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Effects of Television Weather Broadcasters on Viewers During Severe Weather: To Be or Not To Be On-Screen

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Effects of television weather broadcasters on viewers during severe weather: To be or not to be on screen

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An association was tested between the presence of a television weather broadcaster on-screen and viewers' likelihood to seek shelter, measured via risk perception and preventative behavior. Social networking websites were used to recruit respondents. Four clips of archived severe weather videos, one pair (on-screen and off-screen broadcaster) using the reflectivity product and another pair (on-screen and off-screen broadcaster) using velocity product, were presented to participants. Viewers' trust and weather salience were also quantified for additional interactions. A relationship between viewers' risk perception ($p_{reflectivity} = 0.821$, $p_{velocity} = 0.625$) and preventative behavior ($p_{reflectivity} = 0.217$, $p_{velocity} = 0.236$) and the presence of the broadcaster on-screen was not found. The reflectivity product was associated with higher risk perception and preventative behavior scores than the velocity product ($p_{rp} = 0.000$, $p_{pb} = 0.000$).

Key words: weather broadcaster, on-screen, reflectivity, velocity, risk perception, preventative behavior, trust, weather salience, tornado warning response

DEDICATION

I dedicate this work to all the people who were affected by the severe weather outbreak on April 27, 2012 and the many weather broadcasters who worked tirelessly to help save lives and property.

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I would like to take this opportunity to recognize a few people whose aid and encouragement made this work possible: Kathleen Sherman-Morris, James Spann, Renny Vandewege, Adam Lea, Brent and Carol Hipp, and all other friends and family.

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CHAPTER I

INTRODUCTION

Lengthening lead times of tornado warnings alone will not always result in proper emergency responses among the public. Simmons and Sutter (2008) found this to be true when lead times longer than 15 minutes tended to result in more fatalities than if no warning had been issued at all. In fact, research has established that warnings are more effective when communicated in multiple ways (Mileti, 1995). The process of warning communication must be addressed especially concerning the media (Mileti, 1995; Golden & Adams, 2000). To answer this call to action, the current research studied warning communication methods of a weather broadcaster to the viewers and viewers' responses to the broadcaster.

Television has been reported as the most common source of routine and severe weather information (Tan, 1976; Baker 1979; Liu, Quenemoen, Malilay, Noji, Sinks, & Mendlein, 1996; Schmidlin & King, 1997; Lagates & Biddle; 1999, Balluz, Schieve, Holmes, Kiezak, & Malilay, 2000; Brown, Archer, Kruger, & Mallonee, 2002; Hammer & Schmidlin, 2002; Mitchem, 2003; Comstock & Mallonee, 2005; Sherman-Morris, 2005a, 2005b, 2006, 2010; Schmidlin, Hammer, Ono, & King, 2009). The main communicator of the weather forecasts on TV is the local weather broadcaster. Viewers could see this person everyday informing them of the weather and develop a certain amount of trust in the broadcaster. He or she is also the one who lets viewers know when they could be threatened by severe weather. When severe weather does pose an imminent threat to the viewers this weather broadcaster, who shows up everyday to give the day-to-day forecasts, becomes a herald of warning information and an interpreter to the common man of what is happening moment-to-moment.

The weather broadcaster typically spends most of the time in front of the camera. Incoming warnings from the local National Weather Service office are passed on to viewers. Damage reports are relayed. Talking with various government officials about the state of the area is also given a fair amount of attention during severe weather coverage. This information helps viewers understand the scope and magnitude of a possible tornado through what kind of damage is reported and how immediate response is handled. Explanations of radar images, though, comprise the most significant portion of on-air time, which could improve viewers' ability to make accurate inferences of the situation (Allen, Cowan, & Power, 2006; Canham & Hegarty, 2010; Hegarty, Canham, & Fabrikant, 2010; Fabrikant, Hespanha, & Hegarty, 2010).

Broadcasters tend to use body language to help viewers understand what the radar images mean (Cassell, McNeill & McCullough, 1998; Beattie & Shovelton, 1999; Wilson, 2008). Location of a storm and areas likely to be affected by the most dangerous portion of the storm, interpreted from reflectivity products, can be most easily communicated to viewers by hand gestures. Rotation of a storm interpreted from the velocity products is best explained using hand motions to indicate the possibility of a tornado and the most likely location of a tornado. This information helps viewers know whether or not they are likely to be affected by a tornado and, if so, know how quickly they must make a decision to act upon. Up-to-date accurate information is necessary for people to make their own well-informed decisions on how to respond (Mileti, 1995). Do they decide to hunker down in their own home, drive to a safer location, or do nothing?

Much research has been conducted on the many factors that play into the decision-making process. Relatively little research has considered a weather broadcaster's role in the decision-making process of the viewers (Mileti, 1995). Some attention should be paid to the way in which weather broadcasters' actions affect viewers. For example, consider what might happen if the broadcaster steps away from the camera. Even though the broadcaster may still verbally explain radar images, the images are left open to be interpreted by the viewer, who may or may not be able to make accurate inferences (Allen et al., 2006; Canham & Hegarty, 2010; Hegarty et al., 2010). Facial expressions that communicate the broadcaster's own emotional response to the situation are also lacking. Sometimes, the previous experience of the broadcaster tells viewers how this situation relates to previous severe weather.

Camera shots void of a person can become more frequent overnight, at low-market stations, or during extended periods of severe weather TV coverage. Do the hand gestures, facial expression, or other intangible aspects of communication between the weather broadcaster and viewers affect whether or not a viewer will take shelter? It was this question that prompted research to consider whether or not the presence of the weathercaster on-screen had a significant affect on viewers' risk perception and preventative behavior.

CHAPTER II

LITERATURE REVIEW

Review Outline

Sources of weather information that people reference daily and during severe weather is reported so that television, the most commonly cited communication method, can be established as a foundation for research. Then the process by which people make decisions, including warning responses, during hazardous situations will be covered. Internal influences, such as psychological mechanisms or individual circumstances, play a large role in how hazard information is processed and used for decision-making. Personal convictions, alone, cannot fully explain the how decisions are made. External influences, such as compelling social pressures or interactions with other people, can alter how the individual will respond. It is the interaction between internal and external influences upon a person that constitute hazard decision-making. Lastly, research that helped direct the completion of the presented work is given.

Sources of weather information

Television has been reported as the most common source of routine and severe weather information. It is not, however, always the preferred or sole method for weather information. Over 35 years ago, Tan (1976) surveyed residents of Madison, WI and found television was the most used source for everyday weather information followed by radio. When asked which source was preferred among newspapers, radio, television, cable television and telephone respondents were split between radio and television among all demographic types. Warnings are normally received by television and are almost always heard via several sources, most often sirens and telephone. Baker (1979) showed that three of the four hurricane response studies, Baker et al.'s study on Eloise, Moore et al.'s study on Carla, Wilkinson and Ross's study on Camille, and Windham et al.'s study on Eloise, reported some sort of media as the primary source of hurricane information. Television and radio were the top two sources cited.

Hurricane warning information sources and uses, however, are slightly different than tornado warning information. The following studies were conducted on tornado warnings in which most people actually reference more than one source. Respondents to a study conducted by Sherman-Morris (2005) indicated that during severe weather the local television station is the most referenced source for information (94%). The Weather Channel was referenced by 25% of respondents as a weather information source. Schmidlin and King (1997) reported 73% of survivors from a tornado in Arkansas had a television on in their home before the tornado hit. Television and sirens as a warning source combination has been reported by Liu et al. (1996), Balluz et al. (2000), Brown et al. (2002), Mitchem (2003), Comstock and Mallonee (2005), and Schmidlin, Hammer, Ono, and King (2009). Most of those found television as the primary warning source, but Mitchem (2003) found that sirens alerted more respondents of the tornado warnings than television did. Legates and Biddle (1999) and Hammer and Schmidlin (2002) reported television as the top warning source followed by sirens and then telephones. Legates and

Biddle (1999) also reported that 17% of their respondents who did not report television as their primary source, cited television as their secondary source. When surveying employees and students on a college campus, Sherman-Morris (2010) found that the top four sources of the tornado warning for students were local television, an acquaintance, text message via cell phone, and the internet. For employees, an acquaintance was the primary source followed by text message via cell phone, the internet, and television.

Clearly, television ranks as one of the top methods to communicate warning information to the public, but that does not necessarily imply a response by viewers. Balluz et al. (2000) found that the majority of their respondents cited TV as their primary warning source. There was relatively little difference in tornado warning source between respondents who took shelter and those who did not seek shelter. Balluz et al. (2000) concluded that the lack of access to adequate shelter was the main reason for not seeking shelter. Similarly, Mitchem (2003) found that 81% of respondents were aware of the tornado warning, while only 49% actually sought shelter. Almost half of those who were aware of the warning included TV broadcasting as a source of their awareness of the tornado warning. There is yet a third study that presents the same issue. Schmidlin et al. (2009) found 85% of mobile home residents cited TV as their warning source. Only 31% sought shelter. Just like in the study conducted by Balluz et al. (2000), lack of access to adequate shelter was accepted as the main reason for not taking protective action.

Several studies have received some interesting responses by participants that indicated the recommendations that they see or hear from the television may be effective motivators to seek shelter from the tornado. In the research by Brown et al. (2002), 57% of respondents said that what they saw and heard on the television prompted protective action.

Comstock and Mallonee (2005) surveyed people from the same Moore, Oklahoma community that was affected by two tornados, one in 1999 and the other in 2003. In 1999, over half of respondents cited television as their reason for taking protective action. An overwhelming majority of respondents in the Hammer and Schmidlin (2002) study used TV as their warning source and 35% said that TV was the reason for seeking shelter. Gary England, a long-time local weatherman in the Oklahoma City area, was specified by many respondents as their reason for taking protective action. These studies support the notion of further researching the influence of a TV weather broadcaster on viewers to take shelter.

Hazard decision-making

Internal influences

Much more explains the decision-making process during severe weather than where one first learns of a warning. Referencing multiple warning sources is one measure people take (Liu et al., 1996; Balluz et al., 2000; Brown et al., 2002; Mitchem, 2003; Comstock and Mallonee, 2005; and Schmidlin et al., 2009; Sherman-Morris, 2010). Access to a sufficient shelter has also been mentioned (Balluz et al., 2000; Schmidlin et al., 2009). Liu et al. (1996) found shelter availability to be a crucial to respondents deciding to take some sort of protective action or not. They found that 28% of their survey group did not seek shelter because they had no shelter in which to go. Comstock and Mallonee (2005) found that people who took less action from the tornado in 2003 than the tornado in 1999 did so for one of two reasons, inadequate warnings or shelter unavailability. And this is a logical conclusion, if one believes there is no adequate shelter to take, then regardless of what warnings are heard or danger is presented shelter will not likely be sought.

A relatively new concept to the weather hazard research community, termed weather salience, quantifies the importance of weather to a person. Stewart (2009) proposed that the measurement of weather salience among people could aide in understanding the differences in uses for weather information. The effect weather has on planning daily activities, holiday activities, and mood, one's attention to weather information, observation of current weather, attachment to a certain climate, and desire to experience changing weather all comprise the weather salience concept. Stewart (2009) determined that respondents' knowledge of a weather watch and warning and experience with severe weather events were related with weather salience, making weather salience a helpful way to describe people's responses to weather.

Previous experience with severe weather has been another research topic of interest. There does not seem to be a definite association between the experience one had with a previous storm and their response to a subsequent storm. Schmidlin et al. (2009) asked respondents of their past experience with tornados. Over 50% of respondents had at least seen a tornado before and 12% had experienced damage to their home due to a tornado. A startling 69% of respondent did not seek shelter. As previously stated, however, most respondents did not believe they had an adequate shelter to use. Baker's (1979) review of four hurricane studies also reported that previous experience, which included frequency and severity of hurricanes, family injury, and recency of last hurricane experienced, had little to no effect on one's decision to evacuate.

One study in particular does indicate that there may be a link between previous experience and warning response if data collection is done in a specific way (Comstock & Mallonee, 2005). Only 22% of respondents reported taking less protective action from a tornado only four years after a devastating tornado struck their town in 1999. Of the 27% of respondents who took more protective action, having better protection and more safety knowledge were the reasons given by 64%. Knowledge and ability to execute proper safety measures seemed to result in shelter seeking behavior. Comstock and Mallonee (2005) propose that the responses to their survey and possible inferences to be made about people's previous experience is different than most studies because "[our] survey to single a population after two severe tornado events provides a more accurate evaluation of the effect of knowledge gained in previous tornadoes on the implementation of effective injury-prevention action during subsequent tornado events" (p. 284).

It seems that the more informed a viewer is about a hazard, the more likely preparatory action will be taken. For example, in a study of adolescents who work with pesticides, it was found that knowing the harmful consequences of pesticides had a significant effect on whether protective clothing and equipment was used (MacCauley, Sticker, Bryan, Lasarev, & Scherer, 2002). Knowledge or understanding of the difference between a tornado watch and tornado warning has been suggested as a possible influence on shelter seeking behavior. In general, most people know the difference between the two weather terms. Mitchem (2003) reported 70% of respondents were correct. Liu et al. (1996) found that 89% of respondents knew the difference. Balluz et al. (2000) also reported that 96% of respondents understood a tornado watch versus tornado warning. There are even demographic differences between those who understand and do not understand a watch from a warning. Powell and O'Hair (2008) noted that 58% of respondents who correctly answered the difference between a watch and a warning were older, had earned a higher education, were of the white race, and were from a location that often had watches and warnings issued. However, this understanding does not always translate into an action when it comes to the common man.

Balluz et al. (2000) and Mitchem (2003) all reported that about half of their respondents did not seek shelter, even though, for the most part, respondents knew a watch from a warning. Sherman-Morris (2010) also found that knowing the difference was not significantly correlated with seeking shelter. This phenomenon exists in research of other hazards as well. Palm and Hodgson (1993) surveyed California residents in the general vicinity of the San Andreas Fault to discover which physical or situational variables (proximity to fault line, awareness of hazard, previous experience with earthquakes, etc.) indicated whether a household was likely to purchase earthquake insurance or not. They did not find a relationship between a respondent's knowledge of earthquake likelihood and the purchase of earthquake insurance.

A viewer's ability to make accurate inferences from a scientific map, or radar image, is also affected by the knowledge they possess in that subject area (Allen et al., 2006, Hegarty et al., 2010). They found that participants with greater knowledge of weather processes and map reading skills tended to make more accurate interpretations from weather maps. Experts and non-experts alike are hindered by distractions when attempting to make accurate inferences from maps (Canham & Hegarty, 2010; Fabrikant et al., 2010).

Johnson (1993) suggests that there are additional ways to define knowledge, especially for the non-expert or lay person, because the human mind is more complex than the objective viewpoint implies. A subjective viewpoint, held predominately by lay persons, is based upon personal experiences and resulting emotions (Smith & Petley, 2009). Johnson's (1993) proposition, that heuristics are a part of a person's knowledge, fits into the subjective viewpoint. The availability heuristic, optimistic bias, representative heuristic, and gambler's fallacy all influence the way in which a lay person perceives risk. When a tornado warning has been issued, the first thing that enters someone's mind will affect their response. For example, if a person recalls the most recent tornado warning that resulted in no harm to that individual, the decision to seek shelter may not be their first instinct. The belief that "the tornado will not hit me; it will affect someone else" would also discourage seeking shelter (Weinstein, 1989).

Another concept that affects one's decisions during hazardous situations, which has been documented in several studies already mentioned, is the perception of severity or danger one associates with the storm (Baker, 1979; Riad & Norris, 1998; Mitchem, 2003; Schmidlin et al., 2009). Slovic (1987) reported that a lay person's assessment of risk was not based on facts, but rather on intangible characteristics such as potential disaster, threat to younger people, or threat to the environment. According to Slovic, people tend to rate events as more risky if the events are perceived as uncontrollable, involuntary, new, catastrophic, or if the effects of the event are unknown. In these situations, certain psychological processes are involved in which people are more likely to attend to details of the situation and heed advice given by those in roles of expertise (Bless, Fiedler, & Strack, 2004). Baker (1979) and Riad and Norris (1998) found that people who expected the hurricane to be "bad" were much more likely to evacuate prior to the hurricane than those who did not perceive as much risk. People who felt that they were in danger from a tornado were also more likely to seek shelter than people who did not feel in danger according to Mitchem (2003) and Schmidlin et al. (2009).

Risk perception, however, is not accepted by all researchers as a predictor of protective action. Fishbein and Yzer (2003) brought together three behavioral prediction theories to develop an effective strategy to alter people's behavior surrounding health issues. In their opinion, risk perception is not an antecedent of intentions but rather an indirect measure of intentions. Slovic's (1987) research considered all types of hazards, including technological, health, and occupational. Contrary to Fishbein and Yzer's (2003) supposition about the usefulness of risk perception, the variety of hazards covered in Slovic's research suggest that risk perception would still be a valid way to measure the likelihood for protective action, especially in the case of environmental hazards where several studies have effectively shown that higher risk perception is associated with some form of mitigative action.

The degree to which one will heed the advice of another person depends upon how much trust exists between two parties. According to a review of trust literature by Colquitt, Scott, and LePine (2007), trust can be defined between two people by measuring two things: trust propensity and trustworthiness. Trust propensity is the degree to which a person is likely to rely upon others. Trustworthiness is a threefold description of how dependable a person is, which can be measured by their ability to perform an action (ability), genuine interest for the good of others (benevolence), and adherence to moral uprightness (integrity). While trust propensity is a part of the total concept of trust, it has a relatively weak influence when compared to the influence of trustworthiness upon trust. Thus operationally, trust can be measured by trustworthiness alone. Examples of survey questions written by Mayer and Davis and useful synonyms for ability, benevolence, and integrity developed by Mayer et al. can be found in Colquitt et al.'s (2007) work.

The concept of trust has been used in a variety of ways, and has relatively recently been used in hazards research regarding the influence of a weather broadcaster. The relationship between a television performer and an audience has been studied and described several ways. One description termed parasocial interaction (PSI) by Horton and Wohl (1956) is an apparent face-to-face interaction that television viewers tend to form with actors on television or some other medium (Horton and Wohl, 1956). Over time, PSI tends to become more meaningful as the viewer becomes more attached to the television persona. Much research has, therefore, used this PSI concept between news anchors and viewers, and recently between weather broadcasters and viewers to seek a weatherman-induced cause for heeding advice through protective action among viewers during severe weather. Towards that end, Sherman-Morris (2005, 2006) documented that the higher a viewer's PSI with a weather broadcaster, the more a viewer trusts that broadcaster and is likely to seek shelter. An interesting question that arises is why would a viewer's trust in a weather broadcaster most often result in a mitigative action? Possible answers to this will be discussed in the next section concerning external influences to the decision-making process.

External influences

Individual factors of the hazard decision-making process while significant in and of themselves cannot be considered outside a social context. Riad & Norris (1998) noted that one's intention to evacuate due to a hurricane were also more open to social influences. According to Mileti's (1995) review of flood warning response there are several key steps that lead to protective action. The steps are hearing the warning, believing that the warning is accurate, making the warning personally relevant, and confirming the warning. Confirmation of the warning can be done through various means, many times in the form of talking to someone else about the situation or seeking additional information from the "authorities". Seldom are people completely alone during the day, therefore when a warning is issued it is more than likely a group of people and not just an individual that must decide how to respond (Drabek, 1999).

Interactions among people are very important in understanding hazard warning response. In the case of severe weather, the broadcaster serves as one of these influential individuals. He serves as a weather expert upon whom a viewer can depend for accurate warning information (Wilson, 2008) and as a closer acquaintance to whom one can confer for warning confirmation (Sherman-Morris, 2005). During severe weather, one of the main objects of focus is the weathercaster who is the main communicator to the viewer. Bearing in mind that much of the communication between two people is non-verbal, a broadcaster's hand gestures, facial expressions, and other physical motions will be used by the viewer to respond to the weather situation (Cassell, McNeill & McCullough, 1998; Beattie & Shovelton, 1999; Mogg & Bradley, 1999; Anderson, Christoff, Panitz De Rosa, Gabrieli, 2003; Green et al., 2003; Liddell et al., 2005).

The integration of body language into communicated information may seem like a conscious process, but can be considered more of an unconscious one. A viewer pays particular attention to facial expressions that convey threat (angry or fearful expressions) and that information is processed automatically (Mogg & Bradley, 1999; Green et al., 2003; Anderson et al., 2003; Liddell et al., 2005). Thus, thoughtful decisions are not always needed to immediately respond to a threatening situation (Anderson et al., 2003;

Liddell et al., 2005). More specifically, the automatic response of the brain to a possible threatening situation is not affected even when a participant's attention is devoted to another task (Anderson et al., 2003). It is important to note that intense facial expressions tend to be more automatically processed implying a more automatic response, but that automatic responses increase at the expense of gleaning detailed information (Anderson et al., 2003). It is possible for the opposite to take place. Green, Williams, and Davidson (2003) documented increased viewing time and spatial extent of scanning of threat-related facial expressions. Viewers' fixation times on threatening faces increased and distance between focal points increased, meaning that more time and effort was spent, on the part of the viewer, to gather as much information about the situation as possible.

These studies imply that viewers could have an automatic emotional response, which is characteristic of the typical television viewer, to portrayed anxiousness about the threatening weather situation. If the weather broadcaster is in front of the camera during severe weather, this sort of communication can take place. If not, then viewers lose a lot of information that broadcasters could be giving to them. These studies exclude, however, hand gestures from body language, but for the weathercaster, communication modes beyond the face are essential parts of their communication.

Cassell et al. (1998) found that listeners retain information beyond that which was actually spoken. In fact, information given by gestures only is actually integrated into memory just as much as what is spoken. Hand gestures are an effective complement to spoken communication. Beattie and Shovelton (1999) advanced that notion by studying what types of information are best aided by gestures. They found that respondents' memory of characteristics such as size, shape, number, movement, and relative action were significantly improved when both audio and visual cues were present. Information such as this is presented most abundantly during severe weather coverage as a weathercaster tries to communicate a storm's attributes to explain possible danger. If the broadcaster is not on screen, this information is also lost on the side of the viewers.

The results from the aforementioned studies would seem, then, to be consistent with other works where actors being filmed engaging the camera with their body, and thus engaging the viewer, result in higher PSI scores (Auter, 1992; Hartmann and Goldhoorn, 2011). Documented high PSI scores have been associated with high trust scores between viewers and broadcasters, which have also been connected with a higher likelihood of shelter taking among viewers. It stands to reason, then, that if a weathercaster engages the audience, which can only be done if the broadcaster is on-screen, through facial expressions and hand gestures that taking shelter may be a more likely response than if the weathercaster is not on-screen and unable to engage their audience. The presence of a broadcaster on-screen during live severe weather coverage may be a possible answer to why a person who trusts their weather broadcaster is more likely to take shelter than one who does not have trust.

CHAPTER III

METHODOLOGY

Introduction

Based on the suggested future research by Mileti (1995) and Golden & Adams (2008) and the influence of threatening facial features and hand gestures on communicated information to viewers (Cassell et al., 1998; Beattie & Shovelton, 1999; Mogg & Bradley, 1999; Anderson et al., 2003; Green et al., 2003; Liddell et al., 2005)., a survey with an experimental treatment was created to measure the effect of an on-screen weathercaster on respondents' likelihood for mitigative action, measured via risk perception and preventative behavior. Social networking websites were the main method by which participants were recruited. Severe weather coverage from a recent severe weather outbreak was presented to participants during the survey. Clips from the severe weather coverage were the treatment method, where one clip would have a weathercaster on-screen presenting the information and the other clip would have the same information presented without the weathercaster on-screen.

Broadcaster Videos

Archived television coverage from previous severe weather broadcasts instead of recording a pair of clips was the better option for several reasons: 1) to account for realistic anxiety portrayed by the broadcaster, 2) to show an experienced broadcaster to participants, and 3) to show a broadcaster with whom participants might be familiar. Choosing a pair of severe weather coverage clips, such that only the presence or absence of the weather broadcaster changed between the two videos, proved to be more difficult than expected.

James Spann chief meteorologist of ABC 33/40 out of Birmingham, AL gave permission to use any of his previous severe weather coverage. Many hours of video had been recorded and uploaded to youtube.com from recent severe weather outbreaks. Certain criteria were established for a certain portion of the archived coverage to be used. The ideal on-air clip would have been at least 30 seconds long (preferably longer), included radar reflectivity images, and the broadcaster with no data boxes, no icons, nor animation of radar sweeps or radar images. The off-air clip would have been identical to the on-air clip except that James Spann would be missing from the video.

Two separate sections, one on-screen clip and one off-screen clip, which were identical visually and in duration that also met all of the criteria listed above were not found. Audio was not considered as a part of the original criteria because it was assumed that for the one pair of clips the audio from the on-screen clip would be superimposed to the off-screen clip eliminating unwanted variance. Two pairs of clips were used, however, instead of one because of the inability to find a set that met all of the criteria. Audio from the on-screen clips were superimposed upon the off-screen clips for both pairs, but because the first pair of clips was not in essence the same as the second pair, it was not reasonable to superimpose audio from one set to the other set. The audio was, therefore, not considered in the subsequent set of criteria and was introduced as a source of variance between the pairs of clips.

The first set of clips was 13 seconds long, included a still image of radar reflectivity with a red tornado warning box behind the reflectivity image, and a white trapezoid signifying the areas most likely to be affected by the storm. Three cities were also visible: Hamilton, Hackleburg, and Hodges (Figure 1). This set of clips will hereafter be referred to as the Hamilton/reflectivity videos. The second set of clips was 22 seconds long, included a still image of radar storm relative velocity, and included a rotating white line symbolizing a scan of the radar. Two cities were visible; Boley Springs and Sandtown, and a third city was mentioned with very strong words of caution, Oakman (Figure 1). The second set of clips will hereafter be referred to as the Boley Springs/velocity videos. Previous studies conducted that used videos at the core for experimental testing had videos that were much longer in length. Auter (1992), Cassell et al (1998), and Hartmann and Goldhoorn (2011) used videos that were longer than 7 minutes, on average.

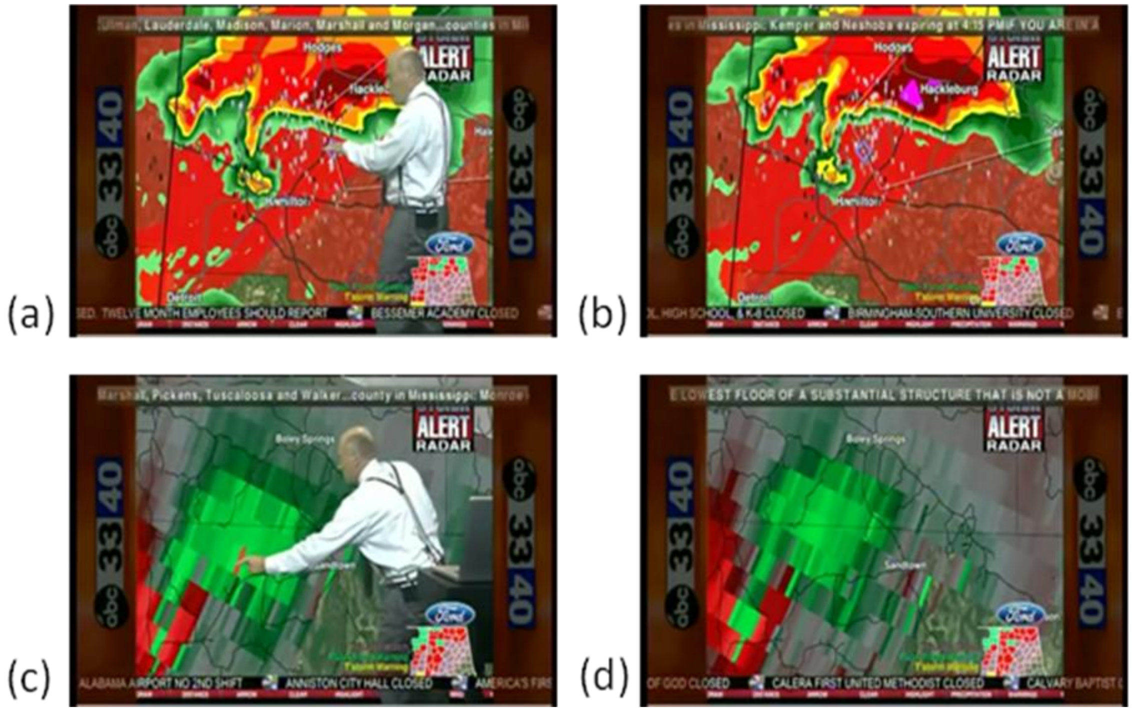


Figure 1 Broadcaster Videos

(a) Hamilton/reflectivity video, on-screen
(b) Hamilton/reflectivity video, off-screen
(c) Boley Springs/velocity, on-screen
(d) Boley Springs/velocity, off-screen

The Hamilton/reflectivity videos were much shorter than desired, but because radar reflectivity is presented to non-meteorologists more often than radar storm relative velocity they were approved by the researcher for use. The Boley Springs/velocity videos were the longest set of clips found and as such were also approved for use by the researcher. The final group of videos could be categorized based on location or visibility of broadcaster. There were two clips from the Hamilton area and two from the Boley Springs area each with an on-screen broadcaster and an off-screen broadcaster.

Survey design

The survey was designed in sections. The first section had questions about a participant's weather history and salience. Questions about how daily and severe weather information is normally obtained and about how often were in this section. Options were weather channel, local television station, friends/family, radio broadcast, internet, and an "other" section that participants could include a source not given as a choice. The severe weather questions had an additional choice of siren as a source of information. Four questions to assess weather salience were included. Each participant was then randomly assigned one of the four clips. This is very similar to other surveys that review sources of severe weather information, but most similar to studies conducted by Sherman-Morris (2005b, 2006).

The second section was video specific. Two versions were written; one for the Hamilton/reflectivity videos and one for the Boley Springs/velocity videos. Section two was intended to evaluate how well information from the videos was remembered and to get an idea of risk perception based on the video watched. Questions were written to provide the best continuity between the two versions for the sake of comparison. The Hamilton version had four recall questions while the Boley Springs version had three recall questions. Other questions asked respondents to rate the severity of the storm and likelihood of a direct hit to two of the cities in the video. Hamilton and Hodges were chosen as risk locations for the Hamilton/reflectivity clips. Oakman and Sandtown were chosen as risk locations for the Boley Springs/velocity clips. There were also a few questions about preventative behavior. The last question in section two asked participants to choose which cities were most likely to be hit from the possible tornado. All combinations of the three cities per clip were available as a choice.

The third section was based predominately on risk perception. One question was based on the paradigm developed by Slovic (1987). Words that hinted at the essence of the two factors were presented and respondents were asked to indicate how accurately those words described the weather situation presented in the video. A few antonyms were chosen to decrease the likelihood of survey bias, for example abnormal and common. Choosing opposite words was based on a similar application of Slovic by Sherman-Morris (2005a). Additional risk perception questions designed to assess the subconscious emotional response about scariness and dangerousness of the storm were also in the third section.

The fourth section had six questions to assess respondents' trust of the broadcaster adapted from the trust review by Colquitt et al. (2007). Participants' frequency of watching James Spann was also included in case a bias appeared in the results from the trust questions. The fifth and final section gathered demographic information. A five-point Likert scale was used for all questions with ratings.

The nature of the experiment required the use of computers by respondents. The survey was therefore hosted online via surveymonkey.com. Section one of the survey was presented first, then respondents were randomly shown one of the four clips. Participants that watched one of the Boley Springs/velocity clips were given the section two written for Boley Springs and the same was true for the Hamilton/reflectivity clips. After watching the clip, the rest of the survey was taken in order.

All participants were also asked if they knew the difference between a tornado watch and tornado warning. Each person who indicated that they knew the difference between a watch and a warning were then asked to provide an explanation of their understanding then evaluated on their accuracy. If a participant knew enough to make an informed decision to take shelter based on their knowledge of watch vs. warning, their response was considered correct. Participants who watched the Boley Springs/velocity clips were asked if they knew the difference between the red and green colors characteristic of the storm relative velocity product. If they said yes, then they were evaluated on their accuracy. Just like the evaluation of tornado watch and warning, if a participant knew enough to make an informed decision to take shelter based on their knowledge of red vs. green, their response was considered correct.

A copy of the survey is provided in Appendix A.

Derived Variables

Much of the statistical testing relied on several variables that were derived from multiple questions. Three risk perception variables were created: Overall risk, Hamilton/reflectivity risk, and Boley Springs/velocity risk. Overall risk was based on three questions in section three that all respondents had in common: questions 31, 32, and 33. Overall risk was used when surveys from all samples were included in testing. Hamilton and Boley Springs risk values were calculated with the overall risk question plus video-specific risk questions in section two. A total of seven questions, 10, 11, 14, 15, 31, 32, and 33, comprised the Hamilton risk variable. The Boley Springs risk variable was also comprised of seven questions 19, 20, 24, 25, 31, 32, and 33. These risk variables were used when tests were separated based on the videos. Two other risk perception variables were derived, one based on the work of Slovic (1987) and another that combined overall risk with Slovic's concept of risk. The Cronbach's alpha reliability test was used on all the derived risk variables to determine if they in fact successfully measured the same concept and were thus useful as a group for statistical testing. Because of low reliability scores, neither variable that included a measure of risk based on Slovic's work was used for statistical testing.

Overall preventative behavior was based on a question from section three, asking respondents how likely they would be to seek shelter from the storm they saw. It was used as the preventative behavior variable when surveys from all samples were included in a statistical test. Like the risk variables, two preventative behavior variables were created for each pair of clips, one for the Hamilton/reflectivity videos and one Boley Springs/velocity videos. These variables included the overall preventative behavior question and two more questions from video-specific section two. The two questions in section two asked respondents how likely they would be to call and alert someone else of the storm in two of the three cities. These video-specific variables were also used when the pairs of clips were separated for testing.

To give video recall a numerical value, several questions' responses from section 2 were used. Questions 9, 12, and 17 were used to assess video memory of the Hamilton/reflectivity clips. Questions 22 and 29 were used to assess video memory of the Boley Springs/velocity clips. The questions and correct answers can be found in Appendix B. All contributing question responses were added and normalized for each variable; three risk perception variables, three preventative behavior variables, and two video recall variables.

Hypotheses and expected results

The choosing of the four severe weather clips directed the process by which the research was conducted and flow from one hypothesis to another. Hypotheses 1a and 1b were derived to test whether the presence of a weathercaster had an effect on viewers' propensity for mitigative action.

> $H_{1a,b}$ = Risk perception and preventative behavior are different between people who watched the on-screen and off-screen videos.

Since there was a pair of Hamilton/reflectivity videos and a pair of Boley Springs/velocity videos, hypotheses 2a and 2b became a core component to the research.

> $H_{2a,b}$ = Risk perception and preventative behavior are different between people who saw the Hamilton/reflectivity and Boley Springs/velocity videos.

After the first two hypotheses were tested, hypotheses 3, 4, and 5 based on several questions written specifically for each pair of clips were tested.

> $H_{3a,b}$ = Risk perception and preventative behavior are correlated with the accuracy of video recall among Hamilton/reflectivity watchers.

> $H_{4a,b}$ = Risk perception and preventative behavior are correlated with the accuracy of video recall among Boley Springs/velocity watchers.

> $H_{5a,b}$ = Risk perception and preventative behavior are different among family member locations.

Questions about participant trust in the broadcaster and the importance of weather to participants were also included, thus hypotheses 6 and 7.

> $H_{6a,b}$ = Risk perception and preventative behavior are correlated with trust of broadcaster.

> $H_{7a,b}$ = Risk perception and preventative behavior are correlated with weather salience.

The last four hypotheses focused on the demographic effects on participants' risk perception and likelihood of preventative behavior.

> $H_{8a\text{-}f}$ = Risk perception, preventative behavior, trust, weather salience, Boley Springs/velocity video recall, and Hamilton/reflectivity video recall are different between males and females.

> $H_{9a\text{-}f}$ = Risk perception, preventative behavior, trust, weather salience, Boley Springs/velocity video recall, and Hamilton/reflectivity video recall are correlated with participant age.

> $H_{10a\text{-}f}$ = Risk perception, preventative behavior, trust, weather salience, Boley Springs/velocity video recall, and Hamilton/reflectivity video recall are different among all education levels.

> $H_{11a\text{-}f}$ = Risk perception, preventative behavior, trust, weather salience, Boley Springs/velocity video recall, and Hamilton/reflectivity video recall are different among all races.

Based on the results from all the literature discussed in the hazard decision-making section, it was expected that risk perception and preventative behavior will be higher and more likely for viewers of the on-screen broadcaster than for the viewers of the off-screen broadcaster (hypotheses 1a and 1b). It was also expected that risk perception and preventative behavior would be higher and more likely for the viewers of the Hamilton/reflectivity video viewers than for the Boley Springs/velocity video viewers (hypotheses 2a and 2b). This was based upon research concerning non-expert understanding of complex maps and ability to make correct inferences from those maps.

It was expected that better video recall would result in higher risk perception and a higher likelihood for preventative behavior (hypotheses 3 and 4). Video recall was also expected to be different between Hamilton/reflectivity and Boley Springs/velocity videos. Because most people are exposed to reflectivity more than velocity, memory among participants was expected to be higher from the Hamilton/reflectivity videos. Thus, risk perception and preventative behavior was also expected to be higher for Hamilton/reflectivity watchers than for Boley Springs/velocity watchers. Also included in this group of hypotheses was the location of family members or friends. If a relative or friend of a respondent was near the location of the storm, it was likely that risk perception would be high and preventative behavior would also be more likely (hypotheses 5a and 5b).

Trust of the weather broadcaster and weather salience were also expected to cause higher risk perception values and a higher likelihood of preventative behavior among viewers (hypotheses 6 and 7). Hypotheses 8-11 were exploratory and did not necessarily have documented or expected tendencies.

Recruitment process and problems

Since social networks have become popular and are relatively widespread, it was decided that attempting to capitalize on this new mode of communication, also used by Hartmann and Goldhoorn (2011), was an effective means of recruiting possible participants. A request for participation was placed on the researcher's personal Facebook page. James Spann, a relatively famous weather broadcaster in his area (Birmingham, AL), also publicized and announced the study through his numerous means of communication to viewers that included, but were not limited to, television, radio, twitter, Facebook, and a blog. A weblink that then directed respondents to SurveyMonkey.com was accessible through the various "status updates", "tweets", and online postings that are characterisitic of social networks, ideally leading to other people also requesting "friends" or "followers" to participate creating a snowball effect of responses. Students in the Mississippi State University Physical Geography classes were also asked to participate in the study by their professor and their lab teaching assistants, one of which is the principle investigator. They were chosen to provide a different demographic and education level of respondents.

There were three distinct times of recruitment. The first was an internet announcement by James Spann, which constitutes sample 1. After looking through the data from sample 1, an issue was found with the online recording method that made it impossible to use this dataset for inferences about the weather broadcaster's effect on viewers. Therefore, additional surveys had to be obtained. The second was via professors and lab teaching assistants for MSU students, which constitutes sample 2. The third was another internet announcement by James Spann and an announcement by the researcher, which constitutes sample 3. Roughly one month passed between the first announcement and the third.

Statistics

Many of the statistical tests used were basic and need very little explanation. Age, risk perception, weather salience, trust of the weather broadcaster, preventative behavior, and Boley Springs/velocity video recall were not normally distributed. When using these variables, the Mann-Whitney test, Kruskal-Wallis test, and Spearman's correlation were used in lieu of the student t-test, ANOVA, and Pearson's correlation, respectively, because a normal distribution is not assumed. Significance was determined at the 95% confidence level.

Surveys from all three samples were used to test for differences in risk perception and preventative behavior based on radar reflectivity and radar storm relative velocity. Only the surveys from the second and third samples were used to test for differences in risk perception and preventative behavior against an on-screen or off-screen broadcaster. The surveymonkey.com algorithm used to randomly assign each respondent one of the four broadcaster clips worked relatively well (Table 1).

Table 1 Broadcaster Video Watched

	On-screen	Off-screen	Sample 1	Totals
Reflectivity (Hamilton)	*86*	*81*	*238*	*405*
Velocity (Boley Springs)	*98*	*78*	*248*	*424*
Totals	**184**	**159**	**486**	**829**

Since the Hamilton/reflectivity clips and the Boley Springs/velocity clips differed in the radar product shown, overall risk perception and overall preventative behavior were tested for significance first based on reflectivity and storm relative velocity (hypotheses 2a and 2b). If a difference was found, then the Hamilton/reflectivity and Boley Springs/velocity videos would be separated for on-screen versus off-screen statistical testing; hypothesis 1 would have four parts 1a-1d (Figure 2). Then the variables specifically derived for the Hamilton/reflectivity and the Boley Springs/velocity videos were used to test risk perception and preventative behavior for the subsequent on-screen versus off-screen weathercaster.

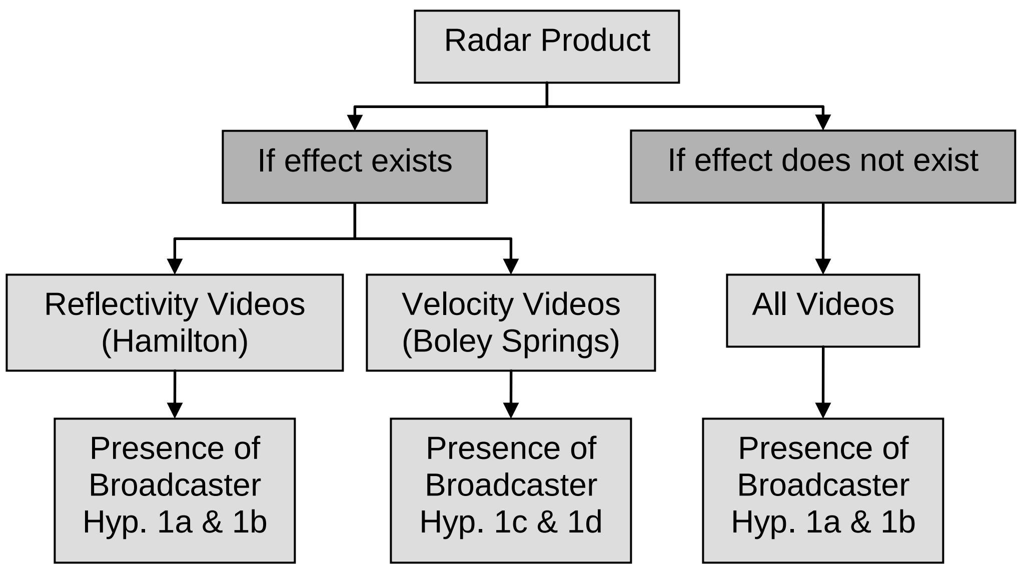


Figure 2 Testing Order

CHAPTER IV

RESULTS

Response rates and participants

There were a total of 1935 surveys attempted. Respondents from James Spann's first announcement accounted for 486 out of 1160 attempted surveys (sample 1), students from the Physical Geography classes at Mississippi State accounted for 22 out of 42 attempted surveys (sample 2), and respondents from James Spann's second announcement and the researcher's personal announcement accounted for 321 out of 733 attempted surveys (sample 3). A grand total of 829 were completed and used for statistical testing (combined samples). The remaining 1106 surveys were disqualified for use based on a lack of data. Some incomplete surveys only had responses from the first section. It is thought that many people who attempted the survey and did not complete it did so because of a compatibility issue with their electronic device and the format of the video in the survey. If the respondent was unable to watch the clip, then they were not really able to answer the questions in section two and therefore opted to skip the remaining questions.

Table 2 Participants' Age

	15-24	25-34	35-44	45-54	55-64	65+
Sample 1	*61*	*143*	*112*	*98*	*51*	*14*
Sample 2	*17*	*1*	*0*	*0*	*0*	*0*
Sample 3	*46*	*93*	*78*	*62*	*31*	*6*
Total	**124**	**237**	**190**	**160**	**82**	**20**

Most of the respondents were in the younger age groups (Table 2). The average age of respondents was 38 years. It was surprising that 20 adults above 65 years old completed surveys with the oldest person at 80 years. More women participated in the study than men (f = 512, m = 313). Also, ~ 96% of people indicated that they identified most with the white race. The amount of education respondents had was more representative (Table 3) than the other demographic characteristics. The majority, however, have had some sort of college experience, meaning that they are a relatively educated sample overall. Approximately 14% of respondents had no education beyond high school. Of the people who indicated "other", some indicated that they were still in high school or college, both of which could have been indicated with a different response. Most "other" responses, however, were either an associate's degree or a specialized certification or degree. Since the second sample consisted of only MSU students, this group contrasts with the other two samples demographically, which was expected and desired.

Table 3 Education Levels

	Some High School	High School Diploma	Some College
Sample 1	*7*	*63*	*184*
Sample 2	*1*	*2*	*17*
Sample 3	*6*	*28*	*109*
Total	**14**	**93**	**310**

	Bachelor's Degree	Advanced Degree	Other
Sample 1	*119*	*69*	*39*
Sample 2	*0*	*0*	*1*
Sample 3	*104*	*57*	*17*
Total	**223**	**126**	**57**

Survey question responses

Section 1

The first section to the survey consisted of questions regarding respondents' weather history and salience. It was common among respondents for weather to be rather important and for their actions to reflect that. Weather salience values were highly skewed such that the majority of responses were near the top of the scale (Table 4). The average score for weather salience was above 4 (s = 0.83). The maximum score of 5 on the weather salience scale was the most common response (Table 21). These respondents also tended to seek forecasts on a daily basis (Table 5). The trend was the same regardless of sample.

Table 4 Weather Salience Values, based on a 5-point scale

	0 - 1	1.1-2	2.1-3	3.1-4	4.1-5
Sample 1	*0*	*10*	*62*	*153*	*261*
Sample 2	*0*	*1*	*5*	*6*	*10*
Sample 3	*0*	*8*	*45*	*115*	*152*
Total	**0**	**19**	**112**	**274**	**423**

Television and the internet were by far the top two sources of daily and severe weather information (Table 6). Respondents were allowed to choose more than one source. Newer technologies were the most common clarifications for the choice "other" for daily weather forecasts. Cell phones and tablet computer applications were the top comments while the NOAA weather radio, ham radio, and specific websites were also mentioned. More people chose "other" for severe weather updates than for daily information. Cell phones and computer applications were again the top comments. The next most mentioned source was the NOAA weather radio followed by personal radar software and amateur ham radio.

Table 5 Daily Forecast Seeking

	Never	Once / week	Several times / week	Everyday
Sample 1	*5*	*16*	*113*	*349*
Sample 2	*1*	*3*	*7*	*11*
Sample 3	*2*	*16*	*93*	*210*
Total	**8**	**35**	**213**	**570**

All survey participants were asked if they knew the difference between a tornado watch and a tornado warning. Eight hundred twenty-one respondents indicated that they did, in fact, know the difference between a watch and a warning. Approximately 96% of those were deemed correct. Some examples of typical correct responses include:

> “Watch means conditions are favorable. Warning means rotation has been sighted (either on radar or visibly)”
>
> “Watch means there could be one and warning is that there is one.”
>
> “A tornado watch means conditions are favorable for a tornado. A warning means a tornado/rotation/hook has been seen.”

A few examples of typical incorrect responses include:

> “A watch means that one has been spotted and conditions are very dangerous. Warning means that conditions are favorable.”
>
> “one is a tornado is likely to develop and the other is one has been spotted”
>
> “warning means the weatherman picked it up on radar. Watch means its possible of hitting your area.”

The number of people who mentioned specific radar terminology used for identifying possible tornados in their explanations of tornado warnings was a surprise. Among the 4% whose responses were deemed incorrect, sometimes it was difficult to know whether their explanation was not correct because of a lack of time taken to form an appropriate response or a lack of understanding. Based on remarks like that of the second and third incorrect quotations, it could be argued that having an adequate understanding of watches and warnings does not mean an appropriate response to a tornado warning will result. This is more than likely one explanation for why knowledge and understanding, in and of themselves, are not good indicators of seeking shelter.

Table 6 Sources of Weather Information

		Weather Channel	Local Television	Internet	Siren	Friends/ Family	Radio Broadcast	Other
Daily	Sample 1	*76*	*316*	*343*	*N/A*	*42*	*67*	*100*
	Sample 2	*6*	*4*	*12*	*N/A*	*5*	*4*	*5*
	Sample 3	*60*	*192*	*221*	*N/A*	*39*	*56*	*77*
	Total	**142**	**512**	**576**	**N/A**	**86**	**127**	**182**
Severe	Sample 1	*55*	*369*	*316*	*102*	*100*	*127*	*200*
	Sample 2	*9*	*8*	*11*	*8*	*6*	*2*	*4*
	Sample 3	*58*	*233*	*193*	*73*	*66*	*88*	*147*
	Total	**122**	**610**	**520**	**183**	**172**	**217**	**351**

Section 2

There were two versions of this section for the Hamilton area and the Boley Springs area. The following reports will have results for both the Hamilton/reflectivity videos and the Boley Springs/velocity videos. At the beginning of each version, respondents' familiarity with the location was asked so that it could be linked to varying results in other parts of the survey, such as video recall or risk perception, if needed. All three samples from both videos were not very familiar with the region. Sample 2, the MSU student sample, was especially unfamiliar with these areas. The averages for Hamilton and Boley Springs were 2.58 and 2.29, respectively, below the mid-point of the scale. Based on these responses, familiarity with the area viewed in the clip should not bias any of the other responses.

Table 7   Location Familiarity

		1 (Not Familiar)	2	3	4	5 (Very Familiar)
Hamilton	Sample 1	*75*	*45*	*47*	*38*	*33*
Hamilton	Sample 2	*7*	*0*	*0*	*0*	*0*
Hamilton	Sample 3	*57*	*22*	*27*	*27*	*23*
Hamilton	Total	**139**	**67**	**74**	**65**	**56**
Boley Springs	Sample 1	*110*	*34*	*36*	*33*	*35*
Boley Springs	Sample 2	*10*	*2*	*2*	*1*	*0*
Boley Springs	Sample 3	*81*	*17*	*26*	*13*	*20*
Boley Springs	Total	**201**	**53**	**64**	**47**	**55**

The cities that were chosen as the most in danger were Hamilton and Oakman (Table 8). Appropriately, most respondents understood that one of the three cities was likely to be affected. Hamilton, which was the first and most likely city to be affected by the possible tornado, and the Hamilton two combinations (Hodges & Hamilton, Hamilton & Hackleburg), accounted for 295 (80%) of the responses. Hodges or Hackleburg only accounted for 20% of responses. Oakman and its two combinations (Oakman & Sandtown, Oakman & Boley Springs) accounted for 340 (83%) of the responses. All remaining choices accounted for 17% of responses. All Oakman choices were chosen more times than all other choices.

Table 8 City Most Likely to Experience a Direct Hit

	Hodges	Hamilton	Hackleburg	None	Hodges & Hamilton	Hodges & Hackleburg	Hamilton & Hackleburg
Sample 1	*6*	*123*	*25*	*1*	*22*	*11*	*29*
Sample 2	*0*	*4*	*0*	*1*	*1*	*0*	*0*
Sample 3	*5*	*89*	*17*	*0*	*9*	*8*	*18*
Total	**11**	**216**	**42**	**2**	**32**	**19**	**47**

	Oakman	Sandtown	Boley Springs	None	Oakman & Sandtown	Oakman & Boley Springs	Sandtown & Boley Springs
Sample 1	*75*	*6*	*32*	*3*	*46*	*69*	*9*
Sample 2	*8*	*0*	*1*	*0*	*1*	*4*	*1*
Sample 3	*63*	*3*	*10*	*4*	*28*	*46*	*2*
Total	**146**	**9**	**43**	**7**	**75**	**119**	**12**

A question unique to the Boley Springs version of the survey, regarding respondents' knowledge of the storm velocity product, yielded interesting results. Four hundred twenty-four people watched the Boley Springs clips, 309 of which indicated that they knew the difference between the red and green colors. These answers were evaluated similarly to the watch versus warning responses. Approximately 61% understood enough about the storm relative velocity product to provide a correct answer. Examples of correct responses are:

> "the red is winds away from the radar and the green is towards"
>
> "red is movement is one direction , green is movement in the opposite direction as detected by doppler radar."
>
> "inflow/outflow"

Several examples of incorrect responses include:

> "Severity of the storm in that particular area"

"Red- Severe weather   Green- Rain"

"Red in Torando Warning Green is watch"

The evaluation of the red versus green responses was a little more lenient than for the watch versus warning responses in that a respondent's answer only needed to explain a difference in wind direction to be counted correct.. Detailed understanding was not necessarily needed for a viewer to be able to make an informed decision.

Section 3

All respondents gave the possible tornado a rating from the video they watched. These data are normally distributed (Table 9). Respondents preferred a basement in which to shelter from the storm they watched more than any other place (Table 10). The second and third choices, which were not much different in frequency, were an interior room and outdoor storm shelter. Very few respondents indicated that would not seek shelter from the storm. Even fewer respondents would have driven away. Most indicated that they would feel very safe in their preferred shelter (Table 11).

Table 9   Tornado Ratings

	F0	F1	F2	F3	F4	F5
Sample 1	*5*	*49*	*146*	*178*	*61*	*23*
Sample 2	*0*	*0*	*7*	*8*	*3*	*2*
Sample 3	*6*	*42*	*95*	*104*	*47*	*15*
Total	**11**	**91**	**248**	**290**	**111**	**40**

Table 10 Preferred Shelter

	Basement	Interior Room	Outdoor Storm Shelter	Other
Sample 1	*220*	*106*	*84*	*36*
Sample 2	*13*	*0*	*7*	*1*
Sample 3	*168*	*71*	*43*	*25*
Total	**401**	**177**	**134**	**62**

	Drive Away	Not Seek Shelter	Home of Someone Else
Sample 1	*3*	*5*	*19*
Sample 2	*0*	*0*	*1*
Sample 3	*0*	*1*	*12*
Total	**3**	**6**	**32**

Table 11 Safety Felt in Preferred Shelter

	(Not Safe) 1	2	3	4	(Very Safe) 5
Sample 1	*9*	*42*	*113*	*170*	*136*
Sample 2	*1*	*1*	*5*	*5*	*10*
Sample 3	*11*	*21*	*73*	*115*	*97*
Total	**21**	**64**	**191**	**290**	**243**

Section 4

The trust scores among viewers were also not normally distributed. In fact, trust of the broadcast was the most skewed data of all that was collected with 84% of scores in the highest category (Table 12). Samples 1 and 3 were most similar in their means and standard deviations ($x_1 = 4.53$, $s_1 = 1.22$, $x_3 = 4.59$, $s_3 = 0.91$) while sample 2 was slightly different ($x_2 = 4.04$, $s_2 = 0.89$). Asking respondents how often they watch James Spann reveals a possible reason for such skewed data. Twenty-two percent indicated that they never watch James Spann. The remaining 78% watch him at least once per week, 64% watch him at least several times per week (Table 13). Sample 2 was much different in this regard, and purposely so, in that 20 of the 22 respondents never watch James Spann. This, however, did not have a huge effect on the overall results based on the limited number of responses.

Table 12 Trust of the Weather Broadcaster, based on a 5-point scale

	0 - 1	**1.1-2**	**2.1-3**	**3.1-4**	**4.1-5**
Sample 1	*26*	*6*	*9*	*27*	*418*
Sample 2	*0*	*0*	*6*	*6*	*10*
Sample 3	*4*	*4*	*24*	*20*	*269*
Total	**30**	**10**	**39**	**53**	**697**

Table 13 Frequency of Watching James Spann

	Never	**Once / week**	**Several times / week**	**Everyday**
Sample 1	*75*	*67*	*158*	*183*
Sample 2	*20*	*1*	*1*	*0*
Sample 3	*88*	*40*	*86*	*107*
Total	**183**	**108**	**245**	**290**

Experimental results

Video specific risk perception scores were calculated from responses of 7 total questions, 4 of which were from section 2 of the survey. Hamilton risk perception was not normally distributed, yet was much closer to being normal than the other non-normal derived variables. The mean was above mid-scale ($x_c = 3.63$, $s_c = 0.73$) (Table 19). Boley Springs risk perception was not that much different from Hamilton ($x_c = 3.65$, $s_c = 0.74$), but was normal distributed. Sample 1 and sample 3 were the most similar varying in mean by no more than 0.06 points (Hamilton: $x_1 = 3.65$, $s_1 = 0.71$, $x_3 = 3.59$, $s_3 = 0.75$; Boley

Springs: x_1 = 3.66, s_1 = 0.72, x_3 = 3.68, s_3 = 0.74). However, even sample 2 was not that much different about 0.2 points higher for Hamilton risk perception (x_2 = 3.80, s_2 = 0.48) and 0.4 points lower for Boley Springs risk perception (x_2 = 3.25, s_2 = 0.7). Overall risk perceptions of sample 1 and sample 3 were also very similar with only 0.01 points difference. Overall risk perception from sample 2 was noticeably different than the other two samples (x_2 = 3.77, s_2 = 0.81) with a lower mean score with a smaller standard deviation.

Video-specific preventative behavior scores had similar trends to the risk perception scores. None were normally distributed and were highly skewed to the left. Samples 1 and 3 were most similar while sample 2 was a little bit different (Table 20). Hamilton preventative behavior scores averaged above 4 for all samples, but was highest for sample 2 (x_2 = 4.14, s_2 = 0.54). Boley Springs preventative behavior scores varied a bit more with samples 1 and 3 means above 4 (x_1 = 4.21, s_1 = 0.8, x_3 = 4.16, s_3 = 0.9). Sample 2 had a lower mean with a standard deviation that split the other two (x_2 = 3.78, s_2 = 0.87). These scores varied more than the risk perception variables because video specific preventative behavior was based on only 3 questions while risk perception was based upon 7 questions.

Video recall for Hamilton/reflectivity was calculated from 3 questions. Video recall for Boley Springs/velocity was calculated from 2 questions. The answers were coded one for correct and 0 for incorrect. After being normalized, a perfect score for each was 1. Average scores for recall did not even reach 50% for any sample of either sets of videos. Recall among the three samples who watched the Hamilton/reflectivity videos were very similar (Table 21). Boley Springs/velocity video recall for sample 2 was much lower than for the other two samples (x_2 = 0.07, s_2 = 0.18, x_1 = 0.28, s_1 = 0.36, x_3 = 0.27, s_3

= 0.32). Notice that the variation of all three exceeded the mean in all three samples beyond the worst possible score, 0.

Weather salience, trust, overall risk, Hamilton risk perception, and Boley Springs risk perception were approved for use with alpha values above 0.69 (Table 14). Slovic risk and the combined Slovic and overall risk variables were not used in significance testing. Hamilton preventative behavior and Boley Springs preventative behavior were used for statistical testing.

Table 14 Cronbach's Reliability Results

Variable	Alpha Value	Survey Questions
Weather Salience	0.734	5a - 5d
Trust	0.941	38a - 38f
Overall Risk	0.829	31, 32, 33
Hamilton Risk	0.699	10, 11, 14, 15, 31, 32, 33
Boley Springs Risk	0.823	19, 20, 24, 25, 31, 32, 33
Slovic Risk	0.463	30a - 30f
Overall + Slovic Risk	0.636	30a -30f, 31, 32, 33

Viewers did, in fact, have differing risk perceptions and preventative behaviors based on which radar product they saw ($p = 0.000$) with reflectivity having a higher mean rank than velocity. Because there was a significant difference in how viewers responded, the effect of the broadcaster's presence was tested twice, once for the Hamilton/reflectivity videos and once for the Boley Springs/velocity videos (Table 15). These tests did not reveal a difference in either viewer risk perception (reflectivity p = 0.821, velocity p = 0.625) or preventative behavior (reflectivity p = 0.217, velocity p = 0.236).

Table 15 Statistical Significance of Video Effects

	Dependent Variables	
Independent Variables	**Risk Perception**	**Preventative Behavior**
Reflectivity v Velocity	**0.000^	**0.000^
On-Screen v Off-Screen (Ham.)	0.821#	0.217^
On-Screen v Off-Screen (BS)	0.625#	0.236^
Hamilton Video Recall	0.507##	0.058^^
Boley Springs Video Recall	**0.000##	**0.000^^
Trust	**0.000^^	**0.000^^
Weather Salience	**0.000^^	**0.000^^
Family Member Proximity	*0.045^^^	0.602^^^

* = Significant	# = Student t-test	^ = Mann-Whitney Test
** = Very Significant	## = Pearson Correlation	^^ = Spearman Correlation
	### = ANOVA	^^^ = Kruskal-Wallis Test

Weather salience and trust of the broadcaster yielded significant results on both risk and behavior (Table 15). Correlation coefficients for weather salience and trust were 0.206 and 0.222, respectively (Table 16). One question included in the survey asked participants if they had a family member or close friend in the areas shown in the clip. Risk perception based on this question was just beyond the significant threshold (p = 0.045). Preventative behavior was not significant (p = 0.602).

Table 16 Correlation Coefficients

	Risk Perception	Preventative Behavior
Hamilton Video Recall	Not Significant	Not Significant
Boley Springs Video Recall	* 0.274	** 0.225
Trust	** 0.222	** 0.206
Weather Salience	** 0.159	** 0.209

* = Pearson's r ** = Spearman's ρ

Table 17 Statistical Significance of Demographic Effects

	Independent Variables			
Dependent Variables	**Gender**	**Age**	**Education**	**Race**
Risk Perception	0.25^	*0.048^^	0.069^^^	0.23^^^
Preventative Behavior	0.346^	0.881^^	0.907^^^	0.231^^^
Trust	0.115^	0.157^^	0.601^^^	0.471^^^
Weather Salience	**0.002^	**0.001^^	0.129^^^	0.127^^^
Boley Springs Video Recall	0.836^	0.273^^	0.583^^^	0.318^^^
Hamilton Video Recall	0.469#	**0.002^^	0.727###	0.344^^^

* = Significant
** = Very Significant

= Student t-test
= Pearson Correlation
= ANOVA

^ = Mann-Whitney Test
^^ = Spearman Correlation
^^^ = Kruskal-Wallis Test

Overall risk perception, overall preventative behavior, trust, weather salience, Boley Springs/velocity video recall, and Hamilton/reflectivity video recall were tested with four demographic characteristics. Only overall risk perception, weather salience, and Hamilton/reflectivity video recall significantly differed based on age (Table 17). Correlations between age and the other three variables were not strong (Table 18).

Table 18 Age Correlations with Other Variables

Risk Perception	** 0.071
Preventative Behavior	Not Significant
Trust	Not Significant
Weather Salience	** -0.115
Hamilton Video Recall	* 0.154
Boley Springs Video Recall	Not Significant

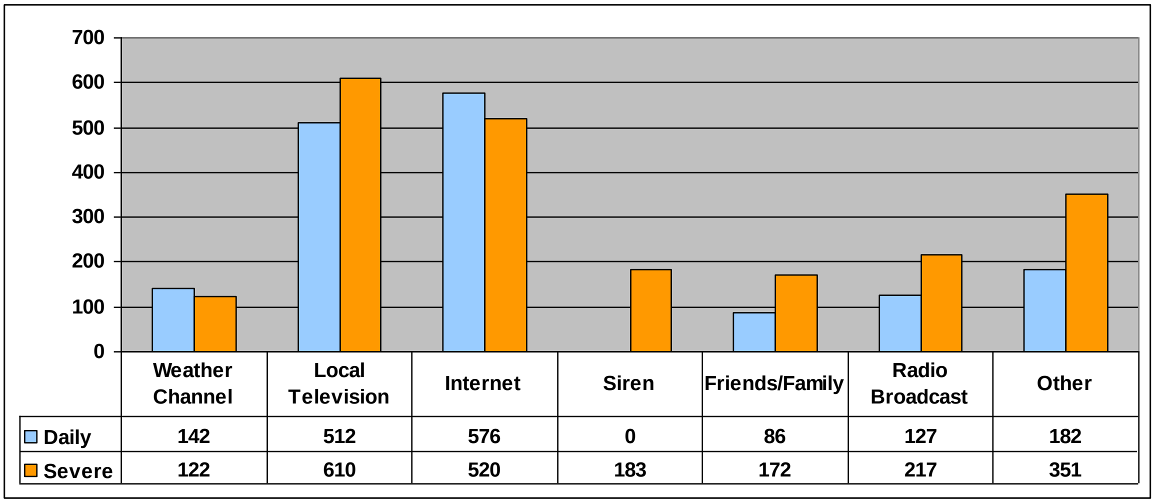
* = Pearson's r
** = Spearman's ρ

CHAPTER V

DISCUSSION

Weather information sources

Survey respondents referenced more than one source of weather information in daily and in severe weather situations (Figure 3), which has also been documented in several previous studies (Legates & Biddle, 1999; Balluz et al., 2000; Brown et al., 2002; Hammer & Schmidlin, 2002; Mitchem 2003; Comstock & Mallonee, 2005; Sherman-Morris, 2005; Sherman-Morris, 2010; Schmidlin et al., 2009). It is also not surprising to see that television and internet sources are referenced much more often than the others. If cellular phones had been an option, it would have been one of the top choices with television and internet as a source of weather information because cell phone weather applications were mentioned more than anything else to clarify “other”. Television has been the most commonly documented source of daily weather forecasts and especially of severe weather information. Several more recent studies have reported the use of television diminishing at the expense of internet or cell phone use (Comstock & Mallonee, 2005; Sherman-Morris, 2005; Sherman-Morris, 2010). The change is even more evident with the samples from this study than from other studies. Specific websites were also mentioned. Internet use has become ubiquitous, affordable, and is easily accessible almost anywhere.



	Weather Channel	Local Television	Internet	Siren	Friends/Family	Radio Broadcast	Other
Daily	142	512	576	0	86	127	182
Severe	122	610	520	183	172	217	351

Figure 3 Sources of Weather Information

Advances in cell phone technology allow people to get up-to-date weather information at any moment in any location. Many businesses and television stations have begun to update their efforts to include these communication modes which further encourage the use of newer technologies as a source of weather information. As early as 1999, Drabek alluded to the fact that researchers must include the new warning methods to keep up with advancements in communication between those who issue warnings and those who should receive the warnings. Based on the changing trends, the presented research may seem out-dated since television use in its traditional sense seems to be fading; on the contrary, television broadcasts are now accessible on station websites. People can view the broadcast on their portable computers (laptops, tablets, etc.) or their cell phones. Maybe a better direction would be to assess the content people search for, i.e. what kind of information they want, instead of continuing the same survey style of categorizing warning source. Personalized detailed information that can be accessed individually on websites via mobile devices seems to be more appealing than the more generic weather forecasts given over the radio or on television.

Watch vs. warning

A 96% accuracy rate for knowing the difference between a tornado watch and tornado warning was quite a bit higher, even though a relatively high percentage of people these days know the difference between a watch and a warning, for this sample than what most studies report (Liu et al., 1996; Mitchem 2003; Sherman-Morris, 2010). This is, in part, due to the type of people who responded to the survey. Because of the way participants were recruited, it is possible that the people who participated in the study were generally more interested, intrigued, and knowledgeable of the weather than people who did not respond. Skewed weather salience scores support this supposition (Table 4).

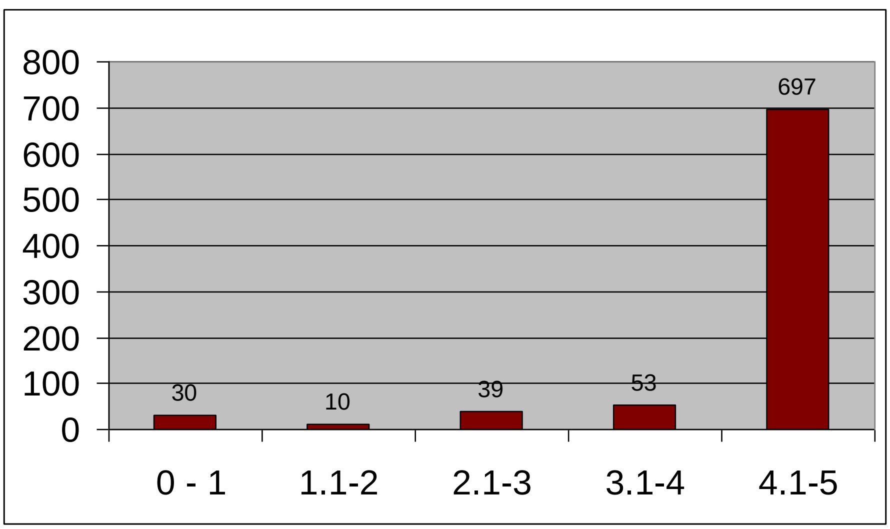


Figure 4 Trust

The high accuracy could also be explained by the fact that James Spann sent out a request for participation. Most of the respondents were internet "followers" of his to some degree which is how most people learned of the survey. There is evidence to support this claim as well in the trust responses (Figure 4) and responses for how often each person watches Spann (Figure 5). Spann is known for his desire for public education and preparedness. Considering that 78% of respondents watch Spann at least once per week, one explanation is that Spann has effectively taught his viewers the difference between a tornado watch and tornado warning. Ultimately, this should be the goal of all on-air meteorologists; to communicate to viewers in such a way that they become knowledgeable enough about the weather and how it is forecasted to make an informed decision during severe weather. No inferences can be made about people who do not watch Spann on a relatively regular basis because this sample does not include a wide range of people.

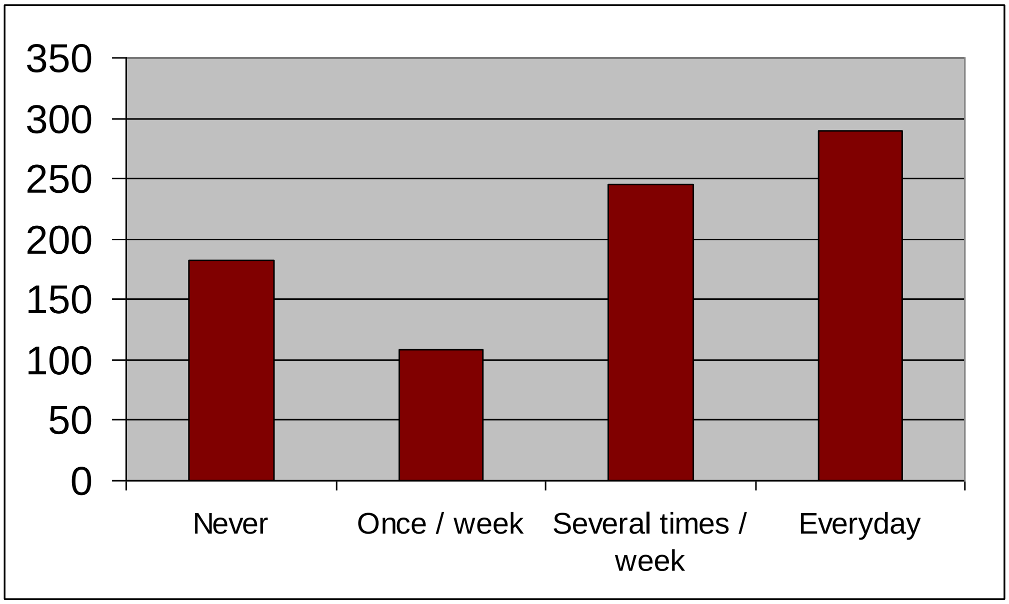


Figure 5 Frequency of Watching James Spann

Storm relative velocity knowledge

The storm relative velocity product is most often referenced during tornadic severe weather. In fact, it is almost never referenced at any other times. It stands to reason then that viewers would be less familiar with the velocity products than reflectivity which is the typical radar product shown during any situation, whether severe, winter, non-severe rain or clear. There were 424 people who watched the Boley Springs (velocity) clips. These respondents were asked if they knew the difference between the typical red and green colors of the storm velocity product. A sizeable majority, 73%, indicated that they did. Of the 309 that provided an explanation, about 61% would have been able to interpret what they saw from the storm relative velocity to make an informed decision to seek shelter or not. It was unexpected to have such high percentages of people who thought they knew what the velocity product was and were able to explain it.

Referencing the same data as above (Figures 4 & 5), it seems as though viewers of Spann are surprisingly more "weather-aware" than other people.

Statistical assessment of risk perception and preventative behavior

The effects of the radar product were found to be significant and therefore caused hypothesis 1 to become fourfold (Figure 2). A p-value of 0.000 confirmed hypotheses 2a and 2b, that viewer risk perception and preventative behavior would be the different between those who saw the reflectivity and those who saw the Boley Springs/velocity videos (Table 15). Viewer risk perception and preventative behavior ranked higher for reflectivity watchers than for velocity watchers, implying a higher likelihood of shelter seeking among respondents.

Three factors could explain the difference: familiarity, display salience, or knowledge. Broadcasters show and thus explain the reflectivity product more often than other radar products. Thus, viewers are generally more familiar with the reflectivity product. It could be that the color scheme of reflectivity in the video seemed more dangerous to viewers and thus caused a higher perception of risk. The Hamilton/reflectivity clips shown to participants had highly concentrated hot colors. The storm in the clip was very strong and returned values that were mostly colored yellow, orange, and red. Even purple, the color for one of the highest values was returned. The background was also predominately red from tornado watch and warning underlays. In contrast, the velocity clips were more neutral in appearance. Green and gray were the dominate colors.

A third possible explanation could be that the inferences that viewers made from either radar product itself resulted in their risk perception scores (Allen et al., 2006; Canham & Hegarty, 2010; Hegarty et al., 2010). Since reflectivity is explained more than velocity and respondents' tendency to watch Spann regularly, viewers may have been able to make correct inferences that resulted in higher risk perception scores. On the other hand, it could be that the velocity products are just simply more difficult to understand and pull meaning from for the average person with very little education on interpreting radar.

Since an effect was discovered between radar products, the presence of the weather broadcaster was tested separately for the Hamilton/reflectivity and Boley Springs/velocity videos (Figure 2). No difference was found in risk perception or preventative behavior from the broadcaster being on- or off-screen for both the Hamilton/reflectivity and Boley Springs/velocity videos (Table 15). Hypothesis 1 was rejected. A viewer who watched severe weather coverage with a broadcaster on-screen was not necessarily more likely to seek shelter. It is likely that the supposed effect of the broadcaster was undetected or diminished because of the short length of the videos. Auter (1992) showed videos 17 minutes long to participants. Hartmann and Goldhoorn (2011) used a set of videos that were about 3 minutes long to test for parasocial interaction. Cassell et al. (1998) used videos about 2 minutes apiece to test for speech-gesture mismatches. With a pair of videos 13 seconds long and another pair 22 seconds long used in the presented research, it is entirely possible that if an effect does exist that it would require longer videos to become evident.

Hypotheses 3 and 4 were the separated versions of a single question. Risk perception was not correlated with accuracy of video recall among all the reflectivity watchers ($p = 0.507$). Preventative behavior was also not correlated with accuracy of video recall among reflectivity watchers ($p = 0.058$), although it was along the threshold of significance. Hypothesis 3 was rejected, meaning that even if a viewer was able to remember much of what was seen and/or heard during the video, it did not result in a higher likelihood of seeking shelter. Overall, viewers were not able to accurately answer the three questions from the survey evidenced by an average score of 0.39 out of 1(Table 20).

Risk perception and preventative behavior were both found to be correlated with video recall among velocity watchers ($p = 0.000$). The correlation coefficients for video recall with risk and behavior were both positive but not strong (Table 17). Hypothesis 4 was confirmed. People who were able to remember what was seen and/or heard during the velocity videos were more likely to seek shelter. Though, similar to the reflectivity watchers, overall memory was low for velocity watchers as well ($x = 0.27$).

Hypothesis 5 was included to determine if viewers were more likely to respond to the broadcaster's suggestions because a person emotionally connected to the viewer might be affected. As it turned out, 88% of respondents did not have or did not know of any close relations living in the areas shown in the videos. Tests confirmed that family member proximity had an effect on risk perception ($p = 0.045$). Someone's risk perception should be higher if a family member is in danger of the storm based on the optimistic bias. People will attribute higher levels of risk upon other people than they will assess for themselves (Weinstein, 2004; Bless et al., 2004). Hypothesis 5a was confirmed.

Hypothesis 5b was rejected. Tests revealed that family member proximity did not have an effect on preventative behavior (Table 15). Since the overall preventative behavior variable was used in this test (this question asked how likely the respondent was to take shelter), the fact that preventative behavior of seeking shelter was not affected by family member proximity to the storm makes sense. One will not actively look for a safe place from weather if they are not directly in danger. If, however, the video-specific preventative behavior variables (included questions asking how likely respondent was to call and alert someone else of the storm) had been used, different results may have become evident.

Hypothesis 6 was confirmed implying that the more a viewer trusts the broadcaster, the higher their perception of risk and likelihood of preventative behavior. The correlations were not strong (Table 16), but both of these associations are logically sound. Statistical significance with these data may not necessarily infer an association between trust and risk and behavior because trust of Spann was so extremely skewed (Table 12). Seventy-five percent of participants had a trust value at the very top of the scale at 5. Even though the Spearman's rank-order correlation was used, statistical testing may not be very useful. The skew of the data results from the recruitment process previously described. A more representative sample of the Birmingham, AL area would require a different recruitment method and more than likely yield results more useful for statistical testing and inferences.

Hypothesis 7 was confirmed with p-values below 0.01 for significance of risk perception and preventative behavior with weather salience. The correlations between viewer risk and behavior with weather salience were less strong as correlations with trust and velocity video recall (Table 16). The fact that the importance and value of weather to a viewer results in a higher perception of risk during severe weather and a higher propensity for preventative behavior was expected.

Hypotheses 8-11 all deal with viewer demographic characteristics and the effect each have on the various concepts. Hypotheses 10 and 11 were rejected, while hypotheses 8 and 9 were only partially confirmed. Of the 24 tests run, only 4 returned any results of significance (Table 17). Weather salience differed between men and women (hypothesis 8d) such that men found weather more important and valuable than women. Age of viewers was correlated with risk perception, weather salience, and reflectivity video recall (hypotheses 9a, 9d, 9f) (Table 18). These relationships were not very strong, however, with correlation coefficients not exceeding 0.16 positively or negatively. As age increased, so did viewer video recall ($\rho = 0.154$) and perception of risk ($\rho = 0.071$). Age was negatively correlated with weather salience ($\rho = -0.115$).

Validity of risk assessment

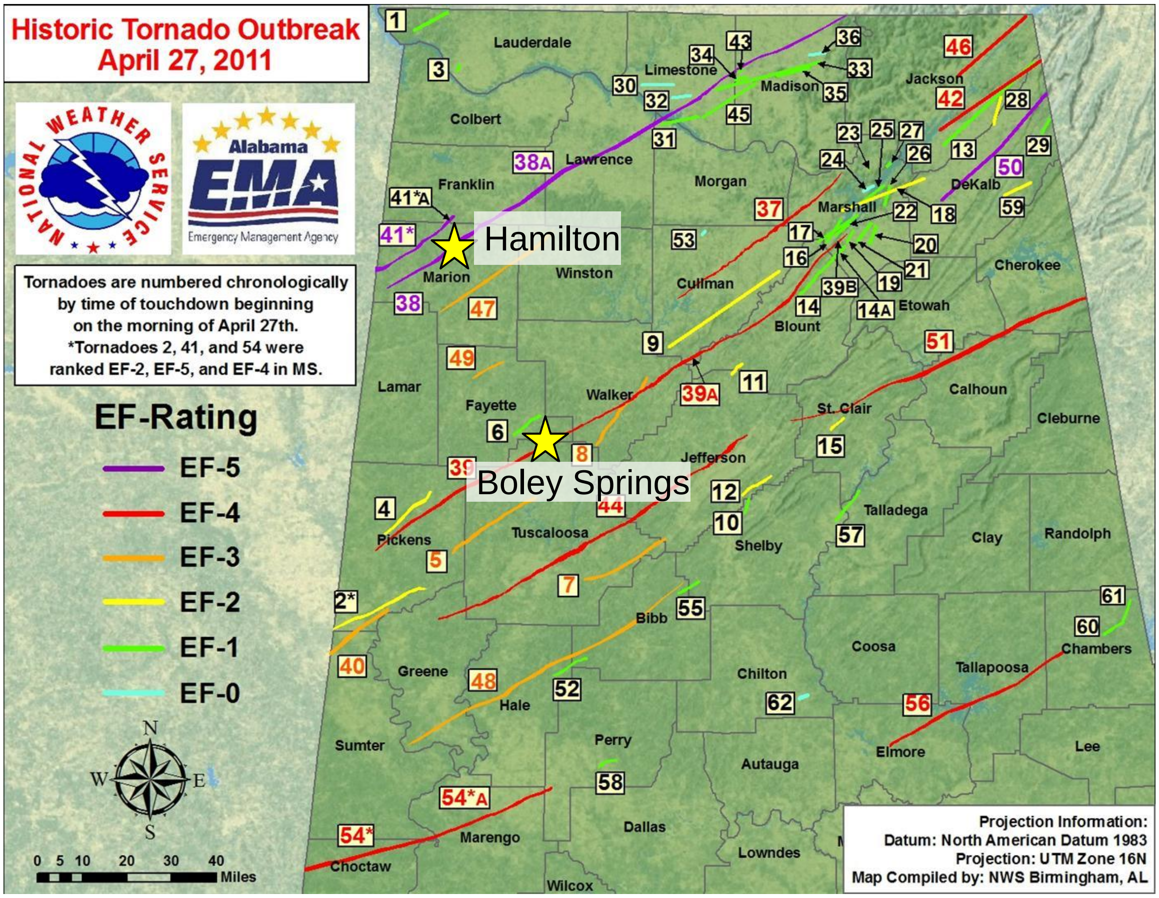


Figure 6 April 27, 2012 Tornado Tracks Across Alabama

An appropriate question to ask at this point would be if viewers would have been justified if they had perceived a high enough risk to seek shelter. When these videos were live on television, the storms were producing tornados. Looking back at the NWS storm survey information shows the path of the tornados, the strength of the tornados at various points along the path, and the relation to the surrounding cities (Figure 6). During the Hamilton video, the storm had not yet crossed the future interstate 22. The NWS storm survey team assessed tornado damage at several locations near the interstate as a result of an EF-1 to EF-2 tornado (Figure 7). During the Boley Springs video, the storm was nearing Sandtown, AL. Damage assessments in that area resulted from an EF-1 tornado and varied in intensity up to EF-3 before arriving in Sandtown. The tornados produced from the storms were not at their strongest in either situation, but eventually both produced damage corresponding to an EF-4 tornado. Viewers with higher perceptions of risk would have appropriately assessed the situation to be dangerous by seeking shelter.

(a)

(b)

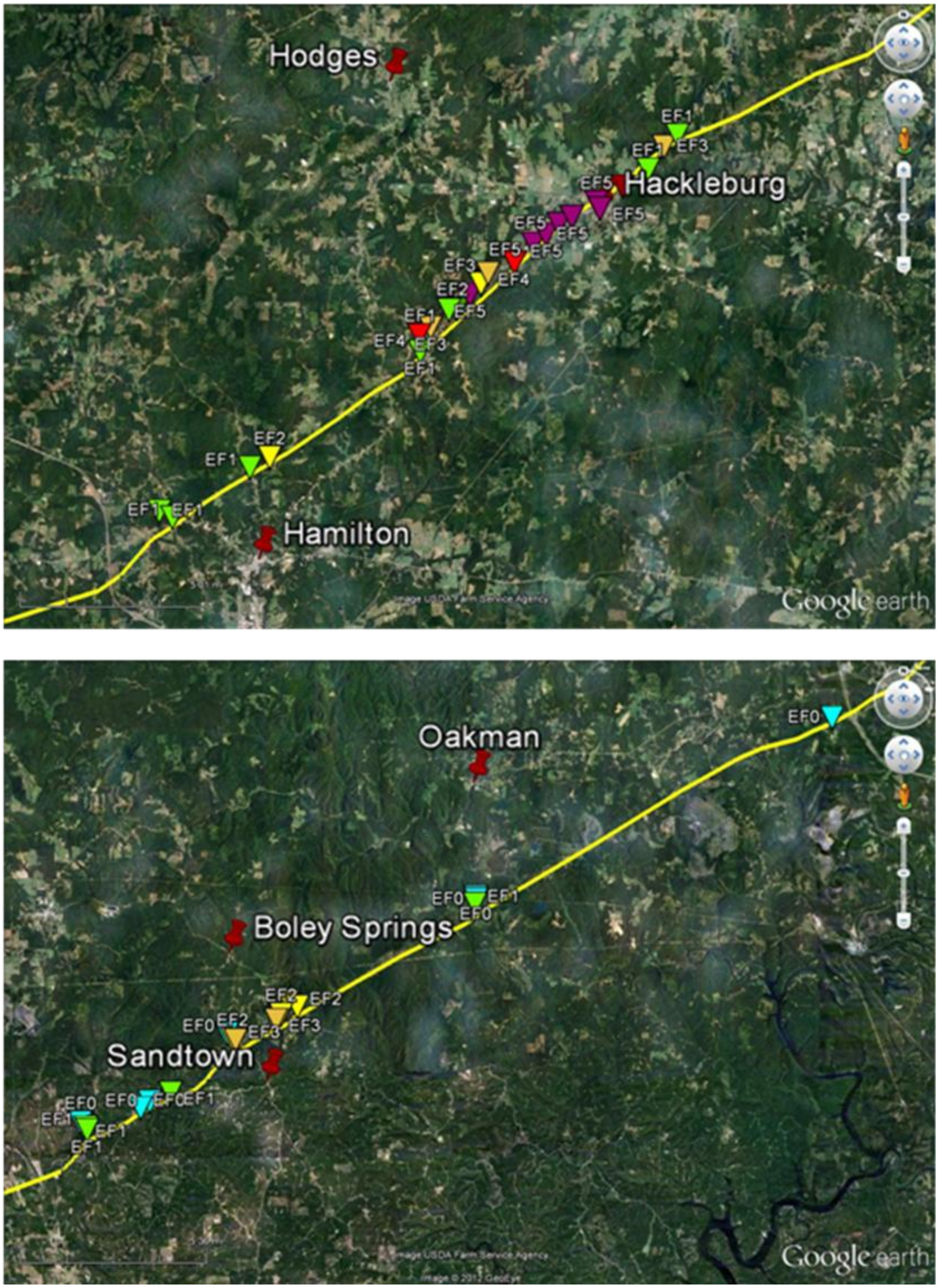


Figure 7 Video Tornado Tracks

(a) NWS Damage Surveys and Tornado Track – Hamilton Videos
(b) NWS Damage Surveys and Tornado Track – Boley Springs Videos

Subjective assessment of risk perception and preventative behavior

At the time the Hamilton videos were recorded, the storm was passing over Hamilton and had not yet affected either Hodges or Hackleburg (Figure 1). The National Weather Service damage assessments found debris congruent with damage from an EF-1 tornado to the west of Hamilton and EF-2 damage just north of Hamilton (Figure 7). Respondents accurately assessed that Hamilton was the most likely to experience a direct hit from the possible tornado (Figure 8). The three answer choices that included Hamilton were the top three answers at a total 80% of respondents. As it turned out, Hackleburg suffered a much stronger tornado than Hamilton did. It was expected to see a bit of a bias towards Hackleburg because of respondents' experience and memory, but a bias did not appear in the data. The answer choice that included Hamilton and Hackleburg was chosen more often than the answer with Hamilton and Hodges; however, there was not a big difference in frequency of the previous two choices when compared to the Hamilton answer choice. Based on this subjective review of respondent answers and damage history, respondents to the reflectivity clips were relatively aware of the weather situation and understood which cities were in the most danger. If risk perception was high and a response resulted, viewers of these videos would have been justified and able to make wise and accurate decisions about seeking shelter and alerting others.

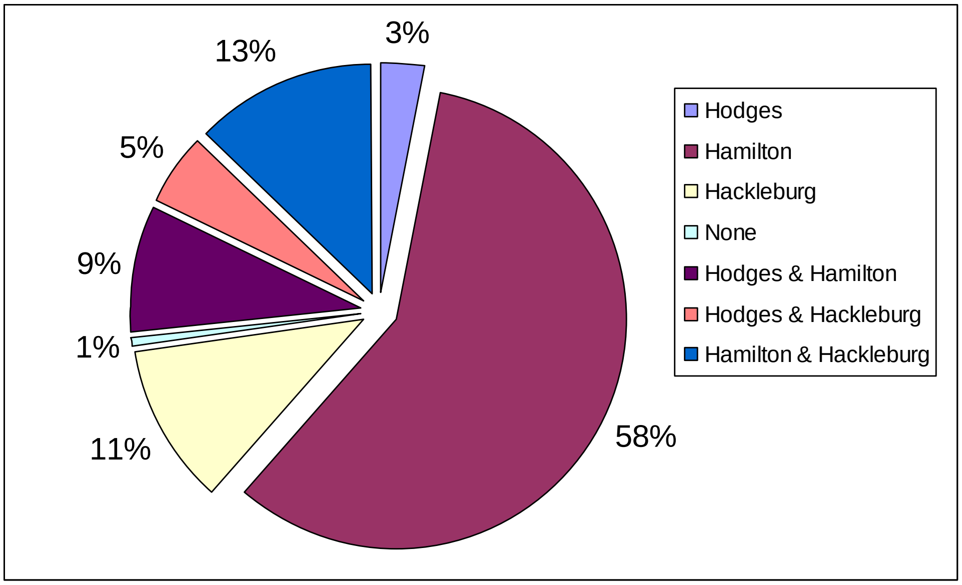


Figure 8 Hamilton/Reflectivity Videos: Which City Will Experience a Direct Hit?

During the Boley Springs videos, the storm was nearest to Sandtown, but not as obviously affecting Sandtown as much as the other storm was affecting Hamilton (Figure 1). Neither Boley Springs nor Oakman was in the "line of fire" based on visual cues alone. One key difference about these videos was that the recommendations of Spann towards Oakman citizens to seek shelter were quite emphatic, much more so than his speech about the other cities in the Boley Springs videos or the cities in the Hamilton videos. There was not a clear trend in responses for the Boley Springs clips about which city would be most likely to experience a direct hit. Oakman did receive the highest percentage, but only by 7% (Figure 8). As expected, the responses to this question revealed that, overall, respondents were not really sure which city was in the most danger. Sandtown was very low on the list of likelihood for direct hit, but Oakman and Sandtown together somehow were the third highest choice.

According to the National Weather Service damage assessments in this area, damage from an EF-0 tornado was occurring to the southwest of Sandtown at the time of the clips and the strongest damage occurred right around Sandtown and was caused by a tornado around EF-2 to EF-3 strength (Figure 7). Neither Boley Springs nor Oakman received a direct hit from the tornado. The city that did experience a direct hit from these videos (Sandtown) was not chosen by respondents as the most likely to be directly hit by the tornado (Figure 9). Neither of the combinations of Sandtown and the other two cities was near the top answer choices. Respondents to the velocity clips were much more confused about which city would receive a direct hit than the respondents to the reflectivity clips. If risk perception was high and a response resulted, viewers deciding to alert others may provide incorrect information based on their understanding of the velocity clips. Seeking shelter by both the original viewer and the alerted individual would have been appropriate.

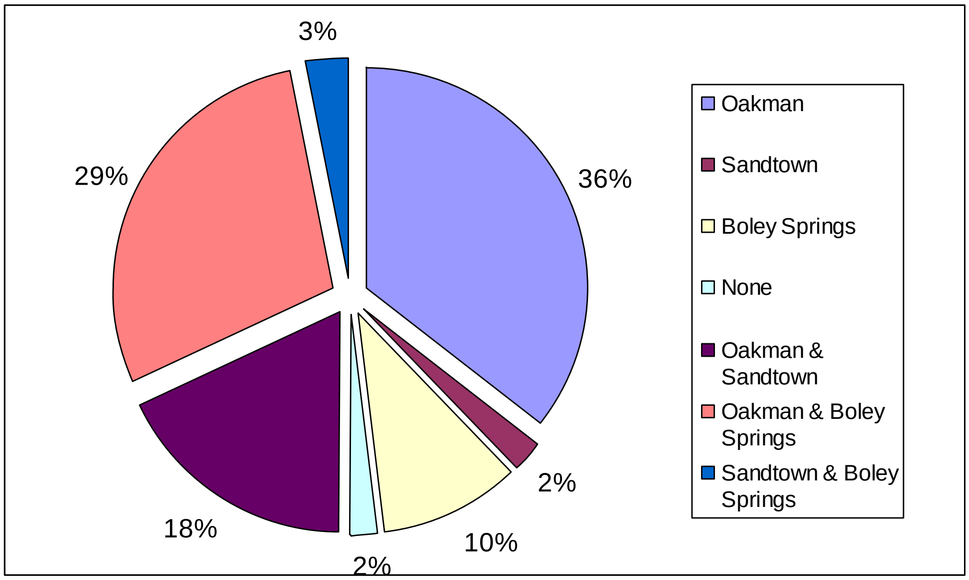


Figure 9 Boley Springs/Velocity Videos: Which City Will Experience a Direct Hit?

Recruitment issues

The first recruitment method, a request for participation by Spann through any number of his social networking venues, was an efficient means to recruit respondents. Over 1000 people responded within 12 hours of his initial "status update" or "tweet". After the first 12 hours, however, the response rate dramatically decreased. Only an additional 100 people responded to the survey over the next month. Of the 1000 people who responded, less than half of those completed surveys. This was sample 1, the group of 486 respondents who were "friends" of Spann on Facebook, "followers" of his on Twitter, or made sure to check on his blog periodically. After looking through the data, an issue was found with the online recording method that made it impossible to use this dataset for inferences about the weather broadcaster's effect on viewers. Therefore, additional surveys had to be obtained.

Students from Mississippi State University were then recruited to take the survey. These data allowed for additional troubleshooting of the online survey and a different demographic of participants. Student surveys were completed over a two week period and did not have a similar number of responses like the first sample. The students alone did not provide enough responses (only 22) with which to make any statistical inference; therefore more respondents were needed to test the original hypotheses about the effect of the weather broadcaster on a viewer’s risk perception.

A third sample was obtained by the researcher posting a similar announcement on a personal Facebook account that Spann posted on his public accounts. When this did not result in enough responses for statistical tests, Spann posted a second request for participation. The surveys from the third sample were gathered over a 1½ month period. There was approximately one month between Spann’s first announcement and his second announcement. Approximately two months passed between the first completed survey and the last completed survey. No major severe weather events occurred during that time.

CHAPTER VI

CONCLUSIONS

Trust and weather salience were quantified in this study. Results of these two variables were rather skewed likely because the sample did not accurately represent the population of Birmingham, AL. The recruitment method using social networking websites was efficient, but it did not supply a sample generalizable enough for inferences to be made about anyone except television viewers who are already interested in the weather and trust their local weather broadcaster.

The primary findings are: 1) a relationship between viewers' risk perception and the presence of the broadcaster was not found, 2) a relationship between viewers' preventative behavior and the presence of the broadcaster was also not found, and 3) the reflectivity product was associated with higher risk perception and preventative behavior scores than the velocity product. It is suggested that the effect of an on-screen versus off-screen broadcaster was not found because the length of clips used in testing were not long enough to elicit authentic emergency responses. Other studies using video in testing that resulted in statistical significance were at least 2 minutes long while the clips administered in this study were less than 25 seconds long. The broadcaster's effect may still be found if longer clips were employed or if the content were more carefully controlled.

Although never tested before, the fact that the reflectivity radar product was associated with higher risk perception and preventative behavior scores, thus implying an intent to seek shelter, does not come as a surprise. Familiarity, knowledge, and display salience were three suggested reasons for the discovered effect. Reflectivity is shown during daily weather shows and severe weather coverage more than any other radar product. As such, reflectivity is the most explained by broadcasters and best understood by viewers of all other products. Although knowledge itself does not imply that someone will take shelter, it certainly aids the decision-making process by supplying accurate information by which to come to a conclusion about the imperativeness of seeking shelter during a severe weather situation. The difference in color schemes between the reflectivity and velocity clips may also have been a reason for significantly different risk perception and preventative behavior scores.

Higher risk perception scores resulting in seeking shelter is only helpful if the situation actually warrants it. Otherwise, over time respondents may experience the "numbing" effect like that described by Schmidlin and King (1997) or claim that broadcasters only "cry wolf" if viewers continually seek shelter and do not personally see a storm's damage. In this case, respondents who assessed high amounts of risk were justified in their response because the storms in the videos produced tornados of at least EF-3 intensity, and at times up to EF-5, at some point within the spatial confines of the clip.

Studying the way in which a broadcaster communicates to the viewers during severe weather is inherently a multidisciplinary topic and answers the call of previous research to update and improve warning communication through diverse perspectives

(Mileti, 1995; Golden & Adams, 2000; Simmons & Sutter, 2008). The culmination of the research reveals 1) that social networking for use in the research domain is an efficient means of recruitment, but has difficulty ensuring a specific representative sample, 2) that choosing video clips in the direction of this research may be a more delicate process than originally thought, and 3) that the communication methods and practices of broadcasters during severe weather can have a significant impact on the way in which viewers respond during emergency situations.

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APPENDIX A

IRB APPROVAL LETTER

Informed Consent:

This survey is designed to learn about your responses to a weather broadcaster during a severe weather event. You will be shown a short clip from severe weather coverage. It should take you approximately 20 minutes to complete the survey.

Your participation in this study is voluntary. You must be 18 years of age or older to participate. You may withdraw at any time. We will not collect identifying information such as your name, email address or IP address.

This research project is being conducted by Amanda Hipp of Mississippi State University, who can be contacted at amh422@msstate.edu, and Dr. Kathy Sherman-Morris of Mississippi State University, who can be contacted at kms5@geosci.msstate.edu. If you have any questions about the research study, please contact the Mississippi State University Institutional Review Board at irb@research.msstate.edu or 662-325-3994.

Click "Next" to begin the survey.

MSU IRB
Approved: 3 / 22 / 12
Expires: – / – / –

APPENDIX B

WEATHER BROADCASTER VIDEO SURVEY

Section 1: Weather history and weather salience

1. How do you normally receive your daily weather information?
   a. Weather Channel *b. Local Television Station* *c. Friends/Family*
   d. Radio Broadcast *e. Internet* *d. other* ______________

2. How often do you look for a daily weather forecast?
   a. Never *b. Once a week* *c. Several times a week* *d. Every day*

3. How do you normally receive your severe weather information?
   a. Weather Channel *b. Local Television Station* *c. Internet* *d. Siren*
   e. Friends/Family *f. Radio Broadcast* *g. other* ______________

4. Do you know the difference between a tornado watch and a tornado warning?
   a. Yes *b. No* *c. I don't know*

   ➔ If yes, please explain the difference.

5. Please indicate the degree to which you agree with the following statements.

	Strongly Disagree				Strongly Agree
a. When I hear others talking about the weather it bores me.	*1*	*2*	*3*	*4*	*5*
b. It is important to consider the weather when planning for my day.	*1*	*2*	*3*	*4*	*5*
c. I get excited when I find myself talking to others about the weather.	*1*	*2*	*3*	*4*	*5*
d. The weather is interesting to me.	*1*	*2*	*3*	*4*	*5*

Section 2: Video-specific risk perception, preventative behavior, and video recall questions

Hamilton/reflectivity specific questions

(Answer choices in bold were considered correct)

6. How familiar are you with this region of Alabama?
   Not Familiar 1 2 3 4 5 Very Familiar

7. What area of Hamilton is most likely to experience a direct hit from the tornado?

8. Is there a confirmed tornado with this storm?

a. Yes *b. No* *c. I don't know*

9. Has the tornado crossed I-22?

a. Yes *b. No* *c. I don't know*

10. How likely is Hamilton to experience a direct hit from the tornado?

Not Likely 1 2 3 4 5 Very Likely

11. If Hamilton was hit, how severe would the damage be?

Not Severe 1 2 3 4 5 Very Severe

12. The possible tornado is located ______________ of Hamilton.

a. South *b. Southeast* *c. East* *d. Northeast*
e. North *f. Northwest* ***g. West*** *h. Southwest*

13. How likely would you be to call and alert them of the storm if you had a family member or close friend in Hamilton?

Not Likely 1 2 3 4 5 Very Likely

➔ What would you tell them?

14. How likely is Hodges to experience a direct hit from the tornado?

Not Likely 1 2 3 4 5 Very Likely

15. If Hodges was hit, how severe would the damage be?

Not Severe 1 2 3 4 5 Very Severe

16. How likely would you be to call and alert them of the storm if you had a family member or close friend in Hodges?

Not Likely 1 2 3 4 5 Very Likely

➔ What would you tell them?

17. Which city is most likely to experience a direct hit from the possible tornado?

a. Hodges ***b. Hamilton*** *c. Hackleburg* *d. None of the cities listed*
e. a & b *f. a & c* *g. b & c*

Boley Springs/velocity specific questions

(Answer choices in bold were considered correct)

18. How familiar are you with this region of Alabama?

Not Familiar 1 2 3 4 5 Very Familiar

19. How likely is Oakman to experience a direct hit from the tornado?

Not Likely 1 2 3 4 5 Very Likely

20. If Oakman was hit, how severe would the damage be?

Not Severe 1 2 3 4 5 Very Severe

21. How likely would you be to call and alert them of the storm if you had a family member or close friend in Oakman?

Not Likely 1 2 3 4 5 Very Likely

22. About how fast do you think the storm is moving?

a. 10-20 mph *b. 20-30 mph* *c. 30-40 mph* *d. 40-50 mph*
e. 50-60 mph *f. 60-70 mph* *g. 70-80 mph* *h. 80-90 mph*

23. Is there a confirmed tornado with this storm?

a. Yes *b. No* *c. I don't know*

24. How likely is Sandtown to experience a direct hit from the tornado?

Not Likely 1 2 3 4 5 Very Likely

25. If Sandtown was hit, how severe would the damage be?

Not Likely 1 2 3 4 5 Very Likely

26. How likely would you be to call and alert them of the storm if you had a family member or close friend in Sandtown?

Not Likely 1 2 3 4 5 Very Likely

27. The possible tornado is located _____________ of Boley Springs.

a. South *b. Southeast* *c. East* *d. Northeast*
e. North *f. Northwest* *g. West* *h. Southwest*

28. Do you know what the red and green colors indicate on the radar image?

a. Yes *b. No* *c. I don't know*

➔ If yes, please explain.

29. Which city is most likely to experience a direct hit from the possible tornado?

a. Oakman *b. Sandtown* *c. Boley Springs* *d. None of the cities listed*
e. a & b *f. a & c* *g. b & c*

Section 3: Overall risk perception

30. Please indicate how accurately the following words describe severe weather situation from the previous clip.

	Not Very				Very Much
a. Threatening	*1*	*2*	*3*	*4*	*5*
b. Common	*1*	*2*	*3*	*4*	*5*
c. Predictable	*1*	*2*	*3*	*4*	*5*
d. Dreadful	*1*	*2*	*3*	*4*	*5*
e. Abnormal	*1*	*2*	*3*	*4*	*5*
f. Unexpected	*1*	*2*	*3*	*4*	*5*

31. How scary does this situation seem to you?
Not Scary 1 2 3 4 5 Very Scary

32. How would you rate the dangerousness of this storm?
Not Dangerous 1 2 3 4 5 Very Dangerous

33. How would you rate the severity of the storm?
Not Strong 1 2 3 4 5 Very Strong

34. What rating do you think the indicated tornado would receive?
a. F-0 b. F-1 c. F-2 d. F-3 e. F-4 f. F-5

35. How likely would you be to seek shelter from this storm?
Not Likely 1 2 3 4 5 Very Likely

36. How safe would you feel in your home if the storm shown in the clip was headed toward your home?
Not Safe 1 2 3 4 5 Very Safe

37. What would be your preferred method of seeking shelter from this storm?
a. basement *b. interior room* *c. drive*
d. outdoor storm shelter away *e. home of someone else*
f. would not plan to take shelter *g. other:* ________________

➔ How safe would you feel in your preferred shelter from this storm?

Not Safe *1* *2* *3* *4* *5* *Very Safe*

Section 4: Trust of the weather broadcaster

38. Please indicate the degree to which you agree with the following statements.

Strongly Disagree — Strongly Agree

a. The person speaking in the video clip is a qualified weather forecaster.

1 *2* *3* *4* *5*

b. The person speaking in the video clip is concerned with my safety.

1 *2* *3* *4* *5*

c. I am confident in the skill of the person speaking in the video clip as a weather forecaster.

1 *2* *3* *4* *5*

d. The person speaking in the video clip is a reliable weather forecaster.

1 *2* *3* *4* *5*

e. I am confident that the person speaking in the video clip will address a severe weather situation when it affects me.

1 *2* *3* *4* *5*

f. The person speaking in the video clip consistently and fairly covers all the storms during a severe weather situation.

1 *2* *3* *4* *5*

39. How often do you watch James Spann's weather forecasts?

a. Never *b. Once a week* *c. Several times a week* *d. Every day*

Section 5: Demographics

40. Does any close friend or family member live in the areas shown in the clips?

a. Yes *b. No* *c. I don't know*

41. Gender:

a. Male *b. Female*

42. Age: _____________

43. Zip code: _____________

44. What is the highest level of education that you have attained?

a. Some high school *b. High school* *c. Some college*
e. Bachelor's degree *f. Advanced degree*

45. With which group do you identify the most?

a. Caucasian *b. Black* *c. Hispanic* *d. Asian* *e. Other:* __________

APPENDIX C

STATISTICAL DETAILS OF DERIVED VARIABLES

Table 19   Risk Perception Results

		Overall	Hamilton	Boley Springs
Sample 1	Sample Size	486	234	245
	Mean	4.08	3.65	3.66
	Standard Deviation	1.09	0.71	0.72
	Median	4.33	4.33	3.71
	Mode	5	3.57	3.71
	Range	5	4.14	4.29
Sample 2	Sample Size	22	7	15
	Mean	3.77	3.80	3.25
	Standard Deviation	0.81	0.48	0.70
	Median	4	3.86	3.43
	Mode	4	4.14	3.43
	Range	3	1.29	3
Sample 3	Sample Size	314	157	157
	Mean	4.07	3.59	3.68
	Standard Deviation	1.06	0.75	0.76
	Median	4.33	3.71	3.71
	Mode	5	4	4.14
	Range	5	3.86	3.86
Combined	Sample Size	829	829	829
	Mean	4.06	3.63	3.65
	Standard Deviation	1.07	0.73	0.74
	Median	4.33	3.71	3.71
	Mode	5	4.14	3.71
	Range	5	4.14	4.29

Sample 1, n = 486
Sample 2, n = 22
Sample 3, n = 321
Combined Samples, n = 829

Table 20 Preventative Behavior Results

		Overall	Hamilton	Boley Springs
Sample 1	Sample Size	486	233	245
	Mean	4.43	4.06	4.21
	Standard Deviation	1.18	0.87	0.80
	Median	5	4.33	4.33
	Mode	5	5	5
	Range	5	4	4
Sample 2	Sample Size	22	7	15
	Mean	4.23	4.14	3.78
	Standard Deviation	0.92	0.54	0.87
	Median	4.5	4.33	4
	Mode	5	4.33	4
	Range	3	1.67	3.33
Sample 3	Sample Size	314	155	155
	Mean	4.43	4.07	4.16
	Standard Deviation	1.07	0.85	0.90
	Median	5	4.33	4.33
	Mode	5	5	5
	Range	5	3.67	4
Combined	Sample Size	829	829	829
	Mean	4.43	4.07	4.18
	Standard Deviation	1.13	0.86	0.84
	Median	5	4.33	4.33
	Mode	5	5	5
	Range	5	4	4

Sample 1, n = 486
Sample 2, n = 22
Sample 3, n = 321
Combined Samples, n = 829

Table 21 Video Recall Results

		Hamilton	Boley Springs
Sample 1	Sample Size	237	254
	Mean	0.39	0.28
	Standard Deviation	0.27	0.36
	Median	0.33	0
	Mode	0.33	0
	Range	1	1
Sample 2	Sample Size	7	15
	Mean	0.43	0.07
	Standard Deviation	0.32	0.18
	Median	0.33	0
	Mode	0.33	0
	Range	1	0.5
Sample 3	Sample Size	131	81
	Mean	0.4	0.29
	Standard Deviation	0.25	0.32
	Median	0.33	0.5
	Mode	0.33	0
	Range	1	1
Combined	Sample Size	404	430
	Mean	0.39	0.27
	Standard Deviation	0.26	0.32
	Median	0.33	0
	Mode	0.33	0
	Range	1	1

Sample 1, n = 486
Sample 2, n = 22
Sample 3, n = 321
Combined Samples, n = 829

Table 22 Other Variable Results

		Trust	Weather Salience	Age
Sample 1	Sample Size	486	486	482
	Mean	4.53	4.06	39.35
	Standard Deviation	1.22	0.83	13.11
	Median	5	4.25	37
	Mode	5	5	28
	Range	5	3.5	64
Sample 2	Sample Size	22	22	18
	Mean	4.04	3.78	20.83
	Standard Deviation	0.89	0.88	1.58
	Median	4	3.75	21
	Mode	5	4.5	21
	Range	2.33	3	6
Sample 3	Sample Size	317	320	319
	Mean	4.59	3.97	38.26
	Standard Deviation	0.91	0.80	12.5
	Median	5	4	37
	Mode	5	5	25
	Range	5	3.25	61
Combined	Sample Size	829	828	819
	Mean	4.54	4.02	38.52
	Standard Deviation	1.11	0.82	13.01
	Median	5	4.25	36
	Mode	5	5	25
	Range	5	3.5	64

Sample 1, n = 486
Sample 2, n = 22
Sample 3, n = 321
Combined Samples, n = 829

Table 23 Unused Variable Results

		Slovic Risk	Overall + Slovic Risk
Sample 1	Sample Size	440	440
	Mean	3.05	3.44
	Standard Deviation	0.62	0.53
	Median	3	3.44
	Mode	3	3.33
	Range	4.17	3.56
Sample 2	Sample Size	22	22
	Mean	2.96	3.23
	Standard Deviation	0.53	0.42
	Median	3	3.11
	Mode	3	3
	Range	1.83	1.56
Sample 3	Sample Size	302	302
	Mean	3.08	3.43
	Standard Deviation	0.64	0.91
	Median	3.08	3.44
	Mode	3	3.67
	Range	3.5	3.44
Combined	Sample Size	764	764
	Mean	3.06	3.43
	Standard Deviation	0.62	0.56
	Median	3	3.44
	Mode	3	3.67
	Range	4.17	3.78

Sample 1, n = 486
Sample 2, n = 22
Sample 3, n = 321
Combined Samples, n = 829