Non-Facial and Non-Verbal Affective Expression for Appearance-Constrained Robots

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Abstract:

Non-facial and non-verbal methods of affective expression are essential for naturalistic social interaction in robots that are designed to be functional and lack expressive faces (*appearance-constrained*) such as those used in search and rescue, military, industry, and law enforcement applications. This research identifies five main methods of non-facial and non-verbal affective expression (*body movements, postures, orientation, color,* and *sound*) and ranks their effectiveness for *appearance-constrained* robots operating within the *intimate* (contact – 0.46 m), *personal* (0.46 – 1.22 m), and *social* (1.22 – 3.66 m) proximity zones of a human corresponding to inter-agent distances of approximately three meters or less. This leads to design guidelines for retroactively adding affective expression through software to a robot with little or no physical modifications. To confirm that humans respond more favorably to an affective *appearance-constrained* robot, a study was conducted with 128 participants and two robots (iRobot Packbot Scout and an Inuktun Extreme-VGTV) in a high fidelity simulated disaster site. Four methods of evaluation were utilized: (1) self-assessments, (2) psychophysiological measures (EKG, abdominal respiration, thoracic respiration, blood volume pulse, skin conductance response), (3) video recording from four different camera perspectives that are currently being coded for behavioral responses, and (4) an audio recorded follow-up interview. This is the largest and most comprehensive controlled study performed in HRI to date. Details of the study design, implications for HRI and robot design, results, video, and current/future research directions will be presented.

Biography:

Dr. Cindy Bethel is an Assistant Professor in the Computer Science and Engineering Department at Mississippi State University. She is the Director of the Social, Therapeutic, and Robotic Systems (STaRS) lab and a Research Fellow with the MSU Center for Advanced Vehicular Systems Human Performance Group. She was an NSF/CRA/CCC Computing Innovation Postdoctoral Fellow in the Social Robotics Laboratory at Yale University. She was an NSF Graduate Research Fellow and the recipient of the 2008 IEEE Robotics and Automation Society Graduate Fellowship. She graduated in August 2009 with her Ph.D. in Computer Science and Engineering from the University of South Florida. Her research interests are in Human-Robot Interaction (HRI), affective computing, robotics, Human-Computer Interaction (HCI), artificial intelligence, psychology, experimental design, and statistical analysis. She graduated with a B.S. in Computer Science Summa Cum Laude from the University of South Florida. She was awarded the King O'Neal Scholar award, the Computer Science and Engineering Outstanding Graduate Award, and the Engineering Alumni Society Outstanding Senior of the Year Award.