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A Dynamic Approach to the Discourse Level Sensitivity of Discourse Markers

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1 Introduction

In this paper, we extend the dynamic treatment of discourse markers (DM) introduced and motivated in (Jayez & Rossari 1998) to address the general problem of the discourse level sensitivity of DM. We first recall the main motivations for adopting a dynamic approach in section 2. Then we show why and how this approach must be enriched to take into account the discourse level sensitivity of DM (sections 3 and 4).¹ In essence, we propose that the ‘connective glue’, which is responsible for the connective power of DM, is a complex set of constraints on the rules and semantic types which are ‘seen’ by the various DM. This allows one to capture more fine-grained aspects of discourse level sensitivity.

2 Basics

The intuitive idea behind virtually any form of dynamic semantics, including Heim’s file semantics, Kamp’s DRT and Asher’s SDRT, Groenendijk and Stokhof’s DPL, van Benthem’s arrow logic and Veltman’s update logic, is summarized in (1)

- (1) **Dynamic Semantics Wisdom** Expressions denote transitions between states or situations, not just states or situations.

The adaptation of (1) to the case of DM gives (2).

- (2) **Dynamic DM** A DM is a constraint on two transitions between information states or situations.

Usually, the transitions themselves are *updates* in the sense of Veltman (1996). Updating an informational state s with p succeeds only if p is consistent with the information in s . For instance, an assertion S is viewed as an update of some s with the content of S . In addition to information states and updates, there

are common sense rules R , which are used by DM to check the satisfaction of the constraints they impose on the updates.² Consider the French *donc* (\approx therefore). A discourse of form S *donc* S' is appropriate w.r.t. some information state s only if the rules R warrant that whenever s is successfully updated with the content of S and becomes s' , s' can be successfully updated with the content of S' : if $s + cont(S) = s'$, then R entails that $s' + cont(S')$ succeeds. An update succeeds iff the resulting state is not the empty set \emptyset , that is iff the update does not create any inconsistency.

A DM like *de toute façon* (\approx anyway) is appropriate only there exists some proposition p such that updating s with S necessarily leads to a state s' where p holds and revising s' with the negation of S and updating the result with the content of S' necessarily leads to a state s' where p holds again. E.g., a discourse like (3) makes sense for $p =$ ‘John couldn’t deliver his speech’. If we update the current information state with the fact that John could not come to the meeting, certainly he could not deliver his speech on that occasion. Withdrawing the fact and updating with the fact that the meeting was cancelled secures the same conclusion again.

- (3) *Jean ne pouvait pas venir à la réunion, de toute façon elle a été annulée*
(John couldn’t come to the meeting, anyway it was cancelled)

There are two reasons for adopting a dynamic perspective on DM. First, it is consonant with the general properties of interpretation emphasized by recent approaches in semantics, most notably the context-dependence and partiality of interpretation. Second, it is observed in (Jayez & Rossari 1998), that a dynamic treatment allows one to deal with some delicate examples involving imperative sentences, whereas static approaches yield false or inaccurate

¹For lack of space, we use a semi-formal style of presentation here.

²We assume that these rules can be nonmonotonic.

predictions.

However, a dynamic treatment in itself is not sufficient, because, except for their logical properties, the dynamic operations are not constrained. One must specify the mode of connection between the dynamic operations, which we call the ‘connective glue’. The connective glue has several dimensions. We explore two of them here, first the admissibility of rules (section 3), second the type of update (section 4).

3 Admissible rules

It has been repeatedly observed that DM can link entities of various semantic types, such as propositional contents (4-a), beliefs or judgments (4-b) and utterances or speech acts (4-c) (see Sweetser 1990, Knott 1996, Sanders 1997 and Degand 1998 for recent presentations).

- (4)
- a. Mary was late, so she was cranky
 - b. Mary was cranky. Then, she was probably late
 - c. Where is the hammer, ‘cause I’ve to fix the shelf?

Although the intuitive fact is uncontroversial, it turns out, on closer inspection, that the three levels illustrated in (4) are not on a par. In (4-a), we appeal implicitly to a rule of the form ‘being late can cause being cranky’. In (4-b), we have rather the (abductive) reverse rule ‘being cranky can be caused by being late’. Does this obvious difference entail that different entities are linked in the two cases? Let us assume that, in (4-b), the connected entities are beliefs or, more generally, epistemic attitudes. Consider now the following contrast in French.

- (5)
- a. *Marie était en retard, alors/du coup elle était à cran*
(Mary was late, DM she was cranky)
 - b. *Marie était à cran, alors/?? du coup elle était certainement en retard*³
(Mary was cranky, DM she was certainly late)
 - c. *Marie a raté son bus, alors/du coup elle était certainement en retard*
(Mary missed her bus, DM she was certainly late)

Consequence connectives in French can be divided into two broad classes according to the levels they are sensitive to (Jayez & Rossari 1996). *Donc* (\approx therefore), *alors* (\approx then, so) and *par conséquent* (\approx consequently) accept connections between propositions

³We assume an abductive reading. Mary being cranky is probably caused by her being late.

or epistemic attitudes. *Du coup*, *de ce fait* (\approx as a result) and *aussi* (\approx as a result, so) are clumsy with epistemic attitudes. Although the exact representation of an epistemic attitude, belief or judgment is a moot point, one can assume that it should incorporate at least three informations, the content of the state (what is believed, or, more generally, what is A-ed, if ‘A’ labels the propositional attitude), the nature of the propositional attitude (knowledge or belief, for instance) and the source of the state, which can indicate the epistemic agent and/or the modal configuration which supports the attitude of the agent with respect to the content (for instance the *modal base* in Kratzer’s (1981) terms).

If we explain the contrast between (5-a) and (5-b) by the presence of epistemic attitudes, we must also assume (α).

(α) Sentences which can provide the conclusion of a causal or an abductive connection are ambiguous between a proposition reading and an epistemic attitude reading.

This is the case for the sentence *Marie était certainement en retard* (Mary was certainly late) which can point to a proposition in (5-c) and to an epistemic attitude in (5-b). Consider now (6).

- (6) *Marie a l’air sinistre, ?? donc elle a, paraît-il, raté son examen*
(Mary is gloomy, DM she reportedly failed her exam)

In French, the parenthetical *paraît-il* indicates that the belief source is different from the speaker. Without the parenthetical, the *donc* version of (6) is ok, while the *du coup* and *de ce fait* versions are deviant, as expected. It makes good sense to assume that, when a sentence S points to an epistemic attitude of the speaker, *paraît-il* is not possible since it indicates an alternative source for the state. Modals are not always compatible with *paraît-il* either.

- (7) *Marie est certainement en retard/doit être en retard, (??) paraît-il*
(Mary is reportedly certainly late / Mary must reportedly be late)

In French, the parenthetical must have scope over the modal for (7) to make sense (the paraphrase being then ‘it has been reported that Mary must be late’). Formal (Kratzer 1981) and linguistic analyses (Dendale 1994, Krönning 1996, Rossari & Dendale 1999) suggest that modalized sentences are associated with the selection of a ground by the epistemic agent (the speaker, in the standard case). In Kratzer’s analysis, the ground is a set of propositions (the *modal base*) on which some epistemic attitude is based. So,

the epistemic agent is committed to the truth of the proposition she asserts in view of the modal base she has selected. This property gives rise to source conflicts with certain parentheticals indicating reported information. This is to be expected if we have on one side a selection of the modal base by an epistemic agent and, on the other, an indication that the truth of the proposition is warranted by a different agent. It is then reasonable to posit (β).

(β) Modalized sentences point to epistemic attitudes. But, then, in virtue of (α) and (β), *Marie était certainement en retard* points and does not point to a simple proposition.

What is needed is an hypothesis which reconciles the persistent feeling that DM like *donc* and *du coup* link in some sense different ‘objects’ with the array of observations. We propose to redefine the sensitivity of DM in terms of rules, and, in parallel, to derive the proposition vs epistemic attitude distinction from this sensitivity.

DM can exploit rules of form CAUSE \Rightarrow EFFECT, which we call *causal* rules, or rules of form EFFECT \Rightarrow CAUSE, which we call *abductive*. There is a well-known distinction between the two kinds of rules. Causal rules can be ‘world-like’, in that they can refer to actual sequences of states of affairs, which can be observed and/or reported in the order in which the states of affairs obtain in the world. It is not so with abductive rules. The actual sequence of states of affairs can hardly coincide with an EFFECT-CAUSE order. In this respect, abductive rules mirror sequences of states of affairs in the mind. Causal rules can also mirror mental sequences but it is not necessarily so. Specifically, the common sense rules R can be partitioned into rules of form $x_{\text{CAUSE}} \Rightarrow_{\text{WORLD} \vee \text{MIND}} y_{\text{EFFECT}}$ (causal rules) and rules of form $x_{\text{EFFECT}} \Rightarrow_{\text{MIND}} y_{\text{CAUSE}}$ (abductive rules). An entailment $p \vdash q$ is causal when it is obtained from R , modulo some deduction rules, by using only causal rules. It is abductive if only abductive rules are used.

- (8) **Rule sensitivity** DM may select the type of entailments they rely on to substantiate the connection. In particular, some connectives like *du coup*, *de ce fait* and *aussi* select causal entailments.

(8) is simple but important. It is intended to replace the level of epistemic attitudes, which has then only a derivative status. The entailments selected by a given DM C will be called *admissible* for C .

In what sense, do we say that the epistemic attitude interpretation can be ‘derived’ from the rule sensitivity? When selected, an abductive rule, by its very nature, promotes an interpretation in which the men-

tal states of the speaker are prominent. We observe the same effect whenever a speaker obviously uses abductive rules, even in the absence of any DM.

- (9) A – *Je pense que Marie a réussi*
(I think Mary passed)
B – *Moi je suis pessimiste, elle a l’air sinistre, elle a raté*
I am pessimistic, she is gloomy, she flunked

Forcing a *paraît-il* into B’s answer produces a very strange sentence if *elle a raté* is interpreted as a guess. We observe that the selection of causal rules is compatible with a reported information indicator, as in (10).

- (10) *Marie a raté son examen, donc elle est, paraît-il, très triste*
(Mary flunked her exam, DM she is reportedly very sad)

In Kratzer’s approach, modal bases are sets of propositions. Using a modal base and an ordering source (which, roughly, ranks the different possible situations according to their plausibility for the agent), an agent may entertain various propositions. When propositions are observed or reported, the agent endorses them ‘as they are’ (in the world or in the report). So, we do not need to resort to the notion of modal base in such cases. The important point is that the rules which substantiate the consequence connection are *not* sensitive to the presence/absence of a modal base. It is possible to use the rules to go from an observational proposition (no modal base) to a modalized proposition (modal base), see *Mary flunked her exam, so she must be sad* where *Mary flunked her exam* could be the description of an actual state of affairs. Similarly, one can go from a reported proposition to an observational one, as in *Mary is said to have flunked her exam, so she is sad, as you see*. The only problematic situation occurs when the same proposition is presented simultaneously as relative and not relative to a modal base. This happens in particular when abductive rules are used. They force the modal base dependency reading on the conclusion, which creates a potential tension with indicators of reported information.

4 Illocutionary goals. The *parce que* example

The causal connective *because* (see Lagerwerf, 1998 for a recent synthesis) and its French mate *parce que* are frequently mentioned as speech act linkers, as in (4-c). But consider the following examples.

- (11) a. *Jean est très violent, ?? parce que je ne veux pas que tu aies d'ennuis*
 (John is very violent, because I don't want you to get into trouble)
- b. *Il est très tard, ?? parce qu'il faut qu'on soit à l'heure*
 (It's very late, because we must be on time)
- c. *Quelle heure est-il? Parce qu'il faut qu'on soit à l'heure*
 (What time is it? because we must be on time)

One would expect those examples to be natural. It makes sense to draw the attention of the hearer *h* to somebody's violent behaviour if one wants to spare *h* trouble. Similarly, it makes sense to emphasize the risk of being late if timeliness is crucial. So, the first speech act is justified by the situation described in the second sentence. The difference between such discourses and a natural discourse like (11-c) pertains to the notion of *illocutionary goal*, as defined by Searle (1969). The goal or point of a representative act is to commit the speaker to the truth of the propositional content. E.g., the point of (11-a) is to commit the speaker to the truth of the proposition that John is very violent. The absence of any clear causal relation between the second sentence and the illocutionary point makes the whole sentence sound strange. There is no causal entailment from the desire to spare the addressee trouble to the belief that John can get the addressee into trouble because of his violence. In contrast, in (11-c), the point of the question, which is to elicit an answer, is caused in some sense by the situation described in the second sentence.

An anonymous reviewer observes that, if (11-a) and (11-b) are analyzed as indirect speech acts, we can explain the strangeness of those examples by the tension between the indirect way of expressing the warning in the first sentence and the direct character of the explanation in the *parce que* sentence. Two comments are in order here. First, we do not deny that (11-a) and (11-b) are warnings. However, to say that they are indirect, we have to take into account the illocutionary goal of the secondary act (the representative). If it was identical to the illocutionary goal of the primary act (the warning), there would be of course no 'indirection'. More importantly, even when the warning value is quite explicit, the connection remains clumsy.

- (11) c. *Attention, Jean est très violent, ?? parce que je ne veux pas que tu aies d'ennui*
 (Attention, John is very violent, because

I don't want you to get into trouble)

So, we consider that the point of the secondary (or 'literal') act is crucial, in the case of an indirect speech act. Anyway, a major problems remains. Illocutionary goals are not asserted by speakers. They belong to the 'background' of speech acts, in so far as they concern the preconditions of the actual utterance. The speaker has to entertain such or such illocutionary goal to issue such or such type of act. How is it that DM such as *parce que* can connect entities from the background? Such entities are similar to presuppositions to some extent, but there is massive evidence that, in monologues, presuppositions cannot be used in linkings based on DM (Ducrot 1972). For instance, (12) cannot mean that Mary is not at the meeting because she is on vacation (note that the comma pause before *parce que* is crucial).

- (12) *Je regrette que Marie ne soit pas à la réunion, ?? parce qu'elle est en vacances*
 (I regret that Mary is not at the meeting, because she is on vacation)

Treating the illocutionary goal as a presupposition is in agreement with a standard assumption in dynamic semantics that presuppositions condition the possibility of updates (Beaver 1995).⁴ Roughly, *S* with the presupposition *p* (noted *S_p*) denotes the state transition $s \hookrightarrow s'$ iff *p* holds in *s* and *S* denotes the transition $s \hookrightarrow s'$. This makes sense with 'standard' cases of presupposition (complements of factive verbs, definite descriptions, etc.), and also with illocutionary goals. The illocutionary goal of a question or command is a prerequisite of the corresponding speech act.

But examples like (11-c) present a case where there is a monologal link between the background of a proposition (its illocutionary goal) and another proposition, a situation which DM tend to ban in general. Must we conclude that DM like *parce que*, *puisque* (\approx since) and *car* (\approx for) evade this constraint in the case of illocutionary goals.

In a dynamic framework, some difference between standard presuppositions and illocutionary goal presuppositions is to be expected. To keep things simple, let us assume that we have only a finite number of epistemic agents (*sp* being the speaker in what follows). Each agent communicates to the others an image of the common ground.

⁴For space reasons, we will ignore the problem of *parce que* in dialogue, which, to our best knowledge, has not yet been addressed in its full complexity (however, see Torck 1995 for interesting indications).

- (13) **Image of the common ground** Let a be an agent. CG_a denotes the information state that constitutes the common ground according to a . CG_a is the set of all propositions such that a believes them and believes that other agents believe them.

From here, we assume the framework of Dynamic Epistemic Logic (Groeneveld 1995), which allows epistemic operators to be represented in the dynamic language. $\Box_a\phi$ says that the agent a has the information that ϕ . If we have a finite set $\{a, b_1 \dots b_n\}$ of epistemic agents, we can define CG_a by

$$CG_a = \{p : \Box_a p \wedge \Box_a \Box_{b_1} p \wedge \dots \wedge \Box_a \Box_{b_n} p\}$$

Note that, if s_a denotes the state of information of a at some point, s_a and CG_a are not necessarily identical, since a might know things that she assumes to be ignored by other participants. Let $[\phi]_a\psi$ denote the fact that updating a 's information with ϕ leads to an information state of a where ψ holds. We define updates of common grounds by.

- (14) **Common Ground Update** Let CG_a be $\{p : \Box_a p \wedge \Box_a \Box_{b_1} p \wedge \dots \wedge \Box_a \Box_{b_n} p\}$. The update of CG_a with ϕ is: $\{q : [\phi]_a q \wedge [\Box_{b_1} \phi]_a q \wedge \dots \wedge [\Box_{b_n} \phi]_a q\}$

This definition ensures that the necessary changes are propagated in the image of the common ground. For instance, suppose that a believes that b_i believes that $\phi \Rightarrow \psi$. Updating CG_a with ϕ leads to a state where a believes that b_i believes ψ . We have $\Box_a(\Box_{b_i} \phi \Rightarrow \psi)$, updating with ϕ gives that $\Box_a(\Box_{b_i} \phi)$, but $\Box_a(\Box_{b_i} \phi \Rightarrow \psi)$ and $\Box_a(\Box_{b_i} \phi)$ give that $\Box_a(\Box_{b_i} \psi)$.

The property of holding in the information state of an agent a , for some proposition ϕ , can be coded by $[\top]_a\phi$, where \top is any tautology. Consider then CG_{sp} , the common ground as viewed by the speaker. For a standard presupposition p , we can rephrase the dynamic semantics basic definition of presupposition as follows.

- (15) **Standard Presupposition** S_p denotes a transition $CG_{sp} \hookrightarrow CG'_{sp}$ iff p holds in CG_{sp} and S denotes $CG_{sp} \hookrightarrow CG'_{sp}$.

If DM connect dynamic operations (updates), as proposed in (Jayez & Rossari 1998), their resistance to presuppositional linkings is an indirect reflection of (15). If p holds in s , the update is just the trivial transition $s \hookrightarrow s$. Under the assumption that DM live on the possibility of non-trivial updates, their allergy to presuppositions is no surprise. By their very nature, presuppositions give rise only to trivial updates of the common ground image. The sit-

uation is not quite the same for illocutionary goals. When issuing a given speech act, the speaker does not present the illocutionary goal as accepted in the image of the common ground she communicates, since participants are not supposed to have a clear idea of what the mental states or concerns of other participants are (they are more naturally supposed to share knowledge about external objects and events). On the other hand, the existence of an illocutionary goal in the information state of the speaker is a precondition of the corresponding speech act. This motivates the following condition (16).

- (16) **Illocutionary Goal Presupposition** S_{ig} , where ig is the illocutionary goal of S , denotes a transition $CG_{sp} \hookrightarrow CG'_{sp}$ iff $cont(S) \Rightarrow [\top]_{sp}ig$ holds in CG_{sp} and S denotes $CG_{sp} \hookrightarrow CG'_{sp}$.

This definition says that, when the propositional content of S ($cont(S)$) is introduced, ig must hold in the current information state of the speaker. Since this rule holds in the initial common ground, introducing the content of S in this common ground results in a new common ground in which $[\top]_{sp}ig$ holds.

1. $CG_{sp} = \{p : \Box_{sp} p \wedge \Box_{sp} \Box_{b_1} p \wedge \dots \wedge \Box_{sp} \Box_{b_n} p\}$
2. $CG_{sp} + cont(S) = \{q : [cont(S)]_{sp} q \wedge [\Box_{b_1} cont(S)]_{sp} q \wedge \dots \wedge [\Box_{b_n} cont(S)]_{sp} q\}$
3. $cont(S) \Rightarrow [\top]_{sp}ig$ holds in CG_{sp} by definition (16).
4. So, $\Box_{sp}[\top]_{sp}ig$ and $\Box_{sp}(\Box_{b_i}[\top]_{sp}ig)$ for $i = \{1 \dots n\}$.

Note that, in the standard presupposition case (definition (15)), the fact that the presupposition holds in CG_{sp} is independent from the content of the sentence. This is exactly the contrary in definition (16). The proposition that the illocutionary goal holds in the information state of the speaker is linked to the content of S , making a non trivial update possible.

This is similar to an update of CG_{sp} with ig . However, in contrast with standard updates, the procedure is only indirect. The speaker does not *say* that she entertains ig . *Parce que* and other causal DM are thus sensitive to those indirect updates which arise from 'conversational events' in the sense of Poesio (1994).⁵ On the whole, they exhibit a mixed behaviour, between the sensitivity to non-trivial updates of other classes of DM and the richer set of parameters of discourse relations.

The following definition summarizes the main idea. $\alpha \xrightarrow{S} \beta$ denotes a successful transition from α to β modulo an operation using the content of S (an up-

⁵In contrast, standard presuppositions are 'anaphoric', see Krahmer 1998.

date, in general). (17) distinguishes the causal or epistemic reading and the ‘speech act’ reading, based on the illocutionary goal indirect update.

- (17) **Parce que** In the uses considered here, *parce que* is appropriate only if it connects two sentences S and S’ such that either:
 if $CG_{sp} \xrightarrow{S} CG'_{sp}$ for some CG'_{sp} , then $CG'_{sp} \xrightarrow{S'} CG''_{sp}$ for some CG''_{sp} w.r.t. the admissible entailments $S'_{\text{CAUSE}} \vdash S_{\text{EFFECT}}$ or $S_{\text{EFFECT}} \vdash S'_{\text{CAUSE}}$ (epistemic reading with an abductive entailment), or, for S_{ig} ,
 if $CG_{sp} \xrightarrow{S} CG'_{sp}$ for some CG'_{sp} , then $CG'_{sp} \xrightarrow{S'} CG''_{sp}$ for some CG''_{sp} w.r.t. the admissible entailment $S'_{\text{CAUSE}} \vdash ig_{\text{EFFECT}}$.

5 Conclusion

The analysis proposed here illustrates two main points. First, the intuitive notion of discourse level is not uniform: it can reflect either the type of common sense rule which is accessed or a genuine sensitivity to various ‘levels’ (types) of discourse information. Second, in the latter case, the information type which is selected can be characterized in a flexible way by using different update scenarios. The indirect illocutionary goal update is illustrated here, but there are other scenarios (in dialogues, in particular) to which the present treatment can be extended. So, the dynamic approach enjoys the versatility required to address complex multidimensional discourse phenomena.

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