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1 Research Interests

My research interests lie in the **nonverbal conversational features** that may contribute to build **rapport** between humans and **Embodied Conversational Agents** (ECAs) in **multimodal** interaction. Some of these nonverbal features include task driven **gestures** and difference between **synthesized voice** versus **recorded voice.** More recently, I have concentrated my focus in the functions of **gaze** in dyad conversations and the importance of **breathing animations**.

1.1 Early Work

I started my research career at the Interactive Systems Group (ISG) in The University of Texas at El Paso (UTEP) During the first projects I participated, our research team analyzed the effects of synthesized speech and recorded across different virtual environments (Gris et al., 2014 The virtual environment either included 3D scenery appropriate for the game's nature or not included any scenery at all. In both conditions the ECA is shown standing in front of the user. We measured engagement by tracking gaze away from or toward the ECA and results indicated that a 3D environment and recorded speech had higher user-to-agent gaze time. In addition, we measured the times the agent was interrupted, which showed that the version with recorded speech had fewer interruptions than the versions that had the synthesized voice.

Given these results, our team's effort shifted to developing an engaging interaction that had a comprehensive story that surrounded an agent. To create more engaging agents we did a survey to list the features that make a "perfect" agent. Items of interest included the potential need for an agent's persona and anthropomorphism (agents with human-like characteristics in terms of behavior and appearance).

In a following study (Camacho et al., 2014) we reviewed the quality in terms of graphical representation, believability, and overall naturalness of existing, commercial, or available ECAs by identifying and evaluating their relevant features. We identified two main characteristics: visual and functional and explored the changes of these qualities as a function of time across several ECA versions when appropriate (i.e. the same agent appeared in several representations, with additional features or improvements over time). Respectively, we identified five key visual features and eight key functional features. However, we acknowledged that a better rubric could be based on a study of user's perceptions that explores the relative importance of the features and whether a feature outweighs another (e.g. a realistically human-like but unusable agent).

After identifying these features, we developed more advanced agents in terms of dialog and visual appeal to engage our users and potentially lead us to results that might indicate higher rapport building while having fully automated agents. The result was "Survival on Jungle Island" (Novick et al., 2016) game, where users carry conversations and a series of activities led by our ECA. We simulated a survival scenario so the user could cooperate with the ECA and create rapport-building opportunities. In addition, we wanted to take advantage of the non-verbal behaviors in a more immersive environment and perform task driven gestures. Since the experiment was devised to measure the effectiveness of gesture-enabled interactions on rapport, two versions were developed to compare participants' experiences between what we denominated the gesture and non-gesture enabled agent versions. To facilitate in gesture analysis and annotation, our system included a module where we capture a collection of poses to be recognized as gestures in the human-ECA interaction and automatically annotate gestures performed by the user using a Microsoft Kinect (Gris et al., 2015). Subjects were previously tested to find their personality-type, enabling us an initial body of recordings for analyzing gestures differences between extraverts and introverts when interacting with an ECA. The goal was to analyze the paralinguistic behavior, and measure the correlation of these behaviors with rapport building. In addition, these behaviors are not limited to facial expressions, hand gestures, or task-related gestures, but rather a set of normal, unconscious gestures and poses over a relatively long period of interaction (40 minutes to an hour). However, these experiments were cumbersome to setup, leading to our current advancements.

1.2 Current and future focus

My current research focus centers on developing automated interactions between humans and virtual agents. In addition, I work on building the infrastructure that

makes these interactions possible, by developing features that control several parts of the agent's behavior and facilitate ECA development. We are developing a systematic way of creating these interaction by creating a scripting system and a simple dialog manager, both of which are now modules of the UTEP AGENT Framework (Gris et al., 2015). We are also working on a tool that will enable users create their own human-ECA interactions as if they were writing a movie/play script.

Lately, I have participated in a shared project with the Communications Department where the aim is to engage humans with cultural aspects (through the use of traditional cuisine) using multiple ECAs.

I am now exploring gaze as a turn-taking modulator. One of the problems in the "Survival on Jungle Island" was that users tended to interrupt the agent by failing to notice the almost non-existing turn-taking mechanisms. Adding proper gaze aversion to our agents helps the user know when to speak, leading to less interruptions.

I am also exploring other non-verbal features that play key roles in dialog naturalness and believability such as breathing. Our intention is to find out whether this will play a positive/rapport building role in the interaction, or will it damage it. Does likeability mean that breathing agents are better?

2   Future of Spoken Dialog Research

I believe that this generation of researchers will be able to take steps towards a dialog system that adapts to its users to better accomplish their goal, and more specifically doing it in multimodal systems. One possible track of doing so is by looking at the personality types and analyzing the differences of users in different domains. Cultural background could also play a big role in adaptability and therefore also presents a potential problem to be analyzed and solved.

3   Suggestions for discussion

- Potential of dialog systems in Augmented Reality, Virtual Reality, and Mixed Reality.
- Influence of different personality type adaptations in dialog systems.
- The use of prosody in dialog systems to convey different messages using the same words and the importance of it.

References

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Biographical Sketch

Adriana Camacho obtained her bachelor's degree in Computer Science in 2014 from UTEP, where she currently is pursuing her PhD. Her research focuses on the development of rapport-building embodied conversational agents in ISG. She is a recipient of the National Science Foundation Graduate Fellowship program. She has co-authored and authored in the International Conference on Intelligent Virtual Agents, Gesture and Speech in Interaction Conference, International Conference on Multimodal Interaction (ICMI), and the RE-WOCHAT: Workshop on Collecting and Generating Resources for Chatbots and Conversational Agents-Development and Evaluation Workshop. She is part of the team that won best demonstration at the ICMI 2015.

Adriana was invited as a PhD student panelist for the Computing Alliance of Hispanic-Serving. She has also managed outreach demonstrations to high school, middle school, and elementary school students and is part of the Inmerssion start-up company that works with virtual reality and immersive environments.