Dangerous HRI: Testing Real-World Robots has Real-World Consequences

Workshop

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***Abstract*—Robotic rescuers digging through rubble, fire-fighting drones flying over populated areas, robotic servers pouring hot coffee for you, and a nursing robot checking your vitals are all examples of current or near-future situations where humans and robots are expected to interact in a dangerous situation. Dangerous HRI is an as-yet understudied area of the field. We define dangerous HRI as situations where humans experience some amount of risk of bodily harm while interacting with robots. This interaction could take many forms, such as a bystander (e.g. when an autonomous car waits at a crossing for a pedestrian), as a recipient of robotic assistance (rescue robots), or as a teammate (like an autonomous robot working with a SWAT team). To facilitate better study of this area, the Dangerous HRI workshop brings together researchers who perform experiments with some risk of bodily harm to participants and discuss strategies for mitigating this risk while still maintaining validity of the experiment. This workshop does not aim to tackle the general problem of human safety around robots, but instead focused on guidelines for and experience from experimenters.**

I. Motivation

As robots move out of the lab and into the real world, we expect them to perform dull, dirty and dangerous tasks. Humans already perform many of these tasks and will be expected to work with or near robots. How can we safely test best practices for HRI in situations that involve risk without harming participants? Human subject training required by Institutional Review Boards and similar organizations often lags behind new frontiers in research and development. We need to define standards now so that our experiments do not become cautionary tales in future IRB training.

Robotics experiments have begun pushing the bounds of traditional HRI experiments, introducing robots to real-world situations with real-world consequences. The field of rescue robotics is constantly testing new robots for life-saving tasks, some tests involve real humans (for example, [1]–[3]). Drone swarms are currently used for student competitions with little risk to students so far, but the potential for risk in the future (see [4]). Robots are already deployed with humans in military situations, sometimes even autonomously [5]. University research also explores similar manned-unmanned teaming [6]–[8]. Industry has also begun testing new robots in situations where humans have been killed [9], [10] or where human bystanders will be at risk after the product is deployed (for example [11]). While those particular projects may be better suited for a workshop on robot safety in general, social and interactive robots are currently sold to the public and it is only a matter of time before one is released for an application that presents some risk of harm to humans. Near-future work is likely to push these boundaries even further, making HRI2019 the right time to discuss guidelines and lessons learned from HRI experiments that involve risk to humans.

II. Goals

- Develop best practices for HRI experiments in dangerous situations
- Share experiences with other researchers already exploring this area
- Define what makes an interaction dangerous to allow future researchers to better understand the risks of potential experiments
- Build and nurture a new community that bridges researchers from different backgrounds

III. Topics

We expect extended abstracts (2 pages, IEEE format), position papers (2-6 pages, IEEE format) and whitepapers (open format) that address past experiences testing or deploying robots in a situation where participants could be harmed

or similar-format papers that address guidelines for such experiments beyond the scope of normal IRB training. Below are some suggested topics, but submissions are welcome that range outside of these topics as well:

- Dangerous human-robot environments (undersea, mining, space)
- Military and defense environments
- Dangerous human-robot collaborations (rescue, autonomous surgery, automated pilots)
- What constitutes too much risk in an experiment?
- Mitigating injury in experiments
- Hidden dangers of HRI experiments

IV. Target Audience

The target audience for this workshop is any researcher who performs experiments or expects to perform experiments in situations where participants experience real risk of bodily harm. This includes researchers from universities and research labs as well as scientists in industry who deploy or test robots expected to interact with people.

V. Organizers

Paul Robinette (paulrobi@mit.edu) is a research scientist at MIT in the Department of Mechanical Engineering currently working on autonomous marine surface robots. His research focuses on human-robot trust in time-critical situations. He received a PhD in Robotics from Georgia Institute of Technology in 2015. He received a BS in Physics, and BS in Computer Engineering from Missouri University of Science and Technology in 2008 and a MS in Computer Engineering from the same institution in 2010. He has worked on the underwater Yellowfin robot, numerous ground robots including an emergency guidance robot, and both fixed-wing and rotary aerial robots. His human-robot experiments have involved over 2000 participants.

Michael Novitzky (novitzky@mit.edu) is a research scientist at MIT in the Department of Mechanical Engineering currently working on autonomous marine robots. His research focuses on multi-robot systems, human cognitive load, and human-robot trust in which humans and robots work as teammates in challenging environments. He received the PhD in Robotics from Georgia Institute of Technology in 2015. He received the BA in Psychology from the Colorado College in Colorado Springs, CO. He received the MS in Computer Science in 2009 and MS in Electrical Engineering in 2014 from The Georgia Institute of Technology. Prior to working at MIT, he was a graduate research assistant at Georgia Tech Research Institute working on heterogeneous robot teams of UAVs and UGVs, and marine robots with both USVs and the underwater Yellowfin robot.

Brittany Duncan (bduncan@unl.edu) is an Assistant Professor in Computer Science and Engineering and a co-Director of the NIMBUS lab at the University of Nebraska, Lincoln. Her research is at the nexus of behavior-based robotics, human factors, and unmanned vehicles; specifically she is focused on how humans can more naturally interact with robots, individually or as part of ad hoc teams, in field-based domains such as agricultural, disaster response, and engineering applications. She is a PI on a NSF Early Faculty Career Award (CAREER), a co-PI on a NSF National Robotics Initiative (NRI) grant, and was awarded a NSF Graduate Research Fellowship in 2010. Dr. Duncan received a Ph.D. from Texas A&M University in 2015 and B.S. in Computer Science from the Georgia Institute of Technology in 2009. For more information, please see: cse.unl.edu/~bduncan or nimbus.unl.edu.

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Alan Wagner (alan.r.wagner@psu.edu) is a Hartz Family assistant professor of Aerospace Engineering at Pennsylvania State University and a Research Associate with Pennsylvania State University's Rock Ethics Institute. His research focuses on human-robot interaction focused specifically on questions of trust and deception for robotic search-and-rescue. He received his Ph.D. in Computer Science from Georgia Institute of Technology.

Chung Hyuk Park (chpark@gwu.edu) is an Assistant Professor at the George Washington University in the Department of Biomedical Engineering and the director of the Assistive Robotics and Tele-Medicine (ART-Med) Lab. His research focuses on multi-modal interaction in assistive robotics and robotic learning of human behaviors and intelligence. He is the lead-PI on a National Robotics Initiative (NRI) NIH grant. Dr. Park received his Ph.D. in Electrical and Computer Engineering (ECE) from Georgia Tech in 2012, M.S. in Electrical Engineering and Computer Science (EECS) in 2002 and B.S. in ECE in 2000 from Seoul National University. Websites: seas.gwu.edu/chung-hyuk-park or chunghyukpark.com.

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