exists!d'': \langle a,d''\rangle \in I_{w'}(R)$. Furthermore, we will assume that in *de re* belief attributions the term that refers to the object the belief is about has wide scope w.r.t. the belief predicate. On this assumption the formula that represents the embedded clause in case of a *de re* belief attribution will contain a free variable. By taking Quine's insight serious, this free variable cannot be interpreted in the same way as it is interpreted in the 'main' context. How then should it be interpreted?

We will assume that the free variable will be interpreted locally. This means that the possibilities that interpret a free variable occurring in a embedded clause should contain enough information of the basic context, the place where the variable was introduced, to determine what object the belief attribution is about. We will represent this information by adding to possibilities an extra argument, *f*, that contains the information of the possibility of which the context of interpretation for the embedded sentence is derived. To determine the relevant acquaintance relation we also have to know what the agent is we are talking about. The term that represents this agent will also be an element of the possibility. In the main context this term will always be *s*, a distinguished variable that is always interpreted as the speaker. The interpretation rule for formulas that represent belief attributions will be as follows:

$$[[Bel(r,A)]](S) = \{\langle g',h,w,f,\mathbf{s}\rangle \mid \exists g,h: \langle g,h,w,f,\mathbf{s}\rangle \in S \;\&\; \forall w' \in K(||x||^{g,h,w,f,\mathbf{s}},w): \exists k,f' \langle g',k,w',f',\mathbf{r}\rangle \in [[A]](\{\langle l,\lambda,w'',f'',\mathbf{r}\rangle \mid w'' \in K(|x||^{g,h,w,f,\mathbf{s}},w) \;\&\; l = g \;\&\; f'' = f \cup \{\langle h,w\rangle\}\})\}$$ [11]

Variables must now be interpreted as follows:

$||x||^{g,h,w,f,\mathbf{r}}$ = [i] \$(h(x)(w)), if $x \in dom(h)$, else
… = [ii] d, if $\exists!R$: $\langle \$(k(x)(w')), R\rangle \in Acq(\mathbf{r},w')$ & $\langle \mathbf{r}, d\rangle \in I_w(R)$ & $\forall \langle m,v\rangle \in k(n)$ [12]:
$\langle ||x||^{g,m,v,\emptyset,\mathbf{r}}, R\rangle \in Acq(\mathbf{r},v)$, if $\langle k,w'\rangle \in f$ & $x \in dom(k)$, else
… = [iii] \$(g(x)(w)), if \$(g(x)(w)) is defined,
… = [iv] undefined otherwise.

We want to know how the variable x in the embedded clause of a formula like '$\exists x Ortcutt(x) \wedge Bel(r, spy(x))$' will be interpreted. Because according to Quine's story Ralph has never heard of the name Ortcutt, the first and third clause of the interpretation of variables are irrelevant. So, either it's established in the conversation that Ralph is acquainted with Ortcutt in one particular way, or what is expressed by the embedded clause is undefined. The variable x in the embedded clause will be interpreted as the individual that is a man with a brown hat in all

*accommodation.*

10 Not fully Lewisean, because we assume that the same individual can exist in different worlds, and thus allow for distinct but qualitatively indistinguishable possible worlds. For that reason we can assume that belief states are modelled by sets of possible worlds, and not by sets of world-agent pairs. We will assume that the agent itself exists in each possible world compattible with what he believes. For discussion, see Stalnaker (1981).

11 Where $\lambda$ is the empty assignment.

12 Remember that if $\langle g,k,w'\rangle$ is a possibility of the main context, k(*n*), where I assume that *n* is the greatest natural number used, will give us a set of world-assignment pairs representing the information presupposed in the main context.

worlds consistent with what Ralph believes as far as we know[13], if *we* only know (presuppose) that Ralph saw the man with the brown hat we know to be identical with Ortcutt. As Quine told the story, this belief attribution will be true in the actual world. On the other hand, the variable will be interpreted as the individual that Ralph saw at the beach in all worlds of the belief context, if *we* only know that Ralph saw the man at the beach we know to be identical with Ortcutt. As Quine told the story, in this conversational context the belief attribution will be false in the actual world, although in both conversational contexts Ralph has the same beliefs in the actual world. Finally, if *we* know that Ralph saw Ortcutt both as the man with the brown hat, *and* as the man at the beach, it will be predicted that no proposition is expressed by the embedded clause, and thus neither by the whole sentence.

Of course, the properties introduced by definites and indefinites have to be changed: they are no longer functions from worlds to sets, but instead agent-dependent functions from worlds to sets. We therefore redefine the abstraction $\hat{x}|\,A\,|^{g}_{h}$ as that function $f$ such that:

$$f(a,f,w) = \{d \in D \mid a \in \text{Agent} \;\&\; f \subseteq G \times W\text{: } [[A]]\,(\{<g,h[^{x}/_{<w,\{d\}>}],w,f,a>\}) \neq \varnothing\}.$$

Of course, if we no longer introduce relations between worlds and individuals, but more complex relations, the interpretation of individual variables has to be changed once again. We only have to change the clause for when a variable is interpreted as a descriptive pronoun:

…
$||x||^{g,h,w,f,a}$ = [iii] $(g(x)(<a,f,w>))$, if $(g(x)(<a,f,w>))$ is defined,
…

## 5. Hob Nob sentences again

Now we can finally explain how we would like to interpret Hob-Nob sentences that cannot be analysed as *de re* belief attributions about particular individuals, nor by assuming that the pronoun is an abbreviation recoverable from the embedded sentence of the belief attribution to Hob in the most straightforward way. In these cases, we propose, the pronoun is an abbreviation of a description, but a more complicated one than is normally assumed. Let's look at the Hob-Nob sentence again:

(1) Hob believes that a witch blighted his mare, and
Nob thinks she killed his sow.

Let us first say how we want to represent such a sentence, and only then discuss why we want to do so. We propose to represent (1) by

(1e) $\exists e P(e) \wedge Bel(h, \exists y[Cause(y,e) \wedge W(y)] \wedge BM(y)) \wedge Bel(n, KS(y))$

Using the Twin-Earth version of Edelberg's Astronomers example, we argued that at least for most cases a necessary condition for attributions of intentional identity is that the relevant beliefs of the agents must have its origin in the same object. But the beliefs don't have to be *de re* beliefs about a particular *individual*, the object that was responsible for both of their beliefs can be an *event*, too. As is always the case for *de re* belief attributions, *we* must presuppose a unique way in which each agent is acquainted with this event. We will assume that this is assured by the contextually given predicate *P* in the above formalisation (1e). This is as far as the *de re* account goes. But that's not far enough. The agents must each have a belief object that is somehow related to this event, and moreover, these belief objects must be related to this event in similar ways. How shall we account for that? It is here that descriptive pronouns become relevant. Both agents have a *de re* belief about an event, and they believe that one object, in the Hob-Nob case this is a witch, was somehow responsible for this event. On our account of the first conjunct of (1), a property is introduced. This property introduced

[13] If *c* is an element of the context C that represents the presupposition state, this set is $\cup\{K(r,c) \mid c \in C\}$. (cf. Stalnaker (1988))

by $\exists y[Cause(y,e) \wedge W(y)]$ is a function from the way the agent thinks about the denotation of e (let's denote that by 'e') to something like 'witch who caused e'. If we are in possibility <g,k,w',f,Nob> of the context of interpretation for the embedded clause KS(y) for Nob, and y is introduced in possibility <g',h,v,f'',Hob>, the extension of g(y) at <a,f',w> will be:

$$\{d \mid a \in Agent \;\&\; \langle d, \|e\|^{g',h,w,f',a} \rangle \in I_w(Cause) \text{ and } d \in I_w(W)\}.$$

Note that g(y) (Nob,f,w') will be {d}, if d obeys the above conditions in *w*'. Because $y \notin dom(k)$ and y is not introduced in the main context, the pronoun *she* represented by variable y can only be interpreted as a descriptive pronoun. If we presuppose that Nob believes that there is only one witch that caused the relevant event, e, $(g(y)(Nob,f,w')) will denote the witch that caused the counterpart of this event in w'. As a result, (1) is interpreted in the following way:

(1e') $\exists e P(e) \wedge Bel(h, \exists y[Cause(y,e) \wedge W(y)] \wedge BM(y)) \wedge$
$Bel(n, \iota v[\exists e\, P(e') \wedge Cause(v,e') \wedge W(v)] \wedge KS(v))$

Now, how does this analysis account for the asymmetry problem that cannot be solved by assuming that pronouns are pronouns of laziness? That is, how can we now handle the *mayor/ commissioner puzzle*, the asymmetry between (1) and (4)? The problem does not arise if it is assumed, as seems natural, that the relevant events w.r.t. which the concept is introduced for (4) and (1) are, respectively, the event where Nob's sow has been stabbed, and the event where Hob's cow has health problems. The asymmetry now simply follows from the fact that while Hob believes that the one who stabbed Nob's sow also blighted his mare, Nob does not believe that the witch who is responsible for the health problems of Hob's cow also killed his sow.

## 6. Afterthoughts

The above account suggests that there is a special intentional identity *reading* of anaphora, that anaphoric pronouns are *ambiguous* between *de re*, *de dicto* (E-type), and intentional identity readings. However, we feel that this is not really so. Rather, we have the impression that the literal reading of any cross-attitude anaphor is *de re*, and all other readings only become available if there is reason to rule out this literal reading. Inspection of the above examples, as well as other cases discussed in the literature, shows that they only seem to work fine when accompanied by a longer text setting up the background that eliminates all unwelcome reading. E.g., it seems to us that the most straightforward understanding of (1) involves a descriptive (E-type) pronoun standing for *the witch that Hob believes to have blighted his mare*, which is explicitly ruled out by our assumptions about *s**. The *de re* reading is also possible but less likely given the fact that witches are mythical beings. But the intentional identity reading is rather remote and only arises once the full story has been told. But if it were merely one of several possible readings, it would be hard to explain why one does not think of it if the sentence is uttered out of the blue, as the beginning of a (different) story. The point is even more obvious when we consider everyday situations in which both E-type pronominalization and intentional identity would make a lot of sense but still only seem to be possible once the *de re* option is out. Consider, e.g., the case of a book missing from the library. It seems to us that (10) says that John and Mary have a suspicion abut the very same person (*de re*):

(10) John believes that an undergraduate took out *War and Peace* and Mary thinks that he will not return it before next month.

But, then, *given* the information that John and Mary do not know any undergraduates but have a general prejudice that, say, undergraduates are into Russian literature and slow readers, various descriptive readings of (10) become more plausible. If this is so, one may speculate how the non-literal readings are derived from the literal ones, given that the latter are impossible or implausible, and why certain other understandings (including some of the construals above) are apparently unavailable as interpretations of anaphoric relations. Why is it, e.g., that

a Twin Earth version of Edelberg's astronomer story makes (10) false on any reading whereas, on the original cold war version, (10) can be saved? These are certainly interesting questions for further research in formal pragmatics; but we will have to leave them open.[14]

**Appendix: Intentional identity for the one agent case**

Until now we have ignored intentional identity attributions with only one agent involved. How could we account for these cases, and how can this be combined with our above proposal with more agents involved? According to Stalnaker's (1987) diagonalisation strategy, we should not ask what is referred to by a referring expression in the actual world, but what a referring expression would refer to if the embedded sentence was uttered by the speaker in worlds that are, as far as we know, compatible with what the agent believes. On the assumption that indefinites are referring expressions, this means that the indefinites should be interpreted directly in these possible worlds. We believe this is the intuition that Saarinen (1978) tried to account for in the game-theoretical framework. Still, the fact that a new object has become available for reference in the possible worlds compatible with what the agent believes has nothing to do with the belief state of the agent himself, it is only a fact about the conversation that is taking place in the actual world (whichever that is). We believe that the modal subordination account of Geurts (1995) successfully captures both intuitions. The idea is that modal statements set up indexed information states and that we can refer back to those information states by anaphoric means. The indexed information states represent the information contained in the embedded clauses of attitude attributions. Just like an original CCT information state, these states are modelled by sets of tuples. If we are in possibility <g,h,w> of the main context and the belief context grows, the assignment-function *h* grows, too, because a new *propositional discourse referent* is introduced. The enriched assignment function assigns to the newly introduced propositional discourse referent the context–dependent information expressed by the embedded clause. From now on, formulas that represent modal sentences will have two extra indices, one of which refers to the information state it anaphorically refers back to, the other will refer to the information state it introduces itself. Thus in '$Bel^{p}_{q}(x, A)$', p refers back to an earlier information state, and q is the information state it sets up. We will assume that K(h(x),w) is a set of possible worlds, and W the expected function, $W(S) = \{w \in W: \exists g,h: <g,h,w> \in S\}$. The above formula will be interpreted as follows:

$$[[Bel^{p}_{q}(x, A)]] (S) = \{<g,h',w>: \exists h: <g,h,w> \in S \;\&\; K(h(x),w) \subseteq W([[A]] (g(p))) \;\&\; h[q]h' \;\&\; h'(q) = [[A]] (h(p))\}$$ [15]

This approach can handle intentional identity cases when one agent is involved in a very satisfactory way[16].

If we now want to account for both kinds of intentional identity relations, our proposal is simply to combine the modal subordination account of Geurts with our suggestion. This results in the following interpretation rule for belief attributions:

$$\begin{aligned}[[Bel^{p}_{q}(r, A)]] (S) = \{&<g',h',w,f,\mathbf{s}> | \exists g \subseteq g': \exists h \subseteq h': <g,h,w,f,\mathbf{s}> \in S \;\&\\ &\forall w' \in K(||x||g,h,w,f,\mathbf{s},w): \exists k',f': <g',k',w',f',\mathbf{r}> \in\\ &[[A]] (\{<l,k,w'',f'',\mathbf{r}> | <k,w''> \in h(p) \;\&\; l = g \;\&\; f'' = f \cup\\ &\{<h,w>\}\}) \;\&\; h[q]h' \;\&\; h'(q) = \{<k',w'> | \exists x,y,z: <x,k',w',y,z> \in\\ &[[A]] (\{<l,k,w'',f'',\mathbf{r}> | <k,w''> \in h(p) \;\&\; l = g \;\&\; f'' = f \cup \{<h,w>\}\})\}\}\end{aligned}$$

14 We would like to thank the following friends and colleagues for helpful comments and discussions: Robin Cooper, Anette Frank, Hans Kamp, Ruth Kempson, and Stephen Neale.

15 For formal details, see Geurts (1995).

16 Of course, the modal subordination account by itself cannot solve the problem posed by intentional identity attributions with more agents involved. It gives rise to the same problems as the E-type approach.

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