

Adapting a Virtual Agent to Users' Vocabulary and Needs

Ana Cristina Mendes, Rui Prada, and Luísa Coheur

Instituto Superior Técnico, Technical University of Lisbon/INESC-ID
ana.mendes@12f.inesc-id.pt

1 Introduction

DuARTE Digital is an agent that engages in inquiry-oriented conversations about an art artifact. Since it was build for a Museum, interactions are supposed to be directed to different types of audience: an interaction with an art expert should be carried out in a different way than an interaction with a child; likewise, interactions with users interested in learning should be distinct from interactions with users having only entertainment goals. Being so, an agent needs to undergo two tasks: it must understand the user's knowledge about the topic, and his/her learning goals; it should adapt its vocabulary and dialogue strategy to cope with the user's characteristics and expectations.

This paper presents a simple and straightforward model of interaction that allows a virtual agent to understand its interlocutors based on their vocabulary and to adapt to their expertise and needs.

2 Interaction Model

The model of interaction is described in terms of a two dimensions graph (Fig. 1): the X axis corresponds to the level of the user's expertise on the topic; the Y axis relates with the degree of the interaction's orientation towards a sub-topic.

DuARTE Digital holds a knowledge base (KB) with the possible users' questions and the answers the agent can provide to users. The agent's lexicon is weighted based on its difficulty level and clustered according to sub-topics. Every answer in DuARTE's KB is tagged with: **easy**, **neutral** or **complex**, based on the difficulty level of its compounding words; and, as **concise**, **neutral** or **detailed**, depending on their informative content.

The user's expertise is calculated by: $E_m = E_{(m-1)} + D_q$, where: E_m is the perceived expertise in a moment m given a question q , and D_q is the difficulty level of the uttered question q . Answers are provided according to (α is a threshold): if $E_{(m)} > \alpha$ the user is an *expert* and give a **complex** answer; if $E_{(m)} < -\alpha$ the user is *unacquainted* and give an **easy** answer; otherwise give a **neutral** answer (X axis). The orientation of an interaction on a moment m towards a topic t is defined as $I_{t(m)}$ and calculated based on the history of questions the user has formulated and their proximity with the sub-topics. Answers are given according to (β is a threshold): if $I_{t(m)} > \beta$ the interaction is *directed*, therefore

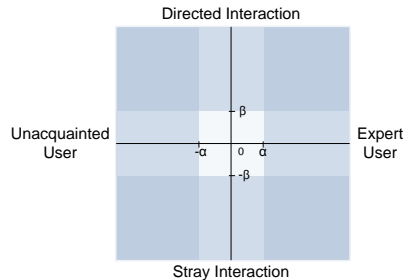


Fig. 1. The interaction model.

utter a *detailed* answer; if $I_{t(m)} < -\beta$ the interaction is *stray*, therefore utter a concise answer and guide the dialogue; otherwise utter a *neutral* answer (Y axis).

3 Evaluation

Two experiments were carried out to evaluate the model: *a)* simulated interactions; and, *b)* interactions with human subjects in a controlled environment.

Virtual users were created by picking 10 random questions from KB. These questions were presented to DuARTE, emulating real interactions. To evaluate the X axis, virtual users were classified according to their expertise (as *expert*, *neutral* or *unacquainted*). When DuARTE used the model of interaction, in 87% of the questions it gave an answer adequate to the virtual user’s expertise (against 53%). To evaluate the Y axis, interactions were classified as being oriented or not. When the model was used, 9 questions were answered by DuARTE that a real user would not need to ask if he would be interested in a particular sub-topic

Human subjects were also manually classified as *expert*, *neutral* or *unacquainted*, depending on their age, academic background and familiarity with the artifact. After the interaction with the agent, most of the users (11/12) reported having understood every word. We believe this situation occurred because no *complex* answers were given. One user revealed a non-understanding about the words employed: DuARTE classified him as *neutral* (instead of *unacquainted*), suggesting the applicability of a model that differentiates users based on their expertise. Some users did not formulate questions as expected: the manually classified *expert* users did not fully explore the agent’s capabilities by employing complex terms. No user was oriented towards a sub-topic; like expected, users did not know what to ask about the artifact. The agent’s guidance was here of great use: in nearly 60% of the situations, the user’s next question was based on a hint provided by the agent. They found it interesting and useful that the agent provide them with directions. Nearly 88% of the users were satisfied or very satisfied with the interaction, and they get more frustrated when DuARTE provides a wrong answer than when it gives an answer which they might not understand.