

Overlaying Contexts of Interpretation

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Abstract

The paper proposes a theory of the context of interpretation that is always an information state with some extra structure. It departs from existing models in going for uniformity and in the way uniformity is achieved: the context is the local context together with as much of the embedding context as can be added without losing consistency. The paper gives a formalisation, shows a number of applications of this idea and expands on the connection between this idea of the context and intentional identity.

1 Introduction

Counterfactuals have long been a challenge to the conception of truth-conditional semantics. It is not easy to give a truth-conditional account and the ones that have been given are controversial (Lewis (1973) and Kratzer (1981)).

In this paper, counterfactuals are properties of information states. A given information may support a counterfactual or not. For this, information states must come with two mechanisms: the possibility of adding new information to the state, even if that information is in conflict with information already in the state, and, second, a relation \models between the state and formulas expressing that the information expressed by the formula is contained in the information state. It is then possible to define:

A counterfactual $A \rightarrow B$ is supported by an information state IS iff $IS+A \models B$.

If this is all there is, the assertion of a counterfactual in a conversation only gives information about the speaker: she could not have found out that A without having to assume B . The hearer cannot just add the counterfactual if her information state lacks that property. But the hearer can ask the speaker for explanation. In this respect, it is rather like the assertion of an

epistemic possibility: it only gives information about the speaker. And one may need an explanation of why the speaker does not rule out the possibility. Counterfactuals are related in a fundamental way to human cognition. It is possible to add conflicting material to an existing information state. This is fundamental in our vision where the background is stable and new (almost by definition conflicting) information is flowing in at the changing focus. It is fundamental in the knowledge of our environment that is changed only by our current experience. It is fundamental in language understanding¹, where secondary contexts conflicting with the primary context can be brought in by negations, modal statements, belief reports, plans and others. The claim of this paper is that these contexts exist as temporary revisions of our primary context.

But the paper is really making a claim about contexts of interpretation. It is the claim that even under operators like negation, belief, supposition and others, the context of interpretation is a single information state. The information states may have a foreground-background division which allows the definition of updates for logically complex information and a definition of presupposition accommodation, but it is still a determinate question what objects and facts there are in the context. Early theories of context like Kaplan (1989) had the uniformity property. The insight of Karttunen, Stalnaker, Heim and Kamp that these contexts could be replaced by the information state under construction has the uniformity property only for the simple cases. It is high time to restore this property, because it simplifies thinking about anaphora and presupposition and is able to shed light on a number of open puzzles.

I will model the non-monotonic merging of two information states by combining Hans Kamp's Discourse Representation Theory with an operation invented by Gerald Gazdar: satisfiable incrementation Gazdar (1979). The paper first explains the problem, then sketches its solution and then goes into the puzzles.

2 Happy and Unhappy Updating

Basic DRT Updating is given by the following definition.

$update(K, S) = K \cup \{S\}$ if S is atomic or a discourse referent and $K \cup S$ is consistent.

¹It is tempting and correct to see a relation with topic and focus expression in natural languages. The intonation of English corrections maps very precisely to the proposal in this paper, other cases can be related to foreground and background as in vision.

$update(K, S \text{ and } S_1) = update(update(K, S), S_1)$

$update(K, \text{not } S) = K \cup \{\neg update(K, S) \setminus K\}$

$update(K, \text{if } S \text{ then } T) = K \cup \{update(K, S) \setminus K \rightarrow update(update(K, S), T) \setminus update(K, S)\}$

A fuller system is obtained by adding rules for articles (no, every, the, a(n)), relative clauses, generalised quantifiers, and tenses.

Within this fragment, there are the following uniformities, uniformities that give content to a notion of “happy updating”.

- a. Accessibility of discourse markers coincides with being a discourse marker of the context of interpretation.
- b. Presuppositional satisfaction (\sim resolution) is truth in the context. Presupposition accommodation leads to truth in the context.
- c. All contexts are consistent.

The last condition follows from the update condition for atomic formulas. Inconsistent contexts cannot play the role of contexts for disambiguation and resolution because any reading would be equally inconsistent and any discourse referent or fact would hold. So contexts of interpretation must have at least one model.

But one does not need to look far to find problems for this idyllic picture: unhappy updating.

1. Accommodation is adding the presupposition to its trigger’s context and gives local accommodation only. This conflicts with the literature, in which global accommodation is the default. (Accommodation Problem I)
2. If global accommodation is inconsistent so is local accommodation: the local context is always an extension of the global context. The literature lets local accommodation save the day if global accommodation is inconsistent. (Accommodation Problem II)
3. Correcting negation. These are inconsistent updates
4. Counterfactuals seem to involve inconsistent temporary updates
5. Beliefs and other attitudes/intensional operators. There can be overtly false beliefs and overtly impossible desires. They can be ways the world could have been which do not obtain.

Accommodation problem I

There is no full consensus about accommodation, but it would be simplest if it were just the minimal adaptation of the context that makes the use of the trigger felicitous. This gives a problem known since Karttunen: a systematic prediction of weaker accommodations than are observed. In fact,

the criticism of Gazdar (1979) on Karttunen's contribution Karttunen (1973), Karttunen (1974) problems, Heim's alternative to Karttunen Heim (1983) and a recent critique by Geurts Geurts (1996) of the "satisfaction theorists" all stem from this difficulty.

Without claiming to understand why NL treats presuppositions in this way, one wants to be able to formally recapture Heim's solution for the happy fragment. This can be done by putting some extra structure over the incoming contexts by giving them a foreground/background structure. Some K s may be written as K_1 **over** K_2 with K_1 the foreground and K_2 the background. The **over** -operation allows structured DRSs of the form K_1 **over** K_2 and inverse operations *foreground* and *background*.

$$K = \text{foreground}(K) \text{ over } \text{background}(K)$$

One can then define accommodation as directed to the background.

$\text{acc}(A, K) = \text{foreground}(K) \text{ over } \text{acc}(A, \text{background}(K))$ if
 $\text{foreground}(K)$, $\text{background}(K)$ and $\text{acc}(A, \text{background}(K))$ defined,
 otherwise:

$\text{acc}(A, K) = \text{update}(\text{foreground}(K), A) \text{ over } \text{background}(K)$ if
 $\text{foreground}(K)$, $\text{background}(K)$ are defined and $\text{update}(\text{foreground}(K), A)$
 is consistent.

Otherwise:

$\text{acc}(A, K) = \text{update}(K, A)$ if $\text{update}(K, A)$ consistent and
 $K \neq K_1 \text{ over } K_2$.

Accommodation is accommodation in the background, but if that leads to inconsistency, it can be done in the foreground (if that is consistent). It is standard update if there is no foreground or background and the update maintains consistency. Otherwise, it is undefined.

Accommodation problem II

If a statement is inconsistent with the background of a context, it is inconsistent with the context. This means that the normal way of explaining local accommodation in the face of a preference for global accommodation is not available. It will never fire.

The solution is to define the problem away, and I will do that. But the motivation for the definition that deals with this problem has to do with inconsistent updates, i.e. the three remaining problems.

Correcting negations

- (1) There is no king of France, so the king of France is not bald.
 Santa Claus does not exist.

The second conjunct in the first example presupposes that there is a king of France, while the first conjunct negates it. Proceeding as up to now adds the presupposition to the global context and makes it inconsistent. But the same happens when it is added to the local context — which is an extension of the global context.

In the second example, the sentence itself denies its presupposition: that there is someone called Santa Claus. Addition to the global context is therefore not an option. But the local context is just an extension of the global context and therefore just as inconsistent.

It can be argued that these sentences are not really negations but denials or that they contain a special negation with different properties from the normal one. That may be so, but a uniform analysis would be preferable. Under these interpretations, the sentence (with its negation operator) are corrections of the corresponding positive sentences uttered (or implied) by the other interlocutor.

- (2) The king of France is bald.
Santa Claus exists.

In fact, all corrections have that problem.

- (3) No, Bill did not eat the cake.
No, Bill ate the cake.

Another construction with the same problem is the proof by *reductio ad absurdum*.

- (4) Suppose that A. Then not A. So not A.

How can one suppose that A if A is a false mathematical statement? How can one maintain a consistent context with a necessarily false statement? Notice however that corrections and proofs contain anaphora and presupposition triggers that presumably have to be treated in the same way as always. A related and similar construction is the counterfactual. It is similar to the conditional but it is distinguished from the indicative conditional by the fact that its condition can not be added consistently to the context (and by special tense and modal markers that seem to mark that this is the case).

Belief

But the worst problem for happy updating are attitude sentences.

What is the context of interpretation for the complements of such sentences?

There are four options.

1. the context is empty
2. the context is the embedding DRS
3. the context is the Kamp/Heim/Zeevat/Geurts² context given by everything that according to the embedding DRS the belief subject believes
4. the context is 2. merged with 3.

The first solution is not able to deal with anaphora and presupposition in the complement sentence, solution 2 is not able to deal with presupposition triggers that are bound by other beliefs of the belief subject, solution 3 with anaphora that take antecedents in the embedding DRS or with presuppositions bound by material in that DRS. The only solution is 4, but the subject may well have beliefs that conflict with material in the embedding DRS, so that 4 would be an inconsistent context. None of the 4 solutions is viable.

Indeed belief contexts —more than any of the other cases— seem a reason to give up on having a uniform context of interpretation and to move to something more complex, like a stack of contexts, an accessibility path or something similar. There is nothing wrong with either option from a mathematical point of view but it replaces the natural picture of a context as an information state by something that does not make intuitive sense.

Solution

How to solve this? My claim is that the second accommodation problem, the downdate problem, and the belief problem can be solved uniformly by giving the following interpretation to the foreground/background structure.

The new interpretation is an application of Gazdar's satisfiable incrementation operation: K_1 **over** K_2 denotes the set K_1 satisfiably incremented with K_2 . This operation is a kind of default unification: K_1 gets priority and is entirely preserved by satisfiably incrementing it with K_2 . But only those parts of K_2 are added that do not give rise to inconsistencies. If K_1 is

²The first place where this is found is Heim (1992) where it is attributed to Kamp. In Zeevat (1992) it is split into a context preparation and a context insertion rule. Geurts (1999) develops the same notion in pure DRT using presupposition resolution.

consistent, so is K_1 satisfiably incremented by K_2 . If $K_1 \cup K_2$ is consistent, K_1 satisfiably incremented by K_2 is $K_1 \cup K_2$.

Gazdar's satisfiable incrementation³:

$K \cup ! K_1 = K \cup \{A \in K_1 : \neg \exists K_2 \subseteq K \cup K_1 : K_2 \text{ is consistent and } K_2 \cup \{A\} \text{ is inconsistent}\}$

I want to maintain that the choice for combining Gazdar with DRT is a healthy one. DRT breaks down semantic material to atomic level whenever it can and so the granularity of the formulas to which Satisfiable Incrementation is applied is nonarbitrary⁴.

The choice for Kamp and Gazdar is not essential. Any successful approach to defaults leads to a solution (and there may be ones that lead to improvements with respect to counterfactuals).

3 Contexts of Interpretation and Updates

Presupposition

Certain inputs A are presupposition triggers which means that the triggered presupposition should be available in the context, either in the foreground or in the background.

The presupposition needs to be developed and this can be done as follows:

$K_1 = foreground(update(1 \text{ over } K, P))$

K_1 now is the DRS corresponding to P . The background K_2 is the new context deriving from K in which accommodations can have taken place.

$pres(K_1, K_2) = K_2$ if $K_2 \models K_1$ otherwise

$pres(K_1, K_2) = foreground(K_2) \text{ over } pres(K_1, background(K_2))$ if $foreground(K_2)$, $background(K_2)$ and $pres(K_1, background(K_2))$ are defined, otherwise

$pres(K_1, K_2) = update(foreground(K_2), K_1) \text{ over } background(K_2)$ if $foreground(K_2)$ and $background(K_2)$ are defined and $update(foreground(K_2), K_1)$ is consistent, otherwise

$pres(K_1, K_2) = K_1 \cup K_2$ if $K_1 \cup K_2$ is consistent.

³The following is a slightly more semantic definition. Let K_1 and K_2 be consistent sets of formulas.

$Mod(K_1, K_2) = \{M : M \models K_1 \wedge \exists Y \subseteq K_2 (M \models Y \wedge \forall Z (Y \subseteq Z \subseteq K_2 \rightarrow \neg \exists M' M' \models K_1 \cup Z))\}$

$K_1 \cup ! K_2 = \{\varphi : Mod(K_1, K_2) \models \varphi\}$

⁴Gazdar's application of the operation depends on the precise syntactic identification of the pre-suppositions. E.g. *Sue is a bachelor or a spinster* should presuppose that Sue is unmarried, but it does not if one stipulates that spinster and bachelor have conjunctive pre-suppositions: *x is adult and female, x is adult and male*

The full update with the trigger A with presupposition P on K is given by:

$$K_1 \text{ over } K_2 = \text{update}(1 \text{ over } K, P) \\ \text{update}(A, \text{pres}(K_1, K_2)) \text{ if } \text{pres}(K_1, K_2) \text{ is defined.}$$

I am here not taking account of other restrictions on accommodation such as Van der Sandt's condition on bound variables Van der Sandt (1992), and not of the unification of variables on resolution and the side effects that that generates. It is not difficult to deal with these, but their treatment is not relevant for the issues addressed in this paper.

The happy part of the system can remain as it is. Monotonic updates are just updates of the background and fail if they reach an inconsistency. Updating K over K leads to the same result as updating K . The general format of non-monotonic updates is updating 1 over K monotonically. The conflicting information in K then becomes invisible behind the new information in the foreground. The choice of 1 (the state of no information, the empty DRS) is correct for corrections, suppositions and counterfactuals. Operators like *belief*, *would* and particles like *then* pick up non-factual contexts (other beliefs, contextually evoked possibilities) that can be loaded "over" K .

Belief update

$$\text{update}(K, \text{believe}(x, S)) = \{B(x, K_1 \setminus \text{bel}(x, K))\} \cup K_2.$$

where K_1 and K_2 are given by:

$$K_1 \text{ over } K_2 = \text{update}(\text{bel}(x, K) \text{ over } K, S)$$

This is a monotonic update of x 's beliefs (with possible side effects in the background). $\text{bel}(x, K)$ collect the beliefs of x in K and is defined in Geurts (1999) or Zeevat (1992). It is possible to generalise this to non-monotonic corrections of x 's beliefs.

Desire update

$$\text{update}(K, \text{want}(x, S)) = \{W(x, K_1 \setminus \text{want}(x, K)), B(x, K_2 \setminus \text{bel}(x, K))\} \cup K_3 \\ K_1 \text{ over } K_2 \text{ over } K_3 = \text{update}(\text{want}(x, K) \text{ over } \text{bel}(x, K) \text{ over } K, S)$$

This update uses the idealisation that desires are consistent among themselves. It implements Karttunen's observation that presuppositions triggered in desires can be resolved to other desires and to beliefs of the same subject, as well as to the global context. The treatment can handle the resolutions needed for (5).

- (5) John wants to marry a Swede and he wants his wife to be rich.
 John believes he has a rich aunt and he wants to inherit her money.
 John has a rich aunt. He wants to inherit her money.

Counterfactual update

$update(K, \text{If were } S, \text{ would } T) = K_4 \cup \{(K_1 \text{ over } K_2) \rightarrow K_3\}$ where
 $update(1 \text{ over } K, S) = K_1 \text{ over } K_2$ and
 $update(K_1 \text{ over } K_2, T) = K_3 \text{ over } K_4$

Conditional update

$update(K, \text{if } S, \text{ then } T) = K_4 \cup \{(K_1 \text{ over } K_2) \rightarrow K_3\}$ where
 $update(K \text{ over } K, S) = K_1 \text{ over } K_2$ and
 $update(K_1 \text{ over } K_2, T) = K_3 \text{ over } K_4$

I treat both conditionals as similar as possible here: they both get coded into the DRS by a syntactic structure that remembers the context of the antecedens. In this way today's conditional may become tomorrow's counterfactual, after it has become clear that the circumstances that were possible today cannot occur anymore. Conditionals and counterfactuals may cease to be true when new information comes in. In this way, (6a) can become first (6b) and then (6c).

- (6) a. If John goes to the party, Mary goes too.
b. If John went to the party, Mary went too.
c. If John had gone to the party, Mary would have gone too.

I would like it to be the case that $A \text{ over } K \models B$ is the correct condition under which K supports a counterfactual "If were A, then would B". Not quite, since the rule does not yet say anything specific about the "counterfactual" aspect. But this can be done: one can demand that $K \models \neg A$. If the first condition holds but not the second, K supports the indicative conditional "If A then B"⁵.

Non-monotonic negation

$update(K, \text{not } S) = K_2 \cup \{\neg K_1\}$

where

$update(1 \text{ over } K, S) = K_1 \text{ over } K_2$

Correction with S would be the sequence of updating $1 \text{ over } K$ with S and then reverting to $K_1 \text{ over } K_2$ where $K_1 \text{ over } K_2 = update(1 \text{ over } K, S)$.

Reductio ad absurdum starts with a statement: suppose that A. This can be represented by updating A on $1 \text{ over } K$. (It does not need to lead to a

⁵There is a problem with having conditional updates: they do not seem to serve a purpose. Space prevents me from a full discussion here

proof, one can suppose for fun). Even if A is necessarily false, 1 does not have the axioms to derive absurdity. The proof consists in monotone updates of the foreground with material from the background until the point that absurdity can be derived. This establishes $\neg K_1 \setminus K$ and makes $K_1 \setminus K = \{A\}$. A bare supposition can be terminated by reverting to the background.

4 Interface with natural language

Conflicts with the background are marked by a number of devices, like the subjunctive mood, the past tense, negation, suppose, correction intonation and denial markers.

They are straight cases of context marking in the sense of Zeevat (2003), a linguistic rule that marks an expression iff its content bears a certain relation to its context. A marker differs from a presupposition trigger in that its occurrence is obligatory and in not allowing accommodation. Both can be resolved to the context (the context marker must be under Gricean meaning_{nn}) and so seem to play a similar role in interpretation.

In this case, there is a relation of inconsistency between the context and the content of the current utterance and there is a rule of language that forces it to be marked. The effect of the marking rule is that the speaker can be assumed to give consistent information when there is no marking and to allow the safe expression of inconsistent information.

It is possible to explain two uniformities using this account of contexts. The first is the similarity in form between (some) corrections and negations. A successful correction entails a true negation that is no longer a correction.

- (7) A (at time t): No, JOHN did not eat the cake.
B (later): John did not eat the cake.

One can think of the negation operator as a semantic bleaching of the corrective context marker: the correction implies the falsity of what is denied and marks that the context entails it. In an ordinary negation only the implication of falsity is retained and the context marking aspect has disappeared. It is interesting that there is no formal separation between the negation and the correction marker in the languages I know. This means that in interpreting a "not", the hearer is always forced to search for something that it might correct and —where nothing is found— to come up with a mere suggestion or expectation that can be corrected by the negation.

Something similar is going on with counterfactuals and indicative condition-

als. Counterfactuals are marked conditionals, twice marked in fact, once by the subjunctive past tense in the antecedens, once by the "would" in the consequens.

5 Overlays and Presupposition

There is one serious difference in what this account of context predicts and what happens in Van der Sandt's theory of presupposition. Van der Sandt uses the standard notion of accessibility in DRT and lets a presupposition trigger to be bindable from any accessible DRS. In our terms this would be identical to interpreting the **over**-operation as set union and using for resolution not the relation \models but the weaker notion of \subseteq (perhaps after closure by some mild conceptual inference, e.g. allowing an explicit inference from "John is married" to "John has a wife").

We get a restriction on the set of possible antecedents for presupposition triggers because of the impossibility of having simultaneously $K_1 \text{ over } \dots \text{ over } K_n \models p$ and $K_1 \models \neg p$. Information that is available in the background can be blocked by conflicting information in the foreground. This gives a restriction on resolution:

Prediction: *there is no resolution to material in the background if it is blocked by conflicting information in the foreground.*

The examples are really hard to tell.

- (8) ?? It is raining. John thinks that it is sunny and that Bill thinks that Mary regrets that it is raining.
 ? Jane has a niece, but Harry thinks that she has not but he accepts that she really believes that her niece will visit her next week.

These examples have the problem that the resolution may be blocked but that new accommodation may take place. The following examples use "too" and "again", because accommodation is not a possibility there.

- (9) #/?? Jane has been to Spain before, but Harry believes that she has made that up and also that she will go there again next week.
 #/?? Jane has been to Spain, but Harry does not believe that and believes that Mary has been there too.
 John may come. Mary will come too.
 #/?? John may come, but I doubt it. Mary will come too.

And, indeed, they seem worse. Suppose that John has seen my brother Tim fall on the street.

(10) John thinks that Tim/he/my brother is wounded.

John can be aware that my brother is called Tim, or can know that I have a brother. But it can also be the case that, for John, my brother is a stranger, or even that he can falsely believe that I have no brother or that nobody has the name Tim. In the last case, the presupposition cannot be resolved in its entirety: only the discourse referent is available. The second case is not a matter of blocking.

(11) #John thinks that I have no brother and that my brother is wounded.
John thinks nobody is called Liba and that Liba will visit us tonight.

6 “Huitink’s paradox”

Consider the following example⁶.

(12) Mary wants me to eat pizza again.

I say (12) to you in a context where Mary is unaware of the fact that you and me had pizza yesterday. Mary and me agreed to meet soon, but I am not so fond of pizza that I will agree to her plan of going for some more of it when we meet. And you know all of this.

The problem is how you can represent the information you take from my utterance and in particular the presuppositional information associated with “again”. Conventional wisdom has it that “again” presupposes another event of the same kind as the one described in the clause in which “again” occurs which happened before it. In this case it is an event of the kind “I eat pizza” and the antecedent is clear: it is me having pizza with you yesterday evening.

The problem is where my two pizza dinners precede one another. There are two subDRSs where this might happen: Mary’s desires (or her beliefs) and the common ground between me and you. The first context does not contain yesterday’s pizza eating, since Mary does not know about it or want it. The second context does not contain my pizza eating with Mary, because you and

⁶I owe these examples to the master’s thesis of Janneke Huitink, but the following is my version and she does not agree that it is a paradox or with the conclusions I draw from it. For her position, see van der Sandt and Huitink (2003)

me agree it is not going to happen. So neither of them can have a condition to the effect that $e < e'$. And there is no other subDRS where a condition of this kind may be inserted.

On the context notion that I have been developing in this paper, there is no problem. The relevant context is Mary's desires **over** Mary's beliefs **over** our common ground. It contains both pizza eatings and (desire is future oriented) entails that yesterday's pizza is before the pizza with Mary. On the account in Zeevat (2003), "again" is a context marker and is obligatory here because another pizza eating of me is reported in a context that contains an earlier occasion.

van der Sandt and Huitink (2003) propose a distinction between events and their temporal locations (also necessary for some aspects of the treatment of tense and aspect) and propose that "again" has two presuppositions: one of the existence of the other event and one of the ordering of their temporal location. Space restrictions prevent me from discussing this fully. I will just note that it does not deal with corresponding problem with *too* like the following.

You are off to Spain, but Mary does not know you or your plans, and just talked to me on the phone.

(13) Eh, that's funny. Mary dreamt that she met somebody who wants to go to Spain too.

We can assume that Mary's dream was not about a real person. The received wisdom is that *too* (with the right intonation on the sentence) presupposes that somebody else did the same.

Now again it is clear that you are the other person going to Spain but unclear where in the DRS you are distinct from the person Mary dreamt about. You are not part of Mary's dream and the person Mary dreamt about is not part of the common ground. Again, it is clear that on the notion of context developed in this paper, the problem largely goes away. On Mary's dream **over** Common Ground, there is both you and the person Mary dreamt about and Corblin (2002)'s observation that DRs are distinct by default, the context entails the distinctness of the two objects. If *too* is a context marker, it follows that *too* is obligatory here.

The theory of contexts of this paper should answer an important question: the context I defined supports the presuppositions of *again* and *too*, but they disappear after the interpretation of the expressions that give rise to them. There is no representation of the temporal ordering of the events or of the distinctness of the objects that survives the interpretation process. What

remains in the information state of the presupposition?

I think nothing remains. The information state just supports certain counterfactuals like the following (14).

- (14) If Mary's plan for having pizza were to come true, it would be after yesterday's pizza dinner.
If Mary's dream were true, it would not be about you.

It is possible, but not necessary, to store these counterfactuals in the information state. Presumably, they should not be. It is—in the view of this paper—resolution and not accommodation, so no traces should remain.

7 Conditional Identities

Contexts and counterfactuals are also a sensible approach⁷ to the Geach sentences about Hob and Nob and to Edelberg's counterexamples to all existing treatments of the Geach sentence (and a serious improvement on Edelberg's own solution).

These examples are all of the form *a* thinks *A* and *b* thinks *B* with anaphora going from *A* to *B*. My claim is that in all cases the right predictions are obtained by claiming that they presuppose an information state *K* that supports "if what *a* thinks were true *A* would refer to an object *x* and *b*'s belief *B* would be about the same object *x*."

The following is a version of Geach's Hob-Nob sentence.

- (15) Hob believes that a witch poisoned his cow.
and Nob believes that she blighted his mare.

If Hob's belief that a witch_{*i*} poisoned his cow were true, Nob would believe that that she_{*i*} blighted his mare.

Now the literature contains many explanations of how information states could be such that they support this counterfactual. Hob may have told Nob about his belief, there may be a rumour in the village about a witch that has played a causal role in the formation of Hob's and Nob's beliefs, there may be an article in the local newspaper that Hob and Nob have each read. If one of those explanations is true, then, if Hob were right, Nob would have

⁷The connection of intensional identities with counterfactuals was the joint conclusion of Paul Dekker and me in a discussion some years ago. But we did not know how to exploit this insight, it seemed an obvious case of *obscurum per obscurior*.

a belief about the very witch that Hob believes poisoned his cow.

Edelberg (1992) gives a number of examples that show that communication processes as usually assumed for the Hob-Nob sentence are not necessary for intensional identities. This is just one.

Arsky and Barsky

Context: Arsky and Barsky are investigating the purported murders of Smith and Jones. In fact, their deaths were accidents, but they do not believe this. Arsky thinks two distinct persons killed Smith and Jones, Barsky thinks the same person killed both Smith and Jones).

(16a) is a correct report but not (16b).

- (16) a. Arsky thinks that someone killed Smith and Barsky thinks he also killed Jones.
- b. Barsky thinks that someone killed Jones and Arsky thinks he also killed Smith.

The counterfactual analysis gives the following two counterfactuals.

- (17) a. If somebody killed Smith, Barsky thinks he killed Jones too.
- b. If somebody killed Jones, Arsky believes he killed Smith.

It is obvious that the information state of somebody who has grasped the context given by Edelberg supports the first counterfactual but not the second. Arsky does not believe at all that the killer of Jones killed Smith.

This connection is interesting, but there is no semantic reason why the content of Hob's belief should be loaded over the information state. Nob's belief could just be added to the context to which Hob's belief was added.

It may well be that the pronoun itself makes it necessary to do that. One can resolve a pronoun to an antecedent in a suggestion S , but only by changing the context of interpretation K to $update(1 \text{ over } K, S)$. Without that, it is as DRT has it: the antecedent is not accessible. And if the suggestion is temporarily added, the context supports the counterfactuals when it contains one of the relevant explanations.

So if the pronoun triggers this change of context, one obtains an almost trivial account of intentional identity. And quite the same holds for modal subordination.

- (18) A wolf might come in. It would eat you first.

The account could be generalised to particles which as noted in Zeevat (2002) also take suggested antecedents. There is only one thing missing. It is not correct English to replace the pronoun in the Geach-sentence by a full NP (e.g. the witch that poisoned Hob's cow) independently of the fact that it probably does not get the correct reading: in a position like that the pronoun is obligatory. This suggests that the context of interpretation (in its other aspect of context of generation) must —perhaps only as a live option— always contain the suggestion to trigger the anaphora or the other forms of context marking.

8 Conclusion

I have made the case for uniform contexts of interpretation. It is a solution to a problem inherent in the work of Kamp and Heim (Kamp (1981), Heim (1982)): to give a non-technical account of accessibility that generalises to belief contexts, counterfactuals, negations and corrections. The semantic account of accessibility in Zeevat (1989) or in Groenendijk and Stokhof (1991) only works for what I called happy updating, the account in this paper generalises the solution to the unhappy cases. The account solves some problems in Zeevat (1992). It also gives the kind of account of context that is necessary to make sense of context marking as discussed in Zeevat (2003) and in particular gives the solution to some interesting counterexamples to that account due to Marie Safarova. The last two sections gave some further applications of the context. My main conclusion is that the concept of a context of interpretation as a simple information state (with internal structure) can be maintained and that it is helpful not to give up on this intuitive conception in favour of unintuitive mathematical constructions. To my surprise, non-monotonicity is not much an extra complication. I also think the application to non-standard anaphora is a considerable step forward with respect to the various accounts in the literature, both in terms of conceptual economy and in terms of uniformity, if one compares them with Roberts (1989), van Rooy (1997), Edelberg (1992) or Zeevat (2000).

I do not see it as my mission in life to come up with a new semantics for counterfactuals, but I would still welcome a less syntactic approach to my **over** -operation. One conclusion can be drawn from this new approach to contexts and its applications. Too much theoretical effort seems to have been directed towards theories that explain why a certain counterfactual is true, e.g. in trying to formulate solutions to the Geach examples. In a dynamic semantics, it may suffice to note that the context of evaluation may just

support certain counterfactuals that one needs for the explanation of what is going on, without a formal statement of the underlying causal connections. A further elucidation of that causal order, especially for the semantic causality that seems involved, would be of considerable philosophical importance but does not really seem to be required for the linguistic analysis.

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