FamCHAI:
An Adaptive Calendar Dialogue System

Ramin Yaghoubzadeh

Sociable Agents Group, CITEC, Bielefeld University
PO box 10 01 31, 33501 Bielefeld, Germany
`ryaghoub@techfak.uni-bielefeld.de`

Abstract. The dissertation project *FamCHAI* aims at creating a 'calendar companion' system in the form of a bidirectionally natural-language interactive scene with a virtual agent, and exploring the effects of adaptation of the agent to specific users both in terms of the support given (i.e. giving options the user likes) and in communication (i.e. presentation in a form the user prefers, and learning their idiosyncrasies for better understanding). Harnessing these models, interactions will grow steadily more effective, comfortable and natural for users.

Key words: Scheduling, Dialogue Models, Adaptivity in Conversation

1   Introduction

Repeated conversation and cooperation change the interpersonal relationship in human dyads in characteristic ways. Increased familiarity with the needs of others facilitates effective accommodation. Verbal communication tends to display better flow of conversational turns, less social "embellishment" of possibly unpleasant topics, a tendency towards simpler grammatical structures, and discussion of more topics while interweaving personal information (self-disclosures). Unfamiliar dyads tend to obscure personal intentions and employ mitigation using *distance*, *deference* or *camaraderie* stratagems [7].

Lee [4], analyzing the Map Task Corpus, characterized communicative differences between strangers vs. friends: unfamiliar dyads tended to use more query/response pairs, more explicit feedback, and more explicit signals for readiness. Cassell et al. [2] experimentally identified improved coordination of dialogue turns and reduced superficial positivity in dyads with repeated interaction.

Regarding the aspect of cooperative task-solving, repeated interaction has the property of increasing overall performance (e.g. time for correct solution). This effect can often be attributed to a familiarization of the participants with the task, yet it has been shown [3] that this effect is not wholly dependent on the task itself: fast improvement is also observable when the tasks across sessions are completely unrelated. Therefore, the improvement must be also explained by a familiarization effect within the human dyad, by building up a model of the communicative behavior of the other, and a notion of their general knowledge and capabilities.

2   Scheduling Dialogue Scenario

Consider the relationship between secretary (S) and his or her 'client' (hence-forth termed the 'user' (U), from an artificial-agent-centered perspective). When talking about U's schedule, both parties have some common ground: knowledge about the current schedule, and at least some contextual knowledge, such as inherent time constraints and a-priori importance of events. When the two are familiar with each other, they will also exhibit some of the conversational features detailed above. Moreover, S has a better knowledge about the nature of U's personal appointments: some are regular, some have clearly differing priorities, some types are liked and others disliked. The secretary might know some of this by simply having observed the same schedule operations repeatedly, and some by experiencing the user's state while talking (possibly during small-talk). Both parties can have intentions or knowledge about modifications to the schedule, which prior to the interaction need not be in a synchronized state. Miscommunication and erroneous recording of entries can moreover lead to later inconsistencies; their resolution also forms part of discussions about the schedule.

We have currently successfully finished recordings for an explorative study aimed at obtaining a corpus of human dyads solving the same calendar issues in free dialogue. The subjects, one playing the role of secretary, and the other the user, talked about the user's fictive two-week schedule. Each role had its own set of desired modifications or updated states of schedule items (adding, canceling, moving, etc.), designed to include various types of purpose-built collisions, and events with well-known priority differences. Sixteen dyads participated, half had no prior acquaintace, and the other half were well-acquainted. Five of the zero-acquaintance dyads agreed to participate a second time with a new calendar, whereby rapid effects on the interpersonal relationship with their effect on the next dialogue can be explored. The study yielded five hours of dialogue about scheduling, containing different conflict resolutions, various ways of communicating the same modifications, and statements of priority and valence towards schedule items. Since the recording phase has only recently ended, in-depth analysis of the data is still pending, and no quantifying statement is made here.

The next step will be the annotation of the corpus, using the technique described by DeVault and colleagues [1], on a word-by-word and dialogue-act basis. The ontology of intentions and dialogue acts contains prototypes relevant to the exchange of facts, to the internal states of the parties, and to the appraisal of individual items. The annotation will also indicate differences in *valence* (e.g. of "ok, great!" vs. "well, ok..."), *priority* and application of mitigating stratagems.

3   Calendar Companion Dialogue System

After the development of the dialogue infrastructure IPAACA [6], development for FamCHAI continues on a dialogue system with an emotionally expressive artificial agent as the secretary (Fig. 1), enabling users to negotiate schedules using natural language, as an interesting and controllable domain to explore familiarity
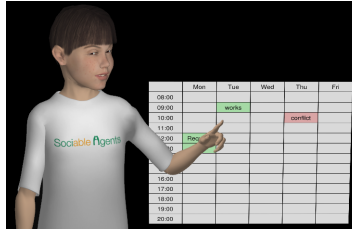
Fig. 1. ECA *Billie* as a calendar companion

effects on conversation. The repertoire obtained from the first study will be used as an uncertain intention–behavior mapping for the agent. The model will enable both clarifying paraphrase and alignment to the user. Features identified as characteristic for unfamiliar or familiar dyads can be used to estimate observed utterances, and also used in production, corresponding to the development of familiarity inside the dyad.
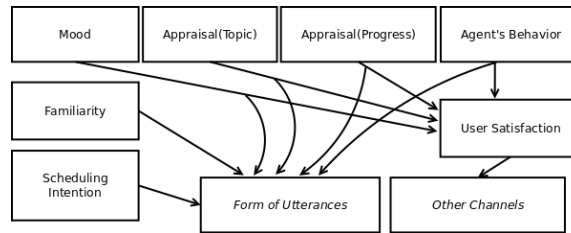

Fig. 2. Causal model for the form of generated utterances

Factors influencing dialogue Figure 2 shows a tentative causal model influencing the selection and embellishment of utterances made by the user. Based on the model, there is an opportunity of inversely determining likely states for the variables from observations using Bayes' theorem. The *mood*, having an extended baseline effect, can be estimated using the mean of observed affective states over time. *Progress appraisal*, indicative of perceived flow in an effective conversation, could be estimated using the number of turns per topic. *Topic appraisal* can be estimated with prior knowledge about the user's past appraisal of similar situations, or utterances expressing valence. *Behavior of the Agent* is the only remaining factor. When the others can be ruled out as an explanation, the agent can assume that its way of saying things has caused any observed changes. *User Satisfaction* can be estimated independently – lower-level acoustical features (pitch, speed) and facial expressions can be indicative of the user's affective state – a focus of recent work, and deployable in our lab. When uncertain, the agent could ask explicitly to pinpoint the source of the change.

Building and applying knowledge Preference learning for schedules is the focus of recent work (e.g. [5]), merging instances of appointments into hypothesized preferences – their extraction from conversational *episodes* is a required step for FamCHAI as well. The episodes are enriched with affective information gathered from the various channels, which facilitates estimation of the expected user state when similar situations arise. Using such uncertain preferences, the agent can take the initiative and make sensible suggestions. Uncertainty about the validity of a preference leads to more effort verbalizing the rationale for its use, repeatedly accepted preferences decrease in the need for justification. Once the agent gains experience with the way a user expresses themselves, it can use the resulting personalized communicative model. With a notion about the user's expected appraisal of situations, the agent could observe the effects of its 'way of saying things' on the user's satisfaction, and attribute any deterioration to its selected behavior, allowing to explore the repertoire for more familiar ways to express an intention, as long as the user is not being imposed upon.

The vision for FamCHAI is a calendar companion agent which can foster a working relationship with a human user, make suitable suggestions, detailing its rationale when required, and detect the user's likes or dislikes in dialogue. The system would actively try to use language deemed more familiar by the user, reducing distance while being able to detect when it went too far.

References

1. DeVault, D., David Traum, D., Artstein, R.: Making grammar-based generation easier to deploy in dialogue systems. 9th SIGdial Workshop on Discourse and Dialogue (SIGdial 2008), Ohio (2008)
2. Cassell J., Gill, A. J., Tepper, P. A.: Coordination in conversation and rapport. In: Proceedings of the ACL Workshop on Embodied Natural Language. 40–50, Prague, CZ (2007)
3. Harrison, D.A., Mohammed, S., McGrath, J.E., Florey, A.T., Vanderstoep, S.: Time matters in team task performance: Effects of member familiarity, entrainment, and task discontinuity on speed and quality. Personnel Psychology 56, 633–669 (2003)
4. Lee, A.: The effect of familiarity on knowledge synchronisation. In: AISB'05 Proceedings of the Joint Symposium on Virtual Social Agents, 185–190, Hatfield, UK (2005)
5. Oh, J., Smith, S. F.: Learning user preferences in distributed calendar scheduling. In: Practice and Theory of Automated Timetabling V , Lecture Notes in Computer Science, vol. 3616, pp. 3-16, Springer (2005)
6. Schlangen, D., Baumann, T., Buschmeier, H., Buß, O., Kopp, S., Skantze, G., Yaghoubzadeh, R.: Middleware for incremental processing in conversational agents. In: Short Paper Proceedings of the SIGdial 2010 Conference, Tokyo (2010)
7. Tannen, D.: Conversational style: Analyzing talk among friends. Ablex, Norwood, NJ (1984)