

# When Anaphoric and Logical Discourse Markers Meet Accommodation

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## 1 Introduction

Aim: contribute filling the gap between discourse and lexicon by studying Discourse Markers (DM).

General approach: to describe DM in their own right rather than just as manifestations of all-purpose discourse relations (Jayez & Rossari 1998).

Importance of *dynamic* properties. DM constrain the possible arrays of discourse operations.

This talk: interaction of DM with accommodation.

## 2 The notion of accommodation

Although the term *accommodation* is frequently used, it is not clear that it has an homogeneous and precise meaning.

- Rule of *accommodation* (Lewis 1979). General definition (1).

1. **Def. of Accommodation** A proposition  $\phi$  is accommodated by an agent  $a$  in a context  $C$  whenever  $a$  assumes that  $\phi$  holds in  $C$  to interpret the discourse, although  $\phi$  is not explicitly introduced in  $C$ .

3 main cases.

- Presupposition

2. I can't come to the meeting—I have to pick up my cat at the vet (Stalnaker 1998)

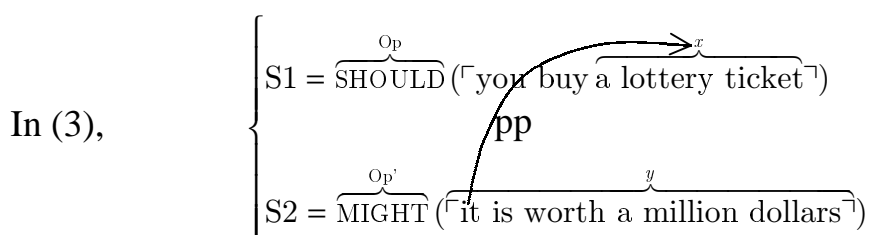
The presupposition that the speaker of (2) has a cat is added to the context of interpretation, if necessary, to make sense of (2).

- Modal configuration (*modal subordination*, see Roberts 1987,1989,1996).

3. You should buy a lottery ticket, it might be worth a million dollars

The second clause is interpreted in a context where the addressee actually bought a lottery ticket.

4. **Modal Subordination** Shows in any sentence pair S1-S2 with a semantic structure:  
 S1 = Op(... x ...), S2 = Op'(... presupposition that x ...) and Op' is intensional.



- Interaction with DM

5. a Marie a peur qu'il y ait des cafards dans sa salle de bains. (<sup>??</sup>∅ vs Dans ce cas) Elle s'en débarrasserait  
 (Mary is afraid that there are roaches in the bathroom. (<sup>??</sup>∅ + In this case) She'd get rid of them)
- b Marie a peur qu'il y ait des cafards dans sa salle de bains. (∅ / Dans ce cas vs <sup>??</sup>Donc) Elle aurait à s'en débarrasser  
 (Mary is afraid that there are roaches in the bathroom. (∅ + In this case + <sup>??</sup>Therefore) She would have to get rid of them)
- c Ferme la fenêtre! (∅ vs <sup>??</sup>Donc) On aura moins froid  
 (Close the window! (∅ + <sup>??</sup>Therefore) We'll be less cold)

We assume that the second clause is interpreted in a context where the factual information is provided by the first clause, not by previous clauses in the discourse.

How to account for such contrasts? Some DM seem to let accommodation work while others block it.

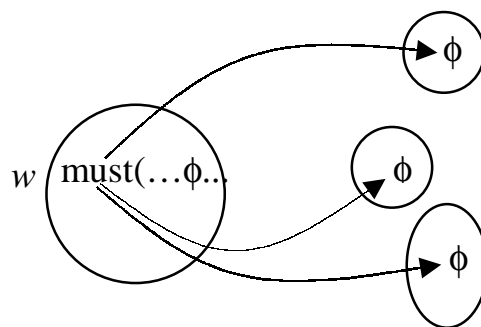
### 3 What is behind accommodation?

We ignore “simple” presuppositional cases (see Krahmer 1998).

- Robert’s analysis of modal subordination relies on Kratzer’s (1981) notion of *modal base*.

A modal/intensional expression  $Op(\phi)$  is evaluated in a world  $w$  (the root world) with respect to the set of worlds  $Op$ -accessible from  $w$ , a set given by the modal base. For instance,  $MUST(\phi)$  is true in  $w$  iff  $\phi$  is true in every world  $MUST$ -accessible from  $w$  (those worlds which represent the possible sets of things which are obligatory, necessary, etc., in view of the information contained in  $w$ ).

**Must  $\phi$**  (the standard modal analysis)



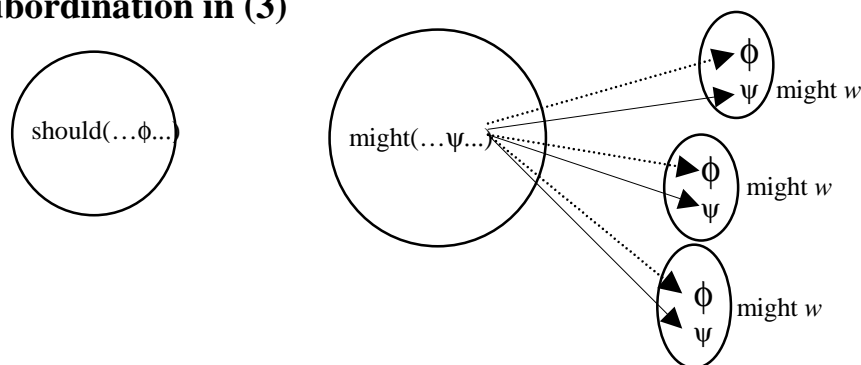
Modal base = a function which, given  $w$ , characterizes the relevant accessible worlds (worlds for obligation, for necessity, etc.). It retrieves the set of propositions which justify the modal expression. The relevant accessible worlds must accept those propositions.

In modal subordination, the modal base is constrained to yield worlds where some proposition associated with the first sentence is true (accommodation).

In (3),  $MIGHT(\phi)$  is true in  $w$  if  $\phi$  is true in some world(s)  $MIGHT$ -accessible from  $w$ .

So, the modal base returns the set of worlds  $MIGHT$ -accessible from  $w$  where the existential presupposition (that some lottery ticket has been bought) is satisfied.

**Modal subordination in (3)**



## 4 The interaction of DM with accommodation

- Modal subordination (5a and 5b).

A. Contrast between conditional mood with a modal operator (*She would have to ...*) and without any modal operator (<sup>??</sup>*She'd get rid ...*).

In French, when it does not introduce a hedged assertion, the conditional mood requires an antecedent hypothetical proposition. E.g., *Marie s'en débarrasserait* (*Mary would get rid of them*) in (5a) cannot be used in isolation. It has to be connected with some hypothetical information (*if ... Mary would get rid of them*).

So, in (5a), *she would get rid of them* is just missing a hypothetical antecedent. Problem. The conditional mood is probably an intensional operator. It is evaluated with the help of possible alternative worlds where the hypothetical antecedent holds.

↓

How is it that there is no modal base to retrieve the appropriate antecedent worlds (which would license the conditional mood in isolation in (5a))?

The conditional mood, in contrast with other intensional operators, demands that the appropriate antecedent be *independently* introduced or retrieved in the discourse. In particular, it may not retrieve this antecedent by itself.

↓

Next problem. What happens in (5b)?

In (5b), the conditional mood requires an antecedent (which is absent). The modal operator *have to* can exploit a modal base to retrieve appropriate worlds. The effects of the conditional mood and *have to* concur to produce an appropriate interpretation.

1. The *have to* operator retrieves the information which is necessary to flesh out the missing hypothetical antecedent.
2. The conditional mood prevents this information from conflicting with the left sentence. Compare with *Mary is afraid that .... She <sup>(??)</sup> must get rid of them*, where the indicative mood implies the existence of roaches, while the left sentence introduces no discourse referent with this property.

B. Contrast between <sup>??</sup>*donc* and *dans ce cas* in the modal operator case.

Roughly, *donc* demands that there be an entailment between two propositions (Rossari & Jayez 1996).

Entailment  $\neq$  material implication. Entailment from  $\alpha$  to  $\beta$  requires that  $\alpha$  be effectively used in a proof of  $\beta$ .

↓

In (5b), there is no obvious entailment between Mary's being afraid that her bathroom is infested and Mary's obligation to get rid of the roaches (although material implication probably holds between the corresponding modal forms in the root world).



Problem. Why is (5d) natural?

5. d Marie a peur que Jean lui offre un chat pour Noël. Son propriétaire les interdit. Donc, elle aurait à s'en débarrasser  
(Mary is afraid that John gives her a cat<sub>i</sub> for Christmas. Her landlord prohibits them. Therefore, she would have to get rid of him<sub>i</sub>)

Again, there is no clear entailment between Mary's apprehension and her obligation to get rid of the (virtual) cat.

But there is an entailment between the landlord's prohibition and the obligation to get rid of the cat, IF it exists. The retrieved conditional antecedent (*If John offered Mary a cat*) is needed to construct the entailment relation.



In (5b), there is no entailment relation between the left sentence and the reconstructed *if* sentence: *Mary is afraid that there are roaches in her bathroom.*  
<sup>??</sup>*Therefore, if there were roaches, she would have to get rid of them.*

To redeem the sentence, one can try to interpret *to be afraid* as conveying a phobia script.



Conclusion. In structures like (5b), modal subordination produces a semantic structure corresponding to a conditional sentence. This confirms Roberts' observation that the conditional paraphrase *if... then* is appropriate in those cases.

*Dans ce cas (in this case)* is an anaphoric item which looks for a propositional antecedent with hypothetical value. It is analogous to *alors* or *then* which look for temporal information. In (5b), it semantically replaces the *if* part of the reconstructed *if... then* structure.

In addition, (5e) shows that *dans ce cas* is able to retrieve the missing information. So, in this respect, it works like intensional operators of type *have to*.

5. e Marie a peur qu'il y ait des cafards dans sa salle de bains. Dans ce cas, elle s'en débarrasserait

• Imperatives (see Sorin 1984, Clark 1993, on these structures).

A. To account for the possibility of (6a), we have to resort to some kind of accommodation

6. a Ferme la fenêtre! On aura moins froid

- (Close the window! We'll be less cold)
- b Ferme la fenêtre! ??Donc on aura moins froid  
(Close the window! ??Therefore we'll be less cold)

B. As in (5b), there is no clear entailment relation between the imperative and the sentence in the future.

C. As in (5d), we can produce a natural connection by adding some adequate clause.

6. c Ferme la fenêtre! Elle a un double vitrage. Donc on aura moins froid  
(Close the window! It's double-glazed. Therefore, we'll less cold)

In this example, the connection makes use of the reconstructed hypothetical information: it's not because the window is double-glazed that people will be less cold. It's because the window is double-glazed that IF it gets closed, people will be less cold.

Summarizing, the intensional operator case and the imperative case are essentially similar. The presence of a semantically reconstructed *if* structure allows us to draw a distinction between DM which point to hypothetical information (*dans ce cas, comme ça, à ce moment là*) and have an accommodation potential, and DM (such as *donc*) which look for certain inferential ('logical') relations.<sup>1</sup>

## 5 Treatment in Arrow Logic

- Arrow Logic (AL) is a logic in which arrows replace possible worlds of modal logic (van Benthem 1991 16.5, Andréka & Mikulás 1994, Marx et al. 1996).  
Standard modal logic:  $\phi$  is true at a world  $w$  ( $w \models \phi$ ).  
AL:  $\phi$  is true at a transition or arrow ( $a \models \phi$ ).  
Main advantage of AL: the dynamic aspect is built-in the representation.  
The dimensionality of an AL defines the number of points on the arrows.  
2-dimensional AL:  $\phi$  is true at  $\langle x, y \rangle$ .

- Info. states

Here, an info. state is an object  $s^\sigma$ . It has an information content (labeled by  $s$ ) and an information type (labeled by  $\sigma$ ).

Some info. states

$s^{cg}$  = the info. state of type common ground,

$!x$ , where  $x$  is an info. state = the set of possible worlds which are used to evaluate the felicity of imperatives in the info. state  $x$ .

$\Diamond x$ , where  $x$  is an info. state = the set of possible worlds which represent the  $x$ -alternatives.

- Transitions.

Arrows are transitions. Instead of having simple propositional transitions, we have operations.

Standard AL:  $\phi$  (a proposition) is true at  $a$ .

The present approach:  $\omega$  (an operation) succeeds at  $a$ .

Two kinds of operations: transfers and updates.

Transfers take us from one type of info. state to another type. Updates update information in states.

1. The simplest case: *updates*. An update  $\oplus\phi$  is true at an arrow  $\langle s^\sigma, s'^\sigma \rangle$  iff  $s'^\sigma$  is the result of adding successfully  $\phi$  to  $s^\sigma$ . Mind the fact that the hidden structure of updates can be *very* complex. For instance, imperative updates use special temporal rules that assertive updates do not.
2. An imperative *transfer*  $\curvearrowright!$  is true at an arrow  $\langle x, y \rangle$  iff  $y = !x$ .
3. An *if transfer*  $\curvearrowright\Diamond$  is true at  $\langle x, y \rangle$  iff  $y = \Diamond x$ .

- Composition.

In AL, there is an operation of composition:  $\phi \circ \psi$  is true at an arrow  $a$  iff  $a$  can be decomposed into two adjacent arrows such that  $\phi$  is true at the first and  $\psi$  at the second.

We can use  $\circ$  to define imperative and hypothetical updates (abusing the term *update*).

4. Imperative updates.  $\curvearrowright!\phi = \curvearrowright! \circ \oplus\phi$ .
5. *If* updates.  $\curvearrowright\Diamond\phi = \curvearrowright\Diamond \circ \oplus\phi$ .

So, *If you are cold, close the window* is the sequence of form:

$$x \xrightarrow{\curvearrowright\Diamond} \Diamond x \xrightarrow{\oplus\langle \text{you are cold} \rangle} (\Diamond x)' \xrightarrow{\curvearrowright!} !(\Diamond x)' \xrightarrow{\oplus\langle \text{you close the window} \rangle} !( \Diamond x )''$$

An *if* update (transfer + update) followed by an imperative update (transfer + update).

We call simple updates and transfers *atomic* operations.

Operations are denoted by variables  $\omega, \omega', \omega_i$ , etc.

Operations which are (or terminate with) simple updates  $\oplus\phi$  are noted  $\omega^{\oplus\phi}$ .

- Successes and entailments.

An operation  $\omega^{\oplus\phi}$  *succeeds* iff its update  $\oplus\phi$  does not create an inconsistency in the target state.<sup>2</sup>

The exact logical situation depends on the approach (partiality vs multi-worlds *à la* Veltman, 1996) and on the logic which is used.

We use the following logic  $\vdash$ .

$\Sigma \vdash \phi$  is a proof iff only either  $\phi$  is not inconsistent and  $\vdash$  corresponds to *relevant* entailment (Anderson & Belnap 1975) or  $\phi$  is inconsistent and the proof is classical.

We say that  $\omega^{\oplus\phi}$  entails  $\omega'^{\oplus\psi}$ , noted  $\omega^{\oplus\phi} \rightarrow \omega'^{\oplus\psi}$ , whenever:

- (i) if  $\omega^{\oplus\phi}$  succeeds, so does  $\omega'^{\oplus\psi}$ ,
- (ii) The logic of the proofs using  $\phi$  and  $\psi$  is  $\vdash$ .

At this stage we can define *donc* very simply.

## 7. **Donc**

$$\text{DONC} = \lambda\omega, \omega'. \omega \rightarrow \omega'.$$

For instance, in a context where the only way to be less cold is to close the window or to turn the heating on, we may have *The heating doesn't work, therefore, if you are cold, close the window.*

$$x_1 \xrightarrow{\oplus\langle \text{no heating} \rangle} x_2 \xrightarrow{\sim\Diamond} \Diamond x_2 \xrightarrow{\oplus\langle \text{cold} \rangle} (\Diamond x_2)_1 \xrightarrow{\sim!} !((\Diamond x_2)_1) \xrightarrow{\oplus\langle \text{window} \rangle} (!((\Diamond x_2)_1))_1$$

- **Conditional mood. Residuation**

For conditional mood, we need an extra operation.

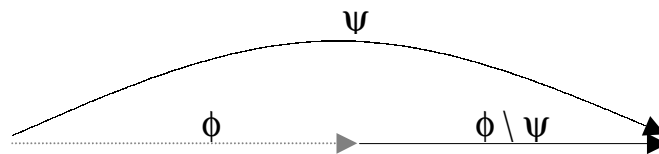
- 6. *Ifcond* updates (typically in the imparfait in French: *S'il faisait froid (If it were cold)*).

$\curvearrowright\Diamond\phi = \curvearrowright\Diamond \circ \oplus\phi$ , where  $\curvearrowright\Diamond$  is like  $\curvearrowright\Diamond$  except that it takes us to possibly different alternative worlds.

Like in CG, algebra, etc. we have *residuation*. A residual is an operator which signals that something is missing on the left or on the right of a given expression.

Left residuation (defined with the left residual  $\setminus$ )

$\phi \setminus \psi$  is true at  $\langle y, z \rangle$  iff for every arrow  $\langle x, y \rangle$ , if  $\phi$  is true at  $\langle x, y \rangle$  then  $\psi$  is true at  $\langle x, z \rangle$ .



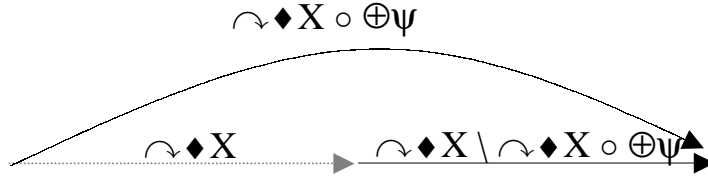
Conditional mood can be defined as a residuation. In this case, an *ifcond* update is missing on the left.

for any  $\phi$ ,  $\text{COND}^\psi$  is true at  $\langle y, z \rangle$  iff  $\forall \langle x, y \rangle$  (if the *ifcond* update with  $\phi$  is true at  $\langle x, y \rangle$  then the composition of the *ifcond* update with  $\phi$  with the simple update with  $\psi$  is true at  $\langle x, z \rangle$ ).



## 8. Conditional mood

$\text{COND}^\psi = \curvearrowright \blacklozenge X \setminus \curvearrowright \blacklozenge X \circ \oplus \psi$ , where  $X$  is a propositional variable

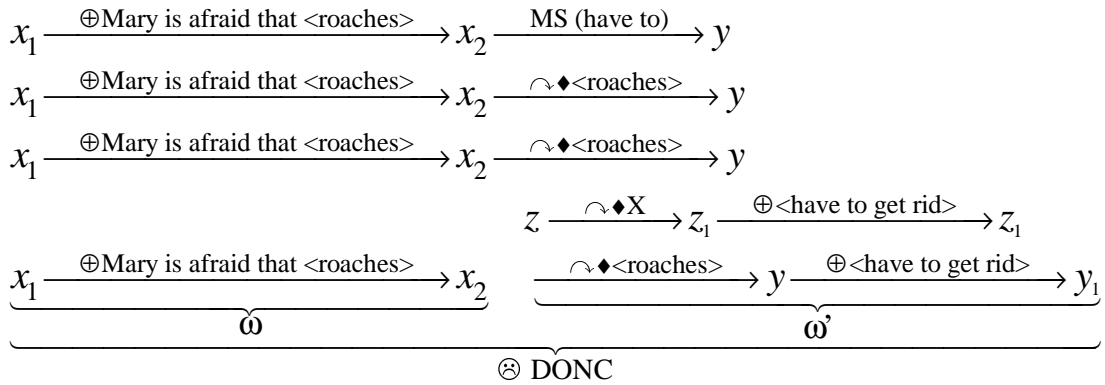
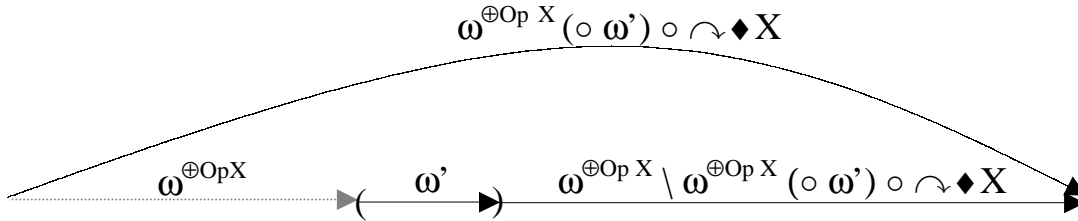


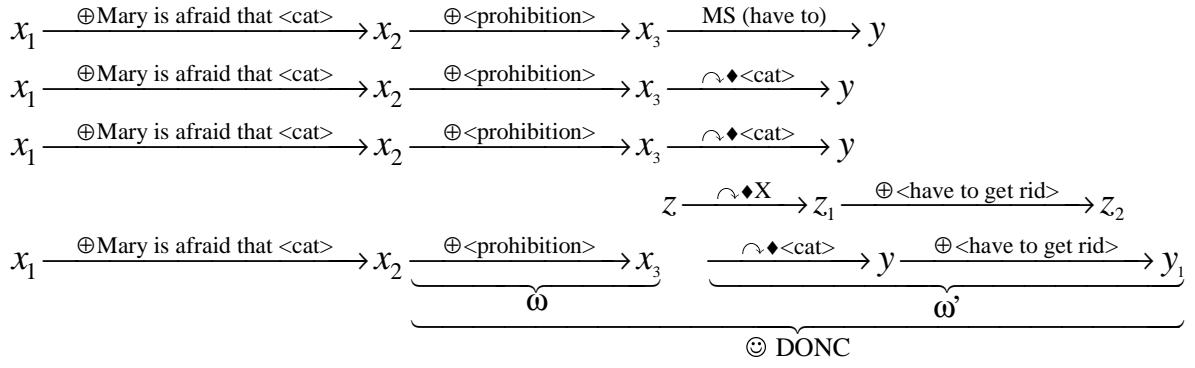
As long as the left operation  $\curvearrowright \blacklozenge \phi$  is missing, we have a gapping operation  $\curvearrowright \blacklozenge X \setminus \curvearrowright \blacklozenge X \circ \oplus \psi$ . Modal subordination can be seen as the operation which provides the missing information.

## 9. Modal subordination

a. Adjacency case.  $\text{MS} = \omega^{\oplus \text{Op } X} \setminus \omega^{\oplus \text{Op } X} \circ \curvearrowright \blacklozenge X$ .

b. General case.  $\text{MS} = \omega^{\oplus \text{Op } X} \circ \omega' \setminus \omega^{\oplus \text{Op } X} \circ \omega' \circ \curvearrowright \blacklozenge X$ .





*Dans ce cas* acts like modal subordination. It can trigger accommodation when necessary.

### 10. *Dans ce cas*

- a. Connective behavior.  $\text{DANS CE CAS}_1 = \lambda\omega, \omega'. \text{DCC}(X, Y)$ , where  $\omega$  is of type  $\sim \blacklozenge X$ ,  $\sim \heartsuit X$  or  $\sim !X$  and  $\omega'$  of type  $\oplus Y$ .
- b. Accommodation behavior (ignoring non adjacency)  
 $\text{DANS CE CAS}_2 = \omega^{\oplus \text{Op}X} \setminus \omega^{\oplus \text{Op}X} \circ \sim \blacklozenge X$ , whenever there is some  $Y$  such that  $\text{DANS CE CAS}_1(\sim \blacklozenge X, \oplus Y)$ .

- Imperatives. In imperatives, the future mood triggers the accommodation. Otherwise the mechanism is similar to the intensional operator case. For simplicity, we ignore the different possible values of the pseudo-imperatives.<sup>3</sup>

### 11. Future

$$\text{FUTURE}^\Psi = \sim !X \setminus \sim !X \circ \oplus \Psi, \text{ where } X \text{ is a propositional variable}$$

## 6 Conclusion

- Importance of the lexical profile of DM
- Importance of dynamic effects

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<sup>1</sup> Some DM such as *alors* and *du coup* exhibit a hybrid behaviour. They are not always quite natural with imperatives (*ferme la fenêtre*, (<sup>??</sup>*alors* + <sup>??</sup>*du coup*) *on aura moins froid*), although *alors* seems ok in some cases (*Offre moi une bague en diamant, alors je t'épouserai* ≈ *Buy me a diamond ring, DM I'll marry you*). However, in the latter sentence, *alors* might be temporal (roughly synonymous with *à ce moment là*). The temporal *alors* in French is not unlike *then* in English (Glasbey 1994). *Du coup* is much better than *donc* and *alors* in modal subordination, which suggests that it has a (limited) accommodation potential.

<sup>2</sup> AL with operations can be rephrased with the help of *hybrid logics* (see Blackburn & Seligman 1998, for an overview). Consider assignments  $g$  which interpret variables as info. states. We define the denotation of a formula of hybrid logics as the set of assignments such that the formula is true at the states assigned by an assignment to the variables of the formula. Let  $R^{\text{imp}}$  the accessibility relation between worlds and their imperative evaluation basis. Define:  $\text{IMP}\phi$  is true at  $s$  for an assignment  $g$  iff there exists some  $s'$  such that  $sR^{\text{imp}}s'$  and  $\phi$  is true at  $s'$  for  $g$ . Then, an update  $\curvearrowright!\phi$  succeeds at a transition  $\langle s^\sigma, s'^\tau \rangle$  iff  $\langle s^\sigma, s'^\tau \rangle \in \llbracket \downarrow_X \text{IMP}\downarrow_Y \phi \rrbracket$ .

<sup>3</sup> As noted by Sorin (1984), *if* clauses and imperatives are not freely substitutable. See for instance (A) vs (B) (her (32a) vs (34)).

- A. Fais <sup>??</sup>quelque erreur et il te méprisera  
(Make DET mistake and he'll despise you)
- B. Si tu fais quelque erreur, il te méprisera  
(If you make DET mistake, he'll despise you)

Sorin proposes that *quelque* is 'positive' (in a more recent formulation, it is not an API in the sense of Giannakidou 1998) and may not, *qua* positive, be used in a threat. This explanation is consistent with the present analysis, if we assume that, in a threat, in parallel with the impera-

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tive update, the ‘realistic’ epistemic alternatives to the current world are updated with the negation of the proposition of the imperative clause. The imperative and ‘realistic’ updates have then a form  $\neg!\phi$  and  $\neg\Diamond^R\neg\phi$ . In contrast, the epistemic alternatives used in the interpretation of the pseudo-imperative remain subject to an update  $\neg\Diamond\phi$ . The realistic alternatives are normally used to evaluate the felicity of polarity items (Giannakidou 1998). When they are updated with a negative proposition, the items occurring in it must have the correct polarity. But *quelque* is hardly compatible with a negative context (*Tu n’as pas fait ?? quelque erreur*). The same observation holds for the Free Choice item *n’importe quel*, which is not felicitous in threats: *Fais ?? n’importe quelle erreur et il te méprisera*.