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Run, Hide, or Freeze: Social and Emotional Influence on Behavior in an Immersive School Shooting Simulation

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ABSTRACT

As school shootings rise in frequency across the United States, understanding how individuals respond during such crises is critical for developing effective safety protocols. This study used an immersive, computer-based simulation to investigate how social influence and emotion level from non-player characters (NPCs) affect behavior during an active shooter event. A total of 285 participants were randomly assigned to one of six experimental conditions varying NPC behavior (run, hide, or mixed) and emotional intensity (high vs. low). Participants were more likely to run when surrounded by NPCs who ran and more likely to hide when NPCs hid, showing that social influence significantly shaped behavior. Emotional evocative imagery and sounds, however, did not significantly affect decision-making. Increases in negative affect after the simulation and male gender were also associated with a greater likelihood of running. These findings suggest that visible social behavior, rather than emotion, drives emergency responses and highlights the value of social modeling in safety training.

Keywords: School shooting, Social influence, Emotional influence, School safety

INTRODUCTION

School shootings in the United States have increased dramatically in recent years. The K–12 School Shooting Database (2024) recorded 348 incidents in 2023, the highest number since records began in 1966. Before 2020, no year exceeded 125 incidents, but from 2021 to 2023, the annual average rose to 257. In that same span, an average of 237 people were killed or injured on K–12 campuses each year. These trends highlight the urgency of developing effective strategies to reduce harm during such events. In light of this growing threat, the Federal Bureau of Investigation (FBI) recommends the "Run, Hide, Fight" protocol as a general guideline for individuals confronted with an active shooter (FBI, 2022). This strategy encourages fleeing the scene if possible, seeking concealment if escape is not viable, and resorting to physical defense only as a last option. However, research has shown that human behavior under acute stress often deviates from trained responses. Factors

such as panic, social cues, and the surrounding environment can strongly influence decision-making, often overriding conscious adherence to protocols (Worthington et al., 2021; Drury et al., 2009; Zhu et al., 2020). These findings suggest that successful emergency response training must account for the psychological and social dynamics that emerge during high-stress situations.

Researchers have increasingly turned to simulation studies to better understand behavioral responses in such contexts. These methods offer safe and controlled environments where participants can respond to realistic threat scenarios (Kapadia et al., 2024). For instance, Bott (2021) used reinforcement learning models to assess mitigation strategies during active shooter events. Awada et al. (2021) incorporated physiological and emotional indicators into VR-based shooter simulations, demonstrating the influence of stress on decision-making. Additional studies have examined virtual environments (Zhu et al., 2019), security countermeasures (Zhu et al., 2022), and student evacuation behavior (Bahmani et al., 2023), all contributing to a growing literature on behavior during emergencies. Work by Zhu et al. (2023) further advanced this field by employing machine learning to simulate crowd behavior, while Arteaga et al. (2023) showed the critical role of leadership in improving safety outcomes during evacuations. The current study builds on this body of research by using an immersive, computer-based simulation to explore how social influence and others' emotionally evocative imagery and sounds affect individuals' decision-making during an active school shooting scenario. Prior work has shown that general populations can reasonably approximate behavior during crises for specific demographic groups, such as office workers (Zhu et al., 2019). In this study, we aim to answer the following research questions. 1) How do proximal social influence, NPC emotion level, and the interaction between the two impact whether participants run away or hide? 2) How do participants' positive and negative affect change in response to the simulation? 3) Which demographic factors are associated with participants' likelihood of choosing to run or hide during the simulation?

METHODS

Participant Information

We recruited 285 participants through Prolific.com, a validated platform for sourcing high-quality online samples in behavioral research (Douglas et al., 2023). We randomly assigned participants to one of six conditions representing all combinations of the behavior of 37 NPCs (all running from shooter, all hiding, or 19 running and 18 hiding [mixed]) and emotion level of the NPCs (high or low). The high emotion condition included blood splatter, NPCs screamed/groaned after being shot, and panicked crowd noises after the shooting began, all of which were absent in the low emotion condition. Social influence and emotion level conditions are named based on the behavior/emotion displayed by the NPCs in each scenario. The sample

size for the Hide-High (NPCs hide and express high emotions) was 45, Hide-Low was 47, Mixed-High was 51, Mixed-Low was 46, Run-High was 52, and Run-Low was 44.

The mean (SD) age of participants was 35.15 (10.89) years. The self-identified gender of the sample was 55.79% male, 40.70% female, and 3.51% other. The self-identified race/ethnicity of the sample was 58.25% White (Non-Hispanic), 14.39% Asian or Pacific Islander, 12.98% Black or African American, 8.42% Hispanic or Latino/a, 3.86% mixed, 1.05% Native American or Alaskan Native, and 1.05% other. Nearly one-third (31.23%) of participants indicated they had received active shooter training. Just under five percent (4.21%) reported having experienced an active shooter scenario in real life. Of those who reported receiving active shooter training, 40.45% indicated they used the training during the simulation, while 30.34% said they did not remember it, and 29.21% said they did not follow it. Around one-third (34.74%) of our sample also reported receiving firearm training, and nearly half (47.02%) reported shooting a firearm in the past. Less than two percent (1.75%) of participants had a military or law enforcement background. Finally, 55.79% of participants currently or previously regularly played first-person shooter video games.

Study Procedure

The current simulation draws directly from a previous study by the authors (Kapadia et al., 2025), incorporating new experimental conditions. Participants first provided informed consent and then completed the Positive and Negative Affect Schedule (PANAS), a widely used instrument for assessing emotional states (Watson et al., 1988). The PANAS consists of ten positive (ex. alert) and ten negative (ex. scared or distressed) affect terms, each rated on a scale from 1 (very slightly or not at all) to 5 (extremely). Prior to the simulation, we instructed participants to report how they had felt over the past week; following the simulation, they rated their affective state in the immediate moment. Subsequently, participants completed two brief training modules to familiarize themselves with the simulation environment. They then proceeded through the simulation (described below), after which they completed the same PANAS items and responded to questions regarding their experience with the simulation, activities related to active shooter scenarios, and demographic information.

Simulation Procedure

Data for this study were collected using a 3D simulation developed in the Unity game engine (Version 2023.2.20), designed to replicate a realistic school environment and foster an immersive experience. Figure 1 displays a map of the school used in the simulation. All participants completed two mandatory training modules before the active shooter simulation. The first module focused on familiarizing participants with basic navigation using keyboard and mouse controls. Upon successful completion, participants proceeded to the second module, which required them to traverse seven designated locations within the virtual school to gain spatial familiarity.

Only participants who completed both training sessions within 15 minutes were permitted to proceed to the active shooter simulation. The school shooting simulation began with participants in the cafeteria (indicated by the star in Figure 1). Three seconds into the simulation, gunshots were audibly triggered, prompting the NPCs to respond by running or hiding, depending on the assigned condition. The simulation lasted up to 70 seconds, allowing sufficient time for participants who chose to evacuate to do so. Participants were free to navigate the environment, but physical constraints, such as boundaries and the presence of other NPCs, restricted movement. Notably, the shooter did not target participants, preventing premature simulation termination and preserving data completeness. Figure 2 presents a selection of screenshots from the simulation. The top-left photo shows the movement training phase. The top-right depicts the cafeteria during the tutorial to help participants become familiar with the school. The bottom-left displays the shooter entering the cafeteria at the start of a high emotion simulation. The bottom-right shows students running away from the shooter.

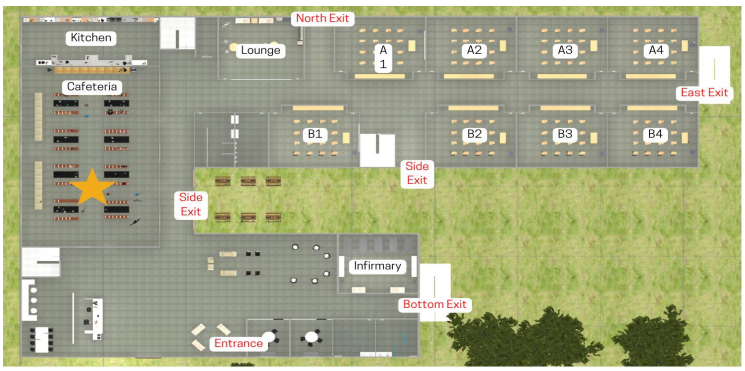

Figure 1: Map of school used in simulation. Rooms are labeled in black and exits in red. Students begin the simulation in the cafeteria indicated by the star.

Figure 2: Selected screenshots from unity simulation. The top-left image shows the movement training phase, while the top-right depicts the cafeteria during the tutorial. The bottom-left captures the shooter entering during a high-emotion simulation, and the bottom-right shows students running away.

RESULTS

Summary of Questions Regarding Simulation Experience

The answers to the additional questions regarding simulation experience are summarized in Table 1. Most participants (64.21%) reported they ran towards an exit after hearing gunshots. A majority of participants (64.91%) also reported that they would behave similarly during an actual active shooter event. Approximately half (49.82%) of students claimed the action they chose was not influenced by the other students (NPCs) in the scenario. Of those who said the other students influenced their actions, the most common action was to run because other students were running (78.78% of participants influenced). A total of 11 participants (8.33% of participants influenced) chose the opposite action of what students around them were doing. Finally, most participants (69.12%) found the simulation at least moderately realistic.

Table 1: Summary of questions regarding simulation experience.

Question	Answer Choices	Count	%
Which of the following best describes what you did when you first heard the gunshots?	Ran towards an exit	183	64.21
	Ran to somewhere else in the school in order to hide	42	14.74
	Initially hid in my starting location and then ran towards an exit	41	14.39
	Hid where I started the entire time	12	4.21
	Stood in the same location but did not try to hide	7	2.46
If this scenario occurred in real life do you think your actions would be similar?	My actions would be mostly similar	185	64.91
	My actions would be exactly the same	50	17.54
	My actions would be mostly different	35	12.28
If this scenario occurred in real life do you think your actions would be similar?	My actions would be completely different	15	5.26
Was the action you chose influenced by the other students in the scenario?	It was not influenced at all by other students in the scenario	142	49.82
	It was slightly influenced by other students in the scenario	80	28.07
	It was heavily influenced by other students in the scenario	45	15.79
	I am unsure if my actions were influenced by other students in the scenario	18	6.32
Which of the following best describes how the other students influenced your actions?	I was not influenced by the actions of others	153	53.68
	I ran because other students were running	104	36.49

Continued

Table 1: Continued

Question	Answer Choices	Count	%
	I hid because other students were hiding	17	5.96
	I hid because other students were running	8	2.81
	I ran because other students were hiding	3	1.05
How realistic did you find the simulation?	Extremely realistic	26	9.12
	Very realistic	69	24.21
	Moderately realistic	102	35.79
	Slightly realistic	81	28.42
	Not at all realistic	7	2.46

Observed Participant Behavior During Simulation

Using participant coordinate data, we categorized behaviors in the simulation as follows: (1) hiding was identified when participants crouched without moving, (2) sneaking was defined as crouching while moving, (3) standing still occurred when participants neither crouched nor moved, and (4) running away was characterized by moving without crouching. Figure 3 presents participants' most common behaviors based on social influence and NPCs' emotion level. In all combinations of social influence and emotion level, the most common behavior was to run away.

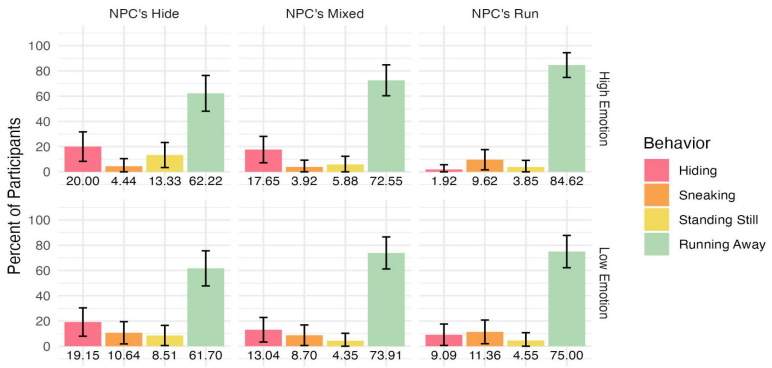

Figure 3: Percent of participants' most common behavior by social influence condition and emotion level.

We used binary logistic regression (BLR) to predict the likelihood that participants spent most of their time running away (vs. hiding, sneaking, or standing still). Predictors included the manipulated levels of social influence and emotion level, participants' perceived realism of the simulation, changes in positive and negative PANAS scores before and after the simulation, whether participants had received active shooter training, and participants' gender and age. Social influence was contrast coded using two orthogonal

contrasts. The first contrast compared the mixed NPC behavior condition to the average of the run and hide conditions. The second contrast compared the run condition to the hide condition. BLR results are presented in Table 2, showing that participants were 1.96 times more likely to run away when others were running than when others were hiding. Additionally, participants were 1.64 (OR = 0.61) times more likely to run away for each one-point increase in the change in negative PANAS score (Post-Pre). Finally, males were 3.16 times more likely to run away than females. No interactions between social influence condition and emotion level were significant. A likelihood ratio test comparing the full model to a null model including only the intercept revealed that the inclusion of social influence, emotion level, their interaction, and covariates significantly improved model fit, $\chi^2(11) = 42.48$, p <.001.

Table 2: Summary of a BLR predicting if participants spent majority of simulation running away.

Predictor	Odds Ratio	95% CI	p-Value
Intercept	4.28	0.97 – 19.20	**0.056**
NPCs Mixed (vs Hide and Run)	1.16	0.65 – 2.05	0.603
NPCs Run (vs Hide)	1.96	1.17 – 3.40	**0.012**
High Emotion Level (vs Low)	1.45	0.82 – 2.63	0.207
Perceived Realism	0.85	0.62 – 1.16	0.296
Difference in Positive PANAS (post-pre)	1.20	0.85 – 1.69	0.302
Difference in Negative PANAS (post-pre)	0.61	0.43 – 0.85	**0.004**
Received Active Shooter Training	0.71	0.37 – 1.37	0.308
Male	3.16	1.78 – 5.74	**<0.001**
Age	1.00	0.98 – 1.03	0.873
NPC's Hid x Low Emotion Level	0.79	0.35 – 1.77	0.571
NPC Behavior Mixed x Low Emotion Level	0.77	0.38 – 1.57	0.476
Observations			282
R^2 Tjur			14.8%

Affective Responses to the Simulation

The average positive and negative affect score of participants before and after the simulation by whether participants were in the high or low emotion condition is presented in Figure 4. For the positive items, a 2 (Occasion) by 2 (Emotion Level) way ANOVA found a significant main effect for occasion $F(1,560) = 24.84$, p <.001, $\eta 2 = 0.04$, no significant main effect for emotion level $F(1,560) = 1.69$, p =.194, $\eta 2 = 0.00$, and no significant interaction between occasion and emotion level $F(1,560) = 0.40$, p =.525, $\eta 2 = 0.00$. For the negative items, a 2 (Occasion) by 2 (Emotion Level) way ANOVA found a significant main effect for occasion $F(1,560) = 32.95$, p <.001, $\eta 2 = 0.01$, no significant main effect for emotion level $F(1,560) = 0.03$, p =.855, $\eta 2 = 0.00$, and no significant interaction between occasion and emotion level $F(1,560) = 0.13$, p =.717, $\eta 2 = 0.00$.

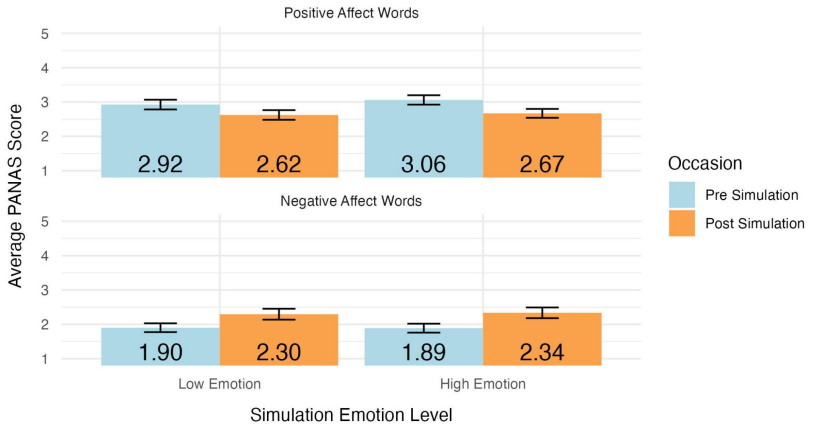

Figure 4: Average positive and negative affect score before and after simulation by emotion level. error bars represent 95% confidence intervals.

DISCUSSION

Social Influence

The present study examined how social influence and emotion level from non-player characters (NPCs) in a school shooting simulation influenced participants' behavioral responses. The primary finding was that participants' behavior was influenced to some extent by that of the NPCs. When NPCs ran away, participants were significantly more likely to run; conversely, when NPCs hid, participants were more likely to hide. This aligns with prior research highlighting the role of social modeling and crowd dynamics in emergency responses (Drury et al., 2009). Interestingly, while participants believed others did not influence them, the behavioral data suggests otherwise, highlighting a disconnect between perceived and actual social influence.

Emotional Intensity and Affective Responses

Contrary to expectations, the emotional intensity of NPCs (high vs. low) had no significant effect on participant behavior. This result suggests that participants may prioritize visible action cues (e.g., running or hiding) over affective expressions when stressed. This insight contributes to growing evidence that concrete behavioral signals are more influential than emotional tone during crisis decision-making (Awada et al., 2021). Affective data from PANAS scores further support the emotional salience of the task. Across all conditions, negative affect increased after the simulation, confirming the emotionally evocative nature of the scenario. Notably, those who experienced greater increases in negative affect were also more likely to run, suggesting that elevated arousal may facilitate escape-oriented behavior.

Gender Differences

Gender emerged as a significant predictor of response behavior. Male participants were more likely to run than female participants. This result is consistent with previous research suggesting men and women may differ in their perceived threat sensitivity or action tendencies during emergencies (Kinateder et al., 2014). Further research is needed to investigate whether these differences are driven by socialization, risk perception, or physiological arousal.

Implications for Policy and Training

These findings have practical implications for school emergency training. Given the strong influence of modeled NPC behavior, protocols should incorporate social modeling. Drills could feature clear behavioral cues from authority figures or trained leaders to guide responses (Arteaga et al., 2023). Our results also suggest many individuals may not realize they follow social cues under stress. Promoting awareness of this through debriefs or educational campaigns may foster more deliberate, adaptive decision-making in real emergencies.

Limitations and Future Directions

Although the simulation offered an immersive setting, it simplified real-life crises as participants were not directly targeted, potentially lowering perceived threat. The adult, online sample also limits generalizability to school-aged populations. Future research should explore whether findings replicate in younger samples or live drills, and how authority figures like teachers or security personnel influence social modeling during active shooter events.

CONCLUSION

This study underscores the powerful role of social influence in shaping decision-making during active shooter simulations. Participants often followed the crowd, even when unaware of doing so, and emotion intensity had little impact on behavior. These insights support the importance of behavioral modeling in emergency preparedness programs. By understanding and leveraging these psychological mechanisms, schools and policymakers can develop training interventions that improve evacuation outcomes and save lives.

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