

# Bridging Reference to Eventualities

Matthias Irmer

University of Leipzig

mirmer@uni-leipzig.de

There is some literature about bridging anaphora concerning indirect reference by association to previously introduced discourse entities ([1, 3]). But there is very little work done on bridging references to abstract entities such as eventualities. Consider a classical example from Clark [4]:

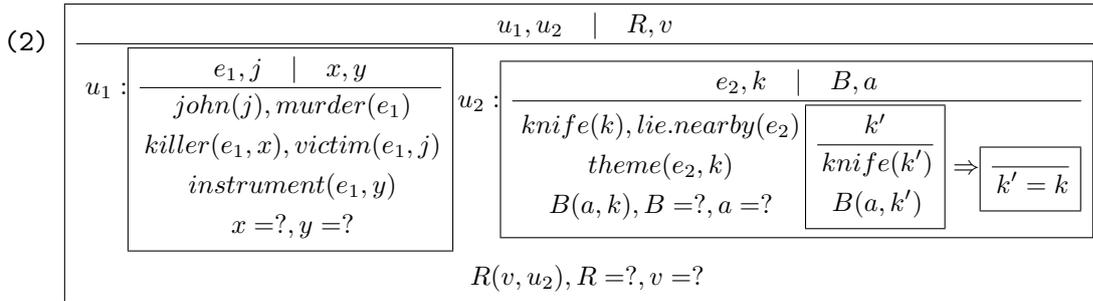
- (1) a. John was murdered yesterday.      b. The knife lay nearby.

Utterance (1a) describes a killing event which took place on the day preceding the utterance. The individual referred to by the proper name *John* is the victim of the event. Utterance (1b) describes a state of the entity denoted by the definite noun phrase *the knife*. This entity is new in the discourse, but stands in an implicit relation to the event described in utterance (1a): the knife served probably as the instrument of the killing event. This relationship is not expressed by linguistic means. Instead, the hearer has to infer it using contextual knowledge. Apart from understanding the previous utterance, successful interpretation of (1b) requires some world knowledge: in a murdering event, there must be a victim and a killer, and normally there is also an instrument used for performing the act. Only by means of this additional knowledge, the hearer can successfully interpret the utterance and connect it to the preceding discourse. In this way, interpretation involves constructing incrementally a structured mental representation of the discourse. In example (1), utterance (b) is subordinated to (a), providing background information. Neither these relations between utterances nor relations between discourse entities (including eventualities) have to be expressed necessarily directly by linguistic means. Often they exist only implicitly, forcing the hearer to infer them using pragmatic inferences. In a successful interpretation, the inferred information will be part of the discourse model constructed by the hearer in course of interpretation.

The proposal made in this paper is to extend the current account of bridging in SDRT [1, 2] such that implicit reference to previously introduced abstract entities such as eventualities can be accounted for. According to [1], the meaning representation for a definite noun phrase, e.g. *the knife*, includes a bridging relation  $B(a, k)$  with  $k$  denoting the entity introduced by the definite noun phrase,  $a$  denoting its antecedent, and  $B$  the relation between them. The parameters  $B$  and  $a$  have to be specified by pragmatic inference. In case of direct anaphora,  $B$  is simply *identity*. For bridging anaphora,  $B$  can be instantiated as *part-of* or *member-of*. Possible values for  $B$  can also be thematic roles such as *agent*, *theme* or *instrument*, in cases when the antecedent is a referent of an eventuality.

To get clues for the resolution of these bridging inferences, we propose to exploit the idea developed by Fillmore (cf. [5] and subsequent work on FrameNet) that world knowledge is organized in frames, mental representations of stereotypical situations. With each eventuality introduced in the discourse, a corresponding frame is evoked in the discourse model. In this frame, all relevant (necessary or optional) participants of an event are stored. For all core frame elements corresponding to thematic roles, there is a representation in the discourse model, i.e. in the SDRS. In case that some participant is not expressed linguistically, its representation remains underspecified. Provided that the discourse referent for the eventuality remains accessible for anaphoric reference, these roles can be further specified by subsequent information.

Accessibility for anaphoric reference is constrained by general discourse principles such as the Right Frontier Constraint [7]. Basically, it draws a distinction between coordinating and subordinating discourse relations: a coordinating relation pushes the right frontier to the right, closing off its attachment point, and a subordinating relation extends the right frontier downwards, leaving open its attachment point. In SDRT, “an antecedent for an anaphoric expression must be DRS-accessible on the right frontier” [2]. Underspecified representations for the semantic content of discourse (1ab) in a SDRT-like framework can be assumed as shown in (2).



The verb “murder” evokes the *killing* frame, inheriting the properties of the abstract frame *event*, and “lie” evokes the frame *being\_located*, inheriting from *state*. As assumed in [2], the occurrence of an event followed by a state indicates the presence of a *Background* relation. In example (1), a *Background* relation  $R$  between  $u_1$  and  $u_2$  can be inferred. Recent work in SDRT [8] has revealed that *Background* should be considered as subordinating by default. Thus,  $u_1$  lies on the right frontier of the discourse, and  $e_1$  is accessible for anaphoric reference in  $u_2$ . The bridging relation  $B(a, k)$  can be specified as  $instr(e_1, k)$ . As a byproduct, the underspecified variable  $y$  in  $instr(e_1, y)$  can be resolved to  $k$ . Although  $k$  is not accessible in  $u_1$ , it is in the superordinated SDRS compromising both utterances, and so, after processing the second utterance, the underspecification can be resolved.

As suggested by the representation in (2), we now have to deal with two different kinds of discourse entities: ‘regular’ discourse referents introduced by linguistic expressions, and ‘weak’ discourse referents which are not (yet) expressed linguistically. These entities are evoked in course of interpretation. They often remain underspecified, but in case that they are referred to by subsequent anaphoric reference, they help to render the discourse more coherent.

Our treatment of implicit discourse referents differs from the proposal of [6]. As these authors argue and affirm by experimental evidence, implicit arguments in short passive sentences cannot serve as antecedents of definite pronouns. They claim that implicit arguments do not introduce any discourse referent at all. Their DRT representation for the utterance ‘A ship was sunk.’ is  $[y|ship(y), sink(x, y)]$ . The problem is that it is not clear how the free variable  $x$ , representing the actor, is interpreted. Moreover, as noted in that paper, bridging references to implicit arguments *are* indeed possible, but no details are given how such an inference is drawn.

Unlike [3], who treat bridging as a lexical phenomenon, our approach extends to cases where non-lexical background knowledge is needed, as FrameNet includes world knowledge that goes beyond strictly lexical information.

The proposals we want to make here is (i) to restrict the search space for suitable antecedents for bridging anaphora to take into account only accessible weak and regular discourse referents, and (ii) to restrict possible bridging relations to conditions on (weak or regular) discourse referents already present in the discourse model.

## References

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