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The Role Social Influence Has On Dormitory Residents' Responses to Fire Alarms

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ABSTRACT

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Public response to fire alarms has been a major concern for decades. In particular, college dormitories pose a real threat for a catastrophic event if proper fire protocol is not carried out. Social influences may play a role in the decision dorm residents make when a fire alarm is sounded. More specifically, this research addresses to what degree does an authority figure, like a community advisor (CA), a friend, an unknown resident, or being alone, influence self-reported responses to fire alarms. Significant evidence was found confirming our hypothesis that participants in an alone condition reported being more likely to exit than participants in the presence of others while in their dorm room. In addition, we found that participants did not equally report a CA, a friend, or an unknown resident as having the same influence on their decision to exit or not to exit during an alarm. We found evidence that participants are significantly more likely to believe a dorm fire alarm is false as opposed to real, however we were unable to show a biased informational search via confirmation bias. Finally, two video clips of different fire situations were shown to participants to see if suggestion had an effect on intended behavior. The responses given to a video suggesting a "real alarm" did not significantly differ to the responses given to a video suggesting a "false alarm."

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"Social action, just like physical action, is steered by perception." - Kurt Lewin

In this quote Lewin suggests that perception guides social action, that is, people's social behavior can be influenced by expectation or prior experiences. Social psychologists have identified public situations in which humans behave differently than the way they behave alone. This holds especially true during emergency situations when roles and course of action tend to be ambiguous. The main focus of this paper is to investigate the cognitive processes of college dorm residents concerning fire alarms in response to different types of social pressures. More specifically, what drives residents' decisions to evacuate or not to evacuate when fire alarms are sounded in their halls?

Recent Research on Fires in Dormitories, Fraternities, Sororities, and Barracks

A tragic reminder of the potential dangers of public fires occurred in 2003 at a Rhode Island nightclub. The band Great White used unauthorized pyrotechnics that engulfed a crowded audience at 'The Station' (McGrevy, 2007). This fire killed over 100 people and injured dozens of others. The material of the building along with a slow response to evacuate both contributed to a number of lives being lost. Many people did not recognize the state of emergency they were in until it was too late. Residential living areas also pose a real threat to fire safety. This is largely due to the number of residents living in close proximity to each other, and that they may not be familiar with proper evacuation protocol. The Station catastrophe illustrates the importance of researching ways to prevent such tragedies in public spaces, including residential areas..

In 2011, the National Fire Protection Association (NFPA) released a report regarding fire statistics for dormitories, fraternities, sororities, and barracks from 2005-2009 in the US. During

that time there were 3,840 structure fires in those residences costing an annual average of 20.9 million dollars in damages. The NFPA has documented a 17% increase in dormitory fires from 1980 to 2009. An average of 3 civilian deaths and 38 fire-related injuries result each year from these types of fires (Evarts, 2011). These statistics underlie the concern for fire safety in such buildings, and highlight the importance of investigating what group influences drive responses to fire alarms in dormitory-like settings.

Evacuation rates during dorm fire alarms can vary for a number of reasons. A few of the reasons include: ignored alarms, vandalized or improperly maintained smoke alarms, and alcohol consumption (American Society of Engineers, 2005). Although there have not been any studies on nation-wide dormitory evacuation rates, fire officials attending to fire alarms at Minnesota State University, Mankato (MNSU) have reported students wandering hallways, gathering in lounges, and hiding in locked dorm rooms instead of evacuating (Bengtson, 2011). During the height of false alarms at MNSU an estimated 20% evacuation rate was observed, as cited in (Bengtson, 2011, p. 6) (D.N. Lehne, personal communication, August 10th, 2011). Despite the high energy one would expect during a dormitory fire alarm, students do not always show a sense of urgency to evacuate.

There is a substantial amount of anecdotal evidence of occupants failing to respond to fire alarms in public facilities (Proulx 2001). According to Proulx there are three main factors that have an impact on human behavior during a fire: characteristics of the occupant, characteristics of the building, and characteristics of the fire. Occupant characteristics such as age, mobility, and role within the building (such as being a visitor) can have a significant influence in predicting an occupant's behavior during a fire situation. In addition, the type of building the alarm occurs in as well as the sensory cues of the fire can have an impact on the behavior during an alarm. If a

person hears an alarm in a church they may react differently than in a movie theater. In addition, if a person sees or smells smoke they may react differently to an alarm. One area that Proulx does particularly highlight as having a significant role on the impact of human behavior during a fire alarm are the social cues given by others. He does mention that the level of commitment in an activity may influence the likelihood to evacuate, but never directly mentions the role of social influence.

A number of factors can contribute to a person's decision on how to act during an alarm; most fire safety researchers have ignored the role that others can have on a decision to evacuate. Cues such as body language, facial expressions and the decisiveness of movements could either promote or inhibit a proper evacuation. Although further research needs to be conducted to precisely determine which factors weigh more on human behavior, fire safety researchers have classified four main reasons occupants fail to respond to fire alarms. The four main reasons occupants fail to respond are: failure to recognize the signal as a fire alarm, unaware of the proper response, loss of confidence in the system because of nuisance alarms, and failure to actually hear the signal (Proulx, 2007). Occupants can often fail to recognize what an actual signal in a building is sounding for. In 1985 Tong and Canter found in a modest sample of building occupants that over 45% were unable to distinguish fire alarms from other types of alarms. In 2001, the National Research Council in Canada conducted a study with over 300 participants and found that only 14% could identify a slow whoop alarm as a fire alarm, and 38% were able to correctly identify a more traditional alarm bell as a fire alarm (Proulx, Laroche, Jaspers-Fayer & Lavallee, 2001). Being able to identify an alarm is a crucial step in fire safety, but identifying alone does not guarantee a proper response.

Perhaps the largest deterrent of proper response behavior during fire alarms is credited to the loss of confidence in the fire alarm system. Nuisance alarms can be classified as any sounding of the alarm when there is not an actual fire. For instance, pulled false alarms, test alarms, and fire drills are all examples of nuisance alarms (Proulx, 2007). Over time nuisance alarms can detrimentally affect human behavior during fire emergencies. In some cases occupants can become so calloused towards alarms that they may not even investigate the situation before discounting it as a false alarm. The two main factors that can affect the degree to which nuisance alarms negatively impact response rates are: the amount of time between nuisance alarms, and the conditions such as time of day or the weather outside. For example, if a building experiences four false alarms in a week compared to four a year it would be likely that those occupants would show a larger loss in confidence in the situation where four happen within one week. Time of day such as 2:00 p.m. versus 2:00 a.m. or a warm sunny day versus a cold cloudy day may also influence the degree to which one would comply with the system. More specifically, if false alarms continuously happen when bars close around 2:00 a.m. residents may just assume that the alarm is a prank given the time of night. There has not been any research on the exact number of nuisance alarms it takes for residents to completely lose faith in a system; however, experts in the field tend to agree that more than three nuisance alarms in a year can negatively affect the credibility of the entire system (Proulx, 2007). There also seems to be a misconception about nuisance fire alarms and mischievous young adults. Although many people assume that nuisance alarms are the result of pranks, the majority are actually due to system malfunctions. In 1999, the NFPA, as cited in Proulx, (2007) found that of the 2 million "nuisance alarm" calls in the country 44% were due to system malfunctions, 30% were calls where

someone thought there had been a fire when there was not a fire, 15% were mischievous false calls, and 11% were other false alarms such as bomb threats.

The final reason identified in fire safety research that occupants may fail to respond to an alarm is due to a failure to hear the alarm itself. In public buildings alarms may be located in corridors and not individual units and with other noises such as TV, stereo, air conditioning, etc., some occupants may not hear an alarm. Another problem that arises is an occupant's ability to hear an alarm while asleep. Multiple studies (Bruck, Reid, & Kouzma, 2004; Ball & Bruck 2004; Bruck, Thomas & Kritikos, 2006) have found that children and the elderly may have trouble hearing an alarm while sleeping, as well as adults who have consumed alcohol or are sleep deprived.

A solution to this problem may be more difficult than just increasing the volume of alarms. If alarms are too loud and go off frequently without actual fires tenants may be tempted to complain or even tamper with the system. It is also important to note that during emergency situations people must be able to communicate with each other. If an alarm is too loud it may negatively impact the ability for occupants to identify and decide what actions to take (Proulx, 2007).

Needless to say these four main reasons given by fire safety researchers can affect evacuation; however, they do not specifically mention the role social perception and expectations play in responses to fire alarms. Some people may have misconceptions of what behavior during a fire emergency actually looks like. These misconceptions can be problematic for dorm residents in particular if they have a schema for what they think a "real" fire will look like. They may fail to evacuate in an actual fire if it does not meet their expectation of what an emergency may look like. Movies and the media often portray human behavior during fires as somewhat

chaotic, which in most situations is not the case, especially in public buildings. Panic behavior has been defined as irrational behavior such as stampeding or fighting at the onset of a fire alarm (Proulx, 2001). Understanding this becomes important when investigating the influence social cues have on behavior during fire alarms. Three studies in the late 70s and early 80s (Sime, 1980; Keating, 1982; and Quarantelli, 1977) found little evidence of panic behavior in actual fire situations. Keating (1982) interviewed several survivors of major fires and concluded that panic behavior is quite uncommon. Keating stated, "Multiple deaths in fire tragedies are frequently headlined in the press by reports of panic behavior of the victims. Such conclusions by the press persist in spite of the insurmountable research evidence that concludes exactly the opposite" as cited in (Klote, Levin, & Groner, 1995, p.132). On the contrary, during a fire emergency, occupants typically survey the situation and act in a calm and collected manner. This research suggests that panic is not a root cause of people's inability to properly respond to fire alarms, but possibly other factors come into play, especially the social cues that other people give during an alarm.

Social and Environmental Cues That Influence Public Evacuation Rates

A relatively new concept to understanding fire evacuation involves examining the social and environmental cues occupants respond to during an emergency situation. Although fire safety researchers have examined the roles of occupants during fire situations they have not fully engaged in a social-psychological explanation of evacuation rates. Such an explanation may encompass the thoughts or expectations an individual may have during a fire alarm in the presence of others or when alone. More specifically, what influences how decisions are made and why? Fire safety researchers have indicated that occupants tend to survey a scene to figure out what role they should play given the situation. If an occupant is unfamiliar with a public

building or is a visitor, it is more likely that they will behave in conformation with what others are doing around them. A study conducted by Shields, Boyce, and Silcock in 1998 examined evacuation rates in a large retail store. An unannounced and unexpected fire drill was videotaped in the store in which the average time for customers to start moving after hearing the sound was 25 seconds. Customers in changing rooms were evacuated within 60 seconds of the alarm. The researchers concluded that the fast evacuation time by the customers was largely credited to the promptness of the sales staff. All cash counters were closed within 30 seconds of the alarm sounding, which suggest that customers or visitors in this case are likely to pick up cues from others when their role is ambiguous.

As previously mentioned, college residents have shown hesitation to behave in congruence with fire safety expectations in the advent of an alarm at MNSU. These behaviors may be the result of not properly identifying an alarm, not knowing proper fire protocol for a specific building, or other psychological components. Such psychological components may include the influence of social cues and the heuristics residents may use when deciding whether to evacuate during a fire alarm. This is especially true in public settings such as resident halls, movie theaters, or department stores. Several studies have shown that occupants will spend several seconds if not minutes in non-evacuation behaviors after the initial sounding of an alarm (Proulx, 2001). Non-evacuation behaviors can include finishing a conversation, saving data on a computer, gathering belongings, or any other behavior that postpones evacuation during the sound of an alarm. If groups of people participate in non-evacuation behaviors during fire alarm, others may interpret the lack of urgency as an indicator of a non-threating situation. Chances are that once a person sees others not reacting to the alarm, they themselves will not react which can lead to a contagious effect throughout the building. This is problematic because if non-

evacuation behaviors become the norm in public buildings people may not react properly to threating situations.

A situation illustrating this non-evacuation problem was seen in a study conducted by Proulx and Sime in 1991. Underground transport passengers were examined to see how they would react to a fire alarm in an underground station. Passengers did not react to the fire alarm and many continued waiting for a train, reading newspapers, or just standing still until staff prompted evacuation behaviors. It appeared that although the alarm was sounding, passengers were looking to others to see how to behave as opposed to evacuating. In the same study it was also found that when messages from a voice communication system informed passengers of the type of incident, its location, and provided instructions on what to do, it only took around 15 seconds for passengers to begin evacuation (Proulx & Sime, 1991). The voice communication system may have alleviated some of the ambiguity of the situation and prompted proper evacuation.

A study examining Canadian government buildings found that it took occupants on average 50 seconds to begin their evacuation even when the office workers had received training and were aware of standard fire procedure (Proulx & Pineau, 1996). Video recordings showed occupants partaking in non-evacuation behaviors such as filing papers, gathering belongings, and finishing phone calls even though training had been provided. This may be the result of a "milling" process where other workers examined what their coworkers were doing and carried on with normal activity as if no threating cues were picked up on. These studies conclude that evacuation start times can be influenced based on the information occupants are provided with. When others such as the staff in the department store (Shilds, Boyce, & Silcock, 1998) act promptly and decisively during an alarm it can have a positive effect on people whose roles in

that situation may be ambiguous. Occupants also seem to take the situation more seriously when receiving a message through a voice communication system such as that in the Proulx and Sime (1991) study.

In public buildings, especially ones in which occupants are just visiting, it can be extremely difficult to for occupants to fully know what the proper plan of action is during a fire alarm. When ambiguity is high occupants may use external cues such as observations from others to decide how to act. It has been well documented in the social psychology literature that the influence of others can lead us to conform because we see them as a source of information (Aronson, Wilson, & Akert, 2007). This phenomenon is known as informational social influence and three situations in particular have been identified as catalyst to this kind of conformity. The most crucial variable to when people are likely to use others as a source of information is when a situation is ambiguous. The second variable is when a situation is an emergency in which people have little time to stop and think. The third and final variable is when other people are seen to be experts (Aronson et al., 2007). All three of these situations can play a factor in a dorm resident's decision to evacuate during an alarm, when the proper response to a fire alarm can be ambiguous, startling, and sometimes involve authority figures.

Training could offer the knowledge needed for occupants to proceed with a proper response, however not all public places such as a department store can effectively train all of their occupants. In circumstances such as these it becomes imperative to have staff and other personnel trained properly especially if occupants are looking to others for cues.

Pluralistic Ignorance

Researchers in social psychology have also examined the effects of other people's actions on our own behaviors during emergency situations. In 1968 researchers Latané and Darley

published a classic social psychology study which investigated the role group influences had on individual behavior in an emergency situation. There were three conditions in which participants were placed into to test the role of group influence during a perceived fire threat. Participants were asked to complete a questionnaire in a room where smoke was purposely blown out of a vent after the completion of two pages of the questionnaire. Researchers observed participants through a one-way window. Participants either filled out the questionnaire alone, in the presence of two confederates, or in the presence of two other "naïve" participants. Confederates were told to act as passive as possible when the smoke began to enter the room.

The median participant in the alone condition reported the smoke within two minutes of first noticing it, and 75% of these participants reported the smoke to an experimenter outside of the room within six minutes. In the confederate condition only 10% of participants reported the smoke. In 38% of groups where participants were with two other naïve subjects at least one participant reported smoke. Four minutes was the fastest time a participant in the naïve group reported the smoke. This study provided clear evidence that other people's behavior strongly influences our own, even in emergency situations.

A related phenomenon similar to pluralistic ignorance is the bystander effect. The bystander effect commonly refers to a reduced likelihood of a person witnessing an emergency to step in and help a victim if other bystanders are not doing so. The more bystanders there are the stronger the effect is. There is a greater likelihood for a person to intervene when they are alone then when in the presence of others (Aronson et al., 2007). The bystander effect is not limited to emergency situations, and in 2000 Markey found evidence for the bystander effect in chat rooms. There were two conditions in which a question was asked to an entire chat group or directly to random individuals in the chat room. When the entire group was asked the question "Can anyone

tell me how to look at someone's profile?" it took a significantly longer time for someone to respond than it did if the question was asked directly to a random person in the chat room (Markey, 2000).

Another classic study conducted by Latané and Darley (1968) examined the rate to which people would respond to a woman in distress. This experiment had three conditions in which participants were asked to fill out a questionnaire in a room next to another room where a woman (confederate) was filing papers. The four conditions were whether the participants were alone, with a "stooge", with a stranger, or with friends. A curtain separated the rooms, which was clearly unlocked to the participants. The confederate in the filing room played a tape that lasted 130 seconds; in the recording, it was quite evident the woman had fallen off a chair while reaching for a stack of papers. The woman's voice on the tape said phrases like "Oh, my God, my foot… I can't move it... Oh my ankle, I can't get this thing off of me." The dependent variable in this study was whether the subjects took action to help the victim and how long it took them to do so. The results of the study showed that 70% of participants in the alone condition offered to help the victim while only 7% in the stooge condition did so. It should be noted that the stooge was also a confederate who, when the incident happened, shrugged their shoulders and acted nonchalantly toward the woman in distress. Only in 40% of the stranger groups did at least one person offer aid. The friends condition yielded higher response rates than the stranger condition where in 70% of friends groups at least one person offered help. The median time it took friends to first respond was 36 seconds while it took strangers over 130 seconds to first respond (Latané & Darley 1968). This study highlights the effect to which the social influence of a friend versus a stranger can have on responding to an emergency situation.

This study also suggests that when alone, people may be more inclined to step up and take action instead of waiting for another person to take the lead.

Latané and Darley (1969) offered a rational model for what may occur in the thought process of humans involved in an emergency situation. First, an individual must notice or be aware of the situation. Then they must interpret the event based on the situational cues they receive. Next they must decide if they have a responsibility to act. If the individual does decide to act, in which way will they provide assistance? Finally the individual must implement or carry out the decision they have made. The first part of Latané and Darley's model aligns with Proulx's explanation that people need to be able to recognize the situation, in this case a fire alarm. Once a person is aware, they then need to decide if and what action to follow given their role in a building (Proulx, 2001). Latané and Darley's model differs from other fire research in the sense that it provides a strong emphasis on the idea that the interpretation of situational cues can determine if a person decides to act. Latané and Darley's model is rational, but in emergency situations individuals may not have all the necessary information, or may process multiple pieces of information simultaneously. In addition, the information they search for may be selective based on what they expect to find.

Confirmation Bias

During a dormitory fire alarm, residents have the choice to search for information that confirms a false alarm, confirms an actual fire, or both. Residents that may have a hunch that the alarm is false may interpret facial expressions, body language, or a lack of urgency as evidence that the fire alarm is not a real threat. Likewise, if a resident has a feeling the fire alarm is the result of an actual fire they may search for cues such as smoke, firefighters, and people rushing towards an exit. Although it would be beneficial to search for both confirming and disconfirming

information, people tend to disproportionately search for information that confirms an expectation. The confirmation bias, as defined by Nickerson (1998), is a less explicit, less conscious, one-sided case-building process where individuals unwittingly select information that corresponds with an already held belief or expectation. That is, people do not always use a deliberate process of searching for both confirming and disconfirming evidence when making a decision. More often then not people select and give undue weight to information that supports an initial thought while failing to gather evidence that discounts or opposes it. In 2008, a study conducted by Hill, Memon, and McGeorge found that undergraduate students who were put in an experiment to investigate the innocence or guilt of another tended to generate and ask more guilt-presuming questions when primed for guilt. Their informational searches were lopsided, which the authors proposed as evidence of the confirmation bias. This phenomenon could influence the way information is processed by public building residents during a fire alarm. If residents search for information that an alarm is false they may pick up on environmental cues that correspond with that belief as opposed to searching for information that suggest the fire alarm is a legit threat to their safety. This process may be escalated during an intense situation such as an alarm.

The previous research has indicted that fires do pose a threat to dormitory residents. One emergency situation could result in a catastrophic tragedy. Fire safety researchers have provided the physical causes and have touched on some of the psychological causes of the failure to evacuate. However, little fire research has focused on the social influence that others have on dormitory residents' responses to fire alarms. In particular, an important question is who has more influence on the decision of a dorm resident to exit during an alarm, and who has more influence on them not to exit during an alarm? Previous research has indicated that in public buildings occupants do not panic at the sound of an alarm, but rather take time to evaluate the

situation. During this time social and environmental cues can play a large role on the behavior of occupants. Given the dynamic of dormitory halls: cues from friends, unknown residents, and authority figures may result in different responses to scenario-based questions regarding fire alarms. In addition, are residents falling victims of the confirmation bias during alarms? That is, do they state looking for more information of a false alarm than a real alarm when a fire alarm is sounded in their building?

Taking into account all of the previous research we have developed a set of hypotheses to test the role social influence has on dormitory residents' responses to fire alarms.

H1: Participants in the alone condition will self-report a greater likelihood to exit during a fire alarm when given no social cues from a CA, friend, or unknown resident. More specifically, the lack of social cues from others will prompt decisive action to evacuate.

H2: Participants in the friend condition will self-report a greater likelihood to evacuate when hearing their friend give instructions to evacuate than will participants who hear an unknown resident giving instructions.

H3: Participants in the CA condition will self-report that instructions given by their CA will have a greater influence on their decision to evacuate than instructions given to participants in the unknown resident condition.

H4: Participants in the unknown resident condition will indicate a greater likelihood to take time to survey the situation when they hear an unfamiliar voice giving instructions than will those in the CA or friend condition.

H5: Participants in the friend condition will self-report a greater likelihood to try and wait out the alarm than participants in the CA or unknown resident condition in the petition scenario.

H6a: Participants will report expecting dormitory fire alarms as "false alarms" more than they will report them being "actual alarms."

H6b: Expectations of a false alarm will lead residents to report initially searching for information confirming a false alarm as compared to initially searching for information confirming a legitimate fire.

H7: When shown a video of a fire alarm situation, participants will report a greater likelihood to exit when given the social cues of a "real alarm" versus a "false alarm."

Methods

The two most common ways previous research has indicated collecting data in regards to thoughts and perceptions of fire alarms are by questionnaires and interviews of burn victims (Proulx, 2001). The current study was aimed to investigate the role social influences and cognitive processes played in the responses of dormitory residents to fire alarms at Minnesota State University-Mankato. We are interested in the social cues and situations that either promoted or inhibited self-reported compliance during dormitory fire alarms. We were also interested in the process in which information was evaluated during an alarm. We asked some general fire safety knowledge items to see if there were gaps in residents' basic knowledge of fire safety. We used a questionnaire to ask participants questions about demographic information, and also included a one-minute video clip either involving compliance or non-compliance cues. In addition, we created four different scenarios in which participants were randomly assigned to. The first set of scenarios can be seen in the table below followed by the second set of scenarios.

Table 1
Conditional Hallway Scenarios

Scenario	Condition
Imagine you are walking down your hallway some afternoon, suddenly an alarm sounds. You recognize that the alarm is a fire alarm. In the distance you hear your CA's voice giving instructions to a group of residents on where to evacuate. What do you do?	CA
Imagine you are walking down your hallway some afternoon, suddenly an alarm sounds. You recognize that the alarm is a fire alarm. In the distance you hear an unfamiliar voice giving instructions to a group of residents on where to evacuate. What do you do?	Unfamiliar
Imagine you are walking down your hallway some afternoon, suddenly an alarm sounds. You recognize that the alarm is a fire alarm. In the distance you hear a friend's voice giving instructions to a group of residents on where to evacuate. What do you do?	Friend
Imagine you are walking down your hallway some afternoon by yourself, suddenly an alarm sounds. You recognize that the alarm is a fire alarm. You do not hear any other voices. What do you do?	Alone

Table 2
Conditional Petition Scenarios

Scenario	Condition
Imagine your CA comes to your room and asks if you have free time to talk about a new campus policy. They tell you that they have a petition they would like for you to sign. You happen to have some free time and invite them in. After a few minutes of conversation the fire alarm sounds. What do you do?	CA
Imagine an unknown resident comes to your room and asks if you have free time to talk about a new campus policy. They tell you that they have a petition they would like for you to sign. You happen to have some free time and invite them in. After a few minutes of conversation the fire alarm sounds. What do you do?	Unfamiliar
Imagine a friend comes to your room and asks if you have free time to talk about a new campus policy. They tell you that they have a petition they would like for you to sign. You happen to have some free time and invite them in. After a few minutes of conversation the fire alarm sounds. What do you do?	Friend
Imagine you are by yourself in your room doing some reading about a new campus policy. You read that there is a petition circulating campus and you become more intrigued. After a few minutes of reading the fire alarm sounds. What do you do?	Alone

While previous fire research has focused on various elements of evacuation, none have specifically looked at the influence others have on dormitory residents using scenario manipulation; thus making this study unique.

Participants

A total of 229 subjects participated in this study. Of the 229 only 161 indicated that they were either a current resident or had previously lived in the dorms. Given the nature of the current study all participants who indicated not living in a dorm were removed from analysis. Of the participants who indicated they currently or had lived in the dorms, 39 were in the CA condition, 39 were in the unknown resident condition, 38 were in the friend condition, and 42 were in the alone condition. The participants were undergraduate students enrolled at Minnesota State University-Mankato. There were 121 females accounting for 75.1% of the sample and 40 males accounting for 24.9% of the sample. The average age of participant was 20.16 years old. Four participants indicated that they were international students while 157 indicated they were not. When asked to indicate how many years in college the participants' had attended, 55 responded 1 year, 34 responded 2 years, 39 responded 3 years, 31 responded 4 years, 1 responded 5 years, and 1 responded 6 or more years. The average years attended by participants was approximately 2.33. When asked to indicate all ethnicities participants belonged to, 143 responded White/Caucasian, 12 responded Black/African/African-American, 7 responded Asian/Asian-American, 3 responded Native American/Pacific Islander, 2 responded Hispanic/Latino, and 2 responded other.

Research Design

The current study used a questionnaire that asked participants questions about demographic information and fire safety knowledge, situational items addressing the social cues that may influence decisions regarding fire alarms, information processing during an alarm, and an embedded video of a fire alarm.

Fire Safety Knowledge Items

Participants were asked a number of fire safety-related questions to determine any gaps in their knowledge. One question asked, "How safe is your dorm room from a fire?" Another item asked participants to indicate how many minutes they thought could elapse before they were in serious danger from a fire. Participants were also asked to indicate on a slider scale from 0-100 the percentage of times a fire alarm is a false alarm. In addition 10 true/false questions were asked, for example, "When inhaled, carbon dioxide is more deadly than carbon monoxide."

Scenario Based Items

As previously shown in Table 1 and Table 2, two different scenarios were created to test differences between groups. For example, "Imagine you are walking down your hallway some afternoon, suddenly an alarm sounds. You recognize that the alarm is a fire alarm. In the distance you hear your (CA's/Friend's/ An Unfamiliar/No One's), voice giving instructions to a group of residents on where to evacuate. What do you do?" Form A scenario involves your CA, Form B involves an unfamiliar voice, Form C involves a friend, and Form D is a scenario in which you are alone. Participants indicated on a 5-point Likert scale how strongly they agreed or disagreed with the following behaviors: Take time to survey the situation, Join the group, Try to ignore the alarm, Try to go back to my room, Tell others to join the group, and Try to exit immediately. Comparisons between the different conditional responses were made to detect any significant differences in means.

The second scenario offered a slightly different situation in which an alarm was sounded: "Imagine a friend comes to your room and asks if you have free time to talk about a new campus policy. They tell you that they have a petition they would like for you to sign. You happen to have some free time and invite them in. After a few minutes of conversation the fire alarm

sounds. What do you do?" Participants then indicated on a 5-point Likert scale how much they agreed they would engage in the following actions: Initiate an exit plan, Try to wait out the alarm, Wait for the other person to make the first move, Continue talking about the petition, and Exit regardless of the other person's decision. The alone condition stated: "Imagine you are by yourself in your room doing some reading about a new campus policy. You read that there is a petition circulating campus and you become more intrigued. After a few minutes of reading the fire alarm sounds. What do you do?"

Information Processing Items

All participants were asked questions about the way they process information during a fire alarm. More specifically, items were included asking about their expectations of whether alarms are usually false or usually real. In addition they were asked if they look for more "real alarm" cues or "false alarm" cues. "Real alarm" cues refer to social cues one would expect during an actual fire and "false alarm" cues refer to those cues one would expect if they thought there was no danger while the alarm sounds. One item asked, "Some people are really good at judging false alarms vs. real alarms. Would you consider yourself a person who is good at judging false alarms versus real alarms?" Another item asked, "When a fire alarm is sounded and you think it may be a 'false alarm,' you look for more information that supports your hunch than goes against it." These items were answered on a 5-point Likert scale.

Video Scenario

There were two randomly assigned conditions in which one-minute video clips of a fire alarm situation were shown to participants. The videos showed two college-aged women walking down an apartment hallway talking about an exam they had just taken; suddenly a smoke detector went off. In the first video one of the women suggested that the alarm was "probably a

real concern" and "we should get out of here." When the fire alarm sounds in the second video the same woman suggested that it is "probably just another one of those false alarms" and that "they happen all the time." After the video ends participants are asked how likely they are to partake in the following actions: exit immediately, ignore the alarm, look to see what others are doing in the building, and wait for someone else to make the first move. Responses were given on a 5-point Likert scale.

The first section of the questionnaire was the same for all participants including items about demographic information, general fire safety knowledge, and information processing. The four conditions of scenario-based section were randomly assigned to the four comparison groups. In addition, the video scenario was randomly assigned between two groups: the "real alarm" cue and the "false alarm" cue. The questionnaire took participants about 10-15 minutes to complete.

Procedure

Data was collected using Sona Systems, an online research system used at Minnesota State University. Some students enrolled in psychology courses were given extra credit for participation. Students were able to access and complete the questionnaire online. Informed consent and debriefing were included in the questionnaire.

Results

To analyze items on the general fire safety section of the questionnaire frequencies, means, and standard deviations were calculated. When asked to report how many minutes could elapse before the start of a fire becomes dangerous, 45.2% of participants responded between 0-3 minutes while 54.7% indicated times longer than 3 minutes. Table 3 shows in more detail the

reported length of time participants indicated it would take from the start of a fire to be in serious danger.

Table 3

Minutes Participants Reported Could Elapse Before The Start Of A Fire Becomes Dangerous

Minutes	# Of Participants
0-3	72
3-6	49
6-9	29
9-12	4
More than 12	5

Participants were also asked to answer 10 true/false items. The number of participants who responded true or false to those items can be seen in the table below.

Table 4

Number of Participant Responses To True/False Items About Fire Safety

Item	True	False
In a fire, you are more likely to die from burns than from smoke inhalation.	18	142*
Carbon Monoxide is one of the highest factors in fire related deaths.	137*	123
When inhaled, Carbon Dioxide is more deadly than Carbon Monoxide.	44	116*
A fire is only dangerous once you begin to smell smoke.	9	150*
I will be fined if I am caught in my dorm room when a fire alarm is sounded.	108	50*
There are legal ramifications for pulling a fire alarm without a legitimate cause for doing so.	154*	5

If a CA is present in the building, he/she is responsible for telling me to leave the building in case of a fire.	73	85*
I am not at serious risk during a fire because my dorm is made of concrete or brick.	9	148*
The fire alarm in my dorm has been able to wake me up when I was sleeping.	138	20
I would need physical assistance evacuating my dorm if a fire alarm was sounded.	4	153

**indicates the correct response for those items with definitive answers*

Participants also indicated how safe they thought their dorm buildings were from fire on a 5-point scale where 1 = not safe at all, 3 = somewhat safe, and 5 = very safe. One hundred fifty-nine participants answered this question ($M = 3.15$, $SD = 1.04$). Participants were also asked to indicate on a slider scale from 0-100 what percent of the time a fire alarm that went off in their dorm was false. The mean was 80.78% with a standard deviation of 24.30. When asked if a participant had ever avoided a fire alarm by staying in their dorm room, 23.5% indicated they had, while 73.5% indicated they had not. Lastly, a few social items were added to the general fire safety section. These three items were answered on a 5-point Likert scale where 1 indicated strongly disagree and 5 indicated strongly agree. The results of these items can be seen in Table 5.

Table 5

Social Items Involving Evacuation

Item	*M*	*SD*
If I am already involved in an activity I am more likely to evacuate during an alarm.	3.26	1.00
Dorm residents usually panic when a fire alarm goes off.	2.36	.98
If I am by myself during a dorm fire alarm I am more likely to exit than with others	2.82	1.09

Before testing our hypotheses, overall means and standard deviations were calculated for each of the responses to the scenario based items. Table 6 shows the overall means for each item in the hallway scenario and Table 7 shows the overall means for each item in the petition scenario. Responses were made on a 5-point Likert scale where 1 indicated strongly disagreeing with the action during an alarm and 5 indicated strongly agreeing with the action.

Table 6

Overall Means Of Responses Participants Gave In The Hallway Scenario

Response	*N*	*Mean*	*SD*
Take time to survey the situation	158	3.11	1.16
Join the/a group	158	3.82	.94
Try to ignore the alarm	158	1.68	.78
Try to go back to my room	158	1.84	.91
Try to exit immediately	158	3.85	.99

Table 7

Overall Means Of Responses Participants Gave In The Petition Scenario

Response	*N*	*Mean*	*SD*
Initiate an exit plan	158	3.70	.91
Try to wait out the alarm	157	1.92	.95
Continue talking about the petition	114	1.80	.80
Exit regardless	157	3.80	1.10

To test *H1-H3* two ANOVAs were conducted to show if there were differences in the responses given by participants in each scenario.

Hypothesis 1 stated that participants in the alone condition would self-report a greater likelihood to exit during a fire alarm when given no social cues from a CA, friend, or unknown resident. An analysis of the variance showed a significant difference ($F(3,153) = 4.31$, $p < .01$) in the petition scenario. Post hoc analysis using the LSD post hoc criteria showed that participants in the alone condition were significantly more likely to indicate exiting when reading in their room ($M = 4.31$, $SD = .78$) than when having a conversation with a CA in their room ($M = 3.56$, $SD = 1.45$), a conversation with a friend in their room ($M = 3.62$, $SD = 1.04$), or having a conversation with an unknown resident in their room ($M = 3.64$, $SD = .99$). This finding supports Hypothesis 1.

No evidence was found to support Hypotheses 2 and 3. In order to test *H2* and *H3*, an ANOVA was conducted to determine if there was a significant difference between the type of voice a participant heard giving instructions to evacuate and their likelihood of exiting. An analysis of the variance showed no significant difference between the four groups ($F(3, 154) =$

.524, $p = .66$). More specifically, hearing a friend give instructions ($M = 3.92$, $SD = .97$) did not significantly influence a participants' decision to exit any more than an unknown resident ($M = 3.77$, $SD = .959$). In addition, hearing a CA give instructions to evacuate ($M = 3.74$, $SD = 1.09$) was not any more influential than an unknown resident ($M = 3.77$, $SD = .959$). These findings do not support our hypotheses *H2* and *H3*, however a chi square test of goodness-of-fit was performed to determine whether participants equally choose CAs, friends, or unknown residents as being most influential in their decision to exit or not to exit during a dormitory fire alarm. When asked who would be more likely to influence participants decision to exit during a dormitory fire alarm participants' responses were not equally distributed ($\chi^2(2, N = 157) = 85.05$, $p < .001$). Ninety-seven respondents indicated that their CA was most influential, 57 reported their friends, and 3 participants said an unknown resident. The same test was conducted to see if responses were equally distributed when asked which of the three would be most likely to influence a participant's decision "NOT" to exit. The chi-square test of goodness-of-fit yielded significant results ($\chi^2(2, N = 157) = 24.20$, $p < .001$). Twenty-nine participants said their CA would be most likely to influence their decision not to exit during a fire alarm, 49 responded an unknown resident would, while 79 reported their friends would be most influential. These findings provide partial evidence to support the notion that friends and CAs may not equally influence dorm residents' decision to exit during a fire alarm.

Hypothesis 4 stated that participants in the unknown resident condition would be more likely to indicate taking time to survey the situation than would participants in the CA and friend condition. No such evidence was found when an ANOVA was conducted ($F(3, 154) = 1.77$, $p > .15$. The mean for participants in the unknown resident condition was ($M = 3.10$, $SD = 1.02$),

while the mean for participants in the CA condition was ($M = 3.31$, $SD = 1.17$) and in the friend condition ($M = 2.76$, $SD = 1.15$).

Hypothesis 5 stated that participants in the friend condition would self-report a greater likelihood to try and wait out the alarm than participants in the CA or unknown resident condition for the petition scenario. An ANOVA did not find significant differences between the groups ($F(3, 154) = 1.09$, $p > .35$). Participants in the friend condition ($M = 1.89$, $SD = .88$) were not any more likely to indicate they would wait out an alarm than participants in the CA condition ($M = 1.74$, $SD = 1.02$) or the unknown resident condition ($M = 1.90$, $SD = .88$) in the petition scenario.

Although we did not hypothesize a significant difference between the four conditional responses to "join a group" in the hallway scenario, an ANOVA detected such differences. An analysis of the variance showed a significant difference ($F(3, 154) = 19.36$, $p < .001$). Post hoc analysis using LSD post hoc criteria showed that participants who heard a voice giving instructions to a group on where to evacuate: CA ($M = 4.10$, $SD = .88$), friend ($M = 4.08$, $SD = .712$), or unfamiliar ($M = 4.15$, $SD = .63$) were significantly more likely to indicate trying to join the group than participants in the alone condition who heard no voice and were asked if they would try to join a group ($M = 3.00$, $SD = .96$).

Table 8

How Likely A Participant Would Try to Join a Group By Condition

Condition	*N*	*M*	*SD*
CA	39	4.10	.88
Friend	38	4.08	.71
Unknown Resident	39	4.15	.63
Alone	42	3.00*	.96

** Indicates significance at or below the $p < .05$ level*

To test *H6a* and *H6b* two paired-samples t-tests were conducted. The first paired-samples *t*-test indicated a significant difference within participants who indicated that their first reaction to every fire alarm was that it is false ($M = 3.51$, $SD = 1.1$), as opposed to their first reaction to every fire alarm as it being an actual fire ($M = 2.29$, $SD = .90$), ($t(154) = 8.30$, $p < .001$). This finding provides evidence that supports *H6a*. However a second paired-samples *t*-test did not yield significant support for *H6b* which predicted that participants would indicate initially searching for cues of a false alarm ($M = 3.02$, $SD = .99$) more so than initially searching for cues of a legitimate fire ($M = 3.11$, SD = 1.1), ($t(156) = -.991$, $p = .323$). It should be noted that when participants were asked, "When a fire alarm is sounded and you think it may be a false alarm, you look for more information that supports your hunch than goes against it" the mean response was ($M = 3.21$, $SD = 1.06$), which was slightly over the midpoint or neutral response.

To test *H7*, a series of 4 independent samples *t*-tests found no significant differences between the responses participants gave in regards to the situational videos they watched. When asked how likely they were to "exit immediately" participants who watched the video with the "real alarm" concern ($M = 3.67$, $SD = 1.03$) were not significantly different than those who

watched the "false alarm" video (M = 3.58, SD = 1.04), ($t(155)$= -.552, p > .58). When asked how likely they would be to ignore the alarm, people watching the "real alarm" video were not significantly less likely (M = 2.09, SD =.98) to report ignoring the alarm as those in the "false alarm" condition (M=2.21, SD=.97), ($t(154)$ = .747, p > .45). The two groups did not significantly differ when asked to report the likelihood they would look to see what others were doing in the building, namely those in the "real alarm" cue condition (M=3.49, SD= 1.13) were not significantly different than the in the "false alarm" condition (M = 3.51, SD=1.14), ($t(154)$=.070, p > .94). Finally, participants in the "real alarm" cue condition (M= 2.75 SD=1.02) were not significantly less likely than those in the "false alarm" condition to report waiting for someone else to make the first move (M= 2.77, SD= 1.05), ($t(154)$=.113, p = .91). Refer to Table 9 for all of the mean responses for the video condition.

Table 9

Participants Responses For The Likelihood Of A Behavior Given the Scenario In The Video

Behavior	Video Condition	*N*	*M*	*SD*
Exit immediately	"False Alarm"	81	3.58	1.04
Exit immediately	"Real Alarm"	76	3.67	1.03
Ignore the alarm	"False Alarm"	81	2.21	.97
Ignore the alarm	"Real Alarm"	75	2.09	.98
Look to see what others are doing in the building	"False Alarm"	81	3.51	1.14
Look to see what others are doing in the building	"Real Alarm"	75	3.49	1.13
Wait for someone else to make the first move	"False Alarm"	81	2.77	1.05
Wait for someone else to make the first move	"Real Alarm"	75	2.75	1.02

Discussion

Results of our analyses have answered some of the research questions we sought to answer, and have also provided us with new research opportunities in the future. Before discussing our hypotheses it is important to take a closer look at the general fire safety questions.

Most of our findings are consistent to the findings of the survey conducted by Bengtson in 2011. While the majority of responses waved no red flags, a few of the items should be highlighted. First, under half of the participants (72) indicated that they were in serious danger within the first three minutes of a fire. That means the rest of the participants (87) indicated that they were not in serious danger until after three minutes of the start of a fire. This is problematic, because like the tragedy at 'The Station,' some fires can engulf a building in a very short period of time. Second, 27.2% of participants believed the following statement was true, "When inhaled, Carbon Dioxide is more deadly than Carbon Monoxide." This indicates that there may be a gap in knowledge for some current and former dorm residents about the dangers of carbon monoxide versus carbon dioxide which is the by-product of respiration. Third, 23.5% of participants indicated that they had avoided a fire alarm by staying in their dorm. It is pretty straightforward why this is problematic, but consider the effect it could have on others. That is, if staying in your room becomes the norm, or people think it is OK to do, they may put themselves and others in dangerous situations. On a similar note 66.7% of participants thought they would be fined if they were caught in their dorm room during a fire alarm. This is interesting because currently MNSU has no fine in place for students who do not evacuate during a fire alarm. Finally, participants on average disagreed more than agreed ($M = 2.82$, $SD = 1.09$) with the following statement "If I am by myself during a dorm fire alarm I am more likely to exit than

with others." This response is intriguing given the responses about being alone in the petition scenario where participants indicated being more likely to exit.

Regarding hypothesis 1, we were able to find support that when being alone, participants indicated they would be more likely to evacuate during a fire alarm than when having a conversation with another person in their dorm room. This finding is consistent with the work of Latané and Darley (1968). It appears when people do not have others to influence their decision they are more likely to indicate evacuating on their own. It should be noted that participants in the alone condition did not indicate a significantly greater likelihood to evacuate than did participants given cues to evacuate by a CA, friend, or an unknown resident. More specifically, all of these groups reported they were likely to evacuate. The lack of significant differences in the hallway scenario could be the results of the social cues given by the CA, friend, and unknown resident. That is, since the instructions given by these individuals were to evacuate and given to an entire group, it may have increased the likelihood a participant would self-report evacuating.

An unexpected finding that yielded significant differences was the likelihood a participant would "join a group" in the hallway scenario. It seems somewhat intuitive, but when a participant hears someone giving instructions to a group of people on where to evacuate they are more likely to indicate joining that group than participants who are by themselves and hear nothing. Once again this finding supports informational social influence or the tendency to think others know something you do not. Participants in the CA, friend, or unknown residents condition may think that the group knows something they do not, however when participants are alone there may be less of a tendency to seek others. In addition, just because someone is instructing a group does not necessarily mean that the instructor is giving the proper instructions.

It may be more beneficial for dorm residents to imagine they are alone during fire alarms as opposed to in a group.

Hypotheses 2 and 3 were not supported in the scenario-based items. Although prior research has indicated a greater likelihood for individuals to act in the presence of an authority figure or a friend, we were unable to significantly detect a difference. It was not clear in this questionnaire that a friend's influence would increase the likelihood of exiting any more than an unknown resident. It was also unclear that an authority figure such as a CA would increase the likelihood that a participant would report exiting given the scenario. However, the chi-square-goodness-of-fit provided partial support for the idea that the influence to exit during a fire alarm is not equally distributed. It appears from the frequencies of responses that a CA has a stronger influence on the decision of a dorm resident to exit during a fire alarm. This could be the result of participants thinking their CA is responsible for their exit, or the idea that because they are the "expert" they have more knowledge of the situation. It was also interesting to find that participants indicated that their friends had a stronger influence on their decision not to exit during a fire alarm. If we consider the number of CAs and friends a dorm resident may have, it is probably less than the number of unknown residents in their dorm building, yet in these two situations participants reported that unknown residents did not share an equal amount of influence.

We hypothesized that participants in the unknown resident condition would indicate a greater likelihood to take time to survey the situation when they heard an unfamiliar voice giving instructions than would those in the CA or friend condition. We were unable to find evidence to support hypothesis 4. We thought that when the source giving the cue was not familiar to the participant they would indicate taking more time to survey the situation before making a

decision. However it appears that taking time to survey the situation does not significantly change based on who is giving the instructions.

Hypothesis 5 stated that participants in the friend condition would self-report a greater likelihood to try and wait out the alarm than participants in the CA or unknown resident condition in the petition scenario. We thought that a friend who had an invested interest in having a petition signed could lead to participants indicating a greater likelihood to wait out the alarm in their rooms. In addition it seems more likely that a friend would suggest waiting out an alarm more than a CA or unknown resident given the petition scenario. This turned out not to be the case, and regardless of the condition, participants indicated they disagreed with the idea they would wait out the alarm in their rooms.

Having participants fill out information about informational search processes can be somewhat problematic. It is difficult to truly capture what information one would search for during a fire alarm. However, we were able to find evidence that supports that participants are more likely to think that when a fire alarm is sounded it is false more often than real. Although this expectation is accurate with the amount of false alarm compared to real alarms it can still bias the social cues dormitory residents may search for. We were unable to specifically find evidence supporting *H6b*. When we asked if participants initially search for more information confirming a false alarm or initially search for more information confirming a real alarm they reported means close to the neutral point of 3, which were not significantly different.

We expected the video clip to produce significantly different responses given the suggestion of a "real alarm" or a "false alarm." Although we were unable to find significant differences it should be noted that all of the means were in the predicted direction. More

specifically we might expect that given a real cue a participant would be more likely to exit during an alarm and less likely to ignore it.

It is important to note that the findings in this study can be used in training for future dorm residents. Prior research and this research alike have both shown that when participants are alone they are more likely to act during emergency situations. Perhaps educated dorm residents with training may reduce the threat that pluralistic ignorance can pose. An example of this occurred in 1998 at Cornell University when a student who had just learned about the bystander effect in her Introduction to Psychology course saw another student attempting suicide. At first the emergency produced some confusion, but after remembering that if she did not step in and help others would likely not step in and help too. She decided to lead the intervention and saved a life (Aronson et al., 2007). If firefighters and campus officials can educate and provide proper training to dorm residents it may help them recognize that they should act or behave as if no one was around, it could potentially save lives.

Limitations

Perhaps the largest limitation of this study is that it used self-report to measure intended behaviors. What people say and what they actually do can differ. We tried to combat this problem by using descriptive scenarios and a video to try and make the participants imagine how they would respond. Unfortunately, conducting an experiment using an actual fire alarm is problematic because it in and of itself can reduce the credibility of the fire system. In the future researchers should try to incorporate an actual alarm, hopefully in conjunction with an already scheduled university fire alarm. In addition to this limitation we suspect that the social desirability bias influenced responses. Participants may have reported what they thought we wanted to hear, or the response that fire marshals would want to hear. Another limitation was our

sample. Initially we wanted 200 participants all of whom lived in the dorm currently or in the past. We did not expect that 67 participants of the 229 participants would not currently or have ever lived in the dorms. Another issue with our sample is that it is not representative of the dormitory residents at MSU, in particular the proportion of males to females.

Future research should continue to investigate the role social influence has on dormitory residents. Increasing numbers of college enrollment on campuses throughout the country increases the potential threat for tragedy. Perhaps virtual simulations could be used to create an emergency setting that would not lose confidence in the system, but still provide a more realistic experiment then a self-report measurement. It would also be interesting to look at gender differences and whether the person giving the cue is of the same or opposite sex. Another direction could examine the size of a crowd and how that influences dormitory fire compliance. This research is important and we can still discover new ways to help prevent the loss of lives in dormitory fires.

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