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14. ABSTRACT

Populations and crowds appear to share many features in common. Both are aggregates of individuals that display group-level organization in space and time. Both are systems through which cultural information and beliefs, as well as genes and diseases, may propagate. And both are capable of turning from benign to hostile. Despite these many similarities, populations and crowds are often treated separately in theoretical and empirical studies. The different temporal and spatial scales at which people conceive of populations and crowds are at least partially

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Report Title

Final Report: Workshop on Populations & Crowds: Dynamics, Disruptions and their Computational Models

ABSTRACT

Populations and crowds appear to share many features in common. Both are aggregates of individuals that display group-level organization in space and time. Both are systems through which cultural information and beliefs, as well as genes and diseases, may propagate. And both are capable of turning from benign to hostile. Despite these many similarities, populations and crowds are often treated separately in theoretical and empirical studies. The different temporal and spatial scales at which people conceive of populations and crowds are at least partially responsible for this conceptual separation; the former evolve on time scales of years or more and occupy sometimes vast spatial regions, while the latter may evolve on time scales of minutes to hours and are generally spatially compact phenomena.

The purpose of this workshop was to bring together leading researchers from both computational and social sciences with expertise in domains relevant to modeling of populations and crowds. Our interest was in understanding how populations and crowds form, how they are organized, how beliefs propagate through them, what underlies tipping points their behavior and, ultimately, what can be done to block contagion of hostile behavior in both population and crowd contexts. The workshop was organized at the University of Southern Cailfornia in September 2012.

Enter List of papers submitted or published that acknowledge ARO support from the start of the project to the date of this printing. List the papers, including journal references, in the following categories:

(a) Papers published in peer-reviewed journals (N/A for none)

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Number of Papers published in peer-reviewed journals:

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<u>Received</u>   <u>Paper</u>

TOTAL:

Number of Papers published in non peer-reviewed journals:

(c) Presentations

Number of Presentations: 0.00

Non Peer-Reviewed Conference Proceeding publications (other than abstracts):

<u>Received</u>   <u>Paper</u>

TOTAL:

Number of Non Peer-Reviewed Conference Proceeding publications (other than abstracts):

Peer-Reviewed Conference Proceeding publications (other than abstracts):

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(d) Manuscripts

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TOTAL:

Number of Manuscripts:

Books

Received   Book

　TOTAL:

Received   Book Chapter

　TOTAL:

Patents Submitted

Patents Awarded

Awards

Graduate Students

NAME	PERCENT_SUPPORTED
FTE Equivalent:	
Total Number:	

Names of Post Doctorates

NAME	PERCENT_SUPPORTED
FTE Equivalent:	
Total Number:	

Names of Faculty Supported

NAME	PERCENT_SUPPORTED	National Academy Member
Milind Tambe	0.00	
P. Jefferey Brantigham	0.00	
FTE Equivalent:	**0.00**	
Total Number:	**2**	

Names of Under Graduate students supported

NAME	PERCENT_SUPPORTED
FTE Equivalent:	
Total Number:	

Student Metrics
This section only applies to graduating undergraduates supported by this agreement in this reporting period

The number of undergraduates funded by this agreement who graduated during this period: 0.00

The number of undergraduates funded by this agreement who graduated during this period with a degree in science, mathematics, engineering, or technology fields:...... 0.00

The number of undergraduates funded by your agreement who graduated during this period and will continue to pursue a graduate or Ph.D. degree in science, mathematics, engineering, or technology fields:...... 0.00

Number of graduating undergraduates who achieved a 3.5 GPA to 4.0 (4.0 max scale):...... 0.00

Number of graduating undergraduates funded by a DoD funded Center of Excellence grant for Education, Research and Engineering:...... 0.00

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Names of Personnel receiving masters degrees

NAME
Total Number:

Names of personnel receiving PHDs

NAME
Total Number:

Names of other research staff

NAME	PERCENT_SUPPORTED
FTE Equivalent:	
Total Number:	

Sub Contractors (DD882)

Scientific Progress

Motivation & Goals

As recent events in across the greater Middle East and North Africa make clear, both populations and crowds can wield tremendous physical, social, economic and ideological power. Crowds may assemble quickly and dramatically alter the course of history. The protests in Sidi Buazid, Tunisia, Cairo's Tahrir Square, and Sana, Yemen, each grew from a few hundred individuals to tens of thousands within days of the first signs unrest. Some of the power of the crowd stems simply from the physical mass of people involved, which may give the crowd the ability to withstand and even overwhelm all but the most extreme kinetic crowd control measures. However, crowds are also powerful in their ability to spread information and rapidly alter their collective behavior. Crowds can transition from loosely to tightly organized and benign to hostile in a matter of moments. They can also disperse as rapidly as they form, making their power also temporary.

The political, economic and social stability of an area often hinges on the alignment and actions of its resident populations. Single events, both local and remote, can lead populations to align, or realign themselves and take action. The gradual spread of information in the form of secular or sacred values across a population may lead to similar realignments over the long run. Ultimately, populations are both repositories for an effective mechanisms for transmitting cultural (and biological) information. In the absence of strong secular institutions, populations may organize along sectarian and cultural lines--witness the dramatic transformation of Baghdad from integrated Sunni-Shia neighborhoods to a largely segregated city from 2003-2006. They can also collapse under internal and external pressures.

The workshop sought to understand the organization and dynamics of populations and crowds in both qualitative and quantitative terms. Yet, despite their apparent many similarities, populations and crowds are often treated separately in theoretical and empirical studies. This may in part relate to the different spatial and temporal scales at which we perceive populations and crowds. Consequently, researchers studying population organization and dynamics may not be fully aware of how their work relates to those studying crowds, and vice versa. Potentially important theoretical and methodological advances bearing on the control and disruption of hostile populations and crowds may be lost in the gap between domains.

To bridge this gap, we held a cross-disciplinary workshop at the University of Southern California on 6-7 September, 2012 concentrating on organization, dynamics and disruption of populations and crowds. The purpose of this workshop was to bring together leading researchers from both computational and social sciences with expertise in domains relevant to modeling of populations and crowds. Our goal was to encourage the development of synergistic theory and methods that go beyond what either domain currently deploys. In this regard, the workshop focused on a range of questions including but not limited to:

1.   Are typological distinctions between populations and crowds useful? Or, do populations and crowds display regular scaling relationships with respect to one another in time and space?

2.   Do the differing temporal and spatial scales of populations and crowds create divergent opportunities for positive and negative assortment, or other organizational differences?

3.   What types of computational techniques and formalisms can be used to characterize and model the dynamic spatial and temporal changes exhibited by populations and crowds?

4.   Do beliefs propagate in the same ways through populations and crowds and, if not, what structural or dynamic properties of populations and crowds explain these differences? Again, what types of computational techniques and formalisms could be used to model such belief propagation?

5.   How does the injection of social-media into crowd & population systems, as opposed to face-to-face interactions, impact crowd & population dynamics? What types of injects can help in competitive contagion or in blocking such contagion?

6.   What are the types of computational techniques can be useful for modeling and analysis of competitive contagion of beliefs or of mechanisms or injects to block belief contagion in both crowds and populations? What role does analysis of social networks play in such modeling?

7.   What are some research challenges in constructing such computational models? How do we validate these computational models?

Format
The 2-day workshop was held in 6-7 September 2012 at the University of Southern California (USC) in Los Angeles. There were 15 to 20 academic participants. In addition, there were about 10 participants from the US military, government organizations, and selected defense organizations. We will host a moderated panel discussion on policing crowds with law enforcement members representing US, UK and Indian Police Forces. The list of speakers from academia and law enforcement agencies in Los Angeles includes:
1.   Jenna Bednar, Political Science, University of Michigan

2. Andrea Bertozzi, Mathematics, UCLA
3. Jeff Brantingham, UCLA Anthropology
4. Francesco Bullo, Mechanical Engineering, UCSB
5. Yu-han Chang, Information Sciences Institute, USC
6. Bob Green, Los Angeles Police Department
7. Anders Johansson, Systems Engineering, University of Bristol
8. Gal Kaminka, Multidisciplinary Brain Research Institute, Bar Ilan University, Israel
9. David Kempe, USC Computer Science
10. Chjan Lim, Physics, RPI
11. Rajiv Maheswaran, Information Sciences Institute, USC
12. Mathew McCubbins, USC Political Science
13. Mubarak Shah, Computer Science, Univerity of Florida
14. Shashi Shekar, Computer Science, University of Minnesota
15. Martin Short, Mathematics, UCLA
16. John Sullivan, Los Angeles County Sherriff's Department
17. Milind Tambe, USC Computer Science
18. Mark Turner, Cognitive Science, Case Western Reserve
19. Arvind Verma, Criminology, Indiana University
20. Nick Weller, USC Political Science
21. Wendy Wood, USC Social Psychology

In addition, several key researchers from federal government agencies were also invited. These individuals included the following (although not all could make it due to last minute contingencies):
22. Chris Arney, USMA
23. Kate Coronges, USMA
24. Hillary Fletcher, USMA
25. Rebecca Goolsby, Office of Naval Research
26. Jeff Johnson, Army Research Office
27. Brian Lande, DARPA
28. Anantharam Swamy, Army Research Laboratory
29. Rand Waltzman, DARPA
30. Bruce West, Army Research Office
31. Jimmie Jaye Wells, 75th training division, mission command
32. Purush Iyer, ARO
33. Fredrick Clark, ARO

http://teamcore.usc.edu/crowds.html
provides all of our presentations held at the workshop

Technology Transfer