Discourse Relations versus Discourse Marker Relations

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Abstract

While it seems intuitively obvious that many discourse markers (DMs) are able to express discourse relations (DRs) which exist independently, the specific contribution of DMs – if any – is not clear. In this paper, we investigate the status of some consequence DMs in French. We observe that it is difficult to construct a clear and simple definition based on DRs for these DMs. Next, we show that the lexical constraints associated with such DMs extend far beyond simple compatibility with DRs. This suggests that the view of DMs as signaling general all-purpose DRs is to be seriously amended in favor of more precise descriptions of DMs, in which the compatibility with DRs is *derived* from a lexical semantic profile.

1 Introduction

The idea that discourse markers (DMs) like *then* or *anyway* signal underlying discourse relations (DRs) like cause, opposition, contrast, etc., has been adopted in a certain number of works on text and conversation structure (see Roulet 1985, Martin 1992, Knott 1996 for various examples). In itself, the idea is reasonably intuitive and appealing and seems empirically true to a large extent (Knott 1996). However, the linking between DRs and DMs is more intricate than is currently assumed. We show here that some French consequence DMs akin to *therefore* (*donc, par conséquent, alors*) are difficult to describe in terms of DRs. We argue that such clashes are due to the semantic *profiles* of DMs, that is to the way DMs 'see' the left and right argument of the semantic relation they denote. We offer an analysis of the profile of the *donc* class DMs along the lines of Veltman's update semantics (Veltman, 1996). We conclude that the compatibility of DMs with DRs must be studied by identifying first the relational core of DMs, that is, the semantic relation they denote and the types of arguments selected by this relation.[1]

2 The profile problem

2.1 Observations

Let us consider the following examples.

(1) a. Je me suis réveillé trop tard. DONC je
I woke up too late. Therefore I
n'ai pas pu aller à la réunion
couldn't go to the meeting

b. Jean n'était pas à la réunion. DONC
John wasn't at the meeting. Therefore
il a dû se réveiller trop tard
he must have waked up too late

(2) a. Je n'ai pas pu regarder la télé, est-ce que
I couldn't watch the TV, is-it that
les Red Sox ont gagné?
the Red Sox won?
(I couldn't watch the TV, did the Red Sox win?)

b. Je n'ai pas pu regarder la télé, ??DONC est-ce que les Red Sox ont gagné?
(I couldn't watch the TV, therefore did the Red Sox win?)

c. Je n'ai pas reçu le rapport, DONC
I didn't receive the report, therefore
est-ce que le départment l' a envoyé?
is-it that the department it sent
(I didn't receive the report, therefore did the department send it?)

(3) a. Ouvre la fenêtre, (et) on aura de
Open the window, (and) we will get some
l'air
air
(Open the window (and) we'll get some fresh air)

b. Ouvre la fenêtre, ??DONC on aura de l'air
(Open the window, therefore we'll get some fresh air)

[1] In this paper, we consider only the *deductive* use of *donc*, in monologual written speech, a use illustrated for example by *Paul opened the window,* DONC *we got some fresh air*. We ignore here other uses of *donc*. We will also ignore the other class of consequence connectives (*du coup, de ce fait*), for which the reader is referred to (Jayez and Rossari, 1998). Unless indicated otherwise, *donc*, *alors* and *par conséquent* are intersubstitutable in the examples. This does not mean, however, that these DMs are synonymous in all contexts (see (Jayez and Rossari, 1998) for the difference between *donc* and *alors*).

c. Si tu ouvres la fenêtre, ALORS on
If you open the window, then we
aura de l'air
will get some air

(4) a. Sois à l'heure. Prends l' autoroute
Be on time. Take the highway

b. Tu es en retard, DONC prends l'
You are late, therefore take the
autoroute
highway

c. Sois à l'heure, ??DONC prends l'
Be on time. therefore take the
autoroute
highway

d. Essaie d'être à l'heure. Donc prends
Try to be on time. Therefore take
l' autoroute
the highway

e. Prends l' autoroute. ??DONC sois à
Take the highway. Therefore be on
l'heure
time

When it is used to connect two assertions, the consequence DONC corresponds either to a cause–consequence relation, as in (1-a), or to a consequence–cause relation, as in (1-b). In contrast, it is not clear how we should analyze the behaviour of DONC in the other examples (2-b)–(4-e). The most striking fact is that no simple correlation between the speech act types (assertion, question, imperative) and the possibility of using DONC emerges from the examples.

In (3-a), the second proposition appears as a consequence of the execution of the imperative, as evidenced by the future tense.[2] DONC is extremely clumsy in such contexts, while it may occur after imperatives in some others (cf. (4-d)). In (4-a), the relation is a means–end one. Taking the highway is a possible means to arrive somewhere in due time. To explain (4-c), it could be argued that DONC does not support means–end relations. But, first, this does not square well with (4-b) and, second, the contrast (4-c)–(4-d) remains to be explained.

2.2 Speech acts and semantic profile

DRs, *qua* relations, bear on arguments of some type(s). We call *profile* of a DR or DM the types of its arguments. It is possible to express profile distinctions within theories of DRs. For instance, Sanders et al. (1992) use the primitive Source of Coherence with the two values Semantic and Pragmatic, corresponding respectively to a link between propositional contents and between illocutionary meanings (or speech acts). In Cause–Consequence or Consequence–Cause relations, the value of Source of Coherence is Semantic, while it is Pragmatic for Goal–Instrument relations. If we assume that questions like (2-a) are grounded on a Cause–Consequence relation, the clumsiness of (2-b) can be explained by noting that there is no link between the propositional contents of the assertion and of the question: my watching the TV cannot influence the result of the game. Unfortunately, the same line of argument predicts that (2-a) itself is anomalous. Symmetrically, let us assume that (2-a) is rather a Goal–Instrument relation with Goal = 'the speaker wants to know whether p' and Instrument = 'the speaker asks whether p'. We could explain (2-b) by denying to DONC any compatibility with a Goal–Instrument connection. However, this is not consistent with the possibility of examples like *I need a hammer,* DONC *lend me yours for a minute.* Another variant of the same problem occurs when one tries to use commonsense DR categories like *justification* (Roulet et al., 1985; Mann and Thompson, 1988). DONC normally resists introducing a justification, as in (3-b). But, in some cases, it is able to introduce a speech act justified by a proposition (4-b), while in other cases the very same pattern does not license DONC (2-b).

Knott (1996) proposes that semantic and pragmatic connections are sensitive to *intended effects.* The semantic intended effect is that the addressee believes the relation associated with the DR to hold between the propositional contents of the arguments. If DONC is semantic rather than pragmatic, we can account for the clumsiness of (2-b) in the same way as Sanders et al.: watching the TV cannot influence the result of the game. However, this is not consistent with the impossibility of (3-b). The pragmatic intended effect is that some relation actually holds between the intended effects associated with the arguments. In (2-a), the intended effect of the assertion is that the addressee believes that the speaker did not watch TV. The intended effect of the question is that the addressee answers the question, if possible at all. The intended effect of the whole is that the first belief causes the addressee to answer the question. If DONC is pragmatic and expresses a consequence relation, the intended effect of the first argument must have the intended effect of the second as one of its consequences. This seems to be the case in (2-b). Yet the linking is not natural.

These hypotheses seem to suffer from calibration problems. The possible profiles they allow us to construct tend to overlicense or underlicense the observed combinations.

2.3 Towards a dynamic notion of profile

The difference between (3-a) and (3-b) hints at what is happening. In (3-a), obeying the command results in a situation in which the window is open. This situation is not real but only potential. Using *accom-*

[2] Such *pseudo-imperatives* are studied in (Clark, 1993).

modation (Lewis, 1979), we can consider a potential version of the real world in which this situation is realized. In such a version, it is legitimate to conclude that we'll get some fresh air. Although the technical details of accommodation are somewhat intricate (see Frank 1996 for a recent survey), the general principle remains constant. Accommodation gives us the opportunity of importing information in a possible world.

How is it that DONC seems to block accommodation in (3-b), although there is a clear Cause–Consequence relation between opening a window and getting some fresh air? Generally speaking, DONC requires that we construct an inferential bridge between the representation of the first sentence and that of the second sentence. In (3-b), obeying the command creates a potential world where the window is open. Assertions consist basically in updating a world with the information conveyed by the asserted sentence. So, they are functions from a state of some world to another state of the same world. This granted, there are several options.

(i) The assertion in (3-b) is evaluated in the potential world where the window is open. There is no reason why the sentence should be odd.

(ii) The opening of the window is evaluated in the world where the assertion is, that is, presumably, the real world. Again, there is no explanation for the oddness of (3-b).

(iii) The opening of the window and the assertion are evaluated in different worlds. This could explain the oddness of (3-b).

So, the option (iii) seems to be the right candidate, but the only difference between (3-b) and (3-a) is the occurrence of DONC in the former. Therefore, DONC must be responsible for the phenomenon.

Specifically, we make two assumptions.

(i) DONC signals some consequence connection between two semantic constructs.

(ii) This connection is evaluated in *one* type of world at one time. It may not link two constructs from two different types of world at the same time.

(i) is unobjectionable. One of the roles of a consequence DM is to signal a consequence relation. Which notion of consequence is appropriate remains to be seen, however. From (i) we derive the observation that the left construct must have the type of a proposition (or, more generally, of a judgment). (ii) explains why we cannot freely mix speech act types with DONC. We can go from assertions to assertions or from imperatives to imperatives because we stay in the same type of world. We can go from assertions to imperatives because there is some reflection of the world of assertions in that of imperatives.[3] This is as expected if we consider that, in a consequence relation, the premise and the conclusion must have the same modal status (belong to the same world).

Condition (i) echoes the current belief that questions do not introduce propositions, that is, semantic constructs evaluated as true or false (in some world). If consequence DMs need propositional premises, they cannot follow questions.[4] That imperatives have a propositional behavior, on a par with assertions and in contrast with questions, is evidenced by the following contrasts.

(5) a. Il a ouvert la fenêtre, ce qui a rafraîchi
He opened the window, which cooled
la pièce
the room

b. Ouvre la fenêtre, ce qui rafraîchira la
Open the window, which will cool the
pièce
room

c. Est-ce qu' il a ouvert la fenêtre?
Is-it that he opened the window?
??Ce qui rafraîchira la pièce
Which will cool the room
Did he open the window? Which will cool the room

The remaining problem is that DONC accepts questions on its right, as in (2-c). DONC does not accept just any question, however, but only those questions which convey some propositional link between one of the possible answers and the proposition/judgment on the left. In (2-c), in view of the fact that the speaker did not receive the report, it is more plausible, other things being equal, that the department did not send it than the contrary. The constraint that the proposition on the left should impinge on the possible answers to the question explains why (2-b) is strange. My (not) watching the TV cannot possibly exert any influence on the result of the game. The observations show that DMs of the DONC class connect speech acts only if the left speech act is a judgment and conveys information which renders the right speech act *propositionally successful*. We define a speech act to be propositionally successful if the states of affairs it represents as true or presupposes to be possible in a given (set of) world(s), by means of its propositional content, are actually true or possible in this (these) world(s). The restriction *by means of its propositional content* is essential. It distinguishes between propositional success

[3] Concerning *if*-clauses, there is a sharp difference between ALORS and DONC and PAR CONSÉQUENT whose compatibility with conditional structures is poor. See (Jayez and Rossari, 1998) for a discussion of this problem.

[4] Recall that we consider here the *deductive* use of *donc*. As shown in (Rossari and Jayez, 1997), DONC may follow questions when it has a *rephrasing* use corresponding to *in other terms* (Tanaka, 1997). Deductive consequence connectives, however, are strange after questions.

and pragmatic felicity. The question in (2-a) is felicitous if we assume that the speaker does not know the answer. But it is not necessarily propositionally successful given the first assertion *I couldn't watch the TV.* The possibility that the Red Sox won is neither implied nor entailed in any reasonable sense by the first sentence. DONC resists the consequence relation in this case because it does not 'see' speech acts as such, but their underlying informational structure. So, the semantic/pragmatic distinction is of no avail in the case of DONC. We need to construct specific objects to which DONC is sensitive. This sensitivity constitutes the *profile* of DONC and of its mates (*alors* and *par conséquent*).

The difference on the left between questions and the other speech acts points to a notion of *dynamicity*: assertions and imperatives update information structures, questions just *test* them, that is, check that certain conditions are satisfied. Veltman's *update logic* (Veltman, 1996; Groeneveld, 1995) provides a convenient framework for studying the dynamics of information at an abstract level. Roughly, updating an information state with an expression ϕ amounts to suppress all worlds where $\neg\phi$ is true. An expression $Might\ \phi$ holds in an information state if the state is consistent with ϕ. Unfortunately, the difference between a possibility $Might\ \phi$ introduced by an assertion and that associated with a question is extremely difficult to express in this framework. There is no substantial difference between the static truth of $Might\ \phi$ (a test triggered by a question) and a dynamic update with $Might\ \phi$ (an assertion of possibility, as in *Mary is late, so she* might *have missed the train*). In the next section, we describe informally a modification of the framework which allows us to take into account this difference.

2.4 Speech acts and DONC

An information state is a set of worlds (epistemic alternatives, possibilities). We consider the basic epistemic objects to be *sets* of information states. Information states and updates in Veltman's sense are called V-states and V-updates. Non-modal assertions (without *Might*) update a set of states by V-updating each member of this set (i.e. each V-state). Imperatives have a similar effect, but they bear on a set of ideal future V-states. $Might\ \phi$ assertions update states by withdrawing every V-state where $Might\ \phi$ is false. Questions only test whether there is some V-state in which a given appropriate answer is possible. So, they do not update anything in a strong sense (they are static or non-eliminative). However, questions, like genuine updates, are functions: applied to a state, they return this state or the absurd state (the empty set of V-states). Consider the two examples below.

(6) a. It's not Paul, neither Henry, so who did it?

b. This is obvious, so who would say the contrary?

In (6-a) and (6-b), the speaker seems to be prepared to accept *Nobody you might know* and *Nobody* as appropriate answers. It is often the case that questions impose a hierarchy of speaker-oriented expectations on the set of appropriate answers. We will speak of *expected answers* in this case. The effect of questions is to test whether appropriate answers are possible. When the question does not imply some preference of the speaker, the set of expected answers and the set of appropriate answers coincide.[5]

Let $O(\phi)$ DONC $O'(\psi)$ be the logical form of a X DONC Y construction, where O and O' are operations (updates, etc.) on ϕ and ψ. DONC signals that there is some set of rules, say R, such that the possibility of updating/testing successfully the way we do on the right ($O'(\psi)$) is predictable from the update on the left ($O(\phi)$). DONC warns us that, for some R, R and $O(\phi)$ jointly predict that $O'(\psi)$ cannot always fail.[6] In other terms, DONC connect operations of certain kinds, not propositional contents, nor speech acts in the traditional sense. This is because speech acts signal operations that they are sometimes (mis)taken for the arguments of the DONC-relation.

3 A dynamic model of profile

3.1 Basics

In update semantics, information states are sets of worlds. Updating an information state with some formula ϕ consists in eliminating from the information state all the worlds where ϕ does not hold.

Def. 1 — Information states and updates
Let P be a set of atomic propositions $p, q, \dots$ and $B(P)$ the set of boolean combinations of members of P. Members of $B(P)$ are called expressions and are denoted by $\phi, \psi, \dots$. A world $(w, w', \dots)$ is a set of expressions. A V-state $(s, s', \dots)$ is a set of worlds.
An expression ϕ holds in a world w, in symbols $w \models \phi$, iff $\phi \in w$. There is no expression ϕ and no world w such that $w \models \phi$ and $w \models \neg\phi$.
The update of s with ϕ, in symbols $s + \phi$, is defined by: $s + p = \{w : w \in s \wedge w \models p\}$, $s + \neg\phi = s - \{w : w \models \phi\}$, $s + \phi \vee \psi = s + \phi \cup s + \psi$. Usual boolean equivalences hold. ϕ is called the update expression.
A V-state s accepts an expression ϕ, in symbol $s \Vdash \phi$ iff $s + \phi = s$. A V-state s tolerates an expression ϕ iff $s + \phi \neq \emptyset$.

[5] In a series of works, Ginzburg has proposed to extend the notion of *appropriate answer* used in the current literature on questions (see Ginzburg 1998 for a global presentation). Assessing the (possible) usefulness of this extension for our current purpose is beyond the scope of this paper, however. We ignore also, for space reasons, the problem of the 'negative value' of questions (Ducrot 1984, 227–228).

[6] That the DONC sentence does not (always) sound redundant comes from the fact that the rules are not explicitly indicated, but are to be reconstructed *via* some abductive process.

Note that the empty V–state (or *absurd* V–state) accepts anything and tolerates nothing.

This basic language is extended by considering expressions of possibility of the form $Might\ \phi$. The update notion is extended as follows.

Def. 2 — Update for $Might$ expressions
$s + Might\ \phi = s$ if $s + \phi \neq \emptyset$, $\emptyset$ otherwise.
Obviously, for $s \neq \emptyset$, s tolerates ϕ iff s tolerates $Might\,\phi$, and s accepts $Might\ \phi$ iff s tolerates $Might\ \phi$.

3.2 Information states

An information state (henceforth simply *state*) is a set of V–states. We distinguish two types of states corresponding to assertions and imperatives. They are noted S^{assert} and S^{imp} respectively. A boolean expression without $Might$ is called *classical*. A state accepts ϕ iff each of its V–states accepts ϕ.

Def. 3 — Assertive and imperative updates
The update of S^{assert} with a classical expression ϕ, noted $S^{assert} \oplus \phi$, is the set of non–empty V–states s such that, for some s' in S^{assert}, $s = s' + \phi$.
The update of S^{assert} with $Might\ \phi$, where ϕ is classical, noted $S^{assert} \oplus Might\ \phi$, is the set of V–states s in S^{assert} such that s tolerates ϕ.
The update of S^{imp} with ϕ, noted $S^{imp} \oplus \phi$, is defined as in the S^{assert} case, provided that S^{imp} does not accept ϕ, in which case the update returns the empty set.
The conditional update of S^{imp} with ϕ, noted $S^{imp} \oplus^c \phi$, returns S^{imp} itself if S^{imp} accepts ϕ, and $S^{imp} \oplus \phi$ otherwise.
The conditional update of S^{assert} is not different from the standard update: $S^{assert} \oplus^c \phi = S^{assert} \oplus \phi$.
When the update of S with ϕ is (not) the empty set, we say that the update fails (succeeds). When $S \oplus Might\ \phi$ succeeds, we say that S tolerates ϕ. ϕ is called the update expression.

Assertive updates with classical expressions consist in V–updating each member of the state with the expressions. For $Might\ \phi$ expressions, we keep only the V–states where ϕ is not *a priori* excluded. Imperative updates with ϕ also amount to force the realization of ϕ, whenever it is not already accepted.

A *global state* **S** is a pair (S^{assert}, S^{imp}). Global states are subject to two conditions on imperative states. A faithfulness condition ensures that imperative states reflect assertive states: every expression accepted in an assertive state is also accepted in the associated imperative state. So, imperative states are 'realistic': they take true states of affairs into account. To avoid conflicts, we use conditional updates for imperatives: S^{imp} is not updated with ϕ if it contains ϕ. The second condition, labelled *Must* $\Rightarrow$ $Might$, stipulates that an obligatory state of affairs is always possible. In a more intuitive form, one does not issue commands which cannot be executed.[7]

[7] See (von Wright, 1971) on this and related topics. $Must\,\phi$ expressions are considered to be classical in the context of this paper.

Def. 4 — *Must* $\Rightarrow$ $Might$
If S accepts $Must\ \phi$, $S \oplus Might\ \phi$ succeeds.

Def. 5 — Global states
A global state **S** is a pair (S^{assert}, S^{imp}) where every expression accepted in every V–state of S^{assert} is accepted in every V–state of S^{imp}. A global state (S, S') is degenerate when S or S' is the empty set. It accepts an expression ϕ when S and S' accept ϕ

Def. 6 — Propositional denotation
The propositional denotation of a sentence P, noted $[\![\mathrm{P}]\!]^I$, is a set of pairs of global states, where the second member of each pair is obtained by updating/testing the first member.
If the sentence P consists in asserting that ϕ, $[\![\mathrm{P}]\!]^{I,\phi} = \{\langle (S_1^{assert}, S_1^{imp}), (S_2^{assert}, S_2^{imp})\rangle : S_2^{assert} = S_1^{assert} \oplus \phi$ and $S_2^{imp} = S_1^{imp} \oplus^c \phi\}$.
If the sentence P consists in commanding that ϕ, $[\![\mathrm{P}]\!]^{I,\phi} = \{\langle (S_1^{assert}, S_1^{imp}), (S_1^{assert}, S_2^{imp})\rangle : S_2^{imp} = S_1^{imp} \oplus \phi\}$.
If the sentence P is a question which respect to which ϕ is an answer, $[\![\mathrm{P}]\!]^{I,\phi} = \{\langle (S^{assert}, S^{imp}), (S^{assert}, S^{imp})\rangle : S^{assert}$ tolerates $\phi\}$.
To shorten notation, we write $\mathbf{S} \oplus \phi$ instead of $(S^{assert} \oplus \phi, S^{imp} \oplus^c \phi)$ when $\mathbf{S} = (S^{assert}, S^{imp})$.

The faithfulness condition is implemented by imposing a parallel update on S^{assert} and S^{imp} in assertions. The definition separates updates and tests. Updates correspond to assertions and imperatives. They consist in changing V–states by eliminative V–updates. Tests correspond to questions. They consist in checking that a state tolerates a certain expression. Since, in this case, the expression is not uniformly true nor possible across V–states, it cannot provide a stable premise from which to draw a conclusion. This explains why consequence connectives, which mimic the game of drawing conclusions from premises, cannot be preceded by questions in monologues. Note that, in line with the remarks of section 2.3, we do not consider the denotation of sentences in general, but only those denotations (propositional denotations) which are 'seen' by DONC.

3.3 Rules

We will not attempt to discuss here the nature of the commonsense rules and inference schemas which are used in theories of semantic interpretation. In the context of this paper, we only need to make two simplistic assumptions.

1. A rule is an implicative structure of form $\phi_1 \wedge \ldots \wedge \phi_n \Rightarrow \psi$, with its traditional semantics: ψ is true whenever $\phi_1 \ldots \phi_n$ are.
2. The set of rules does not form a *theory* in any logically interesting sense. It is just a package of resources. We can freely use any subset of rules to obtain a given conclusion and we have no warranty that the set of rules is classically consistent.[8] This

[8] A well-known cause of inconsistency is the coexistence in a rule database of monotonic rules like $R1$ and $R2$: $R1 = \phi \Rightarrow$

can remedied by imposing a non-monotonic structure on the inferential relation $\Rightarrow$ as in (Veltman, 1996). However, this is not a move we will consider here. We will rather focus on the definition of an appropriate entailment relation. We need a slightly more subtle notion than that of entailment between expressions. The next definition says that some operation (update/test) entails some other operation modulo $\mathcal{R}$ whenever successfully executing the first entails modulo $\mathcal{R}$ that we can successfully execute the second.

Def. 7 — Operation entailment
Let $\mathcal{R}$ be a set of rules and $O(\phi)$ and $O'(\psi)$ two operations of update or test with ϕ and ψ, we say that $O(\phi)$ $\mathcal{R}$–entails $O'(\psi)$ iff, for every global state **S**, applying $O(\phi)$ to **S** results in a state $\mathbf{S}' = O(\phi)[\mathbf{S}]$ for which there exists a rule $r = \phi \Rightarrow X$ in $\mathcal{R}$ such that, if $\mathbf{S}'' = \mathbf{S}' \oplus r$ is non–degenerate, $O'(\psi)[\mathbf{S}'']$ is non–degenerate.

Since operations correspond to sets of pairs of global states which themselves correspond to sentences, the last definition readily extends to sentences and practically gives us the denotation of DONC.

3.4 DONC semantic profile

We now define the denotation of a sentence pair of form P DONC Q, where DONC has its deductive sense. It is the set of pairs of global states $\langle S, S'' \rangle$ such that there is an intermediate global state S' that one reaches from S by a conditional P–update and whose update by a finite subset of $\mathcal{R}$ warrants a successful conditional Q–update or Q–test. We require the operations to be conditional because we want to draw a distinction between cases where imperative speech acts are infelicitous in view of the context and cases where conditions on DONC are not satisfied. E.g., a command that ϕ is infelicitous if ϕ already holds. However, the same command is not necessarily incompatible with the constraints on DONC.

Def. 8 — DONC semantic profile
Let $\mathcal{R}$ a set of rules, ϕ and ψ two expressions. **[**P DONC Q**]** with respect to $\mathcal{R}$, ϕ, ψ is the set of pairs $\langle S, S'' \rangle$ such that:
a. $O(\phi)$ is the conditional version of the operation associated with P and is an update,[9] $O'(\psi)$ is the conditional version of the operation associated with Q.
b. There exists S' such that $\langle S, S' \rangle \in [\mathrm{P}]^{I,\phi}$ and $\langle S', S'' \rangle \in [\mathrm{Q}]^{I,\psi}$.
c. $O(\phi)$ $\mathcal{R}$–entails $O'(\psi)$.

To motivate informally this definition, consider (2-b) again. The first assertion results in updating S_1^{assert} and S_1^{imp} with an expression `not watch TV`. This results into a state $(S_2^{assert}, S_2^{imp})$ which accepts `not watch TV`. Let us assume that we have a rule in $\mathcal{R}$: `not watch TV` $\Rightarrow$ `not know result`. Then, updating S_2^{assert} and S_2^{imp} with the rule results in a global state where the two members accept `not know result`. The question *Did the Red Sox win* is interpreted as connected with answers like `Red Sox win` or `Red Sox not win`. But, clearly, the fact that `not know result` is accepted does not warrant that `Red Sox win` is tolerated by any V–state in the question test on S_2^{assert}. The same holds for `Red Sox not win`. So, we are in no position to conclude that the test will be successful, unless we ascribe to the sentence some contrived interpretation.

The definition distinguishes between (i) the *conditional* operations which are used to check out $\mathcal{R}$–entailment and (ii) (absolute) operations associated with P and Q. This allows for situations in which $\mathcal{R}$–entailment holds, but there are still problems with P and/or Q, which is precisely the case in (4-c). In the next section, we show how the proposed constraints shed light upon other observations.

4 Applications

Assertion–Imperative
This the (4-b) case.
You are late : $(S_1^{assert}, S_1^{imp}) \longrightarrow (S_2^{assert} = S_1^{assert} \oplus \texttt{late}, S_2^{imp} = S_1^{imp} \oplus^c \texttt{late})$ (by def. 6 and 8).
We assume a rule r: `late` $\Rightarrow$ *Must* `highway`. When somebody is late, she must take the highway (in certain circumstances).
$(S_2^{assert} \oplus r, S_2^{imp} \oplus^c r)$ accepts *Must* `highway`.
Take the highway : $(S_2^{assert} \oplus r, S_2^{imp} \oplus^c r \oplus^c \texttt{highway}) \longrightarrow (S_2^{assert} \oplus r, S_3^{imp} \neq \emptyset)$.
Success is warranted because the principle *Must* $\Rightarrow$ *Might* entail that any conditional update with `highway` will be succesful. Of course, (4-b) could be issued in a context where the addresse is already on the highway. It would then be infelicitous, but DONC is not responsible for this communication clash.

Imperative–Imperative Let us explain the contrast (4-c)–(4-d). In (4-c), we have:
Be on time : $(S_1^{assert}, S_1^{imp}) \longrightarrow (S_2^{assert} = S_1^{assert}, S_2^{imp} = S_1^{imp} \oplus^c \texttt{on time})$.
We assume there is a rule r = `on time` $\Rightarrow$ `highway`. This rule is intended to mean that somebody who is on time is on the highway or took the highway.
$(S_2^{assert} \oplus r, S_2^{imp} \oplus^c r)$ accepts `highway`.
Take the highway : $(S_2^{assert} \oplus r, S_2^{imp} \oplus^c r \oplus^c \texttt{highway}) \longrightarrow (S_2^{assert} \oplus r, S_3^{imp} \neq \emptyset)$.
$\mathcal{R}$–entailment holds, *but* the imperative update associated with Q (=*take the highway*) is bound to fail, since S_2^{imp} accepts `highway`. This is a case where satisfying the DONC constraint amounts to an

ψ, $R2 = \phi \wedge \chi \Rightarrow \neg\psi$. When ϕ and χ are both true ψ and $\neg\psi$ are both true.

[9] Actually, we could eliminate this condition by defining a more general notion of *stability*, but this would require some extra technical machinery.

illocutionary suicide: the rule which licenses DONC forbids us to update non-conditionally on the right sentence. A similar explanation goes for (4-e). If the rule links the event of taking the highway and its result (being on time), any update with `on time` fails or is infelicitous, since the addressee is asked to obtain a result (being on time) which is anyway, in the imperative world, an unescapable consequence of what she 'did' (taking the highway) in the same world.

In (4-d), we have:

Try to be on time : $(S_1^{assert}, S_1^{imp}) \longrightarrow (S_2^{assert} = S_1^{assert}, S_2^{imp} = S_1^{imp} \oplus^c \texttt{try on time})$.

We assume that there is a rule $r = \texttt{try on time} \Rightarrow \textit{Must}\ \texttt{highway}$, which is intended to mean that somebody who wants to be on time is going to take the highway.

$(S_2^{assert} \oplus r, S_2^{imp} \oplus^c r)$ accepts *Must* `highway`.

Take the highway : $(S_2^{assert} \oplus r, S_2^{imp} \oplus^c r \oplus^c \texttt{highway}) \longrightarrow (S_2^{assert} \oplus r, S_3^{imp} \neq \emptyset)$. Success is warranted because of the *Must* $\Rightarrow$ *Might* constraint of definition 4.

As noted above, questions on the left are not updates and are thus blocked by def. 8. In contrast, *Might* assertions are treated on a par with assertions. So, *Paul might come,* DONC *he might meet Henry* would analyzed with the help of rules like *Might* `come` $\Rightarrow$ *Might* `meet`, possibly based over non-modal rules like `come` $\Rightarrow$ `meet` in $\mathcal{R}$. Finally, assertion-assertion structures are essentially unproblematic.

5 Conclusion

Although the analysis presented here is limited, it shows that the view of DMs as manifestations of very general communication-oriented DRs is oversimplifying. Some DMs are able to signal DRs only insofar as their own lexical constraints are satisfied. These constrains pertain to the semantic relation and to the argument types associated with particular DMs. An open question is whether the importance of semantic profile is particular to some class(es) of DMs. Consequence connectives are *inferential*, in the sense of (Jayez and Rossari, 1998). The other classes of inferential DMs are oppositive (*yet, however*) and rephrasing (*anyway*). In subsequent work, we will address primarily the following questions. Is the importance of a specific semantic profile particular to the category of inferential DMs? Are the profile restrictions inside the class of inferential DMs just the reflection of the inferential processes these DMs signal, or have they a (partly) independent status?

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