Adapting a Virtual Agent
to Users' Vocabulary and Needs

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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. As 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 straighforward 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' ques-
tions 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. Ev-
ery 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
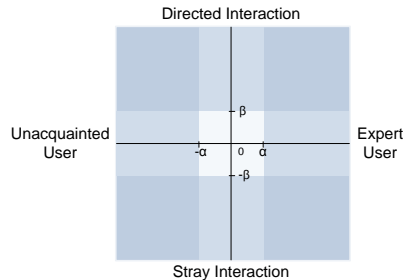
Fig. 1. The interaction model.

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 controled environment.

Virtual users were created by picking 10 random questions from KB. These questions were presented to DuARTE, emulating real interations. 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 adequated 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 differenciates 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.