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Individual Response to Three Types of Nonlethal Weapons

This study investigates behavioral reactions to three types of nonlethal weapons (NLWs) used by the U.S. military. We provided participants with simulated situations involving military use of NLWs, and asked them to predict how they would react. We found variations in response according to weapon type. In general, individuals were unlikely to aggress or disperse, although these reactions were mediated by demographic factors. It may be important for Army officials to know the behavioral effects of NLWs in order to use them effectively.

Nonlethal Weapons (NLWs) are weapons designed to scatter crowds of people or temporarily incapacitate threatening people or machines. NLWs are intended to minimize permanent injury and damage. A well-known example of an NLW is "pepper spray" (Oleoresin Capsicum), which is derived from cayenne peppers. Pepper spray causes inflammation of the eyes and breathing passages, making aggressive behavior unlikely. The effects are generally temporary with permanent physiological damage being statistically rare in comparison to traditional weapons (Haberland, 2006). The U.S. military began using nonlethal weapons during peacekeeping operations in Bosnia and Somalia (Davison, 2006). Maintaining law and order during peacekeeping often meant managing crowds of civilians involved in protest. Nonlethal weapons had the promise of containing or dispersing the crowds while nearly eliminating the threat of civilian injury and death. The need for nonlethal weapons has recently become apparent during combat operations, especially in urban areas (such as Iraqi cities) where civilians are present in large numbers (Thomas & Clements, 1998). Risk of civilian collateral damage is high when military officials are attempting to control crowds using only lethal weapons. The U.S. military and private contractors have made significant advances in the development of nonlethal weapons (Ames, 2003; Komarow, 2005a; White, 2006). However, lack of information regarding the behavioral outcomes associated with the use of nonlethal weapons continues to be a barrier to using the weapons (Bruno, 2007). Our research explores individual reactions to NLWs in simulated situations in order to better predict how individuals may react to NLW use on the battlefield.

Although considerable testing has been done to establish the physiological effects of nonlethal weapons (Levine & Montgomery, 2002), behavioral effects have been largely untested. The human target response must coincide with the desired military outcome if the weapon is to be considered effective (Joint Non-lethal Weapons Program, 2007). Although most weapons have desirable behavioral outcomes, military officials are often skeptical about whether such outcomes will occur (Center for Army

Lessons Learned, 2000; The Future of Crowd Control, 2004). For example, nonlethal projectiles (such as rubber bullets) are often fired from 12-guage shotguns. The goal of firing a nonlethal projectile is to halt aggression or promote dispersal. However, one can envision a scenario in which targets may believe that lethal weapons are being aimed at them and thus may engage their own weapons, thereby increasing aggression (Center for Army Lessons Learned, 2000). Alternatively, the targets may be aware that nonlethal weapons are being used and increase aggression or fail to disperse because they are undeterred by the mild threat. Davison (2006) reports that smoke was once thought to be a viable NLW, as it obscured visibility and made it difficult for organized action. After some experience on the battlefield, however, the use of smoke was abandoned because it impaired the visual capability of military forces as well as the crowd. Moreover, crowds tended to stay in place rather than disperse. These experiences show that testing the behavioral effects of nonlethal weapons is crucial to understanding how they might operate in a battlefield.

The behavioral response to nonlethal weapons will likely vary by the type of weapon. There are three broad classes of NLWs: those directed at 1) crowds (targeting a large number of individuals simultaneously), 2) individuals (targeting an identified threatening individual), and 3) machines (rendering a weapon or machine dysfunctional). Weapons directed at *crowds* are often intended to disperse the crowd or make people flee from the source of the weapon. An example might be the Long Range Acoustic Device (LRAD), an amplification system that sends out a very loud screeching noise (The Future of Crowd Control, 2004). Apparently, it is a deafening, uncomfortable noise. The LRAD is used to flush individuals out of buildings, or to warn small crafts to retreat from a warship. Weapons directed at *individuals* are generally intended to incapacitate a threatening individual or combatant. An example might be the Taser weapon. When used correctly, the Taser should disrupt muscular control, stopping any behavioral response in progress (Marshall, 2007). Finally, NLWs directed at *machines* are intended to disrupt the functioning of the machine. For example, road spikes, when raised, flatten the tires of a vehicle, impeding further travel (Komarow, 2005b). Given the nature of the three groups of NLWs, we would expect to see greatest crowd dispersal when a crowd-directed weapon is used. Since incapacitation is likely, we predict the least aggression when the individual-directed weapon is used. Finally, we expect low levels of dispersal and aggression when the NLW is directed at a machine, since individuals are not directly targeted.

Attributes of the crowd may influence the behavioral response to NLW use. For example, the ages, genders, personality differences, and ethnicities of crowd members may influence the disposition to aggress or disperse in response to NLW use. Given that aggression has been consistently tied to testosterone levels, and males between the ages of 15-25 have the highest testosterone levels (Kalat, 2007), one hypothesis would be that young men have a greater tendency to aggress in response to NLWs than other groups. Since we were unable to locate any existing literature that compared demographic attributes of targets in relation to behavioral response to nonlethal weapons, we could only speculate as to how attributes such as ethnicity, socioeconomic status, or political orientation might affect response to NLWs. Knowledge of how the composition of the crowd is associated with response to NLWs, would allow military personnel to make informed decisions about when the use of NLWs is appropriate.

The purpose of our research is to investigate individual reactions to the use of NLWs in crowds. The main questions we address are:

Q1: What are the predominant reactions of individuals when an NLW is used?

Q2: Do the crowd's reactions differ when the NLW is directed at an individual, crowd, or machine?

Q3: How do personal characteristics (e.g., age, ethnicity, gender) affect individuals' reactions to the use of NLWs?

Method

Participants were 207 university students (58 males and 148 females) who were surveyed during six Psychology classes and one Plant Physiology class at a small, public, historically Black university. Participants' average age was 21 years old (SD = 5.30). There were 75 African American and 117 White participants, in addition to 13 participants in other ethnic groups. Self-reported political party affiliation showed 40% of participants identified as Democrat, 30% Republican, 18% Independent, 2% Libertarian, and 10% other affiliation.

There were two sections of the survey: 1) Demographics and 2) Reactions to Scenarios. The Demographics section contained 18 questions about age, gender, ethnicity, political party affiliation, parents' education level (2 questions, scale = 1-7), parents' occupations (2 questions, scale = 1-7), and state hostility (10 questions, scale = 1-5). Parents' education and occupation scores were used to compute socioeconomic status (SES; Hollingshead, 1975). Since most students have not yet started their careers nor finished their education, we assumed that parental variables were the most accurate indicators of socioeconomic status. Data from students who did not report education and occupation of both parents were excluded from the SES calculation (22% of the sample). We excluded these because we were unable to determine the extent to which the missing parent(s) contributed to the participants' socioeconomic status. After removing these participants from the calculation, the remaining sample (n = 161) showed an average SES (M = 38.38, SD = 12.62) in the middle-class range (Hollingshead, 1975). State Hostility was measured using 10 questions from the State Hostility Scale (Lindsay & Anderson, 2000). The original measure consisted of 35 questions. The original scale showed good reliability and validity but was too long for our purposes. The reliability on our 10 questions remained high (Cronbach's alpha= .88).

Three scenarios were presented to each participant in a repeated measures design. Scenarios each described a case of ethnic rivalry (over immigration or other territorial dispute). The participant was instructed to imagine him/herself as being involved in the protest as a crowd member. Scenarios differed by whether the nonlethal weapon targeted an *individual*, a *crowd*, or a *machine*. One scenario described the use of an NLW in which a specific *individual* was targeted by rubber bullets. In this scenario, a military officer fires rubber bullets that strike other protesters. The second scenario described the use of an NLW directed at a *crowd* of people. In this case, the military officer fires a malodorant at the crowd. The malodorant discharges a chemical odor that induces coughing and nausea. The final scenario depicted the use of an NLW directed at a *machine*. In this case the participant witnesses the military officer using a vehicular entanglement device, which stops a car that is attempting to approach a roadblock. For each scenario, participants completed 15 reaction questions (Anger, α = .84; Anxiety, α = .85; Aggression, α = .82; Dispersal, α = .67; and Helping Behavior, α = .70) addressing how they might react in the situation. In addition, for each scenario they were asked to rate the believability that this scenario might occur in real life. Reaction and believability questions were scored on five-point scales.

Results

Believability

For each scenario, we asked participants to judge the extent to which they believed that "situations like this are likely to happen during future military engagement". Given the limited knowledge and experience that our participants had with nonlethal weapons use, we did not expect these believability ratings to be particularly high. Mean scores ranged between "Agree" and "Neutral" on our scale. Repeated measures ANOVA on believability revealed no significant differences between the believability of different scenarios.

Q1: What are the predominant reactions of individuals when an NLW is used?

We collapsed data across scenarios to examine how individuals predicted that they would feel and act when placed in scenarios involving the use of NLWs. Of the measured *emotional* reactions,

anxiety ($M = 3.39, SD = .78$) was the predominant reaction, although anger was also somewhat likely ($M = 3.09, SD = .70$). Of the measured *behavioral* reactions, helping ($M = 3.09, SD = .76$) and dispersal ($M = 2.98, SD = .63$) were the most likely actions, followed by aggression ($M = 2.22, SD = .81$).

Q2: Do reactions differ when the NLW is directed at an individual, crowd or machine?

Table 1 compares reactions to the three scenario types. In the Individual NLW scenario, the participant has witnessed a fellow protester being shot with a rubber bullet. The most predominant reaction in this scenario was anxiety, followed by a desire to help the individual that was shot, and a desire to disperse or run away. Anger and aggression were unlikely reactions to the situation. In the Crowd NLW scenario, the participant is present when a malodorant discharges. The most predominant reactions in this scenario were anxiety, desire to help those affected, anger, and a desire to disperse or run away. Likelihood of aggression was low. In the Machine NLW scenario, the participant is waiting in a line of cars when a passing car is stopped by a vehicular entanglement device. Although anxiety was the most predominant reaction to the situation, reactivity was generally low for all measures.

We used repeated-measures ANOVAs to test whether reaction measures varied across the three scenarios (see Table 1). The reaction of anxiety differed between scenarios, with anxiety being greatest in the Individual NLW scenario, moderate in the Crowd NLW scenario, and low in the Machine NLW scenario. Anger likewise differed between scenarios. Anger was highest during the Crowd NLW scenario, moderate during the Individual NLW scenario, and low during the Machine NLW scenario. Helping behavior, dispersal, and aggression were significantly more likely in the individual and crowd-directed scenarios and less likely in the machine-directed scenario.

Q3: How do personal characteristics affect individuals' reactions to the use of NLWs?

We examined the effects of gender and ethnicity using *t*-tests. Women were generally more reactive to the scenarios, displaying significantly more anxiety ($t = -5.53, p < .001$), anger ($t = -2.47, p < .01$), helping ($t = -3.64, p < .001$), and dispersal ($t = -2.08, p < .04$) than men. There were no significant gender differences in likelihood of aggression.

Only two ethnic groups (White and African American) had enough participants to include in the analyses. In comparing these groups, *t*-tests indicated that African Americans were more likely to be angry ($t = -5.98, p < .001$), help others ($t = -2.11, p < .03$), and show aggression ($t = -2.42, p < .02$) than Whites.

Since there were three sizable political party affiliation groups (Democrat, Republican, and Independent), we examined political party differences using a between-subjects ANOVA. ANOVA showed significant differences between the anger levels of the political parties in response to the use of nonlethal weapons, $F(2, 176) = 10.56, p < .001$. Tukey post-hoc comparisons revealed that Democrats showed greater anger ($M = 3.34, SD = .66$) than Independents ($M = 3.00, SD = .56$) and Republicans ($M = 2.83, SD = .71$). Anger did not significantly differ between Republicans and Independents. Other reaction measures (anxiety, helping behavior, dispersal, and aggression) were not associated with political party affiliation.

The remaining personal characteristics (age, hostility, and SES) were continuous measures and were analyzed by correlation with each reaction measure. Older people were less likely to aggress in reaction to scenarios, $r(204) = -.20, p < .01$. Participants who felt more hostile while they were completing the questionnaire were more likely to show aggression in response to the scenarios, $r(199) = .29, p < .01$. SES was not associated with any reaction measure.

Discussion

Nonlethal weapons can be effective alternatives to the use of lethal weapons if they operate as manufacturers intend them to operate. The efficacy of nonlethal weapons depends largely upon the behavioral responses produced by the people targeted. In most cases, the desired responses are halting aggression and/or dispersing a crowd. Despite some limitations, our simulated situations

indicate how people tend to react to various types of nonlethal weapons. In addition, our study indicated some individual differences in people's reactions based on demographic characteristics.

One fear of using nonlethal weapons is that they might lead to increased violence of crowd members (Center for Army Lessons Learned, 2000). Contrary to this prediction, our data showed that aggression in response to NLWs was low. Aggression was the least common reaction to individually directed, crowd directed, and machine directed scenarios. The reactions of anger, helping, anxiety, and dispersal were all more common than aggression. Although aggression was generally low, younger and more hostile participants were more likely to aggress than older, less hostile participants. African Americans also scored slightly higher than White participants. Thus, the fear that NLW use might incite high levels of violence is unsupported. However, violence is likely to vary somewhat depending on the composition and mood of the crowd.

The goal of some nonlethal weapons is promoting dispersal, or "persuading people that they would much rather be someplace else" (Council on Foreign Relations, 2004, p.21). For example, experience with crowds in the United States has shown that use of CS-2 (tear gas) tends to effectively scatter a crowd (Council on Foreign Relations, 2004). Other nonlethal weapons have been less frequently tested in the field, and studies focusing on behavioral effects of NLWs are virtually absent in the literature. In our findings, dispersal was a more common response than aggression although the response was not particularly likely. In fact, the most common response to whether a participant would disperse from the situation was 'neutral' meaning that they were unsure. As expected, scenarios in which crowds or individuals were targeted brought about significantly greater dispersal than scenarios in which the vehicle was targeted. Women were also more likely to disperse than men. Our results indicate that nonlethal weapons may fall short of producing high levels of dispersal among crowd members. However, dispersal may be more likely in crowds involving greater numbers of women.

Perhaps the reason why dispersal was so low was because the desire to help people targeted by the nonlethal weapons was relatively high. Helping and dispersal may be incompatible responses if a person fails to disperse because they are remaining in the crowd to help other members of the crowd. However, they may be compatible insofar as people are able to remove the injured from the situation. In our scenarios, people were more likely to help when an NLW targeted a crowd or individual than when it targeted a machine. African Americans and women were also more likely to help after an NLW was used. Further research should investigate the circumstances under which individuals are most likely to stay and help others. In the event that helping impedes the intended effects of the weapon, specific instructions or other techniques might be used to aid the injured, so that helping behavior becomes less necessary.

Our study has four main limitations that could potentially influence the interpretation of our results. First, our study does not capture the diversity of non lethal weapons in existence. There are many different types of nonlethal weapons and, depending on their unique effects, responses of people exposed to them will probably vary. Second, participants responded to simulated situations and therefore were not personally or emotionally attached. Reactions are likely to be more intense in actual situations compared to simulated situations. Third, our sample may not represent typical crowds. We had more female participants compared to male participants. Also, our sample is uniquely diverse because data were collected from students at a historically Black university. Finally, our design would have been improved if we had randomly ordered the presentation of scenarios. Fatigue or order effects may have accounted for some of the differing reactions to scenarios. Despite these limitations, our findings represent the beginning of an understanding of the behavioral responses one can expect when using nonlethal weapons. Further research should expand the study of behavioral reactions in order to better understand the utility of nonlethal weapons use during warfare.

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Table 1

Reactions to Individual, Crowd, and Machine Directed NLW Scenarios (N = 207)

	Hypothetical Scenarios						
	Individual		Crowd		Machine		
Dependent Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*
Anxiety	3.67	.90	3.46	.92	3.08	.99	55.22*[a]
Anger	3.12	.94	3.38	.86	2.78	.89	37.26*[a]
Helping behavior	3.35	.97	3.43	.95	2.49	.97	107.97*[b]
Dispersal	3.28	.96	3.25	.85	2.46	.87	45.00*[b]
Aggression	2.24	.97	2.38	.98	2.05	.89	15.26*[b]

*$p < .001$

[a] *p's* < .01 on all post hoc comparisons

[b] Individual differs from Machine, Crowd differs from Machine, *p*'s < .01