

Meta-language for Dialog Management

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Introduction and Background

As is well known, dialog partners manage the uncertainty inherent in conversation by continually providing and eliciting feedback, monitoring their own comprehension and the apparent comprehension of their dialog partner, and initiating repairs as needed (see e.g., Cahn & Brennan, 1999; Clark & Brennan, 1991). Given the nature of such monitoring and repair, one might reasonably hypothesize that a good portion of the utterances involved in dialog management employ meta-language. But while there has been a great deal of work on the specific topic of dialog management, and it is widely (if often tacitly) accepted that meta-language is frequently involved, there has been no work specifically investigating and quantifying the role of meta-language in dialog management. Thus, this small study investigated the correlation between meta-language and dialog management utterances in three dialog files of the British National Corpus (BNC).

Approach and Methods

The three BNC files used in this study, KRF, KRG, and KRH, are transcripts of a series of *Ideas in Action* radio programs, some of which are interviews. Because interviews are more structured than informal conversation, they involve explicit dialog management, and are therefore a good place to start an investigation into the relation between meta-language and dialog management. Focusing exclusively on the interviews in these three files gives 5900 lines to study.

These three files had been previously annotated for meta-language, using the annotation scheme and methods reported in (Anderson, *et al.*, 2004).

Two different counting methods for conversational management utterances were used. Both were developed using Dialog Act Markup in Several Layers (DAMSL) (Allen & Core, 1977), a method for identifying and tagging speech acts in task-oriented dialog. DAMSL identifies three different information levels: task, task management, and communication management. The task level encompasses utterances directly involved in “performing the task that is the reason for the dialog” (tasks are generally imagined to be such collaborative endeavors as fixing a car) and utterances that “directly move ahead (or attempt to move ahead) the goals of the domain.” The task management level, in contrast, “explicitly addresses the problem solving process”, and “includes utterances that involve coordinating the activities of the two speakers, asking for help on the

procedures, or asking about the status of the process.” Finally, the communication management level includes “conventional phrases that maintain contact, perception, and understanding during the communication process.”

For the first counting method, a very strict interpretation of DAMSL was used, wherein the task was defined as performing/participating in an interview, and strict interpretations of each level were used. Thus, for instance, on this interpretation task level utterances include discussing the interview topic, talking about what was said (e.g. “you said ‘x’ before”) including summarizing, clarifying utterances, requesting utterances, and the like. In contrast, task management utterances would include such things as agreeing on a topic of conversation, changing the topic of conversation, requesting permission to talk about a subject, talking about the format of the interview, etc. The advantage of this method of counting is that it is in strict adherence with a well-established method, allowing a high degree of confidence in the results. However, the disadvantage, as may be apparent from the above list, is that many things that qualify as task level on a strict interpretation of DAMSL, probably in fact belong in the category of dialog management, such as clarifying and requesting utterances.

Thus, the second counting method involved modifying DAMSL somewhat to better fit the case where the task under consideration is an interview. For, when the task is *itself* a discussion, two issues need to be addressed. First, the distinction between the last two information levels blurs somewhat; task management can be considered a kind of communication management. Second, as mentioned above, some task level utterances, that do not involve discussion of the dialog *per se*, are effectively part of the dialog management. An example of such an utterance is: “And can you give me some examples of the firms that the University’s managed to help?” (BNC KRH 818).

To address these issues, we (a) collapsed the task management and communication management levels, categorizing all relevant utterances under the latter, and (b) added a dialog-management marker, applied in addition to the standard markers, for utterances having an explicit, intended effect on the course of the discussion. Such utterances, along with the communication-management utterances, were counted as instances of dialog management. The advantage of this second counting method is that we can be more certain that all the dialog management has been counted. The disadvantage is that,

since the method is new, it is not known how reliable it is. However, using the two methods together, we can be fairly certain that the overall results are sound.

Results

Method 1: Of the 5900 lines annotated, there were 270 task management utterances, and 1086 included meta-language. 151 lines were both dialog management and meta-language, giving $X^2 = 265.2$, $p \ll .001$, and $\Phi = 0.212$. (See Table 1.)

Table 1: Meta-language and dialog management results, method 1

	Meta	-Meta	Totals
DM	151	119	270
-DM	935	4695	5630
Totals	1086	4814	5900
$X^2 = 265.2$ $p \ll 0.001$ $\Phi = 0.2120$			

By this counting method, 60.37% of dialog management utterances involved meta-language.

Method 2: In the 5900 lines annotated, there were 741 dialog management utterances, and 1086 included meta-language. 407 lines were both dialog management and meta-language, giving $X^2 = 753.74$, $p \ll .001$, and $\Phi = 0.357$. (See Table 2.)

Table 2: Meta-language and dialog management results, method 2

	Meta	-Meta	Totals
DM	407	334	741
-DM	679	4480	5159
Totals	1086	4814	5900
$X^2 = 753.74$ $p \ll 0.001$ $\Phi = 0.3574$			

By this counting method, 54.93% of dialog management utterances involved meta-language. Detailed results can be found at <http://www.cs.umd.edu/projects/metalinguage>

Conclusions

Both methods gave results that were largely in accord, thus confirming the tacitly held assumption that meta-language is frequently involved in dialog management. These newer results also confirm the preliminary results reported in (Anderson and Lee, 2004).

Acknowledgments

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References

- Allen, J. & Core, M. (1977). DAMSL: Dialog Annotation Markup in Several Layers. Technical report, University of Rochester.
- Anderson, M., Fister, A., Lee, B., Tardia, L. & Wang, D. (2004). On the types and frequency of meta-language in conversation: A preliminary report. *14th Annual Meeting of the Society for Text and Discourse*.
- Anderson, M., & Lee, B. (2004). Empirical Results for the Use of Meta-language in Dialog Management. *Proceedings of the 26th Annual Conference of the Cognitive Science Society*.
- Cahn, J. E. & Brennan, S. E. (1999). A psychological model of grounding and repair in dialog. *Proceedings of the AAAI Fall Symposium on Psychological Models of Communication in Collaborative Systems*, (pp. 25–33).
- Clark, H. & Brennan, S. E. (1991). Grounding in communication. In: J. Levine, L. B. Resnik & S. D. Teasley (Eds.) *Perspectives on Socially Shared Cognition*.