

## Cognitive and Behavioral Psychological Research for Crowd Modeling

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### **ABSTRACT:**

*Psychologically based crowd modeling is essentially absent from current computer simulations and training. A two-fold method is proposed for incorporating a cognitive psychological layer into models of crowd behavior. Naturalistic observation techniques are employed to measure human behaviors during the 1999 World Trade Organization protest, a 2004 antiwar protest, and military MOUT training exercises involving crowds. Survey research is employed to identify and describe crowd and control force interaction variables and the strength of the relation between variables and a crowd turning violent. The results of these two studies will contribute to an on-going effort to provide a psychological basis for a more realistic model of crowd-control force interactions.*

### **1. INTRODUCTION**

Over the last decade, US military forces have been called upon to handle complex, politically sensitive, and potentially lethal crowd conditions on non-US soil. The performance of US forces in these situations has not only tactical significance to those present but strategic implications for the US, its allies, and the host governments involved. The most recent example of this is the post-war effort in Iraq. Crowds, demonstrations, and protests have become routine occurrences. Some situations, such as those in Fallujah, have resulted in tragic, deadly, and long-term consequences. There is much to be learned from the systematic psychological study of these recent and ongoing events, from informing basic theory of crowd situation dynamics and intergroup relations to supporting the development of tactics, techniques, and procedures to maximize US military performance in similar situations in the future.

The goal of the ongoing research is to assist in the development of psychologically based models for simulation that can be used to (a) map and test-out alternative tactics in the handling of crowd situations, and (b) train troops who may face crowds in the future. In addition, the information could be incorporated into existing and future non-simulation tactics, techniques, and procedures. Finally, the case studies, when brought together for comparative analysis across many situations, would themselves be instructive. One could better visualize the range of situations that are likely to be encountered in the future. Thus far, the project has taken a three-pronged approach to form a psychological basis for the model of crowd behavior: Naturalistic Observation, Interviewing Subject Matter Experts, and Survey Research.

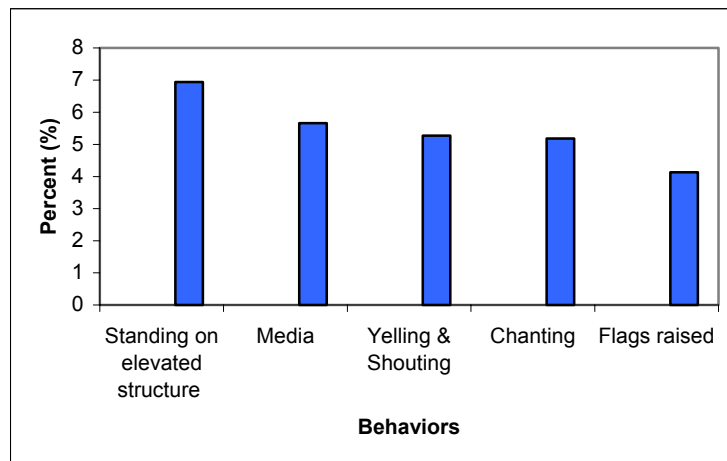
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## 2. CURRENT STUDIES

The Seattle Police Department supplied five hours of raw footage of protestors at the World Trade Organization meeting from the 29<sup>th</sup> of November through the 3<sup>rd</sup> of December 1999. The goal of the demonstrators was to disrupt the Organization’s meeting. Six graduate and undergraduate students participated in a naturalistic observation study. Total participants included three women and three men. Participants observed three hours of videotape footage from the Seattle Police Department. They were given a list of fifty-five behaviors and asked to indicate any of the behaviors that occurred during ten-minute intervals. Participants were given a training session at the beginning of the study. During the training session they were given descriptions of the behaviors and could clarify any questions about the items. For the first hour of the study participants watched the tape together and verbally indicated when the behaviors occurred. The remaining hours were watched individually.

Two of the participants also coded the frequency of violent behaviors over the course of the tape on a five-point scale. Low ratings were given for nonaggressive behaviors such as taking badge numbers. Descriptive statistics were used to analyze the data. Multiple highly aggressive incidents such as setting fires, fights, and attacking police received high ratings. Means and percentages were calculated to determine which behaviors occurred most frequently. Reliability measures were also calculated.

Some of the most frequently occurring behaviors include standing on elevated structures, yelling and shouting, raising flags, filming by media, and chanting. Standing on an elevated platform represented one of the highest percentages of crowd behavior (6.5%), while raised flags and yelling and shouting represented respectively 4.4% and 4.3% of the observed behavior. These behaviors also had the highest means. Aggressive behaviors rarely occurred but were highly effective in disrupting the event when they did occur. These behaviors included throwing glass bottles, fighting, jumping on moving vehicles, looting, and blocking the road by groups lying down across the street. Overall the subjects’ observations of the behaviors were reliable. Reliability increased during the course of the five hours of observations. Standard deviations were also examined as evidence of reliability. Higher deviations occurred for the more frequently occurring behaviors.



**Figure 1. Most frequent crowd behaviors as a function of the percentage of total observed behaviors.**

Another aspect of the study was the examination of the degree of aggressive behaviors. The researchers sought to examine when the most aggressive behaviors occurred during the protest by examining the average of the aggression ratings for each hour calculated by two of the participants. In the beginning, few aggressive acts took place. However, over time the crowd grew more violent. Aggression peaked at the second hour and remained stable through the third hour ( $M = 3.92$ ).

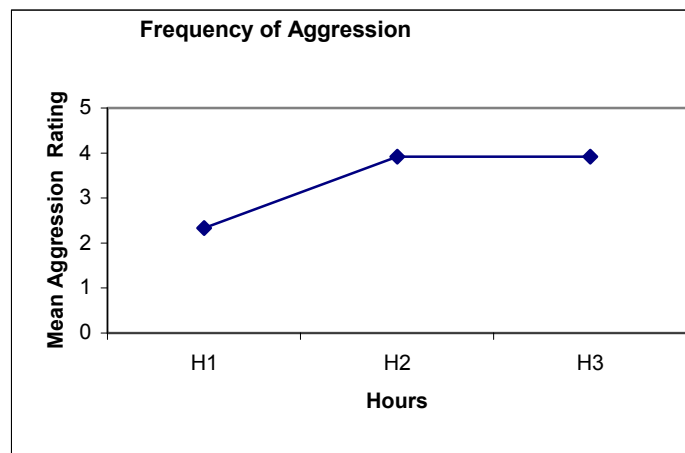


Figure 2. Degree of aggressive behaviors exhibited during each hour.

An additional crowd encounter observed was footage of a March 2004 antiwar protest in New York. This observation provided an opportunity to determine if similar crowd behaviors were evident even in a peaceful protest. These observational studies were used to examine what types of behaviors were exhibited during the course of the protest, which aggressive behaviors were most likely to occur, and how the degree of aggressive acts changed over the course of the protest.

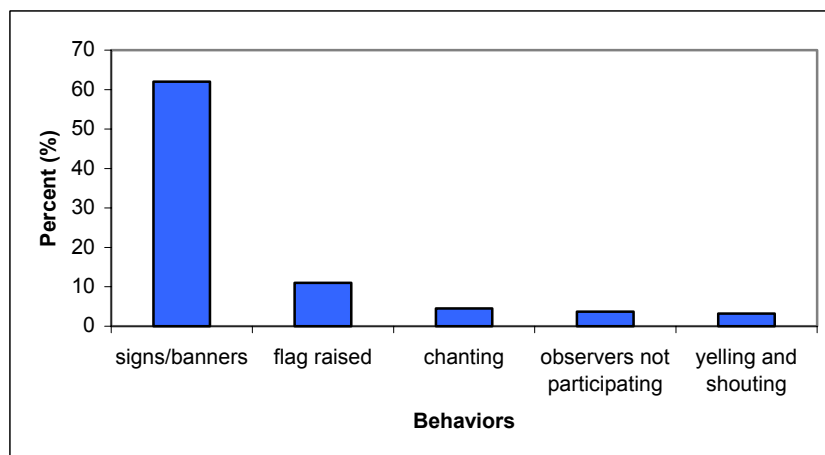


Figure 3. Frequently occurring crowd behaviors at an anti-war protest in New York.

In a separate naturalistic observation study, crowd member and control force behaviors were observed at Fort Polk’s MOUT training facility representing three Iraqi villages. The exercise included various training scenarios involving the military and contracted crowd members, police and guard units. Crowd events occurred during negotiations between soldiers and town leaders, searches for weapons, protest of arrests, protests over food and electricity shortages and during a funeral procession involving a terrorist attack. Crowd behaviors included the formation of two crowds, one male and one female, voicing protest through chanting and heckling, looting, curiosity on arrival of troops and rushing humvees, assembly, and dispersal. Flash points observed include arrival of troops, gunshots and explosions, arrest, not recognizing the village Chief upon arrival, terrorist attacks, and late payroll. Cultural factors resulting from the observations include the curious nature of the Iraqi people, strength of the need for revenge, strength of humiliation effect, and importance of addressing individuals with direct eye contact and without sunglasses. Lessons learned from these observations were that training lacked cultural awareness and consideration of cognitive psychological factors.

A survey was developed and field-tested on six soldiers on active duty in Iraq. The survey examines various psychological variables and their relation to crowd violence. The survey includes both open-ended items and Likert scale items. Open-ended items get at the types of crowd events, demographics of the crowd, the interaction with the crowd, temperament of crowd, events leading up to the crowd event, purpose of gathering, and presence of weapons. The survey also asks questions regarding best practices and attempts to understand what was most effective in dealing with the crowd and re-establishing peace. A number of items question the soldiers' level of experience with crowds. Finally the survey examines a number of crowd factors from the literature and the aforementioned WTO study. Respondents are asked to rate each factor on a 5 point Likert type scale representing the strength of the relation to the crowd event turning violent. Participants indicated several types of crowd incidents including paying Iraqi soldiers, political protest, religious protest, and protesting arrest. Crowds formed due to payment were aggressive at the military police control point. Political crowds were non aggressive and largely used vocal tactics. Religious crowds were aggressive and used physical tactics to gain attention.

Some sample factors from preliminary analysis that were rated as highly related include presence of instigators within crowd, presence of weapons within crowd, willingness to take risk, peacekeeper aggression, size of crowd, use of alcohol and drugs by crowd, societal acceptance of violence, commitment to cause and presence of organized crowd leadership. Several techniques were indicated that could be used to prevent a crowd from becoming violent. These include dispersing the crowd before it can gain strength in numbers and attract agitators, talking to the key leaders of the crowd, maintaining a safe distance from the crowd, and avoid initiating activities that would provoke the crowd.

Future versions of this survey will be administered to a larger sample of troops who have now returned from a yearlong deployment in Iraq as well as troops currently deployed to Iraq, Bosnia, and Afghanistan. In addition to identifying the strength of the relationships of variables to crowd incidents, we plan to develop factual case studies of soldiers encountering crowd situations in Iraq. This would encompass the following situations: planned political protests; spontaneous crowds that form following an incident, such as the forced-landing of a disabled helicopter; food and other-civilian issue related riots; non-hostile crowds that may pose a potential but yet unrealized threat; hostile crowds that use other civilians (e.g., children) as human shields.

### **3. CONCLUSION**

Psychologically based crowd modeling is essentially absent from current computer simulations and training. This omission has been understandable in the context of legacy simulations that were historically focused on large-scale engagements between heavy mechanized forces in primarily non-urban settings. However, in the last decade the threat has changed and future engagements are expected to often involve lighter forces in urban settings. In simulations of such scenarios the absence of crowds and of non-combatants in general is a most serious departure from realism. The absence of accurate computer models of crowds in military simulation and the need to include them has been widely recognized.

The outcome of this research will be improved models for simulation and training to enhance US military performance in such situations in the future. Specific improvements include: (a) the addition of a cognitive psychological layer in the models; (b) basing the models on the most recent experiences; and (c) greater attention, than has been previously given, to mapping out the tactical options available to control forces. In order to accomplish these goals we will continue to explore this approach of understanding cognitive psychological issues as a basis for the more realistic modeling and simulation of crowd behaviors.

## **AUTHOR BIOGRAPHIES**

**Ryland C. Gaskins III** received his Ph.D. in Human Factors and Masters in Industrial Organizational Psychology from George Mason University. Since joining the ODU faculty, he has taught both graduate and undergraduate courses in Human Factors, Industrial/Organizational Psychology, Research Methods, Personnel Psychology, Organizational Psychology, Ethics and Introductory Psychology. Dr. Gaskins' research interests are in the area of training and simulation, virtual environments, human abilities and task characteristics measurement for selection and placement.

**Carlotta M. Boone** received her M.S. in General Psychology from the University of Memphis and her B.S. in Psychology from Xavier University. While completing her Ph.D. in Industrial Organizational Psychology at Old Dominion University (ODU), she taught an undergraduate course in Industrial/Organizational Psychology. Her research interests are in usability, simulation, training and human performance.

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**Mikel D. Petty** is Chief Scientist of the Virginia Modeling, Analysis and Simulation Center at Old Dominion University. He received a Ph.D. from the University of Central Florida in 1997, a M.S. from UCF in 1988, and a B.S. from the California State University, Sacramento, in 1980, all in Computer Science. Since 1990 Dr. Petty has published over 90 research papers and has been awarded over 30 research contract. He is currently an editor of the journal *SIMULATION: Transactions of the Society for Modeling and Simulation International*.

