

Discourse relations, coherence and temporal relations

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1 Introduction

In this paper I want to examine several inter-related claims. First, the claim that discourse relations exist (e.g. Hobbs 1979,1985, Mann & Thompson 1992). Second, the claim that discourse relations are coherence-based (ibid.). And third, the claim that discourse relations play an important role in the derivation of temporal relations between the eventualities described by utterances (Lascarides & Asher 1993). Moreover, I aim to substantiate Kamp & Reyle's (1993:528) comment:

At the present time, no theory of discourse relations that we are familiar with has been worked out in sufficient formal detail to be readily incorporated into a theory of discourse interpretation.

The proposal that has gone further in this direction, and the one on which I will concentrate in this paper, is that put forward by Lascarides & Asher (1993) (henceforth L&A). They propose a formal system which derives discourse connections based on coherence relations and claim that the assumptions used in the process of deriving these relations are also used to establish temporal relations. Their proposal thus brings together the three inter-related claims mentioned earlier.

2 The issue

The types of discourse whose coherence and temporal interpretations L&A's system attempts to account for are those in (1) through to (7):

- (1) Max stood up. John greeted him.
- (2) Max fell. John pushed him.
- (3) Max opened the door. The room was pitch dark.
- (4) Max switched off the light. The room was pitch dark.

- (5) The council built the bridge. The architect drew up the plans.
- (6) The bimetallic strip changed shape. The temperature fell.
- (7)
 - (a) Guy experienced a lovely evening last night.
 - (b) He had a fantastic meal.
 - (c) He ate salmon.
 - (d) He devoured lots of cheese
 - (e) He won a dancing competition.

What is crucial about these discourses is that while they do not encode any temporal relations between their segments, we still derive temporal relations from them. Thus, in (1) the presentation of the events described matches their temporal order, i.e. the event described in the first utterance happened before the event described in the second utterance. By contrast, in (2) the temporal structure is reversed; this is due to the causality we perceive between the two eventualities, which overrides the sequential presentation. In (3) the events overlap, since the second eventuality provides some background information on the situation presented by the first utterance; whereas in (4) they don't; again this is due to a perception of causality. In (5), the temporal structure is also inverse, this is a consequence of the world knowledge we have about the order in which the eventualities described occur. In (6), the temporal structure is ambiguous: it can either be that the eventuality described in the first utterance caused the one described in the second utterance or viceversa. Finally, in (7) the temporal structure is more complex due to the number of temporal relations obtaining across intervening text segments; the details will be elaborated on below.

These temporal relations cannot all be derived using syntax and compositional semantics alone, since temporal relations do not always match the presentation order of the utterances even if they have identical syntax (e.g. (1) and (2) have similar syntax but different temporal relations). L&A claim that in order to explain these temporal differences, other diverse types of knowledge must be used. In particular, knowledge used in establishing discourse coherence.

3 L&A's system

L&A base their framework on the notion of discourse coherence, which Hobbs (1979:5) defines as follows:

a discourse is 'coherent' if it exhibits structural relationships between its various segments, which depend on the propositional form of the segments.

In L&A's system the structural relationships, i.e. the coherence relations, are derived using a set of rules whose output is a Discourse Representation Pair (DRP). A DRP consists of a set of propositions and a set of conditions on the connections between those propositions. The coherence relations they use are those in (8) (L&A 1993:440):

- (8) *Explanation*(α, β): the event described in β explains why α 's event happened (perhaps by causing it); e.g., text (2).
Elaboration(α, β): β 's event is part of α 's (perhaps by being in the preparatory phase); e.g., text (5).
Narration(α, β): The event described in β is a consequence of (but not strictly speaking caused by) the event described in α ; e.g., text (1).
Background(α, β): The state described in β is the 'backdrop' or circumstances under which the event in α occurred (no causal connections but the event and state temporally overlap); e.g., text (3).
Result(α, β): The event described in α caused the event or state described in β , e.g., text (4).

L&A present two types of rules to derive coherence and temporal relations. The first type is a series of defeasible and indefeasible inference rules (represented as $>$ and \rightarrow respectively) which provide the form in which linguistic knowledge (LK) and world knowledge (WK) are couched. We will see examples of these later. The second type is a number of monotonic and nonmonotonic inference rules used to regulate the patterns of inference that can be made in the process of interpretation as shown in (9):

- (9) **Penguin Principle:**
 $\phi \rightarrow \psi, \phi > \neg\chi, \psi > \chi, \phi \mid \approx \neg\chi$

Nixon Diamond:
 $\phi > \chi, \psi > \neg\chi, \phi, \psi \mid \neq \chi$ (or $\neg\chi$)

Closure on the right:

$$\varphi > \psi, \psi \rightarrow \chi = \varphi > \chi$$

Dudley Doorite:

$$\varphi > \chi, \psi > \chi = (\varphi \vee \psi) > \chi$$

Defeasible inference rules: represented as $>$

Indefeasible inference rules: represented as \rightarrow

Monotonic inference rules: represented as $=$

Nonmonotonic inference rules: represented as $|\approx$

The **Penguin Principle** deals with contradictory inferences whose antecedents enter into a logical relation of entailment. It favours the more specific rule. The **Nixon Diamond** rule deals with contradictory inferences whose antecedents do not enter into a logical relation of entailment. It blocks any inference, thereby making the text incoherent. The **Closure on the right** rule allows chains of monotonic inferences. Finally, the **Dudley Doorite** rule deals with ambiguity.

4 Problems with L&A's account

4.0 In what follows I want to discuss two sets of problems that arise from this system of coherence relations and rules. One relates to the psychological reality of the predictions made by the system, and the other relates to the formalism.

4.1 Psychological reality

4.1.0 I will start with psychological reality and assume that a discourse interpretation system must model psychologically real interpretations and not arbitrary ones.

4.1.1 Irrelevant discourse relations. The first problem that I will examine is about the discourse relations L&A propose. What I want to argue is that coherence-based relations do not always predict correct results. For instance, consider the explanation relation repeated in (10):

- (10) *Explanation*(α, β): the event described in β explains why α 's event happened (perhaps by causing it); e.g., text (2).

This definition allows irrelevant explanations to obtain. One such case involves unrelated explanations originating too far back in time as in (11):

(11) ? Peter phoned Mary. Bell invented the telephone.

The second utterance can be construed as describing a cause which explains why the event described by the first utterance happened, i.e. by making it manifest to us that the reason why Peter was able to phone Mary was because the telephone had been invented (that is, if it had not been invented Peter would not have been able to make the telephone call). Nevertheless, this text does not seem to be acceptable in this context (and there would have to be a very substantial elaboration to make it acceptable). Yet, there is nothing in the definition that would block this interpretation, and in turn the derivation of a temporal relation. In fact, a temporal relation could be inferred even if the text is incoherent: we can infer that the first event happened after the first given our knowledge of the world. This would suggest that temporal relations and coherence relations are not necessarily linked.

The same problem arises with explanations which are irrelevant because of their overspecificity as shown in (12) and (13):

(12) ? The crystalline particles underwent a process of separation. John dropped the glass.

(13) ? Peter was operated on. The neurons sent an electrical signal.

These two discourses are introduced by utterances which can be deemed to describe the results of the eventualities depicted by the second utterances. In (12), the second event explains why the event in the first happened: that is, the eventuality of dropping a glass (and the impact that ensues) caused its particles to separate. However, the first utterance seems too specific in the context, so much so that it could be part of a different text, perhaps about physics. In (13), the cause provided in the second utterance does not seem to constitute an adequate explanation for the consequence described in the first, even though it could be construed as one: that is, when a decision is made, e.g. to operate on somebody, some neurological activity must take place in the brain (of the relevant person/s), and this activity can be taken to trigger the sequence of events that lead to the operation and, in that sense, it can be taken to cause it. However, this cause is also too specific. As in the previous case it could be part of a different text, say about neurology, which makes (13) a puzzling text.

Yet, there is nothing in L&A's account that could block these texts from being interpreted as explanations, since the causal links can be reasoned and the necessary

assumptions can in principle be made available to the system too. This goes against our intuitions, which would seem to render them inappropriate in normal circumstances. The contrast between irrelevant and relevant explanations becomes clearer when the two texts are reexpressed more transparently as in (12') and (13'):

(12') The glass broke. John dropped it.

(13') Peter was operated on. The doctor made the decision.

These examples show that there are many types of explanations: historical, physical, neurological, etc., but not all of them are appropriate in all degrees of specificity and in all contexts. They do not all give access to the same assumptions.

The type of problem discussed so far arises in the case of the other discourse relations too. Consider the elaboration relation repeated in (14) for convenience:

(14) *Elaboration*(α, β): β 's event is part of α 's (perhaps by being in the preparatory phase) (e.g., text (5)).

This definition does not account for irrelevant elaborations as in (15):

(15) ? The day came to a close. The sun rose in the east.

The sun rising in the east is a precondition for the day to come to a close. In other words, the day must start before it finishes and in this sense the eventuality described in the second utterance may be considered to be in the preparatory stage of the eventuality described in the first. However, this reasoning does not make (15) any less unfortunate and unacceptable in normal circumstances. In fact, the example seems to direct us to an impossible interpretation where events that are associated with the beginning and the end of the day are presented as if they were part of one and the same situation and it is not clear which one it is. From a temporal point of view we can infer that the sun rises before the day ends but that doesn't seem to help the coherence of the discourse.

A similar problem arises with the background relation, repeated in (16):

(16) *Background*(α, β): The state described in β is the 'backdrop' or circumstances under which the event in α occurred (no causal connections but the event and state temporally overlap).

An example that fits this relation is text (3) above. However, example (17) seems to pose some problems for this account:

(17) ? Max opened the fridge. The forest was dirty.

The second utterance expresses a state which would automatically instantiate a law called *States Overlap* which states:

(18) *States Overlap*

If the clause β is to be attached to the clause α , and β describes a state s , then normally s overlaps the eventuality e described by α (ibid:448).

This would in turn provide the basis for the derivation of the background relation. However, it is not clear in what way the eventuality described by the second utterance can be interpreted as a background to the eventuality described by the first utterance, and yet L&A's account predicts that it is a perfectly acceptable, coherent, discourse and that it is also appropriate to infer an overlap temporal relation between the eventualities described. In fact, an overlap relation may be inferred, without the text being any more coherent, which again suggests that the link between temporal relations and coherence does not square with the data.

These examples seem to show that coherence relations do not guarantee comprehension and raise the question of whether they are necessary in discourse interpretation, that is, whether they are psychologically real. Moreover, the relationship between coherence relations and temporal relations doesn't seem to hold necessarily. In some discourses we can't derive discourse coherence, but we can infer temporal relations.

4.1.2 The pluperfect. Another phenomenon that questions the psychological reality of L&A's predictions is the pluperfect. L&A (1993:473) argue that 'the pluperfect acts as a syntactic discourse marker to indicate that only a restricted set of discourse relations is possible', chiefly elaboration and explanation. This account makes L&A's system susceptible to infinite regress, as there are no restrictions placed on the number of explanations or elaborations that can be given for any particular eventuality. Readers would find resulting texts such as (19) unacceptable. Yet, the texts would comply with the coherence relations and would, on L&A's account, qualify as well-formed and acceptable:

- (19) John arrived late for work.
 He had taken the bus.
 He had totalled his car.
 He had forgotten to put oil in the car.
 He had not taken notice of his own reminder.
 He had been thinking about the problems of the day before.
 He had quarrelled with his best friend.
 He had broken his friend's tennis racket.
 He had hit it too strongly.
 He had felt anxious about the previous shot.
 He had lost concentration.
 Etc...
 His boss summoned him to his office.

Each of the eventualities described by the pluperfect utterances in (19) explains the eventuality described by its preceding utterance, but the overall result is inappropriate. The further away the explanations are from the eventuality they seek to explain the less likely they are to be relevant. Similarly, the amount of cognitive effort we would have to devote to store all the explanations would be unrealistic and would make the text unacceptable. Particularly as, at the end of the discourse, there is an utterance describing the consequence of the events entertained which comes after each of the explanations has been provided.

This type of example shows that the existence of coherence relations doesn't help the overall acceptability of the discourse. In particular, it doesn't explain the usage of the pluperfect.

4.1.3 The interval problem. So far we have seen examples which question the psychological reality of predictions made by coherence relations. I would now like to discuss a phenomenon which seems to be psychologically real and yet not captured by L&A's account. It is the interval problem, which Wilson & Sperber have stated as follows: 'why does the hearer generally take the events described to be separated by different intervals...?' (1993:277).

Following L&A, the two examples in (20) and (21) would seem to be equivalent after applying the narration discourse relation:

(20) Paul switched on the TV. He watched a documentary.

$\langle \tau, \alpha, \beta \rangle \succ Narration(\alpha, \beta)$

$\square(Narration(\alpha, \beta) \rightarrow me(\alpha) < me(\beta))$

α = Paul switched on the TV.

β = He watched a documentary.

DRP = $\{\{\alpha, \beta\}, \{Narration(\alpha, \beta)\}\}$

$\langle \tau, \alpha, \beta \rangle$ is a function that updates Discourse Representation Pairs;

\square symbolises necessity;

me represents the main eventuality described by an utterance; and

DRP is a Discourse Representation Pair: propositions plus conditions on those propositions

(21) Paul went to college. He became a barrister.

$\langle \tau, \alpha, \beta \rangle \succ Narration(\alpha, \beta)$

$\square(Narration(\alpha, \beta) \rightarrow me(\alpha) < me(\beta))$

α = Paul went to college.

β = He became a barrister.

DRP = $\{\{\alpha, \beta\}, \{Narration(\alpha, \beta)\}\}$

The intended intervals between the two events described in each of these texts are different. In (20) the interval between the first and the second events is a matter of seconds or minutes. In contrast, in (21) the interval is much longer: a matter of years. This interval difference has consequences for our understanding of the two situations. For example, one could infer from the second text that Paul has done many (time-intensive) activities in between, e.g. gone to Australia, worked in a shop during the summer, done a pupillage, etc. This could not be the case for the first one. Yet the descriptions afforded by the above mechanism do not capture this fact. A mechanism that purports to compute temporal relations must account for these interval differences; they are after all part of the temporal structure we infer from the texts. And they can have consequences for the derivation, and understanding, of further temporal relations, as the following extensions to (20) and (21) in (20') and (21') show:

(20') ? Paul switched on the TV. He watched a documentary. In between he spent three years in the army.

(21') Paul went to college. He became a barrister. In between he spent three years in the army.

The interval we take as intended in (20) is not long enough to accommodate the time span implicit in the extension (20'), whereas this is possible in the case of (21), as (21') shows. Intervals then are real enough to make us reject discourses with extensions which are incompatible with them, and yet they do not seem to be part of L&A's system. Moreover, as Wilson & Sperber (1993:288-9) argue 'the hearer's choice [of temporal] interval will affect the truth-conditions of the utterance', which further suggests that intervals are psychologically real components of our discourse interpretation as part of the temporal relations. Intervals are not part of the coherence relations and seem to be independent of them. This further suggests that temporal relations do not have to be dependant on coherence relations.

4.2 L&A's formalism

4.2.0 The examples I have discussed so far raise problems from a psychological point of view. I will now turn to examples which raise problems from the point of view of the formalism L&A propose.

4.2.1 World Knowledge Rules. They claim that the Gricean maxim of relevance is implemented by the States Overlap law repeated in (22). This law ensures that unless there is information to the contrary a state will overlap a previously mentioned event. In other words, the fact that the start of the state is not inferable makes it irrelevant, and consequently the eventualities overlap.

(22) *States Overlap*

If the clause β is to be attached to the clause α , and β describes a state s , then normally s overlaps the eventuality e described by α .

However, as we saw earlier, there are sequences which fit the definitions and yet are *not* acceptable. In order to rule out these cases L&A propose a strategy which consists in blocking the derivation of any discourse relation by forcing a contradiction via the Nixon Diamond reasoning pattern repeated in (23) for convenience.

(23) Nixon Diamond:

$\phi > \chi, \psi > \neg\chi, \phi, \psi \mid \neq \chi$ (or $\neg\chi$)

This pattern involves defeasible rules and deals with contradictory inferences whose antecedents do not enter into a logical relation of entailment. Its effect is to block any inference, thereby making the discourse incoherent. This is shown at work in example

(24), which in normal circumstances would be interpreted as a case of overlapping of eventualities:

(24) ? Max won the race. He was home with the cup.

L&A argue that this is an incoherent discourse. To arrive at that conclusion they claim that there is some information available to the inferential mechanism in the form of the WK law in (25):

(25) Win Law

'If e_1 is Max winning, and event e_2 is Max being at home, then normally, these eventualities don't overlap' (L&A 1993:447).

This law contradicts the normal expectation of overlapping eventualities which would arise from the stative verb TO BE found in the second utterance in (24). This contradiction cannot be solved by any other pattern of reasoning such as the one that L&A call the Penguin Principle which resolves contradictions in favour of the more specific antecedent involved when the contradictory antecedents of the two rules enter into a logical relationship of entailment (ibid.:447). The only pattern of reasoning that can be activated in these circumstances is the nonmonotonic inference rule Nixon Diamond.

However, the Nixon Diamond does not yield a conclusion: the States Overlap rule and the Win Law predict contradictory interpretations and there is no other way to resolve the contradiction. As L&A say, there is a lack of inference (ibid.:447). In other words, 'we *fail* to infer any conclusion about the temporal relation between the eventualities described, leading to incoherence' (ibid.:449). A (Nixon Diamond) reasoning pattern which has been activated but does not lead to a conclusion amounts to incoherent reasoning.

However, by explaining the incoherence of (24) this way they are precluding possible readings (which they themselves propose in an earlier paper (Lascarides et al. 1992:1)). Consider a scenario where all the participants know that if Max wins the race he will bring the trophy home afterwards, and Peter, having been past Max's house, utters (26):

(26) Max won the race. He was home with the cup.

In this case, the participants will infer that the fact that Max was home with the trophy must be an indication that he did win the race. If this interpretation is correct in this context, then (26) *is* coherent, and more precisely the two utterances might enter into

what L&A term an explanation relation (in other contexts, the relation could be different, e.g. background), and also in a temporal relation: the first event happened before the second. In L&A's view none of these coherence and temporal relations would have been possible.

The problem, however, is that with the win law in the database and with the system as presented by L&A, this interpretation will never be possible: the win law would apply in the same fashion as in (24) rendering the text incoherent. If the interpretation is to go through, the win law must be deemed to be irrelevant here. But it is not clear how this could be done in L&A's system. Although they include the term 'normally' in their rules, and therefore a given inference would be defeasible, they do not indicate *how* the inference is actually stopped from being concluded. Nor do they seem to entertain an answer to the more general question of *how* pertinent assumptions are selected from the vast knowledge about the world we have at any given time. This is crucial for the dynamics of defeasibility, which is at the core of their rule system.

Another important point related to WK rules is that L&A's account of WK seems to presuppose that all the assumptions we bring to bear on the interpretation of a text will be previously assembled in memory ready to be used in the interpretation process. This seems an unlikely state of affairs as it would preclude us from understanding novel situations, such as the situation described by (27) which I had never thought about before and yet have no problem in understanding:

(27) The milkman climbed up one of the trees. He saved the cat.

This type of example shows that we cannot rely only on ready made connections based on WK. We must have the capacity to construct novel connections whenever it is necessary. Temporal relations can also be inferred between eventualities which had not been temporally connected before. There is nothing in L&A's account which suggests the existence of this general capacity.

Similarly, L&A's account doesn't explain why hearers do not always bring the same WK to bear on the interpretation of texts. This is clearly reflected in the example (28) taken from L&A (ibid:459), which shows that their interpretation and that of my informants are different. And yet none could be said to be wrong. L&A say that (28d) is related to (28a) by narration, and also that (28e) 'is related to ... [(28d)] ... by narration, *and not by any of the other discourse relations*' (my emphasis, ibid:460):

- (28) (a) John arrived late for work.
 (b) He had taken the bus.
 (c) He had totalled his car.
 (d) His boss summoned him to his office.

- (e) John realised that his chances for promotion looked bleak.

As far as my informants (and myself) are concerned, the relation between (28a) and (28d) is one of result. Yet, L&A deny that this interpretation is possible. Similarly, (28e) can be seen a result of (28d) together with (28a), another interpretation which L&A seem to reject from the outset. Moreover, L&A base their relations on pairs (of utterances) when, in fact, there seem to be relations encompassing more than two utterances as in the current example. It also seems to be the case that we know the temporal relations between the various eventualities described regardless of exact coherence relations we derive.

The above discussion shows that varying accessibility of assumptions in a given context plays an important role because, as we see, it gives rise to diverging interpretations even in small texts such as (28). Thus, whichever pragmatic criterion is at work here must account for the variation in resulting interpretations, or in other words, the degrees of accessibility of assumptions (for any given individual in any given context).

4.2.2 The Penguin Principle. Another problem faced by L&A's formalism relates to the Penguin Principle. As mentioned above, the Penguin Principle repeated in (29) was established to resolve conflicts between contradictory rules whose antecedents entered into an entailment relationship:

- (29) *Penguin Principle:*
 $\phi \rightarrow \psi, \phi > \neg\chi, \psi > \chi, \phi \mid \approx \neg\chi$

It amounts to an strategy that does not seem to be enough to manage knowledge resources, for take the example (30), as a police report:

- (30) The suspect walked to the town centre. He was in the market all afternoon.

On updating the Discourse Representation Pair (i.e. the paired sets of discourse segments and the conditions placed on their relations) of the first utterance with the second, both the narration and the States Overlap rules will be activated: the former by default, the latter by the state condition of the verb TO BE. According to the Penguin Principle the more specific rule, i.e. the latter, should be the relevant one to apply in this case. However, this rule would predict that the two eventualities (walking and being in the market) overlap, when in fact we take it that the first happened *before* the second. Note that there may be a spatial overlap between the town centre and the market but clearly the second utterance in (30) is not meant to

function as a background to the first or temporally overlap it. If we are to follow our intuitions here, a choice of discourse relations would favour narration, precisely the less specific rule and the one the Penguin Principle would discard as irrelevant.

Furthermore, (30) would also be a counterexample to the Nixon Diamond as we would need a WK rule which stipulated that walking to the town centre and being in the market constituted two eventualities which did not overlap, thereby maintaining the favoured narration reading. Let's call this new rule the 'Walk Law' shown in (31):

(31) *Walk Law*

If e_1 is Max walking to the town centre, and e_2 is Max being in the market, then normally, these eventualities don't overlap.

But given that the States Overlap rule would still be activated and would predict that the two eventualities do overlap, we would derive two contradictory temporal statements, that is: the two eventualities overlap by LK (as a result of the States Overlap rule), and the two eventualities do not overlap by WK (as a result of the new Walk Law). Hence, the text would be (counterintuitively) rendered incoherent and consequently no temporal relation would be inferred, which also seems to go against our temporal interpretation of (30).

It seems clear that we need a criterion that chooses a narration reading, disregarding the specificity of other rules, and in particular one that in these circumstances does not render (30) inappropriate. In general, a rule such as the Penguin Principle seems inadequate in the face of the evidence, for how are we going to decide, during the process of a coherent discourse, which one of two competing WK rules is going to be selected when their antecedents are not logically related?

Furthermore, the win law, taken at face value, precludes the possibility of Max being able to win at home. There is no abnormality in envisaging such scenarios as: winning at cards, winning at board games, even winning at mock races, events which can all normally take place at home and which can result in winning a cup. The acceptance of these scenarios would mean that there would have to be rules that account for each scenario since the original win law does not cover these cases. The rules would have to be of the form, e.g. as in (32):

(32) *Alternative Win Law:*

If e_1 is Max winning, and event e_2 is Max being at home, then normally, these eventualities do overlap.

One of the problems with this is that they would contradict the original win law, and Nixon Diamond would rule the texts out as incoherent outright. This would again

require that there be a special mechanism to render the original win law irrelevant in this context. Similarly, the inclusion of the rules capturing the above scenarios would give rise to redundancy of information. That is, they tell us that the eventualities overlap when we already know that via the States Overlap rule.

L&A emphasise the notion of normality and defeasibility in their system but have not provided mechanisms to handle any interpretation that deviates from their rules.

4.2.3 Ambiguity. Let me end by turning to ambiguity. L&A propose a method of resolving discourse ambiguity when it originates from semantic meaning, namely, by preferring more specific interpretations in contexts where the antecedents of competing premises are logically related (see the Penguin Principle above). But it is not clear that their proposal resolves discourse ambiguity arising from WK. Consider the following example:

(33) Peter went to Australia. He needed money.

There are two possible ways in which (33) can be causally coherent: either Peter went to Australia *because* he needed money, or he needed money *because* he went to Australia. The consequences for the temporal interpretation are diametrically opposed: the first reading is non-iconic (i.e. the second event occurred before the first), and the second reading is iconic (i.e. the first event occurred before the second).

This causal connection is not semantic, as there is no necessary (i.e. indefeasible) connection between both events. Thus, we would not like to have a rule such as (34):

(34) *Australia law:*

Someone goes to Australia if and only if s/he needs money to go there or s/he goes there to get some money.

It is absurd to say that needing money to go to a place is a reason to go there. Similarly, there are many reasons why someone may go to Australia other than to get some money: e.g. to have a holiday. This shows that the causal relations in (33) are pragmatic rather than semantic. Semantic ambiguities arise from the meaning of the utterance constituents, pragmatic ambiguity arises from the interaction of semantic meaning with contextual assumptions. Hence, in this case WK is crucial. Presumably, in order to represent this WK we would need the rules in (35):

(35) *Rule A*

If event e_1 is Peter going to Australia, and event e_2 is Peter needing money, then normally, e_2 causes e_1 .

Rule B

If event e_1 is Peter going to Australia, and event e_2 is Peter needing money, then normally, e_1 causes e_2 .

The resolution of this ambiguity is not clear. The Penguin Principle would not apply because the antecedents of both rules are identical and no specificity discrimination can be made on that basis. The L&A's ambiguity rule Dudley Doorite, repeated in (36), would not apply either because the antecedents are identical, and the rule requires that only the consequents be the same, not the antecedents as it is the case in (35):

(36) *Dudley Doorite:*

$$\varphi > \chi, \psi > \chi \models (\varphi \vee \psi) > \chi$$

It would seem that we wouldn't be able to derive any coherence or temporal relation in discourse (33). In fact, this presents a more general problem for the rule Dudley Doorite in that even if an ambiguous interpretation was derived, further machinery would be required to disambiguate it because the rule only tells us that an ambiguity exists, it doesn't say anything about which reading is to be selected in a given context. Something which should be part of the explanatory power of a discourse theory, but which isn't part of L&A's account. Moreover, temporal relations will change depending on which connection is made.

Irresolvable ambiguity is not the only type of ambiguity this approach must tackle. Many pairs of sentences can have at least two simultaneous discourse relations and yet be acceptable. Consider the following example (similar examples can be found in Wilson & Sperber 1993:284):

(37) I visited Peru. I discovered an immensely varied country.

The predictions made here by L&A's approach would be either that the eventuality described in the second sentence is a *result* of the first one or that it is a *narration*. In either case the resulting temporal structure would be iconic: the second eventuality occurred after the first, it should then in theory be paraphrasable as follows:

(38) I visited Peru. *Then* I discovered an immensely varied country.

Clearly, this paraphrase does not represent the meaning of the original text. The appropriate meaning would be paraphrasable as follows:

(39) I visited Peru. *In doing so* I discovered an immensely varied country.

Thus, the temporal structure of (37) is more complex than the discourse relations available would suggest. The only relation which seems to approach our temporal interpretation of (37) is background, but we can't derive it in this case because there is no verbal stativeness to warrant it. L&A's proposal doesn't suggest how this type of temporal structures can be accounted for nor does there seem to be any account of it in other formal systems (Kamp & Reyle 1993:669).

5 Conclusion

To sum up, in this paper I hope to have shown that the formal coherence-based system proposed by L&A faces two types of problems. From a psychological point of view the predictions made by their system do not seem to be borne out by our discourse interpretations. In particular, it is not clear that coherence relations play a role in discourse interpretation and in turn in the derivation of temporal relations. L&A also criticise earlier accounts of time in discourse, such as the referential approaches of Reichenbach or DRT by claiming that 'they are unable to explain ... *natural* [discourse] interpretations' (my emphasis, L&A 1993:438), whilst at the same time claiming that their line of reasoning 'doesn't represent a psychologically plausible account of text processing' (ibid.:444). There seems to be a contradiction in terms in their approach. A discourse system should not model interpretations which fall outside the sphere of human cognition and which will never be entertained by a human mind.

From a formalist point of view, L&A's system lacks a general principle which explains the selection of varying assumptions from our world knowledge and the derivation of varying discourse interpretations. In particular, when these varying interpretations result from the same discourse. It also lacks the flexibility to account for the creation of new contexts when confronted with novel input. Similarly, by including the notion of condition in their account of discourse interpretation, L&A are tacitly arguing that discourse has truth-conditions, that is, that a discourse can be entertained as true or false which doesn't seem to make much sense.

Finally, and to go back to the claims mentioned at the beginning of the paper, if discourse relations exist there seems to be evidence that they are not coherence-based and that, by and large, there is no necessary link between them and temporal relations.

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