Argumentation is More Important than Appearance for Designing Culturally Tailored Virtual Agents

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ABSTRACT

Agents that are tailored to appear and behave as members of a particular culture are more acceptable by and persuasive to members of that culture than agents that are not tailored. We report a study that systematically unpacks two tailoring components—appearance and argumentation—for virtual exercise coaches designed for the Indian and American cultures. Indian participants who interacted with an agent whose argumentation was tailored to their culture were significantly more satisfied with the agent irrespective of the agent's appearance.

1 Introduction

In the fields of behavioral medicine and health communication, *tailored communication* is defined as messages, such as health promotion materials, that are adapted to an individual, based on characteristics of that person, including demographic factors, culture, or psychological attitudes such as intention to adopt a target health behavior [1, 2]. Hofstede's research provides a theoretical framework for describing the differences between cultures [3], and a guide for tailoring persuasive messages and argumentation for a particular culture. Several studies in the virtual agents community have demonstrated that users generally prefer a virtual agent that is tailored to their own culture, ethnic background or interactional behaviors based on appearance [4-10]. In this work, we explore the relative contributions of cultural tailoring of appearance and persuasive argumentation for a virtual agent in a health promotion application.

2 Related Work

Given the success of conversational agents in automated health counseling [11-15], the cultural adaption of these agents is an important area of research. The efficacy and overall comprehension of health interventions are shown to increase when delivered by culturally tailored agents as well [16]. Several research efforts have looked at characterizing culture in order to simulate culture-specific behaviors for virtual agents. The development of culturally aware virtual agents for persuasion tasks might pertain to the manipulation of different sets of variables such as the agent's appearance, the language of

communication, argumentation, and nonverbal behavior. Past studies have demonstrated that cultural tailoring of a virtual agent's appearance [17], ethnic background [18, 19], communication management style [6, 20, 21] and conversational behavior [22] leads to improved user perceptions and attitudes towards the system.

3 Design of Culturally Tailored Agents

We developed two exercise promotion interventions guided by different virtual agents: Angela (American woman) and Raveena (Indian woman). We targeted a user population that is familiar with both cultures, comprised of adults born in India, who moved to the United States when they were 16 or older. The agents have a range of nonverbal behaviors such as iconic, emblematic, and deictic hand gestures, facial displays of emotion such as happiness and concern, posture shifts to mark topic boundaries, eyebrow raises for emphasis, gaze shifts and head nods. Nonverbal behavior is determined for each agent utterance using the BEAT text-to-embodied speech system [23], synchronized with a synthetic voice.

Figure 1: Raveena and Angela

In addition to the appearance of the virtual agents, we used tailored voice and accent for Raveena and Angela representing Indian and American accent of English language. We used an American English TTS for Angela and Indian English TTS for Raveena. We adopted Hofstede's theory of cultural dimensions in order to develop culturally appropriate dialogues for the two virtual agents. For example, as per the **individualism/collectivism** scale: The Indian agent appeals to the collectivist values of the society which involve friends,

family and asking to exercise in groups. For example the agent uses dialogues such as: "*By being healthier, you will also have better opportunities to take care of family going forward.*" On the other hand, the American agent emphasizes the personal values of the individual and how exercise can improve their health and overall quality of life: "*Studies have shown that exercise can improve your mood and can help you look better*".

4 Experimental Study

In order to evaluate the effects of an agent's culturally tailored appearance and argumentation on perception of the agent and attitudes towards exercise, we conducted a 2x2 between-subjects experiment, manipulating appearance and argumentation as the two factors. Participants were assigned to one of the four conditions before conducting an interaction with the agent. Participants were required to be 18 years old or older; speak and read English; have been born in India, moved to the United States when they were 16 or older, and have lived in the U.S. for at least six months. The study was approved by our institution's IRB and participants were compensated for their time.

In addition to sociodemographics, participants completed the following self-report measures at baseline assessment: Social Distance [10, 24], Physical Activity Stage of Change [25], Physical Activity Self-Efficacy (confidence) [26], and Physical Activity Decisional Balance (attitude towards exercise) [27]. The following self-report measures were assessed after the interaction with the agent: Satisfaction (10 item composite on a 7-point scale, including "How satisfied were you with the agent?", "How close did you feel to the agent?", α=0.94), Physical Activity Self-Efficacy, and Decisional Balance.

Following administration of informed consent and baseline measures, participants were randomly assigned to one of the four study conditions and introduced to the virtual coach system on a touch screen desktop computer. Participants then conducted a 20-minute conversation with the agent, followed by assessment of post-test measures.

4.1 Results

A total of 40 Indian participants (24 Males, 16 Females) completed the study (Mean age=25.2, SD=1.78). We performed a two-way ANOVA to examine the effects of the agent appearance and argumentation on pre-post changes in self-efficacy.

The interaction effect was significant $F(1, 36)=36.8$, $p<.001$, indicating that self-efficacy for physical activity increased

Significantly more when the agent appearance and argumentation were consistent.

There was a significant interaction between the effects of appearance and argumentation on pre-post change in participants' decisional balance, $F(1, 36)=4.329$, $p=.045$, indicating that the agent with both Indian appearance and Indian argumentation had the greatest effect on participants' decisional balance (Figure 2).

We performed an ANOVA to examine the effect of agent appearance and argumentation on Satisfaction. There was a main effect of argumentation on Satisfaction, $F(1, 36)=4.767$, $p=0.036$, with Indian argumentation leading to higher satisfaction, regardless of appearance.

5 Discussion

Changes in self-efficacy were greatest when tailoring (appearance and argumentation) was performed consistently. However, changes in decisional balance were greatest only when both argumentation and appearance were tailored to the participant: appearance did not have any impact. This indicates that manipulating appearance alone may not be an effective approach to cultural tailoring of a virtual agent: argumentation must also be adapted for it to be effective. Only argumentation had a significant impact on satisfaction.

6 Conclusion and Future Work

Our results indicate that that argumentation is more important than appearance for both attitude change and user satisfaction, although consistency is also important for impacting changes in self-efficacy . Our future work includes evaluation with Americans to determine whether our results hold for this population, as well as conduct in-depth interviews with participants to probe the reasons for their conscious or unconscious biases. This study also acts as a foundation for our work in developing virtual agent frameworks that use data driven models to dynamically tailor behavioral change techniques to people from different cultures.
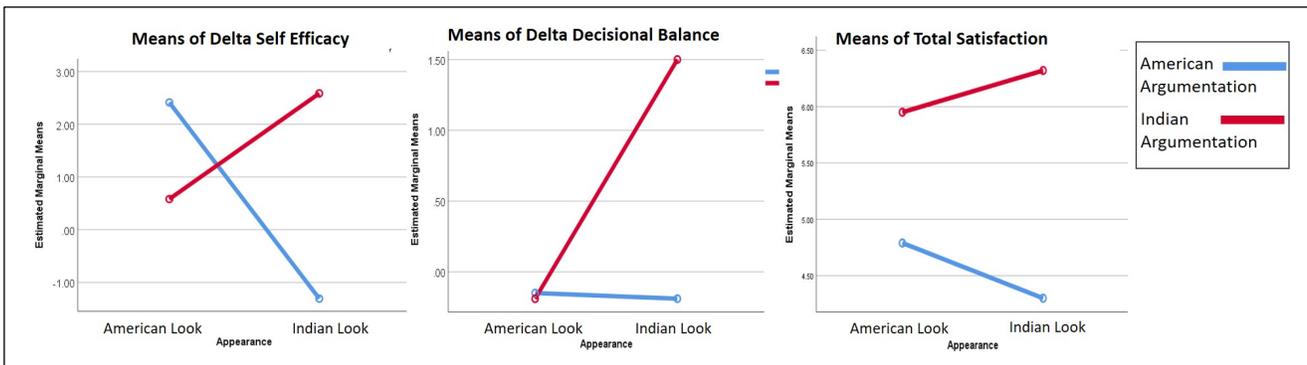

Figure 2: Interaction Effects for Self-Efficacy (left), Decisional Balance (middle), and Satisfaction (right)

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