The Social Medium Is the Message

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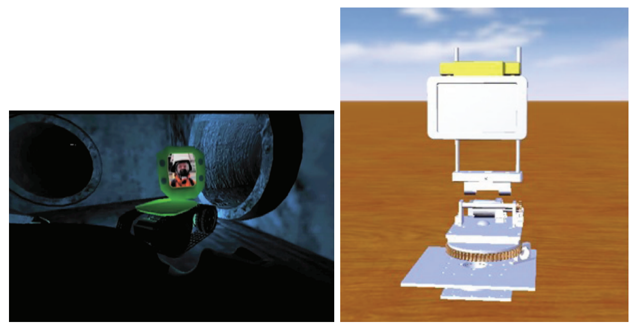
Introduction

Robots are being considered for applications where they serve as proxies for humans interacting with another human, such as emergency response, hostage negotiation, and healthcare. In these domains, the human ("dependent") is connected to multiple other humans ("controllers") via the robot proxy for long periods of time. The dependent may want to interact with humans but also to engage the robot as a medium to the World Wide Web. In the future, medical personnel may use the robot for victim assistance and comfort (i.e., a "survivor buddy" such as seen in Fig. 1(a)) while the rescue team plans and monitors extrication. Other applications include healthcare, where the robot is the link between a patient and a medical provider for intermittent, routine interactions, and hostage negotiation, where police may use a bomb squad robot to talk with and build rapport with the suspect while the SWAT team uses the robot's sensors to build and maintain situation awareness.

Under funding from the National Science Foundation, we are finishing the first year of investigating verbal and nonverbal communication strategies for robots who are serving as proxies for multiple humans interact with the humans who are dependent on them (Fig. 2). Our work posits that such a robot would occupy a novel *social medium* position according to the Computers as Social Actors (CASA) model (Nass, Steuer, and Tauber 1994) (Reeves and Nass 1996). Given that teleoperated robots are treated socially, it is unlikely that a rescue robot would be treated as a *pure medium* even if playing music or videos. Likewise, the limitations of autonomy and the interactions of specialists with the dependent prevent the robot from being a true *social actor*. Instead, social actor and pure medium are two extremes on the agent identity spectrum, with a social medium occupying a middle position. A social medium would be perceived as a loyal, helpful "go between" who is an advocate for the dependent, rather than a device for accomplishing the goals of multiple controllers (medical specialist, structural engineer, rescue operations official, etc.). To explore the social medium identity, we have built a physical prototype of a Survivor Buddy and are creating autonomous affective behaviors and a social medium toolkit to explore human-robot interaction.

Current Formative Studies



(a) Simulation of Survivor Buddy in SARGE

(b) Simulation of Survivor Buddy in Microsoft Robotics Developer Studio

Figure 1: Survivor Buddy in Simulation

Two formative studies have recently been conducted Stanford's CHIMe lab using Texas A&M's simulation of the Survivor Buddy physical prototype (Fig. 1(b)).The studies were set in the disaster response domain, where participants simulated being victims.

Study 1: Social Role and Framing

The first study examined the effects of robot social role and framing on participants' attitudes and behaviors. The study featured a 3(role: pure medium v. social medium v. social actor) x 2(framing: unframed v. framed) design.The pure medium channeled the controllers directly without demonstrating a social presence, the social medium channeled the controllers while demonstrating a social presence, much like a dispatcher, while the social actor communicated with the controllers but did not channel them directly. We hypothesized that participants would prefer a robot that demonstrated a social identity over a robot that presented itself as a pure medium, as the social robots would offer companionship and minimize fear.We also manipulated framing, or setting expectations. We hypothesized that informing participants of the robot's social role before the interaction would

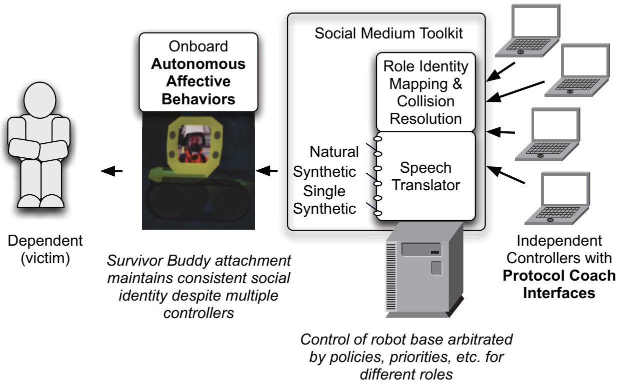


Figure 2: Overview of the Survivor Buddy testbed.

generate greater trust.

The study was conducted entirely online with eighty-four participants. Student participants watched a video about a disaster to set the scene, then, on the computer screen, an animation of a rescue robot with the Survivor Buddy head approached and initiated the interaction. Participants viewed the robot from a trapped dependent's perspective, low on the ground in a collapsed room. Role was manipulated via slight, but explicit, verbal differences indicating the social identity. For example, the pure medium robot introduced itself by saying "I am the controller of the robot that is here to help you. I have information for you." The social medium said, "I am a robot that is here to help you. I will be presenting information to you from my controller" and the social actor said, "I am a robot that is here to help you. I have information for you." Throughout the task, the robot recommended certain media clips, noting that typically different media clips were recommended. This allowed us to record a behavioral measure of compliance by summing the number of times participants selected the robot's recommendations over the typical recommendations. A questionnaire was administered, assessing attitudinal responses of trust and fear.

Study 2: Expressiveness and Personal Distance

The second study extended the work by (Bethel, Bringes, and Murphy 2009) that explored the effects of proxemics on dependents. This study varied the level of expressiveness of the robot and the distance between participants and the robot in a 2(expressiveness: high vs. medium vs. low) x 2(distance: close vs. far) study design. We hypothesized that low expressiveness would be preferred when the robot is close, and high expressiveness when the robot is far, balancing the proxemics with the tendency to like highly expressive agents. Eighty-four participants watched a video of a disaster situation to set the scene. They were then placed on the floor in a dark room at the close or far distance from a wall onto which a simulation of the robot was projected. The close distance was two feet and the far distance was six feet, representing personal and social proxemic zones (Bethel and Murphy 2008). For half the interaction, participants were positioned parallel to the wall and for the other half they were perpendicular. The order of orientation was counterbalanced, allowing us to determine if responses to the independent variables depend on whether the robot approaches from the dependent's side or from behind. The simulated robot initiated the interaction by approaching the participant and starting to talk about the disaster. In each case, the robot had the same actions but different rotational speeds of the joints (i.e., moving head faster and farther), with greater expressiveness manifest with quicker, larger movements. In order to determine cognitive load, tests of creativity and memory were applied. To measure creativity, participants completed an alternate uses task during the interaction. For example, the robot might ask "The first object is shoe. A shoe is usually used to put on your feet to help walking. What else can a shoe be used for?" Higher number of responses indicated greater creativity and lower cognitive load. A memory task was also administered, where participants attempted to remember as many items from a list as possible and restate them after forty-five seconds. In addition to these behavioral measures, self-report measures of attitudinal responses to the robot were assessed with a questionnaire.

Both studies have been completed and the data is currently being analyzed. Results from these studies will reveal the effects of the following variables on dependents' attitudes and behaviors: social role, framing, expressiveness, and personal distance. These results will expand our understanding of the effects of robot social behavior on dependents and enable designers to create robots in the optimal social role, demonstrating social behaviors that improve the experiences of dependents. These studies were the first in a several year program of study. Results will be incorporated into future designs of Survivor Buddy. In addition, more studies featuring physical robots in a realistic survival settings will be conducted to improve the ecological validity, allow for the examination of the physiological impact in a realistically stressful situation, and allow for replication of these results.

Acknowledgements

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