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THE NATURAL LANGUAGE CONJUNCTION *AND*

ABSTRACT. In the first part of this article, we show that, contrary to the Gricean tradition, inter-clausal *and* is not semantically equivalent to logical conjunction and, contrary to temporal approaches such as Bar-Lev and Palacas 1980, it is not temporally loaded. We then explore a commonsense idea – namely that while sentence juxtaposition might be interpreted either as discourse coordination or subordination, *and* indicates coordination. SDRT already includes notions of coordinating and subordinating discourse relations (cf. Lascarides and Asher 1993, Asher 1993), and the meaning of *and* is related to this distinction. Similar distinctions that play a crucial role in anaphora resolution have also appeared in AI – cf. Scha and Polanyi 1988, or Webber 1991. However, this discourse-structure-based distinction has not been well defined yet, and our approach provides independent motivation for it. This paper argues that the semantics of *and* includes a notion of coordination expressed as the requirement of a Coordinated Discourse Topic (CDT). CDT characterizes a class of discourse relations, among which are Narration and Result. Once the basic semantic contribution of *and* is isolated, effects related to its presence such as changes in temporal structure, blocking of a Discourse Relation, or conditional meanings are shown to follow from the defeasible architecture set up by SDRT.

1. INTRODUCTION

In the logical tradition, Natural Language (NL) clause connectives such as *and*, *or*, *if* and *but* have been thought to have a simple truth conditional semantics and a complicated and not well understood pragmatics. In this paper we focus on one of these connectives, the conjunction *and*, to study its meaning and interaction with other discourse meanings such as temporal structure, conditionality, and discourse relations. The results indicate that the traditionally assumed semantic/pragmatic division of labor in truth conditional terms cannot be maintained. The semantics of NL conjunction is defined in terms of discourse structure while its truth conditional properties are only (monotonically or nonmonotonically) inferred.

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2. Against a Truth Conditional or Temporal Semantics for *And*

We first present briefly several traditional approaches to the meaning of *and* such as Grice 1975, Schmerling 1975, or Posner 1978. They all propose that the semantics of *and* is equivalent to that of its logical counterpart – i.e., $(p\&q)$ is true iff p is true and q is true. All other meanings and effects related to its presence should be derived from pragmatic rules of conversation. Although this approach has proved highly resilient, explaining temporal effects only on pragmatic grounds also proves problematic, and researchers such as Bar-Lev and Palacas (1980) defend a temporal semantics for *and*. As we show below, temporally loading the semantics of NL conjunction provides a direct explanation of examples involving temporal reversal. However, this proposal leaves unaccounted several occurrences of *and*; thus, it is not sufficient. Moreover, Carston 1993 and Blakemore and Carston 1999 show that there are counterexamples to the proposal. This leads to our attempt to use the proposed temporal meaning as a default, showing that it does not help construct the right discourse structure. It is also shown that a default of temporal iconicity is mistaken. The conclusion of this section is that neither semantic vacuity nor temporal meanings are appropriate to capture the meaning of *and*.

2.1. *The Truth Conditional View*

In *Studies in the way of words*, Grice maintains that the semantic meaning of *and* equals juxtaposition. He then tries to justify why natural languages include such a particle. Quoting him,

> Devices for expressing the conjunction are rather required because ... speakers must be supposed to be capable of denying whatever it is they can assert. (Grice 1989: 70)

The following example is taken from his book:

(1) A: It will rain tomorrow. It will be fine the day after.
B: That's not so.
A: What's not so?
B: That it will rain tomorrow and be fine the day after.

Grice was mainly concerned with the logical relations between *and*, *or* and *if*. He tried to offer a preliminary approach to the reason why some features of these NL connectives are so hard to explain only in terms of their logical counterparts. For example, redundancy of logical operators does not trans-

late into NL. Few people would be ready to admit the following sentences as equivalents:

(2)a. If he rings, the butler will let him in.
b. Either he will not ring or the butler will let him in.

On the other hand, Posner 1978 distinguishes between symmetric and asymmetric meanings to defend the view that *and* is semantically symmetric, as illustrated by examples such as in (3):

(3) Paris is the capital of France and Rome is the capital of Italy.

Following Schmerling 1975, the temporal priority of the first conjunct in examples such as *Max fell and he broke his arm* is derived as an implicature from the logical meaning, with the help of the following discourse principle:

> (Iconicity)
> In conversation, we first lay the groundwork for what we are going to say next. (cf. Schmerling 1975)

However, the view that the semantics of *and* is truth conditional – that is, that it includes the notion that the conjuncts are true, if an *and*-sentence is asserted – cannot easily explain what is going on in the example below:

(4)a. Stand up; I'm going to break your arm.
b. Stand up, and I'm going to break your arm. (Bar-Lev and Palacas 1980)

The presence of *and* dramatically changes the meaning of the discourse in (4): in (4a), the speaker is giving a command and, then, asserting what is going to happen once the hearer has stood up. In (4b), the presence of the conjunction blocks the speech act of command.[1] (4b) is an assertion and the speaker is committed to its truth. Following a truth conditional logic, the propositions expressed by the conjuncts must be true, if the whole is true. However, the conjuncts are not communicated to be true. The hearer infers a conditional meaning instead: if the hearer stands up, the speaker is going to break his arm. We take this sentence to be a counterexample to the proposal that the semantics of *and* is truth conditional.[2]

[1] This construction also appears in other natural languages such as Spanish or Basque. Moreover, the imperative form is not necessary – the indicative can be used.

[2] See §5.2 for an account of this example in the terms of our proposal.

Another strong argument against the traditional view comes from the complex temporal effects that show up in the presence of *and*. If the presence (versus the absence) of *and* is related to changes in the temporal structure, the appeal to general pragmatic principles is not correct. There must be something in the meaning of *and* that causes the changes. In our opinion, Bar-Lev and Palacas' 1980 examples below indicate that principles such as Schmerling's are not enough. These authors focus on examples where the presence of the conjunction changes the temporal structure. Their crucial instances are given in (5) and (6) below: the insertion of *and* does not change the temporal structure in (5) – the interpreter concludes temporal succession in both (5a) and (5b) –, while a striking change occurs in (6). The interpreter infers temporal reversal in (6a) – the second event temporally precedes the first – but this inference is not available anymore in the presence of *and* in (6b).

(5)a. Max fell; he broke his arm.
b. Max fell and he broke his arm.

(6)a. Max fell; he slipped on a banana peel.
b. Max fell, and he slipped on a banana peel.

Given that the only difference is the insertion of the conjunction, Bar-Lev and Palacas conclude that *and* must have a semantic temporal import.

2.2. *Temporal Approaches*

Bar-Lev and Palacas' 1980 paper claims that examples such as (6) indicate that *and* is incompatible with temporal reversal. They also maintain that not only temporal succession (as in (5) above), but also other temporal relations such as inclusion are permitted, as illustrated by (7):

(7) The lights were off and I couldn't see.

These facts lead them to conclude that the impossibility of temporal reversal is directly signaled by *and*. This idea is expressed in the so-called semantic command:

> (Semantic Command)
> Given *S′ and S″*, *S″* is not prior to *S′* (chronologically or causally).

It is easy to show, that unlike Schmerling's, this proposal is compatible with the temporal structures in (5)–(7) above. However, it has an *ad hoc*

flavor, which is confirmed when one realizes that *and* is also involved in discourse meaning variations in which temporal structure is not at issue. Bar-Lev and Palacas are already aware of this fact, and examples (8) and (9) come from their paper:

(8)a. Wars are breaking out all over; Champaign and Urbana have begun having skirmishes.

b. Wars are breaking out all over and Champaign and Urbana have begun having skirmishes.

(9)a. Language is rule-governed; it follows regular patterns.

b. Language is rule-governed and it follows regular patterns.

The presence of *and* blocks the relation of instance (also called exemplification) in (8). The relation of reformulation is cancelled in (9). Based on these and similar examples, Bar-Lev and Palacas claim that "*and* is mutually exclusive with other conjoining relationships, including exemplification, conclusivity, and explanation" (op. cit.: 143). They do not explain what they mean by "conjoining relations." We argue in 3 below that NL conjunction blocks certain discourse relations as a consequence of the requirement of a coordinating discourse topic. Once the idea of incompatibility of *and* with certain discourse relations is formally captured in a theory of discourse, we show that the temporal effects can be recovered from it and, therefore, that the temporal semantics is spurious.

Bar-Lev and Palacas' proposal is not only insufficiently formulated, however, it also has counterexamples. Their meaning is not necessarily linked to the presence of *and*. Three examples in Blakemore and Carston 1999, repeated below in (10)–(12), make this point. The speaker B in (10) utters an *and*-sentence in which the event expressed in the second conjunct precedes the event described in the first conjunct. Were *and* to introduce the impossibility of temporal reversal, it would lead to inconsistency, contrary to intuition.

(10) A: Did she do all of her education in the States?

B: No, she did her BA in London and she did her A levels in Leeds.

Examples in (11) and (12) below involve marked intonation. Following Pierrehumbert and Hirschberg's 1990 taxonomy, SMALL CAPITALS indicate L^*+H (fall-rise intonation) while BIG CAPITALS indicate H^* (a focus accent). Since intonation is related to focus and topic structures,

which are considered to introduce meanings not yet well understood, these examples are not easy to elucidate:

(11) A: Did John break the vase?
B: WELL / the VASE BROKE / and HE dropped it. (Larry Horn)

(12) A: Bob wants me to get rid of these mats. He says he trips over them all the time. Still, I don't suppose he'll break his neck.
B: (Well, I don't know.) JOHN / broke his LEG / and HE / tripped on a PERsian RUG.

In (11B) the speaker is intuitively asserting only that these two events happened. That is, the utterance does not convey a causal relation (and, thus, temporal reversal) at the level of the assertion. This information is given only at the level of implicatures. Were *and* to semantically indicate the impossibility of temporal reversal, the interpreter would not be able to draw such an inference since it would be inconsistent with an asserted meaning. A similar case can be built in (12).

The same point can be made, in fact, with an example originally due to Cohen (1971), also mentioned by Bar-Lev and Palacas (although to claim that it is not a counterexample).[3] Compare (13a) and (13b):

(13)a. If the old king has died of a heart attack, and a republic has been formed, then Tom will be quite content.
b. If the old king has died, and a republic has been formed, and the latter event has caused the former, then Tom will be quite content.

The events expressed in the antecedent of the conditional in (13a) are understood as forming a resultative discourse and, therefore, temporally related by succession.[4] Including a third conjunct in the antecedent, as in (13b), has strong effects on the discourse structure. The interpreter revises the discourse model on the basis of the information in the new conjunct. This revision involves the relation between the dying of the king and the forming of a republic, which cannot be seen as cause-effect anymore. The temporal relation of succession has been cancelled. If *and* indicated the impossibility of temporal reversal, we would again have inconsistency.

[3] See also Gazdar 1979.

[4] Some authors use the expression of *temporal iconicity* when the actual order of events coincides with the textual order.

2.3. *Temporal Defaults*

Examples in (10)–(13) show that the semantic command has counter-examples since temporal reversal co-exists with (or is even successfully communicated in) the presence of *and*. Note, however, that these examples could also be considered exceptions – that is, one could think that temporal reversal is only *normally* impossible. We check below whether the semantic command is strong enough to handle the normal cases, if taken as a default.

2.3.1. *The Semantic Command as Default*

Some provisional notation should be first introduced. Let '*and*(α, β)' indicate that *and* is the discourse marker linking the formal representations α and β derived from the two NL conjuncts. The symbol '$>$' is a weak conditional operator which can be read as *then normally*. The symbol '$\prec$' indicates temporal precedence. The default of Impossibility of Temporal Reversal (ITR) states that, if *and* is the discourse marker linking α and β, then normally it is not the case that the time of the event in β precedes the time of the event in α:[5]

(ITR) $\quad and(\alpha, \beta) > \neg(t(\beta) \prec t(\alpha))$

Consider the *banana peel* example again:

(14)a. Max fell; he slipped on a banana peel.

b. Max fell, and he slipped on a banana peel.

Assume the interpreter of (14a) infers nonmonotonically the discourse relation of Explanation, given that slipping and falling are normally cause-effect related. From Explanation, he will infer temporal reversal, that is, that the event in β precedes the event in α, $(t(\beta) \prec t(\alpha))$.[6]

If ITR is a rule of our system, $\neg(t(\beta) \prec t(\alpha))$ will also hold, by Modus Ponens. These two meanings, $(t(\beta) \prec t(\alpha))$ and $\neg(t(\beta) \prec t(\alpha))$, are inconsistent. Given that their antecedents are logically independent, and given that both have been concluded only nonmonotonically, we can apply the inference scheme known as the Nixon Diamond. The Nixon Diamond (ND) is defined as follows in the Logic of Commonsense Entailment (cf. Asher and Morreau 1991):

(ND) If $A > C$, $B > \neg C$ and A and B are logically independent, neither C nor $\neg C$ are concluded.

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[5] To simplify matters, we assume that there is only one event per conjunct.

[6] This is the inferential order assumed by SDRT. See details in §3.

Applying ND, both ($t(\beta) \prec t(\alpha)$) and its negation are cancelled. If the logic is strong enough, it will also be able to block the normal rule from which temporal reversal was inferred (i.e., to block that Explanation holds, given that slipping and falling are normally cause-effect related). This means that the discourse relation between these two clauses will remain underspecified. Does this result agree with our intuitions? Native British speakers seem to prefer an iconic temporal reading to interpret (14b). However, if *and* is interpreted just as a default of ITR, it does not facilitate the construction of such interpretation.

To sum up: although including a default of ITR does not lead to inconsistency, one might be willing to reject it given that it does not help to construct the appropriate discourse interpretation in (14b). Moreover, defaults are weak meanings and the idea of linking the semantics of a lexical item to such defaults is not very appealing. If we can find a non-cancelable meaning to do the job, it should be preferred.

Note also the existence of non-temporal examples, as in (8) and (9) above. They show that a temporal meaning cannot predict the blocking of discourse relations such as Reformulation or Instance. There are also non-temporal Explanations that are similarly cancelled in the presence of *and*:

(15)a. Mary and John baptized all their children. They are good Catholics.

b. Mary and John baptized all their children and they are good Catholics.

These facts point out that the primary incompatibility is not between the meaning of *and* and temporal reversal but between the meaning of *and* and some property shared by some discourse relations. If we can identify a property that simultaneously accounts for both temporal and non-temporal cases, it should be preferred by simplicity.

2.3.2. *Temporal Iconicity as Default*

Consider Schmerling's 1975 discourse principle of iconicity again. Also Blakemore and Carston (1999) suggest that, in the absence of a highly accessible scheme or script, the hearer will 'tend to take the natural processing track, that is, the chronological one'. Assume that the principle of iconicity can be rendered as a default of temporal precedence.[7] Using the

[7] The idea would be that temporal iconicity is primarily defined for sentence juxtaposition and inherited in the *and*-case.

same notation as before, Temporal Precedence of Events or TPE can be expressed as follows:

(TPE) $and(\alpha, \beta) > (t(\alpha) \prec t(\beta))$

Following Blakemore and Carston, the principle of iconicity would be responsible for the prevailing temporal readings below:

(16) Mary put on her tutu and (she) pruned the apple tree.

(17) Bill went to bed and (he) took off his shoes.

(18) She rode into the sunset and jumped on her horse.
(Originally in Kempson 1975)

We take issue with this analysis. Note that all the examples above include the same entity as agent in both conjuncts. If we change this, as in (16′) below, TPE does not hold anymore. Temporal overlapping is strongly preferred:

(16′) Mary put on her tutu and Melissa pruned the apple tree.

(16) vs. (16′) allows us to conclude that conjoining two events is not enough to trigger TPE.

On the other hand, remember that temporal inclusion as in (7), and reversal as in (10), are permitted. Also, overlapping can be easily triggered in the right context:

(19) Arantza played football yesterday and (she) broke her knee.

Therefore, we do not see any conclusive evidence to assume that *and* should defeasibly trigger temporal precedence.

Let us summarize the contents of §2.2. We have reached the following conclusions: (1) ITR does not permit us to make the correct temporal predictions, neither as a hard rule nor as a default; (2) there are no grounds to assume that a default of temporal iconicity is associated with *and*; (3) the data show that *and* is compatible with any temporal relation (precedence, reversal, overlapping and inclusion). Therefore, we assume that the semantics of *and* does not include temporal information. The following temporal facts need to be accounted for: (i) The reason why temporal succession is strongly preferred in examples (16)–(18), and (ii) the reason why temporal reversal is blocked in the presence of *and* in the *banana peel*

example. We return to this after proposing a discourse-based approach to *and*.

3. A Discourse-Based Approach to NL Conjunction

We propose to treat *and* as a discourse marker which indicates discourse coordination (*versus* discourse subordination) and, thus, identifies a class of Discourse Relations (DRs), namely the class of Coordinators. This theoretical distinction is addressed in the next section.

3.1. *Coordinators and Subordinators*

Asher 1993 distinguishes between two classes of Discourse Relations: Coordinators and Subordinators. While Narration or Result, for example, are Coordinators, Explanation or Instance are Subordinators. Coordinators and Subordinators are claimed to behave differently in their contribution to discourse structure. Coordinators introduce a flat structure while Subordinators trigger a hierarchical structure in which the subordinated representation is embedded under the subordinating representation.

Although this issue is not settled yet, the foundation of this distinction seems to be found in the idea of discourse topic and how it is constructed. The discourse topic of a segment, intuitively defined as what is being talked about in the segment, is differently built for Subordinators and Coordinators. Coordinators, with Asher 1993, insert a discourse topic built by generalization from the conditions in both DRSs (by equally abstracting over the conditions of both DRSs). The discourse topic for Narration or Result should be built in this way. On the other hand, a discourse topic for Subordinators is basically given by the information in the subordinating representation; that is, the subordinated representation does not contribute to it. This means that subordinated segments do not reset the discourse topic. Consider, for example, Elaboration. The sentence that is elaborating does not reset the discourse topic.

It is worth noting that similar distinctions have been used in the literature about discourse structure, especially in AI. Besides Scha and Polanyi 1988, or Asher 1993 and Lascarides and Asher 1993, who talk about coordination and subordination, Webber 1991 uses parent-of and right-sibling-of, following Cohen 1983. The distinction between dominance and satisfaction-precedence in Grosz and Sidner 1986 grasps a similar division phrased in intentional terms. Polanyi uses sequences (coordination) and expansion units (subordination) in her 1998 and 1999 papers. In Seville

and Ramsay 1999, the terms 'sisters' and 'daughters' capture a similar idea.

The distinction between Coordinators and Subordinators (and the rest of distinctions above) have been used to crucially constrain the process of anaphora resolution. Given a discourse as a sequence of clauses $\langle \alpha, \beta, \gamma \rangle$; suppose we are attaching γ to β, and γ includes an anaphor. The availability of referents of α is made to depend on this distinction in the following sense: while the referents in α are not available, if a coordinating discourse relation links α and β (α is not in the *right frontier*, according to Scha and Polanyi 1988), they can be used as antecedents in a subordinated structure. It is none the less important to note that, although this type of approach has shown to successfully account for a variety of cases and it is very attractive, it has also encountered several problems and a large amount of research is actually devoted to clarifying the issue.

3.2. *A Basic Introduction to SDRT*

It is perhaps time to briefly address some basic aspects of SDRT that will be used in our account below (cf. Lascarides and Asher 1993, Asher 1993). Segmented DRT aims at providing a formal model of the meaning relations in a discourse. The compositional procedure to build representations and associate them with a model-theoretic interpretation is inherited from DRT (cf. Kamp 1981, Kamp and Reyle 1993).[8] A discourse is a sequence of sentences. Assume we have already processed the first $n - 1$ sentences in a discourse. In order to attach the DRS of sentence n to the model, we have to find (i) a suitable attachment point (the last representation is always open to attachments), and (ii) an appropriate discourse relation. SDRT has shown that both monotonic and nonmonotonic inferential systems are needed in order to carry out these tasks. The nonmonotonic system integrated in SDRT is CE (cf. Asher and Morreau 1991). Given that we are mainly dealing with segments of two clauses, the first task is not going to occupy us. With respect to the second task, we have already mentioned that several sources of information such as lexical knowledge or world knowledge are used to normally conclude an appropriate discourse relation.

This paper deals with interclausal occurrences of *and* – that is, with sentences including a number of clauses related by *and*. We take an *and*-sentence to be a processing unit in the following sense. We first construct a DRS for each of the conjuncts; then, we identify the discourse relation that links these DRSs to each other; and, finally, we calculate the discourse relation that attaches the whole segment to the previously built model.

[8] Although we try to introduce the reader into the SDRT features that will be used in our proposal later, previous familiarity with DRT and SDRT might prove useful.

We now need to introduce some more technical apparatus and notation. Let $\pi, \pi', \pi_1, \ldots$ stand for speech acts. Following work on illocutionary acts (cf. Searle 1968 for example), SDRT already includes a distinction between propositional content and illocutionary force which turns out to be crucial for our approach to the semantics of *and*. A speech act includes both an illocutionary force and a propositional content.

SDRT assumes that discourse relations take speech acts as arguments. With Asher and Fernando 1997, the relation between speech acts, illocutionay forces and propositional contents is expressed as follows. If $\alpha, \beta, \delta \ldots$, are names of Segmented DRSs or SDRSs, '$\pi : \alpha$' indicates that the speech act 'π' has the propositional content 'α'. Note that the illocutionary force appears only as an implicit part of the speech act.[9]

3.3. And *Indicates Coordinators*

Departing from Asher 1993, where a coordinating discourse relation defines just a class of discourse relations, we assume that Coordinator is a discourse relation itself. Coordinators require a discourse topic that abstracts over the attached representations in the same way. Moreover, this semantics is also included in the semantics of other discourse relations such as Narration and Result – they need the same kind of discourse topic – and thus Coordinators also define the class of the discourse relations that satisfy its semantics. We take Subordinators to be incompatible with Coordinators given that they build the discourse topic in an incompatible way. We propose that *and* semantically indicates that a Coordinator is needed. Thus, if the interpreter is looking for a Discourse Relation (DR) to attach two representations π and π', $\langle \pi, \pi' \rangle$, and the particle *and* is linking the clauses from which representations π and π' have been built, $and(\pi, \pi')$, then the DR linking π' to π must be a Coordinator. This axiom is expressed as follows:

(*and*) $\quad \langle \pi, \pi' \rangle \ \& \ and(\pi, \pi') \rightarrow \text{Coordinator}(\pi, \pi')$

Given the state of the art in the study of discourse relations, an exhaustive list of Coordinators and Subordinators cannot be given yet. The following are open lists:

(List of Coordinators)
Narration, Result, Parallel, Conditional, ... are Coordinators

[9] Just for a quick comparison, remember that the relation between illocutionary forces and propositional contents is expressed in Searle 1968 as follows: a one-place predicate F (an illocutionary Force) that takes the name of a proposition, p, as argument, $F(p)$.

(List of Subordinators)
Explanation, Instance, Background, Elaboration, Evidence, Generalization, Reformulation, ... are Subordinators.

As mentioned above, the notion of Coordinator has been constrained from the perspective both of discourse structure (see, among others, Asher 1993) and anaphora resolution (see the references above). We claim that the defining feature of Coordinators is the kind of discourse topic they require. A more detailed definition awaits future work, but we can take into account Asher's 1993 axioms for Continuation and Narration to impose a necessary condition on Coordinators (see, in particular, op. cit., p. 301: (C1) and (C3)).[10] If a Coordinator is used to attach π' to π, then the smallest generalization of both π and π' will be inserted in the formal model, structurally dominating π and π'. In order to construct this generalization, a knowledge base encoding both world knowledge and lexical knowledge is assumed. We call this generalization a Discourse Topic (DT) for the segment and, given that it equally abstracts over both π and π', we say that it is a Coordinating Discourse Topic or CDT for π and π'. Thus, a Coordinator introduces an instruction to build a CDT. We use a rewriting rule to express this idea:

(Coor) $\quad \text{Coordinator}(\pi, \pi') \rightarrow_{\text{R}} \text{Build a CDT for } \pi \text{ and } \pi'$

That is, the interpreter is required to build the smallest generalization over π and π' as given by a particular knowledge base.

Let CDT be a 3-place predicate. CDT(γ, π, π') can be read as: γ is a coordinating discourse topic for π and π'. Assume DT(π, π') expresses that π is a discourse topic for π'. Then, the following holds (these postconditions are attached to Narration and Continuation in Asher 1993):

(CDT) $\quad \text{CDT}(\gamma, \pi, \pi') \rightarrow \text{DT}(\gamma, \pi)\ \&\ \text{DT}(\gamma, \pi')\ \&\ \neg(\text{DT}(\pi, \pi') \vee \text{DT}(\pi', \pi))$

We will not have much to say about discourse subordination in this paper. However, we do assume that Subordinators do not construct their discourse topics in a symmetric way as Coordinators do, and that the presence of a Coordinator is incompatible with the presence of a Subordinator for the same segment:

(Incompatibility of Coordinators and Subordinators)
$\text{Coordinator}(\pi, \pi') \rightarrow \neg\text{Subordinator}(\pi, \pi')$

[10] The main difference between Asher's approach and the one taken here is that we take Coordinator to be a discourse relation while, at the same time, it defines the class of discourse relations which share the requirement of a coordinating discourse topic.

We next apply this proposal to account for temporal succession (the *tutu* example, (16)) and temporal reversal (the *banana peel* example, (6)), showing that it predicts the right temporal structure for them. Moreover, we show that it also generates the correct predictions for the non-temporal cases, and provides the basis to account for more complex instances.

4. Applying the Proposal

The proposal that the semantics of *and* includes an idea of discourse coordination is first applied to explain the preference for temporal succession in the examples (16)–(18) above. We show that the assumption that *and* is associated to a default of temporal succession becomes spurious if this approach is accepted.

4.1. *Temporal Succession*

Consider Blakemore and Carston's *tutu* example again, repeated below for convenience:

(20) Mary put on her tutu and (she) pruned the apple tree.

Given the presence of *and*, the rule in Coor is applied. The interpreter generalizes over the contents of both clauses in the process of building a coordinating discourse topic or CDT. Depending on the knowledge base available to him, we can infer that *Mary did two things* or *Mary is the agent of two events*. The interpreter could stop at this point considering that the interpretation process is over, but most hearers will not. Many recent studies, specially in pragmatics, have pointed out that hearers try to maximize coherence, that is, try to connect the different pieces of information to each other and to relate them to other areas of their knowledge as much as they can (see, for example, relevance theory). We do not need to make a strong use of this hypothesis here, but the fact that the hearer tries to build a temporal order between events whenever a speaker utters a sequence of events seems to be a special case of this hypothesis. There are coordinating discourse relations in SDRT that can capture the temporal relations between two events (see the list of Coordinators above). In (20), temporal simultaneity, inclusion and overlapping are ruled out using general world knowledge, since an agent does not normally get involved in these two activities at the same time (if a speaker wants to communicate, for example, simultaneity of events with the same agent, she will probably explicitly indicate so by means of an adverbial such as *at the same time*). Thus, the interpreter is led to consider temporal succession and temporal

reversal. Can temporal reversal be inferred? In order for this relation to be triggered, the discourse relation of Explanation should be assumed (there is no other discourse relation related to reversal that is plausible here). Note, however, that this is not possible because Explanation is a Subordinator and, thus, systematically blocked by *and*. The only temporal relation left is temporal succession, which is recovered using Narration, a Coordinator. If this kind of explanation makes sense, it allows the construction of temporal structure without using a temporal default.

The same point can be made with respect to *the shoes* example, repeated below for convenience:

(21) Bill went to bed and took off his shoes.

As before, simultaneity, inclusion and overlapping are rejected by World Knowledge (WK). Temporal reversal is rejected because *and* blocks Subordinators and no Coordinator will trigger it. As before, temporal succession is possible through Narration. Thus, even though there is general world knowledge pointing out to the temporal reversal of these two events, the discourse structure indicated by *and* leads the interpreter to the reversed order. Again, the explanation does not need to resort to a temporal default associated with *and*. It is based on the hypothesis that *and* signals Coordinators plus discourse principles assumed in SDRT.

The third example introduced the *riding and jumping* scenario. We have to explain why it is not acceptable (unless creative contexts are considered):

(22) She rode into the sunset and jumped on her horse.

The first part of the reasoning is similar to the analysis provided for the two previous examples. Then, the interpreter attempts to infer Narration, and from it, temporal succession. However, now he cannot assume a scenario in which she first rides a horse into the sunset and then jumps on it. She cannot jump on it if she is already on it. While the interpreter in the *shoes* example was able to think that, although odd, the order was possible, here he is unable to do so.

Next, the interpreter tries to build a coherent whole without assuming a temporal order of the two events. The rule in Coor just requires a coordinating discourse topic. If we try to intuitively construct a DT for (22) all we can come up with seems to be an event of a woman riding into the sunset. (This seems to be related to the fact that jumping on a horse is a precondition for riding the horse.) If this is so, the rule in CDT, which states that no conjunct be DT for another conjunct, is not fulfilled. Thus,

the postcondition of Coor is not fulfilled and Coordinator is rejected.[11] Incoherence follows because the semantics of *and* indicates Coordinators but world and lexical knowledge does not allow the construction of a CDT.

We have shown that an account of these examples in terms of our hypotheses that *and* signals Coordinators and that Coordinators and Subordinators are incompatible can be provided. We next apply these hypotheses to temporal reversal cases and non-temporal *and*-examples. Remember that these were our second and third tasks. We will see that there is no difference in the way the meaning of *and* affects those examples: they can be all accounted as a conflict between a cancelable inference and the semantic meaning of *and*, which is crucially able to block the former.

4.2. *Blocking Temporal Reversal*

If the semantics of *and* includes an instruction to build a CDT, and if we assume that Subordinators construct their DT in an incompatible way, then *and* blocks any Subordinator that lexical or world knowledge might lead the interpreter to try to infer. Although the list of Subordinators is still open, Explanation, Instance, Elaboration, Generalization, Evidence, Reformulation, and Background belong to it. Given our hypotheses, our theory can include theorems forbidding particular Subordinators. The theorem for Explanation expresses that if the interpreter is looking for a discourse relation to attach π' to π, and *and* is relating these two representations, it is not the case that Explanation holds:

(¬Explan) $\langle \pi, \pi' \rangle \ \& \ and(\pi, \pi') \rightarrow \neg \text{Explanation}(\pi, \pi')$

Consider the *banana peel* example again:

(23)a. Max fell; he slipped on a banana peel.
b. Max fell, and he slipped on a banana peel.

SDRT assumes the following procedure to infer a discourse relation. Suppose we want to attach π' to π in a discourse model τ; SDRT assumes that the inference of a particular discourse relation depends normally on information coming from sources such as lexical knowledge, semantic

[11] Similar examples might help (thanks to Mixel Aurnague, p.c.):

(i) This morning I read the paper and woke up.

(ii) Last night I went to the movies and left home.

knowledge or world knowledge. This idea is captured in the following general scheme (let **INFO(π)** indicate that π is related to some lexical, semantic or world knowledge information; let **DR** stand for a discourse relation):

$$\langle \tau, \pi, \pi' \rangle \ \& \ \mathbf{INFO}(\pi) \ \& \ \mathbf{INFO}(\pi') > \mathbf{DR}(\pi, \pi')$$

Although explicit discourse markers will licence a monotonic inference (as in the case of *and*), most discourse relations will only follow defeasibly.

In our particular case, the interpreter infers only nonmonotonically that the speaker is communicating that the *slipping* event explains the *falling* event. If it is an Explanation – he goes on reasoning – then the *slipping* event temporally precedes the *falling* event. That is, if π and π_1 stand for the speech acts expressed in the first and second clauses in (23a):

(i) $\langle \pi, \pi_1 \rangle \ \& \ \mathrm{INFO}(e_\pi) \ \& \ \mathrm{INFO}(e_{\pi_1}) > \mathrm{Explanation}(\pi, \pi_1)$

(ii) $\mathrm{Explanation}(\pi, \pi_1) \rightarrow e_{\pi_1} \prec e_\pi$

When *and* is inserted, as in (23b), Coor has to be satisfied. A discourse marker in the linguistic input is severely constraining the construction of the discourse structure. In particular, the interpreter infers that Explanation is not allowed, by (¬Explan). Thus, two incompatible meanings have been derived:

$$\mathrm{Explanation}(\pi, \pi_1) \qquad \neg\mathrm{Explanation}(\pi, \pi_1)$$

The inferential statuses of both meanings are different. While the first is only normally concluded using (i) and (ii) above, the second allows no exceptions and has priority over the nonmonotonic inference. The logic of Commonsense Entailment includes a procedure to get nonmonotonic conclusions. In order to do so, one should first consider all > statements and try to turn them all at the same time into $\rightarrow$ statements. This transformation cannot be carried out if we get an inconsistency. We call this procedure the procedure of checking meaning priorities.

In our particular situation, the conditional worth considering is in (i). When we try to convert (i) we get inconsistency. Thus, this transformation is not allowed. Explanation has been blocked.[12]

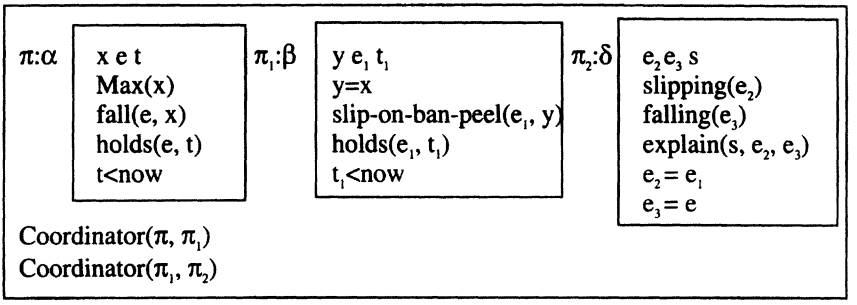
[12] I should thank Nicholas Asher and Laure Vieu, p.c., for helping me clarifying this issue.

4.3. *Is the Semantics of* and *Too Strong?*

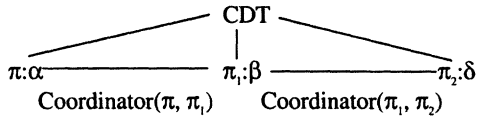
If we recall the semantic command and its counterexamples in §2.2, they showed that ITR could not be the semantic meaning of *and* given that the speaker asserted (in example (13)) or implicated (e.g., in (12)) a meaning that was inconsistent with ITR. Since we also claim that *and* has a semantics that cannot be cancelled, we should check whether a variation of those examples pose the same problem to our approach. Consider the sentence below, which is similar to (13):

(24) If Max fell, and he slipped on a banana peel, and his slipping explains his falling, we don't need to resort to any esoteric or voodoo-related explanation to understand what happened.

Below is the discourse representation for the antecedent in (24). Each clause produces a DRS. Anaphors are already solved. Coordinator is triggered in the presence of *and*:



And instructs the hearer to construct a CDT equally generalizing over the contents of the three conjuncts:



There is a condition in the DRS of the third conjunct – namely, 'explain(s, e_2, e_3)' – which is apparently inconsistent with the assumption that *and* blocks Explanation – that is, '¬Explanation(π, π_1)'. We argue that these two conditions are compatible given that they belong to different information levels in the discourse. It is important to distinguish between the level of discourse structure and the level of other information about the world that can be inferred but it is not intended by the speaker to belong to the discourse structure. This distinction can be captured in SDRT by means of the already introduced distinction between speech acts and propositional

content (see §3.2). While the predicate 'explain' takes events as arguments, 'Explanation' is a DR predicate which takes speech acts. This means that these two predicates are not directly incompatible. However, inconsistency will arise if we can infer from one to the negation of the other. We show that this is not the case in both directions.

Can 'Explanation(π, π_1)' be inferred from 'explain(s, e_2, e_3)'? Suppose the interpreter tries to revise 'Coordinator(π, π_1)' taking into account the new information introduced in π_2 – namely, 'explain(s, e_2, e_3)'. He will have to use a rule that might be roughly stated as follows:

$$\langle \tau, \pi, \pi_1 \rangle \ \& \ \text{explain(s, } e_2, e_3) > \text{Explanation}(\pi, \pi_1)$$

Note that this inference is cancelable since this discourse relation is not explicitly expressed.[13] Given the presence of *and*, he also infers '¬Explanation(π, π_1)', although this time monotonically. In the process of checking for meaning priorities, the default is blocked.

Let us check in the other direction – that is, whether it is possible to infer the condition '¬explain(s, e_2, e_3)' from '¬Explanation(π, π_1)':

(i) $\neg\text{Explanation}(\pi, \pi_1) \models \neg\text{explain(s, } e_2, e_3)$

Note that the information about a particular discourse relation not being available (¬Explanation) is information about the discourse structure for π and π_1 that the interpreter intends to communicate, whereas '¬explain' is information that the speaker is explicitly giving about certain events in the world. The latter information is not necessarily about the discourse she is intending to communicate in a previous segment.

Therefore, our position is that (i) should not be allowed. *And* requires a Coordinator for the *and*-segment and, thus, blocks any Subordinator in the process of checking for meaning priority. *And* indicates, in particular, that the speaker cannot use Explanation to attach the second *and*-clause to the first. But this is only information about the discourse structure that the speaker intends to communicate with the *and*-sentence. It is not information about what the speaker really believes (whether she believes that the slipping explains the falling or not) or asserts later in the same sentence. '¬Explanation(π, π_1)' does not, therefore, support ¬explain(s, e_2, e_3).[14]

[13] That is, we do not have a discourse marker like *because* explicitly indicating that the speaker wants to communicate an Explanation.

[14] Remember example (10) for an argument by analogy: the speaker is not communicating a discourse structure where the second event precedes the first, although British interlocutors quickly draw this inference from lexical and world knowledge (A levels are always done before BA's). We show below that the same distinction can be drawn in examples (11) and (12).

Note also that, were we to allow the rule in (i) to hold, we should also allow the rule in (ii), by deduction theorem and contraposition:

(ii) $\text{explain}(s, e_2, e_3) \rightarrow \text{Explanation}(\pi, \pi_1)$

But (ii) is unacceptable since it allows the interpreter to go from a condition holding between events to a DR holding between speech acts without assuming that the interpreter is looking for a DR.[15]

To sum up: sentences such as (24) do not pose a problem for assuming that *and* blocks Explanation, provided we take seriously the distinction between the level of discourse structure and other pieces of information that can be inferred. The distinction between speech acts and propositional contents has permitted us to capture this crucial feature.

4.4. *Blocking Non-temporal Cases*

Instance is a Subordinator. Therefore, our proposal also supports a theorem that blocks this relation.[16]

(¬Inst) $\langle \pi, \pi' \rangle$ & $and(\pi, \pi') \rightarrow \neg\text{Instance}(\pi, \pi')$

The following example borrowed from Bar-Lev and Palacas 1980 has already been introduced above:

(25)a. Wars are breaking out all over; Champaign and Urbana have begun having skirmishes.

b. Wars are breaking out all over and Champaign and Urbana have begun having skirmishes.

In (25a), the interpreter compares the event types in the two clauses, finding that there is a concept-subconcept relation between them. He concludes that the speaker is communicating that the second clause constitutes an Instance of the first . The following scheme roughly captures this idea (the expression '[...](π)' indicates that π is related to the information inside the brackets):

$\langle \pi, \pi' \rangle$ & [concepts: all over, wars](π) & [subconcepts: Champaign and Urbana, skirmishes](π') > Instance(π, π')

[15] The point made here is related to the distinction between the logic of information packaging and the logic of content currently drawn in SDRT, and it shows that this distinction is crucial to give an account of discourse semantics and pragmatics.

[16] See Olman 1998 for an interesting approach to the relation of Instance.

On the other hand, the presence of *and* in (25b) leads to monotonically infer ¬Instance(π, π'), by (¬Inst). The interpreter still tries to construct a coherent discourse model and Coordinator is available.

4.5. *Other blockings: Elaboration, Reformulation and Background*

The theorem below expresses the systematic blocking of Elaboration:[17]

(¬Elab) $\langle \tau, \pi, \pi' \rangle$ & *and*(π, π') → ¬Elaboration(π, π')

The example in (26) comes from Blakemore and Carston 1999:

(26)a. I had a great meal last week. I went to Burger King.

b. I had a great meal last week and I went to Burger King.

The relation object-attribute will allow the interpreter to normally conclude Elaboration in (26a):

$\langle \tau, \pi, \pi' \rangle$ & [object: meal](π) & [attribute: in Burger King](π') > Elaboration (π, π')

The interpreter concludes a relation part-of ($\subseteq$) between the events from Elaboration (temporal inclusion is recovered from it):

Elaboration(π, π') > $e_{\pi'} \subseteq e_{\pi}$

On the other hand, Elaboration is blocked in (26b) in the process of checking meaning priorities, using (¬Elab). The interpreter still tries to build a coherent whole and Coordinator is available. This conclusion agrees with our intuitions that temporal conditions are not involved in (26b).

Consider (27), given by Ana Alves, p. c. Although (27b) might be thought to be more controversial, we assume that it cannot be used to convey an Elaboration. Remember that Elaboration needs the first clause to be the discourse topic of the second and this interpretation seems intuitively impossible in the presence of *and*:

(27)a. I went to London. I stayed in the Meridian.

b. I went to London and (I) stayed in the Meridian.

Elaboration in (27a) is indicated by a relation part-whole between the event types:

$\langle \tau, \pi, \pi' \rangle$ & [whole: trip](π) & [part: stay in a hotel](π') > Elaboration (π, π')

[17] See Asher 1993 for details about Elaboration.

On the other hand, Elaboration is blocked in (27b). The presence of *and* seems to coerce the event of going to London. It is understood as a whole trip in (27a) that includes going, staying and possibly coming back, while it is more strictly interpreted in (27b) as a movement verb. Coordinator is triggered, and also Narration is inferred, as the interpreter tries to temporally relate both events.

And also blocks the Reformulations – defined just as a subtype of Elaboration in RST (Mann and Thompson 1986). The following theorem captures the idea:

(¬Reform) $\langle \pi , \pi' \rangle$ & *and*$(\pi , \pi') \rightarrow$ ¬Reformulation(π , π')

Consider Bar-Lev and Palacas' 1980 *language* example, repeated below for convenience:

(28)a. Language is rule-governed; it follows regular patterns.
b. Language is rule-governed and it follows regular patterns.

The interpreter tries to relate the contents of both sentences in (28a) and finds out that the second is another way of saying the same as the first. He concludes that the speaker wants to communicate that the second sentence is reformulating the first. Reformulation is normally inferred. In the presence of *and*, Reformulation is cancelled, by (¬Reform), and the relation of Coordinator is triggered.

Background is also a Subordinator and is, thus, incompatible with *and*:[18]

(¬Backgr) $\langle \pi , \pi' \rangle$ & *and*$(\pi , \pi') >$ ¬Background(π , π')

Consider (29), borrowed from Blakemore and Carston 1999 (sentence in (29a) originally in Dowty 1986):

(29)a. He walked into the room. The director was slumped in her chair.
b. He walked into the room and the director was slumped in her chair.

The discourse structure in (29a) can be roughly related to the following rule:

$\langle \tau, \pi, \pi' \rangle$ & [event](π) & [state]$(\pi') >$ Background(π, π')

[18] This discourse relation has been considered in Lascarides and Asher 1993, and Asher 1993, among others.

On the other hand, *and* in (29b) blocks Background, by (¬Backgr), forcing a more complex reasoning to take place to build a coherent whole. In order to build a new interpretation, one possibility seems to be to consider a type shifting from the director being slumped in her chair to x seeing the director being slumped in her chair. The reasoning could roughly go as follows: Given *and*, we cannot use Background to relate the event and the state. Look for a CDT. What could these two clauses have in common? The first clause introduces a man m walking into a room r, and the second introduces a director d being slumped in her chair. They could have in common the room, if we think that the director was in r. This could be enough in some contexts. But most hearers will try to connect these two eventualities further. A way of doing this is by considering that if m walked into r, then m was in r and thus m could see s. This means that the state s is raised to be the object of a perceptual report. Following this path, the agent m can be thought to be involved in two events and, thus, Narration is inferred.

The theorems and examples in this section were meant to illustrate the common mechanism underlying the meaning variation related to the presence vs. absence of *and*. The semantics of this particle requires that a Coordinating Discourse Topic be built, blocking thus the inference of Subordinators. Faced with two inconsistent meanings, the interpreter is able to block the cancelable meaning, given that the other meaning – the meaning of *and* – is crucially monotonic. As a consequence of DR blocking, temporal structure, if involved, can change. However, *and* affects temporal information only in an indirect way. This result agrees with the intuitions about discourse relations and temporal structure developed in SDRT.

In §5, we apply the hypothesis that *and* signals Coordinators to some more complex examples. This was our fourth task.

5. Accounting for More Complex Examples

§5.1 revisits Blakemore and Carston's 1999 examples involving pitch accents. §5.2 and §5.3 offer a first approach to *and*-sentences that are interpreted as resultative and conditional discourses. The notion of veridicality (Asher and Lascarides 1998) is shown to be crucial to account for these meanings.

5.1. *Pitch Accents and Temporal Reversal*

In this section, we go back to example (11), one of the examples presented in 2.1 as counterexamples for the temporal approach in Bar-Lev and

Palacas 1980. This example manages to communicate temporal reversal in the presence of *and*, crucially using marked intonation. We are mainly interested in investigating the relation between the discourse structure signaled by *and* and other meanings such as temporal reversal that can be drawn if one uses other informational sources. We want to illustrate the fact that different informational sources can lead to different meanings with different statuses in the interpretation of a discourse. All of them will be kept as long as they do not lead to inconsistency. Consider Blakemore and Carston's *education* example first to motivate these ideas:

(30) A: Did she do all of her education in the States?
B: No, she did her BA in London and she did her A levels in Leeds.

And in (30B) triggers the search of a CDT which will be something like the following: she did different parts of her studies in different British towns. Note that the information that the second event happens before the first can be inferred at any moment using world knowledge. That is, the interpreter can infer temporal reversal between the events expressed in the clauses. However, it is important to note that the speaker is not asking the hearer to draw this inference. This inference does not belong to the discourse structure she is communicating. There is nothing in B's linguistic input that could lead to that inference. Moreover, A's question, which constrains the type of utterance allowed as an (indirect) answer, does not ask about temporal orderings.

Asher's 1998 example introduced below (originally in Walker 1995) is meant to help to understand the meaning of L^*+H pitch accents (fall-rise intonation). Remember that SMALL CAPITALS are used to indicate this pitch accent:

(31) A: We bought these pajamas in New Orleans for me.
B: We bought these pajamas in NEW ORLEANS.

This example is, with Asher 1998, a Correction. However, note that the correction neither is explicitly indicated (there is no discourse marker such as *no*), nor is a direct correction where the correcting constituent is explicitly given. In (31B) the speaker simply chooses to repeat A's sentence leaving the corrected constituent out. The Correction is conveyed as an implicature – an implicature saying that the pajamas were not for A. The intonation plays a crucial role in that it conveys something like the following: (i) 'what I'm asserting is all I know for a fact' and (ii) 'you are encouraged to draw implicatures taking as premises what you said and I replied'.

Larry Horn's example is given in (32) again. Remember that what is apparently puzzling in this example is that A understands that the second event explains the first and that there is temporal reversal in the presence of *and*. Using the informal interpretation of the fall-rise intonation above, we are now in a better position to account for it:

(32) A: Did John break the vase?
B: WELL / the VASE BROKE / and HE dropped it.

Intuitively, B asserts that both an event of a vase breaking and an event of John dropping it took place, and manages to communicate that John did break the vase. This second meaning is not asserted but conveyed just as an implicature. B gives two linguistic clues to help A build this implicature. On the one hand, she utters the discourse marker *well*, which signals that what follows is not directly related to the previous conversation turn. In this case, *well* indicates that what follows is an indirect answer.[19] On the other hand, she uses a fall-rise intonation with the interpretation above.

This example is interesting because it shows how different layers of meaning communicated with different statuses can coexist. At the level of the assertion, *and* indicates that a Coordinator is required and, thus, Explanation is blocked. Therefore, at the level of discourse structure, there is a semantic requirement to use a Coordinator and build a CDT. However, at the level of what is implicated, things are very different. For B's contribution to make sense in the context, it has to answer A's question. This answer is given as the implicature that she does believe that John broke the vase.

These two inferential chains are independent and can co-exist as long as they do not lead to inconsistency. As we explained before (see the *banana peel* example (24) in §3.2) a distinction between speech acts and propositional contents built up into the theory allows us to maintain that they are compatible. This example is similar to the *banana peel* example in (24). The only difference is that the relation of an event explaining another event is asserted in (24) whereas it only follows as an implicature here.[20]

5.2. *NL Conjunction and Conditional Meanings (i): Commands*

Bar-Lev and Palacas' 1980 example in (4) is repeated below:

(33)a. Stand up; I'm going to break your arm.
b. Stand up, and I'm going to break your arm.

[19] See Carlson 1994 for an approach to *well*.

[20] The *rug* example in (12) can be given a similar explanation.

Consider (33a). The interpreter infers a speech act of command, linguistically codified by the imperative mood, and a threat, which is linguistically codified by the progressive + lexical knowledge.

There are not many studies on the discourse structures built with commands yet and, thus, we are in uncharted territory. Shall we posit a discourse relation between the two speech acts? Which one? Intuitively, no DR seems to hold. However, note that a DR does hold between the contents of the speech acts: the speaker is communicating that the breaking of the arm will occur after the addressee stands up. The interpreter will infer temporal succession by assuming a temporal DR. Narration could be selected. Even a resultative relation could be appropriate given that the command be obeyed is intuitively seen as a precondition for the fulfillment of the threat.

A resultative discourse is normally triggered if a cause-effect relationship can be postulated. A resultative discourse relation between π and π' is veridical iff the propositional contents of π, π' are communicated to be true by the speaker. We talk about Result in this case. But they might also be non-veridical, if the speaker is communicating that a cause relation holds but it is not asserting the truth of the propositions involved. In this case we talk about Conditional. Note that the imperative mood in (33a) introduces non-veridicality.[21] Thus, we tentatively assume that Conditional relates the propositional contents in (33a).

The interpretation of (33a) involves the following normal inferences:

1. Mood(π, imperative) > $\neg$Veridical(π) & Speech-Act(π, command)
2. [Progressive & Lexical-knowledge](π') > Speech-Act(π', threat)
3. $\langle \pi, \pi' \rangle$ & $\neg$Veridical(π) & Cause(e(π), e'(π')) > Conditional(π, π')

We classify Conditional as a Coordinator and thus one of the discourse relations indicated by *and*. This means that the insertion of *and* in (33b) cannot block it. Why, then, does inserting *and* introduce a meaning difference? Note that the presence of *and* blocks the illocutionary force of command, leaving the rest as it was. How is the blocking of an illocutionary force explained using only the premise that *and* indicates Coordinators? This suggests that the meaning of *and* might need to be enriched. One could, for example, require that the semantics of *and* include the constraint that the illocutionary forces of *and*-clauses be identical, that is,

$$and(\pi, \pi') \rightarrow \text{IllocutionaryForce}(\pi) = \text{IllocutionaryForce}(\pi')$$

[21] A notion of non-veridicality has already been discussed in Asher and Lascarides 1998.

However, examples such as the one below show that more refinement is needed:

(34) I do not like your attitude and, please, shut up.

This indicates that this issue requires further consideration, and it is left open for the time being.

5.3. *NL Conjunction and Conditional Meanings (ii): Generics*

Consider the following example (Ana Alves, p.c.):

(35)a. ?I drank coffee after lunch. I couldn't sleep the whole night.
b. I drank coffee after lunch and I couldn't sleep the whole night.
c. ??I drink coffee after lunch. I can't sleep the whole night.
d. I drink coffee after lunch and I can't sleep the whole night.

According to some native speakers, discourse in (a) is not very good. Adding *and* in (b) significantly improves fluency. The interpreter concludes Result. Generics in (c) do not seem to trigger Result (we have substituted present tense by past tense, giving rise to a generic reading). The speaker cannot find a way to build a coherent whole. When *and* is added as in (d), the speaker successfully communicates a conditional meaning. How is this achieved? Let us compare (b) and (d). As stated before, hearers conclude Result in (b). Let us assume that it is normally inferred roughly in the following way:

$$\langle \pi, \pi' \rangle \ \& \ \text{Veridical}(e_{\pi}) \ \& \ \text{Veridical}(e_{\pi'}) \ \& \ \text{Cause}(e_{\pi}, e_{\pi'}) > \text{Result}(\pi, \pi')$$

Then, it seems that Conditional could be concluded in (d) as follows:

1. $\text{generic}(\pi) > \neg\text{Veridical}(e_{\pi})$
2. $\text{generic}(\pi') > \neg\text{Veridical}(e_{\pi'})$
3. $\langle \pi, \pi' \rangle \ \& \ \neg\text{Veridical}(e_{\pi}) \ \& \ \neg\text{Veridical}(e_{\pi'}) \ \& \ \text{Cause}(e_{\pi}, e_{\pi'}) > \text{Conditional}(\pi, \pi')$

6. CONCLUSION

Previous approaches to *and* such as Grice 1975 and Bar-Lev and Palacas 1980 have been revised to conclude that the semantics of *and* is neither

equivalent to its logical correlate nor temporally loaded. We have then put forward the hypothesis that, while sentence juxtaposition allows both discourse Coordinators and Subordinators, the presence of *and* reduces the choice to Coordinators. We have assumed a discourse-based perspective in the framework of SDRT where many studies about Coordinators such as Narration, Result or Parallel, and Subordinators such as Explanation, Elaboration or Instance have been carried out already. We have taken the view that the notion of discourse coordination can be defined in terms of an instruction requiring a Coordinating Discourse Topic. A Coordinating Discourse Topic is obtained by equally generalizing over the contents of the representations thus linked. This means that this notion depends heavily on a highly structured knowledge base. This proposal has been applied to account for (i) cases of temporal succession, (ii) cases of temporal reversal, (iii) non-temporal cases, and (iv) more complex examples.

Nevertheless, this is a preliminary study on the semantics and pragmatics of natural language conjunction and many kinds of examples remain unaccounted. Just to mention a few, consider first the contrast between *and* and *but* in the following example (Blakemore and Carston 1999, originally in Kitis 1995):

(36)a. Her husband is in hospital and she is seeing other men.
b. Her husband is in hospital but she is seeing other men.

Secondly, this paper focuses on the discourse marker *and* syntactically relating two clauses. Intraclausal conjunction and borderline cases are not considered. The conjunction of NPs is compared with NP apposition below:

(37)a. This book is about Joyce, the author of Ulysses.
b. This book is about Joyce and the author of Ulysses. (Ana Alves, p. c.)

Thirdly, we have proposed that a Coordinating Discourse Topic is required in the presence of *and* and we have defined this notion, with Asher 1993, with respect to a knowledge base. There are, however, many issues that need to be carefully addressed. For example, why the CDT for (38) should include that she opened the door with the key? Or, why (39) would not be taken seriously, were it to be found in a panegyric?

(38) She took out the key and opened the door. (Robyn Carston, SPR-01)

(39) He was virtuous and he was stocky. (Bergson 1940)

Finally, the systematic study of the generalization of our hypothesis to *and*-sequences of more than two clauses is left for future work. Also intersentential *and*-examples such as (40) below have been left unaccounted:

(40) A: I'll be here tomorrow before 7am.
B: Yes, and I'm the Pope.

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