

# Report Documentation Page

*Form Approved  
OMB No. 0704-0188*

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE <b>12 MAR 2012</b>	2. REPORT TYPE <b>Conference Proceedings Paper</b>	3. DATES COVERED <b>00-00-2011 to 00-00-2012</b>			
4. TITLE AND SUBTITLE <b>Data-Driven Modeling of Human Behavior in Military Operations Excerpted from the Proceedings of the 21th Annual Behavior Representation in Modeling &amp; Simulation (BRIMS) Conference, March 12-15, 2012, Amelia Island, FL.</b>		5a. CONTRACT NUMBER			
		5b. GRANT NUMBER			
		5c. PROGRAM ELEMENT NUMBER			
6. AUTHOR(S) <b>John Riedener; Elizabeth Mezzacappa</b>		5d. PROJECT NUMBER			
		5e. TASK NUMBER			
		5f. WORK UNIT NUMBER			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>Army, ARDEC, Target Behavioral Response Laboratory, RDAR-EIQ-SD, Building 3518, Picatinny Arsenal, NJ, 07806-5000</b>		8. PERFORMING ORGANIZATION REPORT NUMBER			
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		10. SPONSOR/MONITOR'S ACRONYM(S)			
		11. SPONSOR/MONITOR'S REPORT NUMBER(S)			
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release; distribution unlimited</b>					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT <b>This paper describes the work at the Target Behavioral Response Laboratory to develop data-based general approaches to modeling and simulation of human behavior.</b>					
15. SUBJECT TERMS <b>data, human behavior, model building, verification, validation, non-lethal weapons, Target Behavioral Response Laboratory</b>					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT  <b>Public Release</b>	18. NUMBER OF PAGES  <b>2</b>	19a. NAME OF RESPONSIBLE PERSON
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>			

# Data-Driven Modeling of Human Behavior in Military Operations

*John Riedener, MSSE*

*Elizabeth Mezzacappa, Ph.D.*

Target Behavioral Response Laboratory, Armaments Research, Development, and Engineering Center  
RDAR-QES-D Building 3518, Picatinny Arsenal, (973) 724-8067

[john.riedener@us.army.mil](mailto:john.riedener@us.army.mil)

## Keywords:

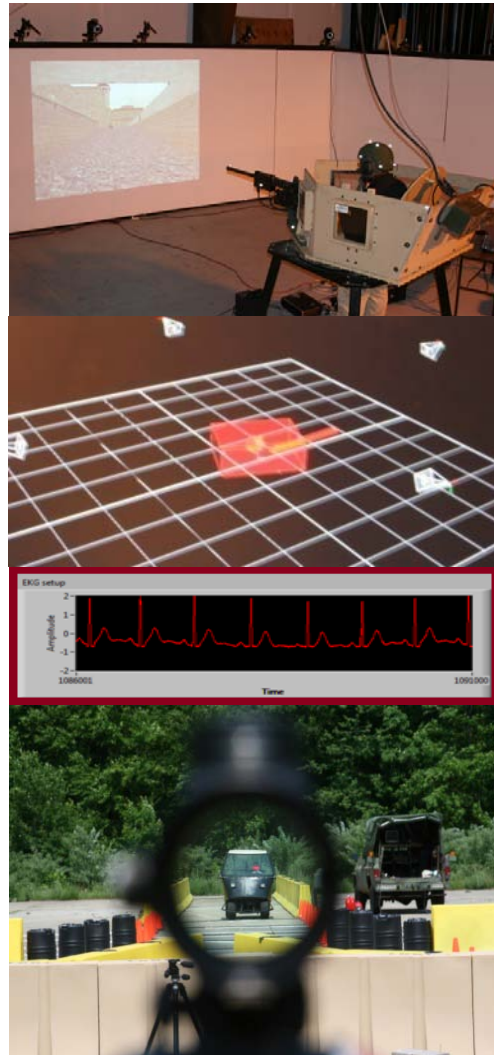
data, human behavior, model building, verification, validation, non-lethal weapons

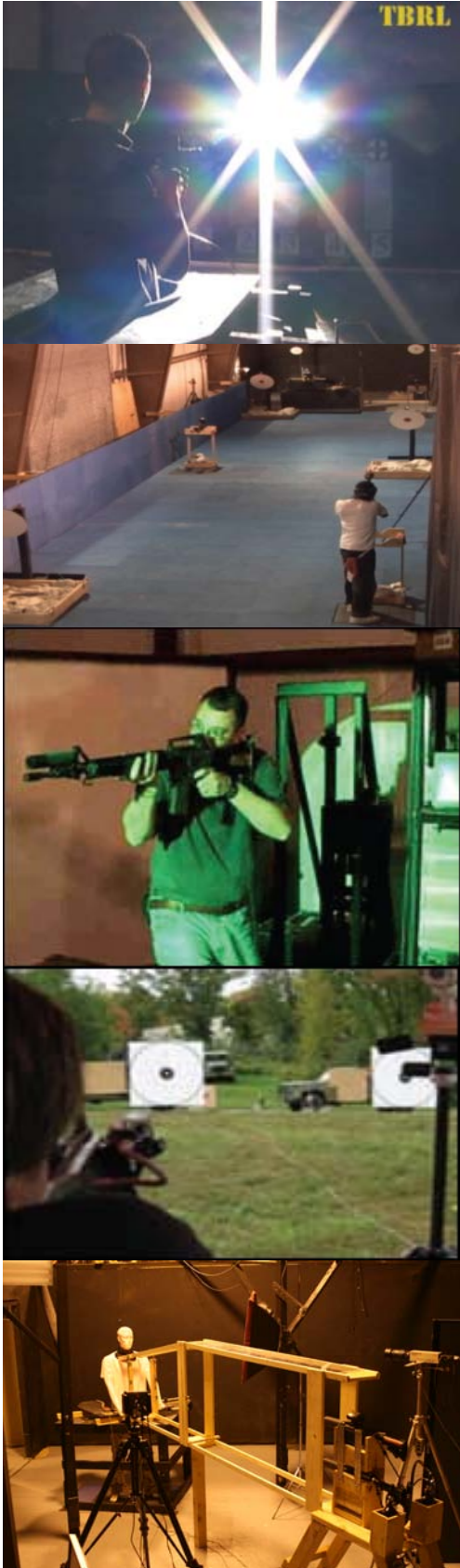
**ABSTRACT:** *This paper describes the work at the Target Behavioral Response Laboratory to develop data-based general approaches to modeling and simulation of human behavior.*

## 1. Introduction

The current theaters of operation have sharpened focus on analytics relevant to irregular warfare (National Research Council, 2011). A critical tool for operations research and systems analysts is the modeling and simulation of tactically relevant human behavior. There are several specific criticisms of the current state of the art. Most critically, there is recognition of the lack of real-life data to provide guidance for these M&S efforts. Moreover, also lacking are methods to assess how well these M&S efforts relate to actual real life human behaviors. One might propose that the lack of data on human behavior is caused by a lack of M&S researchers who are studying human behavior.

The Target Behavioral Response Laboratory (TBRL) is one such collection of scientists and engineers. TBRL's primary mission is to test the effectiveness of non-lethal weapons and systems, and has conducted experiments examining human behavioral response to a variety of stimuli relevant to non-lethal weapons (light, sound, blunt impact) (Cooke, Mezzacappa, Yagrish, & Riedener, 2010; Cooke et al, 2010; Mezzacappa, Cooke, & Yagrish, 2008; Short Riedener, & Cooke, 2010; Short Riedener, Cooke, & Minor 2010 ) and developed general methodologies by which data on actual human behavior in the laboratory serves as a basis for development of mathematical models describing human behavior (Mezzacappa, Cooke, Reid, DeMarco, Sheridan & Riedener, 2011 ). This presentation proposes facilitating close end-to-end collaborations between the laboratory and modeling researchers.





## 2. References

Cooke, G. ; Mezzacappa, E.; Yagrish, K.; Riedener, J (2010). Effects of lasers on driving. *Proceedings of the 2010 Directed Energies Professional Society Meeting*, 15-19 November 2010.

Cooke, G., et al. (2010). Topology and individual location of crowds as measures of effectiveness for non-lethal weapons. *Proceedings of the 27<sup>th</sup> Army Science Conference*.

Mezzacappa, E. S., Cooke, G., Yagrish, K. (2008). Network science and crowd behavior metrics. *Proceedings of the 26<sup>th</sup> Army Science Conference*.

Mezzacappa, E.; Cooke, G.; Reid, G.; DeMarco, R.; Sheridan, C.; Riedener, J. (2011). Mathematical capture of human crowd behavioral data for computational model building, verification and validation. *Proceedings of the 20th annual Behavior Representation in Modeling & Simulation (BRIMS) Conference*, March 21-24 2011, Sundance UT.

National Research Council. (2011). *Sociocultural data to accomplish Department of Defense Missions: Toward a unified social framework: Workshop summary*. Washington, D.C.: National Academy Press.

Short, K.; Riedener, J.; Cooke, G. (2010). Targeting of Convoy Vehicles is Not Disrupted by a Green Laser: Moving, Predictable Targets in Bright Lighting. *Proceedings of the 2010 Directed Energies Professional Society Meeting*, 15-19 November 2010.

Short, K.R.; Reid, G.; Cooke, G.; Minor, T. R. (2010). Can repeated painful blunt impact deter approach toward a goal? *Proceedings of the 27<sup>th</sup> Army Science Conference*.

## Author Biographies

**JOHN RIEDENER, MSSE**, is the Technical Director of the TBRL.

**ELIZABETH MEZZACAPPA, PHD**, is a Principal Investigator at the TBRL.