

## How to infer temporal relations in discourse?

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**Abstract:** How can readers and listeners infer temporal relations in discourse? One of the basic inferential task in discourse comprehension consists in inferring time direction, that is, in determining the time of the event relative to the thread of discourse. I show that the computation of directional inference is the result of the interaction contextual and linguistic information. Finally, I answer the question of the order of backward causal inferences.

### 1. Introduction

In recent works on discourse semantics (DS), one major step has been passed while distinguishing two types of knowledge active in discourse interpretation: linguistic knowledge (LK) and world knowledge (WK). In DS, there is a general agreement about the following fact: while LK is defeasible, WK is not. This principle is a general principle of pragmatic analysis, stating that LK is weaker than WK. If we try to understand this principle relatively to conversational implicatures, the parallelism is striking: implicatures are inferences that can defeat literal and compositional meaning, that is, LK. In discourse semantics (as for instance in Asher 1993, Lascarides & Asher 1993, Asher & Lascarides 2003), discourse relations (DR) are the by-product of WK and LK. For instance, in narrative discourses, LK allows to infer Narration, whereas WK can defeat it, as shown in (1) and (2):

- (1) □ Max pushed John. He fell.  
(2) □ John fell. Max pushed him.

The standard interpretation of (1) is Narration (forward inference, FI), whereas the forward reading in (2) is generally defeated in favour of the Explanation or backward inference reading (BI).<sup>1</sup> In other words, if no information coming from WK cancels LK, we are allowed to conclude that the events described in discourse have to be ordered as the discourse processes. Narration is thus the case when no conflict occurs between LK and WK, whereas Explanation is the case when the Narration default reading crashes.

One of the major contribution of Post-Gricean radical pragmatics, as Relevance Theory (RT), is the distinction between conceptual information (CI) and procedural information (PI) (Blakemore 1987, Wilson & Sperber 1993a), and the parallelism between CI and PI and semantic and pragmatic or truth-functional and non-truth-functional information. While CI encodes information about the state of affairs, concept-type expressed by the lexical item linked to the concept, PI is information about how to treat CI. In narrative discourse, it is crucial both for access to representation of eventualities described by utterances and for information indicating how to process between these eventualities. For instance, the computation of directional inference (DI) typically results of applying instructions encoded within PI on representation of events.

This picture is nevertheless too simple. On the one hand, DIs are not simply the by-product of LK and WK, in the sense that LK can defeat WK as much as WK can defeat LK. On the other

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<sup>1</sup> English allows both backward and forward readings for (1) and (2), whereas French *Passé Simple* forbids it:

- |                                 |                        |
|---------------------------------|------------------------|
| (i) Max poussa Jean. Il tomba   | FI <sup>ok</sup> , BI* |
| (ii) Jean tomba. Max le poussa. | FI*, BI <sup>ok</sup>  |

Cf. Moeschler (2003a) for a general description of tense combination and directional interpretations.

hand, PI is not the only type of information triggering DI: so can CI, as the parallel French examples in Passé Composé shows it:

- (3) □ Max a poussé Jean. Il est tombé      *Max pushed John. He fell*      FI<sup>ok</sup>, BI\*
- (4) □ Jean est tombé. Max l'a poussé      *John fell. Max pushed him*      FI\*, BI<sup>ok</sup>

The question is now the following: how does DI occur in discourse if it is not the simple result of WK on LK of PI or CI? What we know about linguistic data is that DIs are not inferred randomly and that some types of discourse are more optimal than others relative to DIs. In other words, we need a complete explanation that can interface linguistic with non-linguistic information and utterance with discourse interpretation.

## 2. Pragmatic or discourse explanation?

The first point to make explicit is the following: do we need any type of *discourse knowledge* (DK) to process DIs in discourse? This question must be seriously asked, even if it has received a consensual positive answer (see Asher 1993, Caenepeel & Moens 1994, Dowty 1996). The consensual positive answer (cf. Vet 1995 for a cognitive motivation) consists in claiming that DK is crucial to the determination of DI. Thus Narration (FI) is highly preferred in narrative discourse, whereas Explanation (BI) is the case in non-narrative discourse (Labov & Waletzky 1967). But this assumption has heavy consequences: it supposes that while processing a narrative discourse, we have a DK such that we know exactly what we have to know, that is, in order to move time forward, we know that we do so because we are processing a narrative discourse. DK is thus a crucial pre-requisit, and if it can be proved that no such knowledge as DK is required, then the explanation cannot presuppose any discourse rule or principle.<sup>2</sup>

What could be an alternative to a discourse-oriented explanation to the computation of DI? Linguistic explanation would suppose that the only procedural information encoded in tenses would be responsible for the triggering the good DI. This solution, proposed for instance in Kamp & Rohrer (1983), meets too many counterexamples to be considered satisfying.<sup>3</sup> The only solution is thus pragmatic, that is, a solution combining linguistic information (and more precisely CI and PI) and contextual information. No specific discourse rule or principle is needed, as we shall see. What we need on the contrary is a theory on how linguistic information combines within contextual information. We claim that Relevance Theory provides the necessary theoretical background.<sup>4</sup>

## 3. The Model of Directional Inferences (MDI)

In MDI (Moeschler 2000), we assume that two main hierarchies organise the relevant types of information active in processing DI: contextual information vs. linguistic information on the one hand, and procedural vs. conceptual information on the second. Among procedural information, we further distinguish scopes: propositional vs. morphological. We obtain thus the following hierarchy of information:

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<sup>2</sup> This is the thesis advocated in Reboul & Moeschler (1998), in which discourse comprehension is explained as a non-demonstrative inference process including hypothesis on communicative and informative intention attributed to both utterance and discourse (respectively local and global communicative and informative intentions).

<sup>3</sup> In Kamp & Rohrer (1983), French Passé Simple encodes Forward Inference, French Plus-Que-Parfait encodes Backward Inference, and French Imparfait encodes Inclusive Inference.

<sup>4</sup> In Moeschler (2000), we claim that DI are not Gricean implicatures (neither conventional nor conversational), but contributions to the explicatures of the utterances (they contribute to the truth value of the utterance).

- A. Contextual information is stronger than linguistic information.
- B. Procedural information is stronger than conceptual information.
- C. Propositional procedural information is stronger than morphologically incorporated procedural information.

These three principles organise the linguistic system and the principles of its use. Principle A means that a contextual assumption can defeat a DI inferred on the basis of the sole linguistic information. Principle B states that tenses are stronger than concepts, for instance causally related concepts. Finally, principle C claims that all functional materials in C or higher than T in the syntactic tree are stronger than tenses located in the head of TP.<sup>5</sup> Let us illustrate these principles.

### 3.1 Principle A

In (5) and (6), time direction comes from the projection of a causal rule (7) onto a contextual assumption (8), the normal contextual implication being (9):

- |     |                                     |                                  |                        |
|-----|-------------------------------------|----------------------------------|------------------------|
| (5) | Max a poussé Jean. Il est tombé     | <i>Max pushed John. He fell</i>  | FI <sup>ok</sup> , BI* |
| (6) | Jean est tombé. Max l'a poussé      | <i>John fell. Max pushed him</i> | FI*, BI <sup>ok</sup>  |
| (7) | (PUSH, X, Y) CAUSE (FALL, Y)        |                                  |                        |
| (8) | If Max pushed John, then John fell. |                                  |                        |
| (9) | John fell after Max pushed him.     |                                  |                        |

Now we can imagine another contextual assumption, for instance (10). (5) and (6) would then have respectively a BI and a FI reading, allowing the new contextual implication (11):

- (10) Max pushed John and then John fell.
- (11) Max pushed John because John fell.

These readings are certainly less probable than the standard forward (5) and backward (6) ones, but could occur in appropriate contexts. Thus, Principle A does not explain only standard cases, but also non-standard ones.

### 3.2 Principle B

French Passé Simple (PS) and Plus-Que-Parfait (PQP) are the best illustration of Principle B. In examples (12) to (15), procedural information given by tenses either confirms or defeats conceptual information given by the push-fall causal rule:

- |      |                                 |                                       |                        |
|------|---------------------------------|---------------------------------------|------------------------|
| (12) | Max poussa Jean. Il tomba       | <i>Max pushed John. He fell</i>       | FI <sup>ok</sup>       |
| (13) | Jean tomba. Max le poussa       | <i>John fell. Max pushed him</i>      | FI <sup>ok</sup> , BI* |
| (14) | Max poussa Jean. Il était tombé | <i>Max pushed John. He was fallen</i> | BI <sup>ok</sup> , FI* |
| (15) | Jean tomba. Max l'avait poussé  | <i>John fell. Max had pushed him</i>  | BI <sup>ok</sup>       |

Note here that the constraint imposed by tenses differs from the one imposed by a contextual assumption: no alternative reading than FI and BI are here possible. Optimal discourses will be those that violate the less constraints. Thus (12) and (15) are more optimal than (13) and (14).

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<sup>5</sup> We assume that principles A and B are universal, whereas principle C is not. The distinction between incorporated and propositional information can be irrelevant in many languages.

### 3.3 Principle C

What happens when we add functional material like temporal or causal connectives? The prediction is that DI is given by connectives, which implies that connectives can impose a time direction opposite to the one encoded by tenses. If this is the case, the discourse should be interpretable, but less optimal than in cases where PI is co-directional:

- |      |   |  |                  |
|------|---|--|------------------|
| (16) | Max poussa Jean <i>et</i> il tomba              | <i>Max pushed John and he fell</i>           | FI <sup>ok</sup> |
| (17) | Jean tomba <i>et</i> Max le poussa              | <i>John fell and Max pushed him</i>          | FI <sup>ok</sup> |
| (18) | Max poussa Jean <i>parce qu'</i> il était tombé | <i>Max pushed John because he was fallen</i> | BI <sup>ok</sup> |
| (19) | Jean tomba <i>parce que</i> Max l'avait poussé  | <i>John fell because Max had pushed him</i>  | BI <sup>ok</sup> |

In these examples, where PI converge, (16) is more optimal than (17), and (19) more optimal than (18), because in (16) and (19), there are no conflicts between CI and PI, whereas in (17) and (18) such conflicts arise. In examples like (20) and (21) where PI diverges, interpretation processes become more difficult, and judgments of acceptability vary. For instance, (20) could be rejected from a normative point of view, whereas (21) is almost impossible to process because of the divergence between the time directions encoded by the connective (*et*) and by the tense (PQP):

- |      |  |  |                  |
|------|--|--|------------------|
| (20) | Jean tomba, <i>parce que</i> Max le poussa | <i>John fell, because Max pushed him</i> | BI <sup>ok</sup> |
| (21) | Max poussa Jean <i>et</i> il était tombé   | <i>Max pushed John and he was fallen</i> | FI <sup>??</sup> |

We must now introduce two other principles explaining the way we combine in computation temporal and directional information. We have to introduce a new concept, that is, *directional feature*.

### 3.4 Directional features and principles D and E

Linguistic and non-linguistic information are hierarchical in the sense given by principles A to C. But the computation of DIs is based on atomic information encoded in directional features. We will examine here only two different features, forward and backward features. Features can on the other hand be weak or strong. So the DI device contains four types of features: (i) weak forward features [ff]; (ii) weak backward features [bf]; (iii) strong forward features [FF]; (iv) strong backward features [BF].<sup>6</sup>

How can we then compute DIs relatively to directional features? We must introduce two subsequent principles:

- D. A strong feature wins over a weak feature or a string of weak features.
- E. A weak feature or a string of weak features must be licensed by a strong feature.

These principles state that for a DI to be driven a strong feature must be accessible in order to give or to license the DI. The following algorithm makes explicit the procedure of DI assignation:

#### *Algorithm of DI assignation*

1. assign to utterance U1 a directional feature in function of directional features carried by U1's linguistic expressions;
2. if possible, construct of a contextual assumption on the basis of conceptual expressions;

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<sup>6</sup> The hierarchy of information given by principles A to C is not reflected in the typology of features: we are looking for general principles and do not want to have an *ad hoc* hierarchy of features

3. assign to utterance U2 a directional feature in function of directional features carried by U2's linguistic expressions;
4. compute DI of discourse [U1-U2];
5. license DI *via* an accessible contextual assumption.

Here is an illustration of this algorithm, which gives a crucial role to contextual assumption in the licensing of DI:

*Jean tomba, parce que Max l'avait poussé (John fell, because Max had pushed him)*

1. assignation of directional feature to U1 (*Jean tomba*)  
*tomba* [ff]<sub>PS</sub>  
U1 [ff]<sub>U1</sub>
2. no contextual assumption can be formed from the concept *fall*
3. assignation of directional feature to U2 (*parce que Max l'avait poussé*)  
*parce que* [BF]<sub>PQ</sub>  
*avait V-é* [bf]<sub>PQP</sub>  
*poussé* [bf]<sub>PUSH</sub>  
U2: [BF]<sub>PQ</sub> & [bf]<sub>PQP</sub> & [bf]<sub>PUSH</sub> = [BF]<sub>U2</sub>
4. computation of [U1-U2]'s DI  
[U1-U2]: [ff]<sub>U1</sub> & [BF]<sub>U2</sub> = [BF]<sub>U1-U2</sub>
5. license DI *via* an accessible contextual assumption (CA):  
accessible CA: if Max pushes John, then John falls  
[BF]<sub>U1-U2</sub>

#### 4. Causal discourse and cause-consequence order

The Model of Directional Inferences discussed above is based on the assumption that directional inferences are crucial for discourse comprehension. Forward and backward inferences are at this point two ways of ordering events represented in discourse.

What I would like to add in this last section is a new piece of my work, based on the semantic and pragmatic analysis of causality. In Moeschler (2003b), I propose a general description of causal discourses and causal constructions, arguing that what makes causality accessible to inference is, from a semantic point of view, the mention of the result-state and its patient, the explication of the agent and the causal event being specific to causative constructions, as in (22):

(22) Marie a fait manger les enfants                    *Mary made the children eat*

In other causal constructions (intransitive inaccusative and transitive ergative ones as 23 and 24), the causal predicate is present, but includes in its meaning the resulting effect, and the agent is defective in the intransitive construction:

(23) L'enfant a coulé le bateau                    *the child sank his ship*

(24) Le bateau a coulé                                *the ship sank*

In causal discourses, both cause and consequence are made explicit, but the canonical order is consequence-cause (25), and not cause-consequence (26):

(25) Le bateau a coulé. La torpille l'a atteint à la proue.  
*The ship sank. The torpedo reached the prow.*

- (26) La torpille a atteint la proue. La bateau a coulé.  
*The torpedo reached the prow. The ship sank.*

In Moeschler (2003b), I made an attempt to give an unified semantic analysis of these constructions, trying to explain the common semantic nature of inaccusative, ergative, causative constructions, as well as causal discourses with consequence-cause order. What I would like to focus on here is the reason why causal discourses have the reverse order rather than temporal or inferential one, given in (26). The conclusion I would like to argue for is that (i) consequence-cause discourses are not the reverse of cause-consequences discourses, (ii) consequence-cause discourses offer optimal order for pragmatic causal inferences. I will give two arguments for these conclusions: (i) French connectives distribution; (ii) experimental data on causal discourses.

#### 4.1. French connectives distribution

One relevant distributional fact is the order of causal relations with connectives. Causal connectives as *parce que* (*because*) generally introduces the cause.<sup>7</sup> The combination of event and state (as cause or consequence) gives four possible pairs of utterances, given in (27), all interpreted as causal in the consequence-cause order. (28) shows the reverse order (cause-consequence) implying inferential use of *parce que*. (29) presents the cause-consequence sets of utterance with an inferential connective (*donc, so*), (30) the consequence-cause sets of the reverse examples, (31) and (32) the same structure with a temporal connective (*et, and*).

- (27) Canonical (consequence-cause) series with *parce que*: causal readings
- CAUSE (EVENT, STATE) : Marie est malade parce qu'elle a trop mangé  
*Mary is sick because she ate too much*
  - CAUSE (EVENT, EVENT) : Jean est tombé parce que Marie l'a poussé  
*John fell because Mary pushed him*
  - CAUSE (STATE, STATE) : Marie ne peut pas boire d'alcool parce qu'elle est mineure  
*Mary cannot drink alcohol because she is a minor*
  - CAUSE (STATE, EVENT) : Le médecin soigne Axel parce qu'il est malade  
*The doctor is treating Axel because he is sick*
- (28) Non-canonical (cause-consequence) series with *parce que*: inferential readings
- Marie a trop mangé, parce qu'elle est malade  
*Mary ate too much, because she is sick.*
  - Marie a poussé Jean, parce qu'il est tombé  
*Mary pushed John, because he fell*
  - Marie est mineure, parce qu'elle ne peut pas boire d'alcool  
*Mary is a minor, because she cannot drink alcohol.*
  - Axel est malade, parce que le médecin le soigne  
*Axel is sick, because the doctor is treating him*
- (29) Canonical (cause-consequence) series with *donc*: inferential and causal readings
- # Marie a trop mangé, donc elle est malade<sup>8</sup>  
*Mary ate too much, so she is sick*
  - # Marie a poussé Jean, donc il est tombé

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<sup>7</sup> One major exception is its inferential use (28).

<sup>8</sup> # means a change in reading (from causal to inferential).

*Mary pushed John, so he fell*

c. Marie est mineure, donc elle ne peut pas boire d'alcool

*Mary is a minor, so she cannot drink alcohol*

d. Axel est malade, donc le médecin le soigne

*Axel is sick, so the doctor is treating him*

What happens here with the cause-consequence order of *donc* is that the causal reading are restricted the states as causes, event-causes giving rise to inferential reading.<sup>9</sup>

(30) Non-canonical (consequence-cause) serie with *donc*: inferential readings

a. Marie est malade, donc elle a trop mangé

*Mary is sick, so she ate too much*

b. Jean est tombé, donc Marie l'a poussé

*John fell, so Mary pushed him*

c. Marie ne peut pas boire d'alcool, donc elle est mineure

*Mary cannot drink alcohol, so she is a minor*

d. Le médecin soigne Axel, donc il est malade

*The doctor is treating Axel, so he is sick*

(31) Canonical (cause-consequence) series with *et* : causal and inferential readings

a. Marie a trop mangé et elle est malade

*Mary ate too much and she is sick*

b. Marie a poussé Jean et il est tombé

*Mary pushed John and he fell*

c. # Marie est mineure et elle ne peut pas boire d'alcool

*Mary is a minor and she cannot drink alcohol*

d. ? Axel est malade et le médecin le soigne

*Axel is sick and the doctor is treating him*

(32) Non-canonical (consequence-cause) series with *et*: inferential reading impossible

a. ?? Marie est malade, et elle a trop mangé

*Mary is sick, and she ate too much*

b. ?? Jean est tombé, et Marie l'a poussé

*John fell, and Mary pushed him*

c. ?? Marie ne peut pas boire d'alcool, et elle est mineure

*Mary cannot drink alcohol, and she is a minor*

d. ?? Le médecin soigne Axel, et il est malade

*The doctore treats Axel, and he is sick*

The following table gives a summary of these distributions:

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<sup>9</sup> The test is the following: if the consequence can be false, then the reading is inferential.

order of eventualities	causal readings			inferential readings		
	<i>parce que</i> (cons-cause)	<i>donc</i> (cause-cons)	<i>et</i> (cause-cons)	<i>parce que</i> (cause-cons)	<i>donc</i> (cons-cause-)	<i>et</i> (cons-cause)
event-event	+	-	+	+	+	-
event-state	+	-	+	+	+	-
state-state	+	+	-	+	+	-
state-event	+	+	?	+	+	-

Table 1 : causal and inferential readings of *parce que*, *donc*, *et*

The picture is rather interesting: causal readings cannot be obtained in the cause-consequence with *donc* when the cause is an event and with *et* when the cause is a state: *parce que* is the only connective allowing the causal reading whatever the cause is (a state or an event). But the cost to insure causal relation is the consequence-cause reading. This order triggers a necessary constraint; the consequence-cause with *donc* always yields an inferential reading, and no readings are accessible with *et*. So, the causal readings in the cause-consequence order are obtained either by *donc* (the cause is a state) or by *et* (the cause is an event), the consequence of this distribution being that *parce que* is the optimal candidate for causal readings, whatever the cause is.

We have thus a first argument for the consequence-cause order: this order is the only one compatible with any type of aspectual classes (state or event) and corresponds to the canonical order of causal relations with a connective (*parce que*).

#### 4.2. Experimental data on causal discourses

This argument is not strong enough: it should be tested with other languages than French to have a greater strength. But we can add another one, due to experimental data.<sup>10</sup> I will give a very brief survey of a first interesting conclusion obtained from two experiments. The first experiment was a simple elicitation task: we prompt a series of eventive sentences composed by 8 syllables and ask 38 students from Lyon 2 to complete the stimuli either by a cause (20 students) or a consequence (18 students). 36 stimuli were offered for each subject.<sup>11</sup> From these 36 initial propositions, 10 pairs of propositions have been selected, 5 pairs of highly associated propositions (more than 50% of given responses) with the consequence-cause and the cause-consequence order, 5 weakly associated (less than 35% of given responses) with both orders. The first condition to be tested was the strength of association, and the second condition the order of utterance (cause-consequence and consequence-cause). Table 2 (from Moeschler et al. 2005) gives the series of inputs for the second experiment.

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<sup>10</sup> The work I refer to is based on a series of psycholinguistic experiments developed at the Institute for Cognitive Science (Lyon) with Jean-Baptiste van der Henst, Coralie Chevalier and Thomas Castelain in spring 2005. Cf. Moeschler et al. (2005) for a description of the experiments and a precise discussion of the results.

<sup>11</sup> The extensive analysis of all pairs of examples (cause-consequence and consequence-cause order) is given in Blochowiak et al. (2005).

strength of association	Proposition 1	Proposition 2 (consequence)	% answers	Proposition 2 (cause)	% answers
strong	Paul a pris ses médicaments,	il va guérir.	50	il était malade.	94
	Le gendarme a beaucoup couru,	il est essoufflé.	85	il poursuivait quelqu'un.	94
	Jérôme a arrosé les plantes,	elles poussent mieux.	50	elles avaient besoin d'eau.	55,5
	Jean s'est acheté des lunettes,	il voit mieux.	70	il avait des problèmes de vue.	50
	Le vase de cristal est tombé,	il s'est cassé.	70	quelqu'un l'a fait tomber.	50
weak	Marie s'est tordu la cheville,	elle doit se soigner.	20	elle faisait du sport.	16,6
	La barque a heurté le rocher,	elle a coulé.	35	il y avait du courant.	16,6
	Marie a lu sans ses lunettes,	elle n'a rien vu.	15	elle voit bien de près.	22,2
	Le chien a attrapé des puces,	on va l'emmenner chez le vétérinaire.	20	il s'est roulé dans l'herbe.	16,6
	Véronique s'est lavé les mains,	elle va passer à table.	25	elle avait jardiné.	22,2

*Table 2 : ten selected propositions for the experimental*

These 20 likely utterances were balanced by 20 unlikely utterances (in the order cause-consequence and consequence-cause), and all of these 40 utterances have been checked by control-utterances. 22 subjects passed the cause-consequence series, 27 subjects the consequence-cause series, and 22 the control-utterances. The design of the experiment was implemented with E Prime software, and the subject, after having read the prompt, had to read the second proposition and type e or p for 'likely' or 'unlikely'<sup>12</sup>. Reading time has been recorded, the analysis dealing with reading time.

The results are the following:

- (i) with high associated pairs of propositions, no significant difference in reading time occurs;
- (ii) on the contrary, with weak associated pairs of propositions, a significant difference in reading time occurs: the causal reading (consequence-cause) is quicker than the "natural" cause-consequence order (164,80 ms against 308,84 ms).

This result must be precisely analysed, and our data have now to be completed by new ones. At this stage, the precise interpretation is not certain, but some hypotheses can be formulated:

H1: Causal backward readings are default interpretations.

H2: Causal backward readings are the results of pragmatic inferences at the level of implicatures (implicated conclusions).

H3: Causal backward readings are the result of pragmatic inference at the level of explicatures.

H1 fits the weak association results, but do not explain why, in case of strong associations, forward and backward readings are not differentiated. The non-significant difference in reading time for strong associations rules out the default interpretation hypothesis.

H2 gives to backward causal readings the status of implicatures. This would imply that the reading 'P1 because P2' is inferred through some premises: P1, P2, P2 causes P1.

<sup>12</sup> Half of the subject received the instruction e for 'likely', p for 'unlikely', and half of them the opposite instruction.

H3 (backward causal reading are explicatures) corresponds to the result of a free enrichment process: 'P1 because P2' is accessible not through an implicated premise as 'P2 causes P1', but because the subject is looking for relevance, i.e. obtaining a positive balance between cognitive effects and cognitive efforts while processing discourse. With regard to H3, backward causal readings contrast with forward causal reading in that relevance is more accessible with a backward causal link than with a forward one. The ultimate explanation is communication: backward causal interpretation gives an explanation of why the speaker uttered the first proposition.

## 5. Conclusion

In this paper, I have provided an explicit model for the computation of Directional inferences in discourse and an explanation why canonical order of causal discourse is consequence-cause. The model of directional inferences gives a crucial role to contextual assumptions, in the sense that they license or block the computed Directional inferences. Moreover, I provided principles that organise not only the different types of linguistic expressions, but also the way pragmatic computation works. Notice that the model of directional inference does not require any principle of discourse analysis, let alone principles of narrative discourse, and is thus compatible with inferential pragmatics like Relevance theory. Finally, I gave two arguments supporting the hypothesis that canonical causal discourses have the consequence-cause order.

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