TEMPORAL REASONING WITH ASPECTUAL ADVERBS

ABSTRACT. Validity of dynamic temporal reasoning is semantically characterized for English and Dutch aspectual adverbs in Discourse Representation Theory. This dynamic perspective determines how the content needs to be revised and what information is preserved across updates, when the order of premises is considered relevant. Resetting contextual parameters relies on modelling the basic aspectual polarity transitions and temporal reasoning extensionally. For intensional aspectual adverbials the speaker’s attitudes regarding past alternatives to and possible continuations of the current state come into play. Additional considerations are offered for generalizing this system to the full logical space for linguistic universals, lexicalized quite differently in Dutch and English.

1. INTRODUCTION

Human reasoning about temporal relations between events is itself a cognitive process taking place in time. Not only does the time at which information is received often affect the conclusions we draw from it at a particular moment, processing the premises itself constitutes change of context and resets various temporal indexical parameters. Such forms of reasoning may be reported in natural language using aspectual adverbs, such as not yet, still or finally, which efficiently combine factual content with information about the speaker’s attitudes and presuppositions. To characterize the valid patterns of such situated reasoning in time about time, this paper proposes an analysis in Discourse Representation Theory

(DRT),\(^1\) in which components of truth functional content are combined with information regarding the speaker’s attitudes towards possible past alternative courses of events and future continuations of the current state. Subjective evaluation of the speed and progress of changes that occur interact systematically with the actual polarity transitions, representing positive and negative phases of events. This account assigns a pivotal role to the perspective of the reasoner, herself situated at the current reference time, looking either back to what has happened or forward towards what may happen. This captures the essential situatedness of human temporal reasoning, which the Dynamic Aspect Trees of ter Meulen (1995) were designed to model for English aspectual verbs, aspectual classes and aspectual inflection of verbal predicates in discourse.

Adverbs are called aspectual when they carry information about the start or end of an event, which are themselves essentially polarity transitions, changing a negative state into a positive one or vice versa. We espouse the use of an event-based semantics, customary in DRT, from which an interval semantics may be derived, as used in van der Auwera (1993, 1998) and L öbner (1999).

A simple example of the kind of inference we are interested in is the following, intuitively obvious case of a valid temporal reasoning pattern, where the premises are presented in the order given.

(i) When Mary arrived, John was *still* asleep
(ii) John woke up
(iii) Bill arrived
(iv) \(\vdash\) When Bill arrived, John was *not* asleep *anymore*

Presented first is the factual information in (i) that at the time of Mary’s arrival John was asleep. This information about John is revised upon adding the second premise in (ii), introducing a later reference time and resetting the polarity for John’s sleeping from positive (being asleep) to negative (not being asleep). In processing the premises in the given order, the premise in (iii) again introduces a later reference time of Bill’s arrival. This is the time at which the conclusion is drawn in (iv) that John is not asleep anymore. The aspectual adverbials in the first premise (i) and in the conclusion (iv), *still* and *not anymore*, contribute additional information with their presuppositions. The presupposition for *still*, for instance, will be characterized as relating to the 1/0 ending transition, relative to which the speaker herself is situated at an earlier point, looking towards it into the future. Even though *still* in (i) is not strictly necessary to infer the conclu-

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\(^1\) See Kamp and Reyle (1993) and Van Eijck and Kamp (1997) for an introduction to DRT.