Artificial Conversational Companions

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Abstract

This document describes the problem statement, the methodological framework, the current state of the work and the expected contribution of my doctoral dissertation. The main focus of my dissertation is long-term interaction with an Artificial Conversational Companion in the context of conversation training for second language acquisition. I use a data-driven approach and conversation analysis methods to build computational models for long-term interaction as a meaningful activity. I work on the concept of interaction profiles for human-agent interaction. The resulting models will be integrated in an AIML-based chatbot that helps to practice conversation in a foreign language.

Introduction and Problem Statement

The term *Artificial Companion* (AC) has been introduced in (Wilks 2005). The most important characteristics of an AC are a sustained discourse over a long time period, a capability to serve interests of the user, and a lot of personal knowledge about the main user. Similar definitions can be found in (Pulman et al. 2010; Benyon and Mival 2008; 2010). An AC is seen as a personalised, helpful and persistent conversational agent that knows its owner and interacts with the user over a long period of time.

The form of an AC influences all the issues of interaction and possibilities for companionship (see also (Benyon and Mival 2010)). We therefore use the term Artificial Conversational Companion (ACC) for companions that are aimed to simulate interaction with the user in a natural language. Recent contributions in the domain of ACC are the EU-funded Companions project with the "How Was Your Day" Companion (Pulman et al. 2010), the Senior Companion (Wilks et al. 2011), and the Health and Fitness Companion (Turunen et al. 2011), and the ALIZ-E project focusing on robot companions for children in a hospital environment (Baxter et al. 2011). The idea to use conversational agents in second language acquisition domain (SLA) was investigated using modified chatbots for conversation training (Jia 2009).

We consider the application scenario where advanced learners of a foreign language practice conversation in dialogues with a language expert - the ACC. We focus on interaction via instant messenger (IM) because it combines the advantages of spoken and written communication being conceptually oral and medially written (Koch and Oesterreicher 1985). In earlier work, we identified the minimum requirements that an artificial agent must satisfy in order to be mentioned as an ACC (Danilava, Busemann, and Schommer 2012). We refined the requirements for the application scenario of conversation training in SLA (Danilava et al. 2013).

Language acquisition *"requires meaningful interaction in the target language [...] in which speakers are concerned not with the form of their utterances but with the messages they are conveying and understanding"* (Krashen 1981). However, the design of the agents is still focused on the content of responses, but not on language as a meaningful activity co-constructed according to rules of social interaction.

This research was inspired by the work on *interaction profiles* by (Spranz-Fogasy 2002). Interaction profiles incorporate the entire interactional phenomena of a talk and the connections among them related to each single participant of an interaction. Our investigations on interaction profiles for ACC rely on an analysis of an empirical data set of IM interactions and focus in particular on the following questions:

1. How the participants of an IM interaction make the meaningful activity, social interaction and emotions explicit by means of an IM chat? How can these phenomena be implemented in an AIML-based ACC?
2. Pattern based language understanding of learner language. What strategies language experts apply in an interaction if learners produce errors? How these strategies can be implemented in an AIML-based ACC?
3. Which strategies the users are likely to use to indicate non-understanding? Which strategies can the ACC apply for meaning negotiation? How can these strategies be implemented in an AIML-based ACC?
4. How can learner's responsiveness values be use for recognition of particular types of turns, e.g. self-repairs?

Method

In order to model a long-term interaction with an ACC via IM dialogue, it is necessary to understand how natural long-term IM-based interaction between human language experts and language learners works. We created a corpus from natural interactions for this type of analysis. Language experts

provided interaction patterns for the future ACC, and language learners offered information for user modelling.

Data

We collected a data set of IM dialogues between 9 advanced learners of German and 4 German native speakers who produced 72 dialogues (ca. 4.800 messages, 6.100 unique tokens and 52.000 tokens in total). The parties communicated with the same partner for 4-8 weeks in IM sessions of 20-90 minutes. The participants did not know each other before and did not see each other directly, the communication was established over a forwarding chatbot which was always "available". Typing notifications and status changes were not visible for the parties. Thus, the awareness of co-constructing an interaction as a joint activity was only possible through posting messages. We plan to make the annotated corpus available for the research community in 2013.

Data Analysis and Modelling

We combine the top-down requirements for ACCs with the bottom-up approach commonly used in conversational analysis. According to the research goals, we analyse responsiveness values in IM interaction, specifically, interaction practices where the participants make explicit that the allowed response time is exceeded, parallel productions and sequences of turns produces by the same participants (e.g. increments, self-repairs and counters). Expected in 3/2013.

We develop an appropriate annotation for learner language in IM interaction (conceptually oral language). The existing annotations were created for corpora of written essays (see for example (Boyd 2010)), which are medially and conceptually written. Error recognition is important for automatic language understanding and for error correction. We therefore analyse how language experts implement error correction in chat, and which types of mistakes have been corrected. Expected in 6/2013.

We analyse how the participants make explicit their understanding of social closeness or social distance expressed by emoticons, language complexity, topics discussed and politeness. We obtain from the data set scenarios for meaningful activities in conversation training, including explanation for unknown words, introducing new lexical material and error correction. We will integrate these models into the concept of user's *interaction profile*, which we use for user modelling and dialogue design. Expected in 10/2013.

Implementation and Evaluation

The resulting models will be integrated in an AIML-based conversational agent that helps advanced learners of German as a foreign language to practice conversation. The system will be tested with advanced learners of German in comparison with an AIML chatbot without these extensions, and evaluated based on user interviews. An experimental evaluation of a conversation agent is challenging due to mutual dependencies among all the components, however the accuracy of particular components (error recognition and classification, self-correction recognition) can be measured. Expected in 1/2014.

Expected Contribution

This multidisciplinary work will contribute to the AI research by providing models for long-term interaction between humans and artificial agents. In particular, data-driven models for responsiveness, social interaction and a co-constructed meaningful activity will improve the understanding of what is possible to achieve with computer systems and the limitations.

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