

# Insights into Expertise and Tactics in Human-Robot Teaming

Rob Semmens  
Naval Postgraduate School  
Monterey, California  
semmens@nps.edu

Paul Robinette  
University of Massachusetts Lowell  
Lowell, Massachusetts  
paul\_robinette@uml.edu

Michael Novitzky  
The United States Military Academy  
West Point, New York  
michael.novitzky@westpoint.edu

Gregory Lieberman  
US Army CCDC Army Research Laboratory, Human  
Research and Engineering Directorate  
Aberdeen Proving Ground, Maryland  
gregory.a.lieberman.civ@mail.mil



Figure 1: The red human-robot team defending their flag against a blue team human attacker.

## ABSTRACT

As robot capabilities rapidly evolve, the dynamics of human-robot teams will change. Autonomous, intelligent technologies will come to serve in roles that more closely resemble those of teammates, as opposed to tools. This will require humans to adapt and remain agile in developing novel strategies and tactics for employing these systems in complex, real-world scenarios. Building on previous work that presented a novel data set collected from teams of humans and robots playing capture the flag, the current research aims to identify measures capable of predicting successful teaming that lead to a positive, winning outcomes in the game. Video and text log analysis were used to describe gameplay and identify specific successful tactics. In conjunction with the experience levels of the participants, a number of measures of communication with autonomous robot teammates and robot efficiency were used to predict game performance. Only one metric was found to successfully predict

game outcomes across all four games: level of robot involvement with offensive maneuvers. Several possible mechanisms for this observation are discussed, as well as multiple directions for future research directions leveraging this human-robot teaming platform.

## CCS CONCEPTS

• **Computer systems organization** → **Embedded systems**; *Redundancy*; Robotics; • **Networks** → Network reliability.

## KEYWORDS

datasets, human-robot team, measures, tactics

## ACM Reference Format:

Rob Semmens, Michael Novitzky, Paul Robinette, and Gregory Lieberman. 2019. Insights into Expertise and Tactics in Human-Robot Teaming. In *HRI*, March 23 - 26, 2020, Cambridge, UK. ACM, New York, NY, USA, 8 pages. <https://doi.org/xx.xxxx/xxxxxxxx.xxxxxxx>

## 1 INTRODUCTION

Robots already play a significant role in the world, sometimes in teaming situations directly with humans, so human-robot tactics have become an important area of study. Additionally, it has been predicted that rapid advancements in robotic technologies

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the owner/author(s).

ACM/IEEE Conference on Human-Robot Interaction, March 23 - 26, 2020, Cambridge, UK

© 2019 Copyright held by the owner/author(s).

ACM ISBN xxx-x-xxxx-xxxx-x/xx/xx.

<https://doi.org/xx.xxxx/xxxxxxxx.xxxxxxx>