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## Navigating Monsters: Credibility in the Twittersphere

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Severe thunderstorms in the Midwest and South of the United States reveal situations with a high degree of uncertainty and concern, and evoke descriptions such as monster tornado (Jimenez, 2019; Madani, 2019) and monster storm (Guarino, 2010). The occurrence of tornadoes damages and destroys communities in the United States each year beckoning a continued need to improve understanding of the ways the severe weather enterprise seeks, utilizes, and disseminates information during severe weather events. In recent years, the use of online social media (OSM) has changed the information environment of severe weather events. Approximately 22% of adults in the United States use Twitter (Perrin & Anderson, 2019) including 40% of Twitter users that visit the site daily, 80% weekly (Pew Research Center Internet & Technology, 2019). Of those who visit the site daily, 25% of Twitter users visit the site several times per day (Perrin & Anderson, 2019). As the number of social media users increase, OSM also contributes to uncertainty and evokes concern “in danger of becoming the Frankenstein’s monster of our historical moment” (Rosenberg, 2013, para. 6). Yet, OSM remains as an information source during severe weather events. The current toolbox of the severe weather enterprise includes OSM as a way to disseminate information during severe weather events, but also to retrieve information to enhance situational awareness. The increasing use of OSM during emergency, or potentially threatening, situations creates conditions in which emergency planners and responders need a high level of investigative skill to weed through a dynamic information landscape to determine the quality of information to contribute to improved situation awareness. This weeding process transforms the big data environment of OSM to focused information retrieval. This study investigated indicators of quality in OSM (authority, objectivity, currency, coverage, and glyphicality) during severe weather situations to identify how OSM impacts the information behavior of the severe weather enterprise of the U. S. Specifically, this study investigated how a particular element of the severe weather enterprise in the Midwest, the integrated warning team (IWT), identifies relevant information in OSM during severe weather events. Exploration into the information behavior of the IWT during severe weather events through the lens of cognitive authority theory (Wilson, 1983) and Bonnici’s (2016) CAF-QIS provided a framework for understanding the phenomena of both credibility and trustworthiness in the Twittersphere where author is potentially unknown.

## **Background**

Severe thunderstorms and tornadoes continue to be a common occurrence. For example, in Kansas, the National Weather Service (NWS) received preliminary severe weather reports including 95 reports of tornadoes, 569 reports of hail, and 528 reports of wind in the months of January through December of 2016 (National Weather Service, 2016a). Reports received by the NWS in Kansas during 2018

include 46 reports of tornadoes and 1,854 reports of severe wind, hail, and flooding (National Weather Service, 2019). The NWS reports that Kansas experienced an average of 80 tornadoes per year between 1985 and 2014 with the most active severe weather season for tornadoes including the months of April, May, and June during the years of 1989 to 2013. During that 24-year period, Kansas experienced 13 tornadoes in April, 36 in May, and 20 in June (National Weather Service, 2016b). Livingston (2016), a storm chaser, describes the frequency of severe thunderstorms in the Midwest as “prime ‘chasecation’ season” (para. 6) and provides an account of his experience with severe weather near Leoti, KS on May 21, 2016. In addition to his written description of a “magical scene” (para. 5), Livingston’s account of the severe weather includes multiple photos and videos documenting the event. Photos and videos such as these are examples of the information encountered in the online and mobile information environment during severe weather situations.

### **Integrated Warning Team**

Severe thunderstorms and tornadoes are common in the Midwest and Southeastern areas of the United States occurring any month of the year, but most common during the months of April, May, and June, described as severe weather season. A supercell thunderstorm is capable of producing damaging winds, hail, and tornadoes. A strong reminder of the power of nature, these storms annually damage and destroy structures and cause concern for human injury and death. Critical to emergency preparedness planning and response to severe weather is the coordination of meteorologists and emergency responders. Of particular relevance for planning and response to severe weather is the Integrated Warning Team (IWT); a team consisting of individuals tasked with making sense of severe storm information to issue severe weather alerts and warnings. Structurally, the IWT consists of a multidisciplinary team of individuals that operate before, during, and after severe weather. The team operates in a distributed and virtual environment to prepare for and respond to severe weather events. The distributed nature of this multidisciplinary team brings together each team member as a subject matter expert, without the cost prohibitive limitation of a co-located workspace, within a shared time during high risk severe weather events for the common good of the community. Each member of the IWT operates during severe weather events from physical locations appropriate to their work. Summarized in Table 1 (see Appendix), the core team members of the IWT include broadcast media meteorologists, local emergency management, and meteorologists with the NWS.

The IWT as described is a relatively new concept dating to 2009 (National Oceanic and Atmospheric Administration, 2010) and not yet implemented fully throughout the United States. In contrast, all NWS offices in Kansas developed and continue to coordinate an IWT. Considering the implementation of IWTs in Kansas, and the low average annual number of tornado related fatalities, one might ponder the role that the IWTs play in the community's response to severe weather. Investigation into the nature of information and ways of knowing within the IWT will inform a deeper understanding of information behavior that leads to severe weather warnings. This understanding will probe the fundamental principles of emergency communication and information exchange to improve life safety for at-risk populations and property preservation.

Before disseminating severe weather information to the public, the IWT encounters an information situation(s); does the situation on their computer screen match what is occurring in the environment? Situational awareness includes more than radar data, the IWT filters through verbal reports, meteorological data, and countless OSM posts to determine if a severe weather event is unfolding. Information sources include on-duty and off-duty members of the IWT, including non-core members, and the public. Investigating the information behavior of the IWT contributes to the overall understanding of the public information and warning process.

### **Online Social Media**

Although severe weather forecasting and warning dissemination is a constantly evolving landscape utilizing low-tech and high-tech options, it is the responsibility of the IWT to develop a shared sense of meaning from a multitude of information sources. It is the development of this sense of shared meaning that is centric to this study. This has become increasingly challenging due to the inherent nature of OSM. Information seeking and retrieval contributes to the IWT's situational awareness of the ongoing severe weather event. Core partners of the IWT extend their understanding of the ongoing situation by looking to other sources of information such as storm spotters, publicly generated photos and comments posted to OSM, and communication with community partners.

Utilization of OSM certainly presents challenges to the goal of disseminating quality and accurate information about ongoing severe weather events. An increasingly difficult challenge that users of online information encounter is the volume of inaccurate information present in OSM (Guskin & Hitlin, 2012; Vosoughi, Roy, & Aral, 2018). Investigating rumor cascades in Twitter from September 2006 to December 2016, Vosoughi et al. (2018) identified 1,699 false rumors, 490 true rumors, and 259 mixed true and false rumors. Social media also includes the dynamic nature of an ever-changing information landscape consisting of known and unknown information contributors. The increasing use of

OSM during emergency, or potentially threatening, situations creates conditions in which emergency planners and responders need a high level of investigative skill to weed through a dynamic information landscape to determine the quality of information to contribute to improved situational awareness. Inaccurate information creates noise that interferes with quick decision-making in time sensitive situations. Information use, specifically OSM, in time sensitive situations such as severe weather events relies upon interpretation of cognitive authority. Interpretation involves issues of currency, accuracy, perceived credibility, and usefulness of the information available.

### **Cognitive Authority Theory**

Developed by Wilson (1983), cognitive authority theory includes the fundamental concept that knowledge is constructed in two ways. Knowledge of the world is gained through first-hand experience and through second-hand knowledge. Wilson claimed that much of what we think we know of the world is gained through the account of experiences of others. What is known first-hand is limited and depends on the stock of ideas brought to the “interpretation and understanding of . . . encounters with the world” (Rieh, 2005, p. 83). We depend on others for ideas and information outside of our direct experience and it is our trust and belief in the provider of information that contribute to the influence of our thoughts. Second-hand knowledge is considered second best, not as good as first-hand experience, but good enough. Good enough within cognitive authority theory is not considered equivalent to satisficing within LIS literature. It is not possible to gain all knowledge from first-hand experience; therefore, we gather much of what we know from second-hand knowledge. Information systems provide the opportunity to organize and retrieve information relevant to an information search. An information seeker that satisfices (Case & Given, 2016) selects the first acceptable answer. The information seeker that determines information is good enough based on cognitive authority because of belief; “the authority’s influence on us is thought proper because he is thought credible, worthy of belief” (Wilson, 1983, p. 15). The decision to accept second-hand knowledge is based on credibility and authority, including the competence and trustworthiness of the author of the information, the publisher of the information, the document type, and the context of the document.

Having an understanding of the central points of cognitive authority provides a foundation for this research. According to Wilson (1983), all we know of the world is based on personal experience and what others have told us, first-hand and second-hand knowledge described above. That which is told or shared by others is not always reliable, so cognitive authority is determined before authority, influence, and credibility is attributed to second-hand knowledge. The four points identified by Wilson (1983) to attribute cognitive authority to a source includes a relationship of at least two people, cognitive authority is a matter of

degree and relative to a sphere of interest, and cognitive authority is related to credibility.

According to Wilson (1983), each individual contains a limited first-hand stock of knowledge of the world contributing to the need for credible information to expand our understanding of the world around us. Competent and trustworthy sources of information are necessary to expand this knowledge base. These sources include books, instruments, organizations, and institutions: “those we think credible [that] constitute the potential pool of cognitive authorities on which we might draw” (Wilson, 1983, p. 16). The credible source does not declare cognitive authority on a subject matter; instead, the information user attributes cognitive authority to a source of information. A cognitive authority is an “influence on one’s thoughts that one would consciously recognize as proper” (Wilson, 1983, p. 15), but we must take the time to listen, reflect upon the information, and decide if an information source or expert is a cognitive authority in a sphere of interest.

Different types of authority may address an information problem. Wilson (1983) identifies three types of authority including cognitive authority (influence on thoughts), administrative authority (influence on actions by person(s) in power), and institutional authority (influence from institutional affiliation). Even during times of emergency, different types of information problems exist, and different types of authority are needed. For instance, a community public works department may serve as an institutional authority to identify road closures due to downed tree lines following a severe thunderstorm. An administrative authority such as the department of health and environment may prevent sale of certain food and drink products if the community water supply was damaged during a severe storm. A content provider in OSM may indicate if the severe weather event is ongoing influencing our thoughts on whether to leave our shelter after severe weather. We seek advice from a cognitive authority in addition to seeking information. Wilson (1983) states “the cognitive authority is one to whom we turn for information but also one to whom we turn for advice, even (or particularly) in cases where it is clear that there is no knowledge to be had at all” (p. 18). In situations with limited information or knowledge available, Bonnici and Ma (2018) assert a lack of information from professionals is the root of information problems. During emergency events, Vieweg, Hughes, Starbird, and Palen (2010) identified situations in which information was limited due to the rapid development of the emergency event. Moments after a severe weather event, the outdoor warning system is no longer sounding, and the sun is shining after the storm has passed, but we may still seek cognitive authority in OSM to confirm going outside is no longer hazardous.

Wilson (1983) claims cognitive authority is attributed to books, instruments, organizations, and institutions in addition to individuals. Applicable to information retrieval within OSM are the external tests for recognizing cognitive

authority of a text described by Wilson (1983); personal authority (author), institutional authority (publisher), textual type authority (document type), and intrinsic plausibility authority (context of text). Rieh and Belkin (1998) identified that subjects assessed information quality through information source credibility and authority at both the individual and institutional levels. Subjects depended on source credibility and authority, rather than information content, more in the online environment than the print environment.

The external tests applied to OSM include the Twitter user as the author, the Twitter user's institutional affiliation, the Tweet or link to another online resource within the Tweet, and the context of the social media post. For example, a local meteorologist posting guidance regarding sheltering options during a tornado may hold high cognitive authority for some individuals due to high visibility of the meteorologist on television and local radio, association with a particular television station, the Tweet and link to the National Weather Service severe weather preparedness webpage, and the authoritative nature of the content provided within the Tweet.

However, many of the features to identify cognitive authority may be absent or unknown in OSM including the potential for false information, misinformation, or irrelevant information. The cognitive work contributing to the development of situational awareness of severe weather scenarios takes considerable effort and commitment of time, energy, and resources that are based on the IWT's "ability to collect, assess and interpret information, and draw proper conclusions from it" (Etzioni, 1986, p. 19) to make decisions about when to issue severe weather alerts, watches, and warnings. Sorting the relevant information from misinformation is a question of interpreting cognitive authority.

**Quality.** Quality information within the context of severe weather contributes to the situational awareness of emergency planners, forecasters, and the public to mitigate and respond to a severe weather situation. Taylor (1982) describes the validity, quality, and ease of access that contributes to use of formal knowledge. It is the "degree of 'fit' between the knowledge provided and the information environment within which the user operates and where he must make decisions. It is this 'fit' that determines the value of that knowledge" (p. 342). By including value in his definition of quality, Taylor (1982) identified values that contribute to information quality, accuracy, comprehensiveness, currency, reliability, and validity. Rieh and Belkin (2000) identified additional values of cognitive authority as trustworthy, credible, reliable, scholarly, official, and authoritative. Schamber (1991) identified accuracy and currency of the content of information in alignment with Taylor's (1982) information quality through an investigation of occupational users of weather information in aviation, electric power utilities, and construction. Also included within Schamber's view of quality

of information content were specificity and geographic proximity, all factors relevant to the IWT.

**Cognitive authority in context.** The local emergency manager in Kansas communities provides context to interpreting Wilson's (1983) points on understanding cognitive authority. First, cognitive authority includes a relationship of at least two people extending beyond subject matter expertise. An emergency manager may serve a community as a subject matter expert in emergency planning and response, but not a cognitive authority for each member of the community due to a lack of a relationship between the emergency manager and each individual. Individuals within the community that work with the emergency manager may come to attribute cognitive authority to that individual because of the relationship developed through planning meetings and community-based trainings and workshops. Wilson's second point states cognitive authority includes a matter of degree such as subject experience or connection with the subject. An emergency manager in Kansas may hold a high degree of cognitive authority when planning for a severe thunderstorm but a low degree of authority when planning for earthquakes because the former is more common in the community than the latter. This extends to the sphere of interest, which is Wilson's third point. The local emergency manager may hold a high degree of cognitive authority with the local emergency planning committee when planning for a severe thunderstorm with potential flooding, but hold a low degree of cognitive authority, or no cognitive authority at all, when considering how much rain will fall over a specific timeframe. Wilson's fourth point is that of credibility. Within each community, the emergency manager strives to serve as a credible source of information. For the community, "the authority's influence on us is thought proper because he is thought *credible*, worthy of belief" (Wilson, 1983, p. 15). The community may attribute cognitive authority to the local emergency manager, and others, if these four points are met, as credible sources of information to prepare for, mitigate the effects of, respond to, and recover from emergencies.

### **Models Used to Develop CAF-QIS**

Although forecasts may indicate severe weather is possible during a specified time, actual severe weather events include uncertainty and evolve quickly contributing to a continual need to update and enhance situational awareness of the ongoing event. Information such as radar data, IWT and public reports via telephone calls, OSM, and radio communication enhance situational awareness of the severe weather event. The IWT encourages communication from the public including photos and videos posted to OSM during severe weather events to enhance the team's situational awareness. Although OSM provides opportunity for enhanced situational awareness, the available and real-time nature of OSM creates a potential



information situation where OSM users may post information with unknown identification or misinformation (Sloan, Morgan, Burnap, & Williams, 2015) presenting a need to investigate the credibility and trustworthiness of the information available. Also contributing to the information situation are limited search and retrieval options in OSM. Within OSM is a lack of proper tools to navigate the abundance of available information to make a judgment about the information retrieved (Maron, 1977) from OSM. As a result, the IWT must sift through the available information to determine cognitive authority of OSM posts before retrieval of information and integration into the overall situational awareness.

Bonnici (2016) modeled a framework for such situations “to identify [cognitive authority] when personal ties between author and reader are weak to non-existent” (p. 2). This framework, CAF-QIS, extends cognitive authority theory beyond print materials when Wilson’s (1983) four conceptual dimensions of source of authority, personal authority, institutional authority, textual type authority, and intrinsic plausibility authority, may be unknown. Bonnici’s (2016) framework integrates cognitive authority framework (CAF) with a library and information science model for evaluation of website quality, referred to as quality of information source (QIS), providing conceptual “filters for identifying trustworthiness of OSM posts” (p. 5). The CAF-QIS framework provides a structure from which to investigate OSM posts for credibility and trustworthiness through the quality indicators of authority, objectivity, currency, coverage, and glyphicality. Documentation of the quality indicators in OSM are identified as authority, documented by sharing experiences and title/qualifications; objectivity, expressed through statements of fact, fair-mindedness balancing emotion and passion; currency, expressed as date and additional factors codifying timeframe of experience; coverage, qualification of opinion, examples provided to clarify the post including photos and video as evidence of the objectivity and currency; and glyphicality, diacritic and other visual enhancements of information (Bonnici, 2016). Application of CAF-QIS to examination of veterinary practices within the Yelp! OSM community revealed the functionality of the framework is plausible (Bonnici, 2016). Further application of the framework to information-based Facebook groups revealed the groups “function with the intent to provide cognitive authority empowered information” (Bonnici & Ma, 2018, p. 14). Both applications of the CAF-QIS framework to information environments included organized social communities within OSM indicating need for further research to develop the framework.

The quality indicators presented in the CAF-QIS framework share resemblance with quality indicators identified earlier. Table 2 (see Appendix) includes quality indicators identified by Taylor (1982), Schamber (1991), and Rieh and Belkin (2000) cross-referenced with the CAF-QIS framework (Bonnici, 2016).

Application of the CAF-QIS framework to explore the IWT's use of information shared via OSM during severe weather events further develops the functionality of the framework to less organized OSM communities and contributes to the broader perspective of the relationship between credibility and information available online. Flanagin and Metzger (2000) found information obtained from the internet is "perceived to be as credible as that found through magazines, the radio, and television (irrespective of information type)" and recommended further research "should examine Internet users' *reasons for* credibility perceptions ... in order to pinpoint the specific features that inform users' opinions of credibility" (pp. 529-530). The quality indicators in the CAF-QIS framework identify the features that inform the decision of the IWT to include OSM information in the situational awareness status of ongoing severe weather events.

### **Summary**

Interaction between the IWT and OSM during severe weather events includes the necessary components of quality and credibility in order to positively impact the team's decision of when, and when not, to issue severe weather alerts and warnings. Exploration into the information behavior of the IWT during severe weather events through the lens of cognitive authority theory and CAF-QIS provides a framework for understanding the phenomena of both credibility and trustworthiness of second-hand knowledge in online social media. This paper described the theoretical framework of an inquiry into the information behavior of the IWT during severe weather events through the lens of cognitive authority theory (Wilson, 1983) and the CAF-QIS framework (Bonnici, 2016) for understanding the phenomena of both credibility and trustworthiness in the Twittersphere where author is potentially unknown. Rather than shy away from a rapidly evolving and monstrous information environment during high-risk situations, situation-relevant cognitive authority (Bonnici, 2016) within OSM provides insight into the use of information by the IWT during severe weather events.

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## Appendix

Table 1  
*Integrated Warning Team*

<b>Core team members</b>	<b>Physical environment</b>	<b>Information environment</b>
Broadcast Media Meteorologists	Company home office, television station, vehicle	Phone, online, social media, radar, broadcast radio, NWSChat
Local Emergency Management	Office, emergency operations center, vehicle	Phone, 800 mh radio, online, social media, radar, television, broadcast radio, NWSChat
National Weather Service	Local forecast office/operations center	Phone, 800 mh radio, online, social media, radar, television, broadcast radio, NWSChat

Table 2  
*Crosswalk of Quality Indicators, by Author, with CAF-QIS Framework*

CAF-QIS (Bonnici, 2016)	Authority documented by sharing title/qualifications	Objectivity expressed through statements of fact, fairmindedness balancing emotion	Currency date and additional factors codifying timeframe of experience including time, noted date and time within the content of the post, and location to confirm currency of the post	Coverage qualification of opinion, examples provided to clarify the post- includes photos and video as evidence of the objectivity and currency	Glyphicality diacritic and other visual enhancements of information
Taylor (1982)	Reliability	Comprehensiveness Validity	Accuracy Reliability Validity	Comprehensiveness Currency Accuracy Reliability	Comprehensiveness
Schamber (1991)	Reliability Verifiability	Accuracy Clarity	Accuracy Reliability Currency Specificity Geographic proximity Verifiability Accessibility	Accuracy Reliability Currency Specificity Geographic proximity Verifiability Clarity	Specificity Dynamism
Rieh & Belkin (2000)	Credible Reliable Scholarly Official Authoritative	Scholarly Trustworthy	Credible Reliable	Trustworthy Official Authoritative	Aesthetic and affective aspects of evaluative judgment of information Graphical characteristics of information objects

