Focus of Attention, Discourse Structure and Intonation

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Program Area: Speech and natural language processing.

Keywords: Dialogue, discourse structure, intonation, centering theory, language generation, speech synthesis.

Related Program Areas: Other communication modalities, adaptive human interfaces, user-centered design.

PROJECT SUMMARY

In a theory of discourse structure, developed with Sidner (Grosz and Sidner, 1986), we distinguish among three components of discourse structure: linguistic structure, intentional structure, and attentional state. The grouping of utterances into discourse segments forms the basis of the linguistic structure. Discourse segment purposes and the relations between them form the intentional structure. Attentional state, an abstraction of the discourse participants' focus of attention, records the objects, properties, and relations that are salient at a given point in the discourse. Our current research addresses open problems in all three components.

At the linguistic level, we are investigating several fundamental problems in the production of appropriate intonational variation in computer synthesized speech. We are studying the reliability of discourse structural analyses based on the Grosz and Sidner theory of discourse structure and analyzing a corpus of spoken language to determine the intonational indicators of discourse structure. The major components of this project include collection and analysis of a large corpus of direction-giving discourses, specification of representations of discourse features required to produce appropriate intonational variation at the discourse level, and development of algorithms utilizing these representations to produce appropriate intonational variation in speech synthesis systems. We expect the resulting system to extend the state of the art in speech synthesis by basing the control of intonational variation on a more substantial discourse model than any previous system and by incorporating the results of the empirical studies of the relationship between intonation and discourse structure.

There are two levels of attentional state. The global level is concerned with the relations between discourse segments and the ways in which attention shifts between them; it depends on the intentional structure. The local level is concerned with changes of attention within discourse segments. Centering (Grosz et al., 1995), an element of the local level, pertains to the interaction between the form of linguistic expression and local discourse coherence. Our previous research empirically validated and refined several basic claims in the original formulation of centering. Our current research addresses four central open problems that remain: (1) integration of centering with other processes for interpreting pronouns; (2) application of centering to additional context-dependent linguistic forms (e.g., ellipsis, accentuation); (3) the interaction between centering and discourse segmentation; (4) formulation of computationally tractable rules constraining center transitions. In addressing these issues we are also investigating how to incorporate centering into a general architecture for intra-segment discourse processing.

At the intentional level, we are developing models of collaboration and constructing systems that collaborate with one another and their users. As computer systems become ubiquitous and more information becomes available electronically, it is increasingly important for computer systems to be able to collaborate with each other and their users. The development of the underlying theories and formalizations needed to build collaborative systems will have far-reaching practical import as well as addressing challenging computer science problems. The SharedPlan formalization of collaboration (Grosz and Kraus, 1995) provides a specification of the capabilities to act and mental attitudes that agents must have to participate in collaborative activities with

one another. We are extending this formalization by developing strategies for elaborating partial plans and by specifying axioms that treat more completely the attitude of *intending that* a proposition hold. In addition, we are designing a collaborative communication system based on SharedPlans; this system will both demonstrate the value of a model of collaboration to the design of human-computer interface systems and test the formalization. We expect this research to contribute to the development of computer agents that are fully collaborative, with each other and their users; it should also enable the construction of more flexible and user-friendly interfaces.

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