TEMPORAL RELATIONS: REFERENCE OR DISCOURSE COHERENCE?

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Abstract

The temporal relations that hold between events described by successive utterances are often left implicit or underspecified. We address the role of two phenomena with respect to the recovery of these relations: (1) the referential properties of tense, and (2) the role of temporal constraints imposed by coherence relations. We account for several facets of the identification of temporal relations through an integration of these.

Introduction

Tense interpretation has received much attention in linguistics (Partee, 1984; Hinrichs, 1986; Nerbonne, 1986, inter alia) and natural language processing (Webber, 1988; Kameyama et al., 1993; Lascarides and Asher, 1993, inter alia). Several researchers (Partee, 1984; Hinrichs, 1986; Nerbonne, 1986; Webber, 1988) have sought to explain the temporal relations induced by tense by treating it as anaphoric, drawing on Reichenbach's separation between event, speech, and reference times (Reichenbach, 1947). Specifically, to account for the forward progression of time induced by successive simple past tenses in a narrative, they treat the simple past as referring to a time evoked by a previous past tense. For instance, in Hinrichs's (1986) proposal, accomplishments and achievements[1] introduce a new reference point that is temporally ordered after the time of the event itself, "ensuring that two consecutive accomplishments or achievements in a discourse are always ordered in a temporal sequence." On the other hand, Lascarides and Asher (1993) take the view that temporal relations are resolved purely as a by-product of reasoning about coherence relations holding between utterances, and in doing so, argue that treating simple and complex tenses as anaphoric is unnecessary. This approach parallels the treatment of pronoun resolution espoused by Hobbs (1979), in which pronouns are modeled as free variables that are bound as a by-product of coherence resolution. The Temporal Centering framework (Kameyama et al., 1993) integrates aspects of both approaches, but patterns with the first in treating tense as anaphoric.

We argue that aspects of both analyses are necessary to account for the recovery of temporal relations. To demonstrate our approach we will address the following examples; passages (1a-b) are taken from Lascarides and Asher (1993):

(1) a. Max slipped. He spilt a bucket of water.
  b. Max slipped. He had spilt a bucket of water.
  c. Max slipped because he spilt a bucket of water.
  d. Max slipped because he had spilt a bucket of water.

Passage (1a) is understood as a *narrative*, indicating that the spilling was subsequent to the slipping. Passages (1b-d) are instead understood as the second clause *explaining* the first, indicating that the reverse temporal ordering holds. We address two related questions; the first arises from treating the simple past as anaphoric. Specifically, if a treatment such as Hinrichs's is used to explain the forward progression of time in example (1a), then it must be explained why sentence (1c) is as felicitous as sentence (1d). That is, one would predict a clash of temporal relations for sentence (1c), since the simple pasts induce the forward progression of time but the conjunction indicates the reverse temporal ordering. The second question arises from assuming that all temporal relations are recovered solely from reasoning with coherence relations. Specifically, because the use of the simple past in passage (1c) is as felicitous as the past perfect in passage (1d) under the *explanation* interpretation (in these cases indicated explicitly by *because*), then it must be explained why passage (1a) is not understood as an *explanation* as is passage (1b), where in each case the relationship needs to be inferred. We present our analysis in the next section, and account for these facts in Section 3.

The Account

We postulate rules characterizing the referential nature of tense and the role of discourse relations in further constraining the temporal relations between clauses. The rules governing tense are:

[1] We will limit the scope of this paper by restricting the discussion to accomplishments and achievements.

1. Main verb tenses are indefinitely referential, creating a new temporal entity under constraints imposed by its type (i.e., past, present, or future) in relation to a *discourse reference time*[2] t_R. For instance, a main verb past tense introduces a new temporal entity t under the constraint *prior-to*(t,t_R). For simple tenses t_R is the speech time, and therefore simple tenses are not anaphoric.
2. Tensed auxiliaries in complex tenses are anaphoric, identifying t_R as a previously existing temporal entity. The indefinite main verb tense is then ordered with respect to this t_R.

The tenses used may not completely specify the implicit temporal relations between the described events. We claim that these relations may be further refined by constraints imposed by the coherence relation operative between clauses. We describe three coherence relations relevant to the examples in this paper and give temporal constraints for them.[3]

Narration: The *Narration* relation is characterized by a series of events displaying forward movement of time, such as in passage (1a). As did Lascarides and Asher (1993), we capture this ordering as a constraint imposed by the Narration coherence relation itself:[4]

(2) If $Narration(A, B)$ then $t_A < t_B$

Parallel: The *Parallel* relation relates utterances that share a common topic. This relation does not impose constraints on the temporal relations between the events beyond those provided by the tenses themselves. For instance, if passage (1a) was uttered in response to the question *What bad things happened to Max today?* (inducing a Parallel relation instead of Narration), a temporal ordering among the sentences is no longer implied.

Explanation: The *Explanation* relation denotes a cause-effect relationship with reversed clause ordering, as in sentences (1b-d). Therefore, the second event is constrained to preceding the first:

(3) If $Explanation(A,B)$ then $t_B < t_A$

To summarize the analysis, we claim that tense operates as indefinite reference with respect to a possibly anaphorically-resolved discourse reference time. The temporal relations specified may be further refined as a by-product of establishing the coherence relationship extant between clauses, *Narration* being but one such relation.

Examples

We now analyze the examples presented in Section 1, repeated below, using this approach:

(4) a. Max slipped. He spilt a bucket of water.

b. Max slipped. He had spilt a bucket of water.

c. Max slipped because he spilt a bucket of water.

d. Max slipped because he had spilt a bucket of water.

The implicit ordering on the times indefinitely evoked by the simple pasts in passage (4a) results solely from understanding it as a Narration. In passage (4b), the auxiliary *had* refers to the event time of the slipping, and thus the past tense on *spill* creates a temporal entity constrained to precede that time. This necessitates a coherence relation that is consistent with this temporal order, in this case, Explanation. In passage (4c), the times evoked by the simple pasts are further ordered by the Explanation relation indicated by *because*, resulting in the backward progression of time. In passage (4d), both the tense and the coherence relation order the times in backward progression.

Restating the first problem noted in Section 1, if treating the simple past as anaphoric is used to account for the forward progression of time in passage (4a), then one would expect the existence of the Explanation relation in passage (4c) to cause a temporal clash, where in fact passage (4c) is perfectly felicitous. No clash of temporal relations is predicted by our account, because the use of the simple pasts do *not* in themselves imply a specific ordering between them. The Narration relation orders the times in forward progression in passage (4a) and the Explanation relation orders them in backward progression in passage (4c). The Parallel relation would specify no ordering (see the potential context for passage (4a) given in Section 2).

Restating the second problem noted in Section 1, if temporal relations can be recovered solely from reasoning with coherence relations, and the use of the simple past in passage (4c) is as felicitous as the past perfect in passage (4d) under the Explanation interpretation, then one asks why passage (4a) is not understood as an Explanation as is passage (4b), where in each case the relationship needs to be inferred. We hypothesize that hearers assume that speakers are engaging in Narration in absence of a specific cue to the contrary. The use of the past perfect (as in passage (4b)) is one such cue since it implies reversed temporal ordering; the use of an explicit conjunction indicating a coherence relation other than Narration (as in passages (4c-d)) is another such cue. While passage (4a) could be understood as an Explanation on semantic grounds, the hearer assumes Narration since no other relation is cued.

[2] This term is borrowed from Kameyama et al. (1993).

[3] We assume here that the two clauses in question are related directly by a coherence relation. This may not be the case; for instance the use of a past perfect may signal the start of an embedded discourse segment, as in Webber's flower shop example (Webber, 1988; Kameyama et al., 1993). How this account is to be extended to address coherence at the discourse segment level is the subject of future work.

[4] The *Cause-Effect* relation also has this ordering constraint.

We see several advantages of this approach over that of Lascarides and Asher (1993, henceforth L&A). First, L&A note the incoherence of example (5)

(5) ? Max poured a cup of coffee. He had entered the room.

in arguing that the past perfect should not be treated as anaphoric:

(6) Theories that analyse the distinction between the simple past and pluperfect purely in terms of different relations between reference times and event times, rather than in terms of event-connections, fail to explain why [(4b)] is acceptable but [(5)] is awkward. (Lascarides and Asher, 1993, pg. 470)

Example (5) indeed shows that coherence relations need to be utilized to account for temporal relations, but it does not bear on the issue of whether the past perfect is anaphoric. The incoherence of example (5) is predicted by both their and our accounts by virtue of the fact that there is no coherence relation that corresponds to Narration with reverse temporal ordering.[5] In addressing this example, L&A specify a special rule (the *Connections When Changing Tense (CCT)* Law) that stipulates that a sentence containing the simple past followed by a sentence containing the past perfect can be related only by a subset of the otherwise possible coherence relations. However, this subset contains just those relations that are predicted to be possible by accounts treating the past perfect as anaphoric; they are the ones that do not constrain the temporal order of the events against displaying backward progression of time. Therefore, we see no advantages to adopting their rule; furthermore, they do not comment on what other laws have to be stipulated to account for the facts concerning other possible tense combinations.

Second, to explain why the Explanation relation can be inferred for passage (4b) but not for passage (4a), L&A stipulate that their causal *Slipping Law* (stating that spilling can cause slipping) requires that the CCT Law be satisfied. This constraint is imposed only to require that the second clause contain the past perfect instead of the simple past. However, this does not explain why the use of the simple past is perfectly coherent when the Explanation relationship is indicated overtly as it is in sentence (4c), nor do they adequately explain why CCT must be satisfied for this causal law and not for those supporting similar examples for which they successfully infer an unsignaled Explanation relation (see discussion of example (2), pg. 463).

Third, the L&A account does not explain why the past perfect cannot stand alone nor discourses generally be opened with it; consider stating sentence (7) in isolation:

(7) Max had spilt a bucket of water.

[5] For instance, in the same way that Explanation corresponds to Cause-Effect with reverse temporal ordering.

Intuitively, such usage is infelicitous because of a dependency on a contextually salient time which has not been previously introduced. This is not captured by the L&A account because sentences containing the past perfect are treated as sententially equivalent to those containing the simple past. On the other hand, sentences in the simple past are perfectly felicitous in standing alone or opening a discourse, introducing an asymmetry in accounts treating the simple past as anaphoric to a previously evoked time. All of these facts are explained by the account given here.

Conclusion

We have given an account of temporal relations whereby (1) tense is resolved indefinitely with respect to a possibly anaphorically-resolved discourse reference time, and (2) the resultant temporal relations may be further refined by constraints that coherence relations impose. This work is being expanded to address issues pertaining to discourse structure and inter-segment coherence.

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