Annotated bibliography: Social media, technology and climate change

Social media analyses and studies

Within the crisis context

Weather crises

Hurricanes

Title: Think Local: Retweet Global: Retweeting by the Geographically-Vulnerable during Hurricane Sandy

Citation:
Kogan, M., Palen, L., & Anderson, K. M. (2015, February). Think local, retweet global: Retweeting by the geographically-vulnerable during Hurricane Sandy. In *Proceedings of the 18th ACM conference on computer supported cooperative work & social computing* (pp. 981-993). ACM.

Keywords: Crisis informatics; Disasters; Protective decision-making; social computing; social media; Twitter

Commentary: Interesting and relevant methodology - including some network analysis (network structures, network mixing, establishing important users), geographic patterns of retweet activity, retweet count distributions of various populations, content analysis on tweet.

Intent, problem, objective:
- Want to continue to validate and deepen earlier findings that state "'locals' are more likely to retweet content that has 'local utility,' and that non-locals are more likely to retweet the 'abstract' of the event.
- Provide a foundation for the understanding of how the geographically vulnerable make decisions to evacuate, take shelter, etc.
"...We examine those who were under the most serious threat before and during the 2012 Hurricane Sandy, and who used Twitter to post during that time. Specifically, this is an analysis of how people who are at risk from a natural hazard with an advanced warning period—a hurricane— retweet information before, during, and after the event." (page 981)
"Do new relationships between people form during disasters in the online world?" (page 982)

Findings:
- Geographically vulnerable twitter users propagate more information during the disaster period than before or after.
- During the disaster period, local government authorities and the media are the most important nodes in comparison to their presence before or after the disaster.
- The tweets retweeted by the geographically vulnerable are more likely to have some kind of local utility.

Method notes:
Content, network analysis; Twitter
- Collects twitter data using Streaming API, using keywords for data collection
- Collect the user streams, the contextual streams of the geolocated users to find context before and after a keyword tweet

---

Title: Variability in Twitter Content Across the Stages of a Natural Disaster: Implications for Crisis Communication

Citation:
Patric R. Spence, Kenneth A. Lachlan, Xialing Lin & Maria del Greco (2015) Variability in Twitter Content Across the Stages of a Natural Disaster: Implications for Crisis Communication, Communication Quarterly, 63:2, 171-186, DOI: 10.1080/01463373.2015.1012219

Keywords:
Issue management; social networking; stakeholder; Twitter

Intent, problem, objective:
Social media and the use of social media during the prodromal (Fink; pre-crisis warning stage) stage is a rather unique phenomenon that has received little attention in the literature.
1: How does the balance between affect display and useful information shift over the course of the storm?
2: What specific information regarding relief efforts is available through Twitter as the prodromal stage develops?
3: How does available information on Twitter change as a widespread crisis moves from the prodromal to acute stages?

Findings:
Specific to the #sandy hashtag: "...the data suggest that information concerning specific behavioral recommendations was difficult to locate at best...this information became more difficult to find as the storm progressed, buried in thousands of Tweets expressing sorrow, anger, and fear." (page 180)
- Tangible, useful information is more available on the first two days and then begins to dissipate

Method notes:
Sentiment analysis

Quotes:
"...government agencies need to deploy information providing the specifics the public is looking for, specifically because the act of promoting the hashtag places responsibly on these agencies for communicating through this medium." (page 180)

"...in the time leading up to the acute stage of this crisis, Twitter transitions from being a medium of information providing an outlet for affective responses and expressions of fear. The real risk here is losing the availability of information concerning tangible steps people can take to reduce harm to health and property. It is quite likely that as large-scale crises build toward a crescendo,

it may actually become more difficult to locate relevant information such as that related to evacuation efforts, the availability of relief, or the whereabouts of others." (page 182-183)

"Government agencies and emergency responders should consider not only the placement of this information but the relative frequency with which it must be repeated. It may be a suggested best practice that the same messages should be Tweeted and reTweeted several times per minute in order to ensure that they show up in searches related to the event." (page 183)

"In addition to consistent retweets of general warnings, emergency managers and government agencies would do well to consider the relative importance of repeated messages concerning specific behavioral advice [messages related to food, shelter, whereabouts of others, etc]." (page 183)

"Researchers should continue to monitor the information present in tweeted messages related to crisis and disasters in order to evaluate the relative effectiveness of these information campaigns, any progress that may be made in utilizing the medium effectively, and the ways in which Twitter functions for those affected by crises and disasters that vary in scope and nature." (page 183)

Title: Harnessing the power of machine learning: Can Twitter data be useful in guiding resource allocation decisions during a natural disaster?

Citation:
Reynard, D., & Shirgaokar, M. (2019). Harnessing the power of machine learning: Can Twitter data be useful in guiding resource allocation decisions during a natural disaster? Transportation Research Part D: Transport and Environment, (xxxx), 1–15.
https://doi.org/10.1016/j.trd.2019.03.002

Keywords: Disaster management, geotagging, machine learning, natural language processing, sentiment analysis, social media data

Commentary: This article provides a clear methodology to make Twitter data useful, for the sake of real, live disaster situations, and provides some insight on the practical use of this data.

The authors do not go further in understanding to show when opinions are occurring and changing - they propose that future analysis should dig deeper to understand how opinion changes over time.

Intent, problem, objective:
The authors aim to understand if Twitter data has information that can be useful for designing disaster management programs. Can Twitter data be useful in guiding resource allocation decisions during a natural disaster?

Findings:
The authors found, through their research, that it is in fact possible to use Twitter data for designing policies during and after disasters, and that the spatial and temporal nature of Twitter

data can be leveraged effectively (using natural language processing and geospatial analysis tools to build models).
- In addition to this finding, they recommend a three step process for disaster managers in need of real-time information during disasters: collecting and analyzing a small dataset of tweets, using this dataset to train a machine learning algorithm for the kinds of questions that may be important, and run this machine learning tool during the disaster to extract insights in real-time.
- The authors also have a number of suggestions, including: focus on longer tweets due to the increased usefulness of the data, investigate tweets from those who have been members of the social media platform for a longer time, focus both on positive and negative sentiments, focus on tweets in the damage-area of the disaster as well as those from other sites, and finally, to use land-use or census geography as a background to understand where needs may be more important to address quicker.

Method notes:
The authors used: sentiment analysis to classify tweets into positive, negative, and neutral groups; geospatial and machine learning techniques to categorize geolocated tweets; American Community Survey geography to provide socio-economic context; relied on "multinomial logit specification to examine which features of the tweet, tweeter, or location were likely to be associated with negative or positive sentiments.

Title: Mapping the data shadows of Hurricane Sandy: Uncovering the sociospatial dimensions of "big data"

Citation:
Shelton, T., Poorthuis, A., Graham, M., & Zook, M. (2014). Mapping the data shadows of Hurricane Sandy: Uncovering the sociospatial dimensions of “big data.” Geoforum, 52, 167–179. https://doi.org/10.1016/j.geoforum.2014.01.006

Keywords: Big data, geoweb, Hurricane Sandy, mixed methods, socio-spatial theory

Commentary: This article is a more self-aware Twitter analysis (during a crisis situation) than most. While analyzing big Twitter data during Hurricane Sandy, they actively self-critique the analysis, pointing out the issues with big social media data, and offer a few concepts and methodological points specified in the conclusion to inform future similar studies. One notable point they offer is the importance of employing "existing conceptual frameworks...to better understand the complexities of user-generated content and the sociospatial relations they embody." (page 178)

Intent, problem, objective:
There is a "...gap in previous studies of the geoweb, which have often avoided explicitly theorizing the nature of sociospatial relations." (page 168) "...what can big data from geographically referenced social media reveal about material processes and practices? And what can our pre-existing knowledge about such material processes and practices tell us about the underlying spatialities of big data?" (page 167)

Findings:

The authors found that the small subset of geotagged tweets related to Hurricane Sandy were sufficient for statistically significant insights in the quantitative analysis, and the small amount is also more manageable for the qualitative analysis, emphasizing that more data does not necessarily lead to more meaningful results. They also show the importance of including both quantitative and qualitative analysis. Finally, they argue that using existing frameworks to better understand the content is of high importance.

Method notes:
Content analysis, Twitter

Quotes:
"While there is undoubted potential in using social media in times of crisis, we worry that too much of the discourse and practice of crisis mapping, let alone other applications of this kind of data, relies on the relatively simple spatial ontologies and epistemologies that we have critiqued here. That is, seeing spatial concentrations of social media activity in disaster situations as being equivalent to areas in need of relief vastly oversimplifies the ways that social media is used in disaster situations, while also potentially reinforcing offline social inequalities by failing to provide relief to areas which may not be producing such content because of lack of access to the appropriate technologies or material conditions preventing the use of such tools (e.g. power outages)." (page 178)

"...we have shown the importance of a mixed methods approach to understanding big data. A quantitative mapping of tweet density, however technically sophisticated, ultimately stops short of understanding the complex and polymorphous geographies of such data without also performing a qualitative analysis of the actual tweets and the context in which they are produced, or even employing a diversity of quantitative methods, such as social network analysis." (page 178)

Tsunamis

Title: Twitter tsunami early warning network: a social network analysis of Twitter information flows

Citation:
Chatfield, A. T. & Brajawidagda, U. (2012). Twitter tsunami early warning network: a social network analysis of Twitter information flows. In J. W. Lamp (Eds.), ACIS 2012 : Location, location, location : *Proceedings of the 23rd Australasian Conference on Information Systems 2012* (pp. 1-10). Australia: Deakin University.

Keywords: Twitter; social network analysis; information flow; emergency warning

Intent, problem, objective:
“In this research, therefore, we address two research questions: Does Twitter work as a tsunami early warning network? If it does, how does the Twitter tsunami early warning network diffuse tsunami warning information within a very limited time?” (p 2)

Findings:
“This research also shows that the BMKG Twitter tsunami early warning network could effectively engage citizens and government disaster management agencies in diffusing the tsunami early warning information.” (p 9)

Method notes:
Network analysis.
“More specifically, the social network in this research is created by the information flows of a Tweet tsunami warning released by the BMKG. We have selected the first Tweet released by the BMKG to inform the 4.11 2012 tsunami.” (p 4)

Fires

Title: Microblogging During Two Natural Hazards Events: What Twitter May Contribute to Situational Awareness

Citation:
Vieweg, S., Hughes, A. L., Starbird, K., & Palen, L. (2010, April). Microblogging during two natural hazards events: what twitter may contribute to situational awareness. In *Proceedings of the SIGCHI conference on human factors in computing systems* (pp. 1079-1088). ACM.

Keywords: Computer-mediated communication; crisis informatics; disaster; emergency; hazards; microblogging; situational awareness

Commentary: An example study of extracting Twitter data into categories that contribute unique ways to gaining a complete situational awareness of an event.

Intent, problem, objective:
- To inform next steps for extracting useful, relevant information during emergencies using information extraction techniques.
- To identify information that may contribute to enhancing situational awareness by analyzing the communications of people experiencing the Oklahoma Grassfires of April 2009 as well as the Red River Floods in March 2009.

Method notes:
- Collected data on Twitter activity using Twitter Search API and specific search terms chosen through an initial investigation of the public Twitter stream.
- Then collected the entire Twitter stream for each user found in the first step of data collection. Reduced data sets to those user streams that included more than three tweets containing search terms.
- Tweets coded as on- (content that relates to given emergency) or off-topic (does not mention given emergency).
- Identified emerging themes/categories in tweets.
- Coded the original sources of information (i.e. information that is original, secondarily synthesized, re-sourced) and for those seeking/providing information, support/humor.

Quotes:
"[Situational awareness] describes the idealized state of understanding of understanding what is happening in an event with many actors or other moving parts, especially with respect to the needs of command control operations. [It is defined as] all knowledge that is accessible and can be integrated into a coherent picture, when required, to access and cope with a situation." (page 1079)

Title: Finding community through information and communication technology in disaster response

Citation:
Shklovski, I., Palen, L., & Sutton, J. (2008, November). Finding community through information and communication technology in disaster response. In Proceedings of the 2008 ACM conference on Computer supported cooperative work(pp. 127-136). ACM.

Keywords: Community; innovation; crisis informatics; disaster; wildfire; emergency; computer-mediated communication

Intent, problem, objective:
To present evidence of ICT use for re-orientation toward the community; to study the role of ICT use in disasters.
"Here, we consider how community members use ICT [information and communications technology: all digital forms of technology, hardware and software] for organizing in crisis situations." (page 127)

Findings:
- 24 hour news coverage tended toward sensationalism, and failed to provide the information the locals sought.
- Central problem in the disaster was failure to obtain local information from traditional broadcast sources.
- National media outlets lost credibility with local residents because of lack of familiarity with the areas.
- Locals turned to local news outlets for reliable information, with different degrees of success.
- Because of lack of information, respondents relied on local contacts.
- Some relied on community-based email service run by volunteers for proper evacuation routes.
- People "found community" by using ICT to actively seek others with similar needs and concerns about their geographical communities.

Method notes:
- 2007 Southern California wildfires: collected empirical data using qualitative methods of observation, interview, and collection of online texts.
- Online questionnaire about ICT use and information gathering and sharing activities to capture a broad base of experiences of those affected by the wildfires.
- From the interviews and questionnaire reports, learned of two different community websites, and conducted email interviews with the site operators and observed activity on the site's discussion threads.

Quotes:
"In response to disasters, people organize themselves to conduct search and rescue, administer first aid, provide shelter and other necessities and orient toward long-term recovery." (page 128)

"...the expressed need to go local, that is, to seek out similarly affected others, express concern for the same locale, and find accurate information about immediate issues at hand. Thus going local in this urgent, necessary search is a mechanism for finding community. Affected residents regarded much of media activity as 'outsiders looking in' as they, as one of our respondents aptly put: 'got the subtleties of the area wrong.' In response, many concentrated their information search on personal contacts and specifically local sources." (page 132)

"It was from information provided by research participants residing in these remote areas [that get much less coverage, if at all] that we see focused and sometimes socio-technically mature organization around community-based computing enterprises [community-driven discussion boards]." (page 132)

"...ICT use can enable reliance upon one's own local community, even in circumstances where people become geographically dispersed. ICT use can help people not only to connect to the outside world but also to reconnect to the affected community during disruption. Not only does ICT provide a means for communicating with others who are in similar circumstances, it helps to leverage and even build community resources. As people generate information and correct misinformation peer-to-peer in the midst and in the aftermath of disaster, new relationships–and perhaps new community-based information practices–are forged." (page 134)

"To go local to find information is to make use of local knowledge about people and places through social connections and resources. Local knowledge is necessary for assessing the true state of affairs of the physical community—both its people and geographical area—with more accuracy, detail, and understanding of implications than broadcast media can possibly allow. This need to go local can be particularly acute in protracted and expansive disasters where the threat of damage and danger is extended over time, such as the wildfires that we investigate here." (page 134)

"We argue that although information-seeking in a disaster context may start out as an individual pursuit, it frequently transforms into a process of finding community—both by leveraging local knowledge and returning investment into places where others are also invested and attached—an explanation that helps elaborate motivation for this helping phenomena." (page 135)

"In disaster, finding community by discovering others who care for the locale and who are willing to share information and provide support in times of need, gives new reason for forging social connections. Thus use of ICT to find community can help facilitate social cohesion in geographical communities post-disaster, which is crucial for progress in recovery." (page 135)

Title: Warning tweets: serial transmission of messages during the warning phase of a disaster event

Citation:
Sutton, J., Spiro, E. S., Johnson, B., Fitzhugh, S., Gibson, B., & Butts, C. T. (2014). Warning tweets: serial transmission of messages during the warning phase of a disaster event. Information Communication and Society, 17(6), 765–787.
https://doi.org/10.1080/1369118X.2013.862561

Keywords: Social media, online communication, disaster, Twitter, warning, networks

Commentary: This article is a good, detailed study of what types of messages public officials tweet online are retweeted more, rather than the usual popular users. It also includes suggestions on how public officials should post.

Intent, problem, objective:
Previous studies focus on how citizens use Twitter during an event, and less focus on the Twitter use of public officials. How do message content, message style, and public attention to tweets relate to the behavioral activity of retweeting a message in disaster? This article studies messages from public officials on Twitter and how they propagate through the social network during a "high-threat event."

Findings:
The authors find that due to the nature of Twitter post limits, warning tweets from officials tend to be incomplete and focus on one or two "themes" at a time. The warning tweets are mainly situational updates, rather than guidance or recommendations on what to do. They found that the tweets most highly retweeted are more "advisory" in nature, intended for a broad audience. Tweets that are more clear and specific are likely to be retweeted than those that are not: "...we note that a clear and specific sentence style, rather than the use of ALL CAPS as a stylistic feature, is a greater predictor of retweets in this case." (page 784)

Method notes:
Content analysis; Twitter

Quotes:
"If the goal of a warning is to reduce the time it takes for someone to take a protective action, then it is important that a message be specific and clear in order to reduce the need for additional information search. However, we know that people mill about in disaster situations. Therefore, it becomes imperative to induce favorable milling, which will increase protective action, and reduce unfavorable milling, which will increase the time spent looking for useful information. The social network on Twitter can help to facilitate these things by building an informal information dissemination channel to amplify the message, by reinforcing messages, and by motivating behavior via structured effective message content." (page 784)

Title: Natural Language Processing to the Rescue? Extracting "Situational Awareness" Tweets During Mass Emergency

Citation:
Verma, S., Vieweg, S., Corvey, W., & Palen, L. (2011). Natural Language Processing to the Rescue? Extracting" Situational Awareness" Tweets During Mass Emergency. Proceedings of the Fifth International AAAI Conference on Weblogs and Social Media, 385–392. Retrieved from http://www.aaai.org/ocs/index.php/ICWSM/ICWSM11/paper/download/2834/3282

Keywords: Computer-mediated communication, Twitter, crises

Commentary: This is a good article containing methodology involving NLP and content analysis to identify which tweets are useful for emergency situations and which are not.

Intent, problem, objective:
Valuable information during mass emergency can provide useful insight into critical situations if captured properly. The authors develop a methodology to automatically identify those messages on Twitter which contribute to situational awareness, i.e. tweets which provide actionable information and details about the situation.

Findings:
"We demonstrate that a classifier based on low-level linguistic features performs well at identifying tweets that contribute to situational awareness. Further, we show that linguistically-motivated features including subjectivity, personal/impersonal style, and register substantially improve system performance. These results suggest that identifying key features of user behavior can aid in predicting whether an individual tweet will contain tactical information. In demonstrating a link between SA and other markable characteristics of Twitter communication, we not only enrich our classification model, we also enhance our perspective of the space of information disseminated during mass emergency." (page 392)

Method notes:
Content analysis; Twitter
"We collected Twitter messages from four different crisis events of varying nature and magnitude and built a classifier to automatically detect messages that may contribute to situational awareness, utilizing a combination of hand annotated and automatically-extracted linguistic features." (Abstract)

Floods

Title: Microblogging During Two Natural Hazards Events: What Twitter May Contribute to Situational Awareness

Citation:
Vieweg, S., Hughes, A. L., Starbird, K., & Palen, L. (2010, April). Microblogging during two natural hazards events: what twitter may contribute to situational awareness. In *Proceedings of the SIGCHI conference on human factors in computing systems* (pp. 1079-1088). ACM.

Keywords: Computer-mediated communication; crisis informatics; disaster; emergency; hazards; microblogging; situational awareness

Commentary: An example study of extracting Twitter data into categories that contribute unique ways to gaining a complete situational awareness of an event.

Intent, problem, objective:
- To inform next steps for extracting useful, relevant information during emergencies using information extraction techniques.
- To identify information that may contribute to enhancing situational awareness by analyzing the communications of people experiencing the Oklahoma Grassfires of April 2009 as well as the Red River Floods in March 2009.

Method notes:
- Collected data on Twitter activity using Twitter Search API and specific search terms chosen through an initial investigation of the public Twitter stream.
- Then collected the entire Twitter stream for each user found in the first step of data collection.
- Reduced data sets to those user streams that included more than three tweets containing search terms.
- Tweets coded as on- (content that relates to given emergency) or off-topic (does not mention given emergency)
- Identified emerging themes/categories in tweets
- Coded the original sources of information (i.e. information that is original, secondarily synthesized, re-sourced) and for those seeking/providing information, support/humor.

Quotes:
"[Situational awareness] describes the idealized state of understanding of understanding what is happening in an event with many actors or other moving parts, especially with respect to the needs of command control operations. [It is defined as] all knowledge that is accessible and can be integrated into a coherent picture, when required, to access and cope with a situation." (page 1079)

Title: Exploring association between perceived importance of travel/traffic information and travel behaviour in natural disasters: a case study of the 2011 Brisbane floods

Citation:
Zheng, Z., Lee, J. B., Saifuzzaman, M., & Sun, J. (2015). Exploring association between perceived importance of travel/traffic information and travel behaviour in natural disasters: A case study of the 2011 Brisbane floods. Transportation Research Part C: Emerging Technologies, 51, 243–259. https://doi.org/10.1016/j.trc.2014.12.011

Keywords: Travel information, traffic information, travel behaviour, adverse weather, natural disaster, random-effects ordered logit

Commentary: This article is somewhat basic, but does confirm that there is an increase in the perception of importance of travel information during a flood. It also importantly supports that demographics have an effect on that perception, as well as showing that TV, despite social media being all the rage, is still an important source of information during natural disasters.

Intent, problem, objective:
"A sound understanding of travellers' behavioural changes and adaptation when facing a natural disaster is a key factor in efficiently and effectively managing transport networks at such times." (Abstract, page 243) This study quantitatively and qualitatively analyzes perceptions of the importance of travel or traffic information and its potential impact on travel behaviour during the 2011 Brisbane floods.

Findings:
The authors found that TV was the most important source of travel information. Socio-demographic features of the respondents had a significant impact on the importance of the travel information: females tended to think that the information is more important than males do, and older respondents had a stronger attachment to the routes they normally use. Additionally, they found that the respondents' perceptions of the importance of the information increased because of the flood, then decreased afterwards, but not to pre-flood levels. They also confirm that "...inducing changes in travel mode is generally very challenging." (page 258)

Quotes:
"A hysteresis phenomenon in respondents' perceptions of the importance of information is consistently observed in our analysis. Namely, because of the flood, perceptions of the importance of information were increased, and although its perceived importance decreased after the flood, it did not return to pre-flood perceptions... While the traffic hysteresis is likely caused by behavioural reasons, the hysteresis in perceived information importance is likely caused by psychological reasons: because of experiencing the flood, the importance of information has been reinforced, which [causes] many respondents to perceive information's importance more favourably even after the flood. A question worthy of further investigation is: how long does such influence last?" (page 257)

"...the substantial behavioural consequences of various perceptions of the importance of information are highlighted by the magnitude of difference in the estimated odds. When controlling for other factors, the estimated odds of changing routes and cancelling trips for a respondent who thinks that the information is important, are respectively about three and sevent times the estimated odds for a respondent who does not consider it important." (page 257)

Title: Natural Language Processing to the Rescue? Extracting "Situational Awareness" Tweets During Mass Emergency

Citation:
Verma, S., Vieweg, S., Corvey, W., & Palen, L. (2011). Natural Language Processing to the Rescue? Extracting" Situational Awareness" Tweets During Mass Emergency. Proceedings of the Fifth International AAAI Conference on Weblogs and Social Media, 385–392. Retrieved from http://www.aaai.org/ocs/index.php/ICWSM/ICWSM11/paper/download/2834/3282

Keywords: Computer-mediated communication, Twitter, crises

Commentary: This is a good article containing methodology involving NLP and content analysis to identify which tweets are useful for emergency situations and which are not.

Intent, problem, objective:
Valuable information during mass emergency can provide useful insight into critical situations if captured properly. The authors develop a methodology to automatically identify those messages on Twitter which contribute to situational awareness, i.e. tweets which provide actionable information and details about the situation.

Findings:
"We demonstrate that a classifier based on low-level linguistic features performs well at identifying tweets that contribute to situational awareness. Further, we show that linguistically-motivated features including subjectivity, personal/impersonal style, and register substantially improve system performance. These results suggest that identifying key features of user behavior can aid in predicting whether an individual tweet will contain tactical information. In demonstrating a link between SA and other markable characteristics of Twitter communication, we not only enrich our classification model, we also enhance our perspective of the space of information disseminated during mass emergency." (page 392)

Method notes:
Content analysis; Twitter
"We collected Twitter messages from four different crisis events of varying nature and magnitude and built a classifier to automatically detect messages that may contribute to situational awareness, utilizing a combination of handannotated and automatically-extracted linguistic features." (Abstract)

Earthquake

Title: "Voluntweeters": Self-Organizing by Digital Volunteers in Times of Crisis

Citation:
Starbird, K., & Palen, L. (2011, May). Voluntweeters: Self-organizing by digital volunteers in times of crisis. In *Proceedings of the SIGCHI conference on human factors in computing systems* (pp. 1071-1080). ACM.

Keywords: Computer-mediated communication; crisis informatics; crowdsourcing; disaster; emergency; microblogging; organizing; risk communication; self-organizing; volunteers

Commentary: Dives into the motivations of around 35 digital volunteers. Small sample size, so results taken with grain of salt

Intent, problem, objective:
To investigate the emerging role of the "digital volunteer" as an element in crowdsourcing, to show how microblogging platforms serve as a new arena for self-organizing, and to offer insight about features of coordination within a setting of massive interaction. To understand the motivations and experiences of Haiti's tweeting population during the immediate aftermath of the Haiti earthquake.

Findings:
- Majority of users who translated information into TweakTheTweet (TtT) syntax were female, and most were from North America
- Motivation for tweeting (“voluntweeting”) was mainly because of personal connections, but also due to some motivation of trying to help out in any way possible

Method notes:
- Large-scale tweet collection, Twitter Search API and search terms
- Capture the users' entire Twitter streams (contextual streams)
- Manually coded each tweet
- Identified those using TweaktheTweet or those translating tweets into TweakTheTweet format
- Interviewed through email about general Twitter use, Twitter use during the earthquake, use of TweakTheTweet syntax, awareness of Twitter followers, other volunteer experience, and further comment and suggestions for social media use during crises.

Quotes:
"The broad attribution of social media-related behaviors to “crowdsourcing” can be more finely understood, in this case, as a collection of resources, capacities and a progression to increasingly more defined tasks and even organizational identity. In the matter of sudden and tragic events, the desire that some feel to help is newly enabled by resources like Twitter, where assistance can be provided remotely. Information creation and movement as the basis for social connection and subsequent collective action is at the core of these operations. The emergent ICT-abetted behaviors we have documented here and their consonance with knowledge about

existing self-organizing mechanisms suggest that the digital volunteer will become a common and likely influential feature of social life." (page 1080)

Title: AIDR: Artificial intelligence for disaster response

Citation:
Imran, M., Castillo, C., Lucas, J., Meier, P., & Vieweg, S. (2014, April). AIDR: Artificial intelligence for disaster response. In Proceedings of the 23rd International Conference on World Wide Web (pp. 159-162). ACM.

Keywords: Stream processing; crowdsourcing; classification; online machine learning

Commentary: This paper describes AIDR, which is a platform to classify Twitter messages into a set of user-defined situational awareness categories, in real-time. It combines artificial and human intelligence to obtain labels of a subset of messages and trains an automatic classifier to classify further posts. The platform uses an active learning approach to select potential messages to tag, and learns continuously to increase classification accuracy when new training examples are available.

Intent, problem, objective:
- To leverage different machine learning techniques to process individual tweets, so emergency managers and other stakeholders do not have to manually investigate each tweet for useful information. "...we aim to ingest and classify social media streams in real-time through automated means with the help of human intervention." (pdf page 2)
"In AIDR, we aim to find a right balance so that the human intelligence [filling the gaps for the tasks that cannot be automated] can be used in an effective way." (page 2)

Findings:
"AIDR was successfully tested during a recent earthquake in Pakistan in 2013. ...we achieved a maximum classification quality up to 80%." (page 2-3)

Method notes:
Content analysis; Twitter
"Specifically, AIDR collects crisis-related messages from Twitter ("tweets"), asks a crowd to label a subset of those messages, and trains an automatic classifier based on the labels. It also improves the classifier as more labels become available." (page 2)

Title: Twitter under crisis: Can we trust what we RT?

Citation:
Mendoza, M., Poblete, B., & Castillo, C. (2010, July). Twitter under crisis: Can we trust what we RT?. In Proceedings of the first workshop on social media analytics (pp. 71-79). ACM.

Keywords: Rumor identification; social media analytics; twitter

Commentary: This article covers a simple methodology to track rumors and misinformation. Its results come to a different conclusion regarding Twitter's ability to deny rumors than Arif et al. 2016. This may be due to the different types of crises the rumors are about, or due to different methodologies.

Intent, problem, objective:
Twitter not only enables the effective broadcasting of valid news, but also of baseless rumors. To analyze the impact of Twitter on the propagation of information during the Chilean earthquake, by characterizing the usage and social networks of the days immediately after the event, and by investigating the ability of the social network to discriminate between false rumors and confirmed news.

Findings:
In a small set of cases, the results indicate that false rumors tend to be questioned much more than confirmed truths. As an application, microblogging platforms could warn pepole that many other users are questioning the information item they are reading, to determine how much to trust a certain piece of information.

Method notes:
Rumor propagation:
- Manually selected relevant cases of valid news items, referred to as confirmed truths
- Manually selected important cases of baseless rumors which emerged during the crisis, referred to as false rumors
- Retrieve unique tweets for classification: affirms, denies, questions, and unrelated/unknown

---

Title: An Exploration of Social Media in Extreme Events: Rumors Theory and Twitter During the Haiti Earthquake 2010

Citation:
Oh, O., Kwon, K. H., & Rao, H. R. (2010). An Exploration of Social Media in Extreme Events : Rumors Theory and Twitter During the Haiti Earthquake 2010. Thirsty First International Conference on Information Systems, St. Louis, (April 2014), 231. Retrieved from http://aisel.aisnet.org/icis2008/217

Keywords: Twitter, social media, rumor theory, haiti earthquake, non-parametric analysis, semantic network analysis

Commentary: This article covers how social media propagates information from a rumor theory perspective.

Intent, problem, objective:
Twitter, due to questions of the quality of its information, is sometimes despised as a social media for propagating misinformation, rumors, and (in extreme cases) propaganda. To investigate social media in the extreme event scenario by applying rumor theory to tweets

posted during the Haiti Earthquake of 2010. The authors aim to "...explicate the conditions needed to enhance information quality of Twitter in the extreme event context." (page 2)

Findings:
The results of the analysis confirms that reliable information with credible sources can contribute to reduce anxiety, suppressing groundless rumor.

Method notes:
Sentiment, content analysis; Twitter

Quotes:
"Our study suggests that the high levels of anxiety can be controlled at the early stage through feeds of credible and accurate information by means of links to websites of the emergency response center or authenticating governmental organizations, RSS, streaming videos, photo, text message, or Retweet etc... If reliable information is not provided in this short period of urgent time, then it is likely to stimulate citizen's anxiety such that rumor propagates to fill the gap of informational uncertainties. Therefore, speedy provision of credible information is important to turn citizens' anxiety to positive energy of helping relief activity." (page 12)

"However, in all types of extreme events, consideration of 'anxiety' and 'informational ambiguity' is a key to explicate the working mechanisms of the rumor mill. The key to the matter is how quickly anxiety and informational ambiguity can be configured to different situations. Therefore, as a practical implication of rumor theory in online communities under the extreme event scenario, we argue that it is important to (1) monitor social media to assess the level of social tension, and (2) feed in certain information at the early stage of post-disasters as a emergency response strategy in the Web 2.0 era." (page 12)

Title: Social media usage during disasters and social capital: Twitter and the Great East Japan Earthquake

Citation:
Kaigo, M. (2012). Social media usage during disasters and social capital: Twitter and the Great East Japan earthquake. Keio Communication Review, 34(1), 19-35.

Keywords: Crisis informatics

Commentary: This article finds itself in the Crisis Informatics domain, and is primarily a personal account of how social media played a role in the Japan Earthquake of 2011. It does not bring much new to the crisis informatics table.

Intent, problem, objective:
The use of Twitter in Japan allows for new communication contexts that were not present before Twitter's widespread use. The author examines how new technology, including social media, was used in the Great East Japan Earthquake of March 2011.

Title: Natural Language Processing to the Rescue? Extracting "Situational Awareness" Tweets During Mass Emergency

Citation:
Verma, S., Vieweg, S., Corvey, W., & Palen, L. (2011). Natural Language Processing to the Rescue? Extracting" Situational Awareness" Tweets During Mass Emergency. Proceedings of the Fifth International AAAI Conference on Weblogs and Social Media, 385–392. Retrieved from http://www.aaai.org/ocs/index.php/ICWSM/ICWSM11/paper/download/2834/3282

Keywords: Computer-mediated communication, Twitter, crises

Commentary: This is a good article containing methodology involving NLP and content analysis to identify which tweets are useful for emergency situations and which are not.

Intent, problem, objective:
Valuable information during mass emergencies can provide useful insight into critical situations if captured properly. The authors develop a methodology to automatically identify those messages on Twitter which contribute to situational awareness, i.e. tweets which provide actionable information and details about the situation.

Findings:
"We demonstrate that a classifier based on low-level linguistic features performs well at identifying tweets that contribute to situational awareness. Further, we show that linguistically-motivated features including subjectivity, personal/impersonal style, and register substantially improve system performance. These results suggest that identifying key features of user behavior can aid in predicting whether an individual tweet will contain tactical information. In demonstrating a link between SA and other markable characteristics of Twitter communication, we not only enrich our classification model, we also enhance our perspective of the space of information disseminated during mass emergency." (page 392)

Method notes:
Content analysis; Twitter
"We collected Twitter messages from four different crisis events of varying nature and magnitude and built a classifier to automatically detect messages that may contribute to situational awareness, utilizing a combination of hand annotated and automatically-extracted linguistic features." (Abstract)

Winter storm

Title: Twitter use during a weather event: Comparing content associated with localized and nonlocalized hashtags

Citation:
Lachlan, K. A., Spence, P. R., Lin, X., Najarian, K. M., & Greco, M. D. (2014). Twitter use during a weather event: Comparing content associated with localized and nonlocalized hashtags. Communication Studies, 65(5), 519-534.

Keywords: Crisis; risk; snow storm; social media; Twitter; Stages of crisis

Commentary: This study first reviews the important stages of a crisis from Fink's model. The authors then show the differences, in one specific event, of localized (location-specific hashtags) and non localized (national-level) hashtags, in terms of their information content. They conclude that location-specific hashtags provide more usable information. The authors end with the practical implications of the results, making suggestions on future research as well as suggestions to government organizations on how to improve their crisis communications on Twitter.

Intent, problem, objective: Little is known about the effectiveness of social media strategies in delivering information effectively to at-risk audiences, or the ease with which audiences can locate information. Little scientific research is available about the ideal techniques for retrieving information related to an impending threat via social media.
1: How does the balance between affect display and useful information shift over the course of the storm?
2: What specific information regarding relief efforts is available through Twitter as the Prodromal Stage develops?
3: How does available information on Twitter change as a widespread crisis moves from the Prodromal to Acute Stages?
4: Are there differences in these content attributes between tweets retrieved using localized and nonlocalized hashtags?

Findings:
- Useful and needed information is more available during the beginning of the storm and then begins to dissipate into the late evening.
- As heavy snowfall begins to accumulate, the event becomes more visceral, producing affective displays related to fear, dread, and anxiety.
- During the Prodromal Stage of a crisis (the warning stage, beginning of a crisis), localized hashtags may present a more advantageous place to seek needed information on social media in the event of a crisis.
- National hashtag tweets had an absence of useable information: government agencies need to "... work on their own image and work on providing relevant and useful information within the hashtags they promote." (page 528)

Method notes:
Content analysis; Twitter
- TweetArchivist used to collect tweets at exact time points, using specific search terms, 4 hour intervals, producing a total of 400 tweets
- Content attributes identified for each tweet as well as user attributes (demographic)
- Coded by content type: information about the storm, expressions of affect, spam, humor, or insult; general risk, loss of assets, whereabouts of food/shelter, evacuation efforts, whereabouts of others, how to obtain financial assistance, and how to care for the sick and elderly.

Quotes:
"As publics increasingly rely on social media during extreme weather events, it is necessary for government agencies and organizations to understand how to effectively incorporate these new technologies into crisis management." (page 520)

"...the use of a localized hashtag may provide a closer or stronger sense of immediacy and relevance than would information associated with broader hashtags." (page 528)

"Therefore, those who did not prepare or obtain information during the Prodromal Stage begin their information seeking at or slightly before the trigger event, signaling the onset of the Acute Stage. ... If a member of the public waits until the Acute Stage to seek information, it is possible that information provided during the Prodromal Stage is absent or hard to find because of new information in the feed. ... Therefore, messages with specific behavioral recommendations and information should be tweeted regularly to allow late information seekers to obtain it and to simultaneously reinforce those recommendations ..." (page 528)

"If government agencies and relief organizations wish to provide information to the public concerning specific interventions, then they must survey the Twitter landscape as an event begins to unfold, detect the specific hashtags that are germane to particular at-risk locations, and use those hashtags to connect local audience with information that is specifically geared toward their needs." (page 529)

"Further content analytic research in this area should aim to examine the feeds of specific relief agencies to understand the extent to which they use location-specific hashtag strategies in getting information to localized publics." (page 529)

"In addition to the need for government agencies to use the medium in the most effective manner possible, at-risk audiences must be savvy enough with the medium to locate and retrieve this information." (page 529)

"...the data in the current study suggest that these agencies may be unlikely to hold a conversation with the public through promoted hashtags and are therefore missing opportunities to implement best practices." (page 530)

"The act of promoting a hashtag and then not adequately utilizing it runs the danger of undermining trust, damaging credibility, and leading tech-savvy audience members to seek information elsewhere." (page 530)

Other crises

Terrorist attacks

Shooting

Title: Crisis Informatics: Studying Crisis in a Networked World

Citation: Palen, L., Vieweg, S., Sutton, J., Liu, S. B., & Hughes, A. (2007, October). Crisis informatics: Studying crisis in a networked world. In *Third International Conference on e-Social Science* (Vol. 7, No. 10).

Keywords: Crisis informatics

Commentary: Contains a detailed account/timeline of online response to the crisis at Virginia Tech, including how they react to the eight socio-temporal stages of disaster.

Intent, problem, objective:
This article focuses on the challenges and findings of empirical studies of social media information propagation, specifically considering the situation of the crisis at Virginia Tech in 2007. The authors intend to help establish the crisis informatics area - combining information communication technology with sociological research. "Our overarching objective has been to outline the extended social arena of this crisis as supported by on-line activity. ... we wanted to account for and describe some of the central citizen-side information dissemination activities following the crisis..." (pdf page 2)

Method notes:
- Monitoring online activity as well as on-site quick response research in the initial hours following the shooting
- Face to face interviews (convenience sampling)
- Visualizing information networks online that were made during the crisis

Quotes:
"Participation in the distributed problem-solving activity included family and friends—and students on behalf of them—seeking information about their missing loved ones." (page 8)

"Motivation for participation in the distributed problem-solving activity by other people (which were many more than those directly affected by the crisis) was driven, we propose, by ... people who were remotely located away from the event, but who also wanted to provide some kind of assistance. The information they volunteered and the research assistance they offered were part of the “remedying” of the incomplete knowledge about the scope and implications of the event." (page 8)

"Though the few central citizen-generated victim lists were compiled in different sequences, they were never incorrect. Participants in the list-building activities self-policed, and they knew that adding a name to the list was a serious statement indeed. Accuracy, verification, and gravitas

ruled the interaction on these focal point sites. On Wikipedia in particular, contributors participated in an editorial dialogue that critiqued accuracy of the informal, citizen-originated information and their channels of communication, and how that information should be interpreted via formal channels." (page 8)

"Crisis informatics (first coined by Hagar, 2007 and elaborated here) includes empirical study as well as socially and behaviorally conscious ICT development and deployment. Both research and development of ICT for crisis situations need to work from a united perspective of the information, disaster, and technical sciences." (page 9)

Title: Online Social Media in Crisis Events

Citation:
Palen, L. (2008). Online social media in crisis events. *Educause quarterly*, 31(3), 76-78.

Keywords: Crisis informatics

Commentary: This short article covers broadly Palen's lab's recent work on the Virginia Tech crisis, the wildfires of Southern California in 2007, and other studies.

Quotes:
"ICT enables people—disaster survivors, curious observers, and those who wish to help victims—to connect to one another and to participate in events, including through seeking and providing information peer-to-peer." (page 76)

"In this quick response research [on the 2007 wildfires in Southern California], we show how the unidirectional model of information dissemination from officials to the public, which has been historically and conventionally the basis for emergency response, increasingly fails to account of growing forms of backchannel communication—that is, peer-to-peer communications that are not part of the official discourse of the event." (page 77)

"Respondents felt they lacked information they needed over the course of the disaster, a not uncommon feeling in emergency events. Although traditional media and official communications were reported as helpful by many, it was reported as problematic by others, and respondents actively sought accurate, up-to-date information specific to their area by consulting their peers." (page 78)

"Respondents felt they lacked information they needed over the course of the disaster, a not uncommon feeling in emergency events. Although traditional media and official communications were reported as helpful by many, it was reported as problematic by others, and respondents actively sought accurate, up-to-date information specific to their area by consulting their peers. Some people came to serve as “information brokers” in the event using various media and sources to disseminate information. They distributed information about road closures, fire line encroachments, shelter openings and closings; they annotated maps; and they created and participated in community web-based forums..." (page 78)

"Our data suggest that social media support critical information distribu- tion activity among members of the public that we believe needs to be better integrated with official disaster response activities." (page 78)

"For policy reform, the findings from this work suggest that future emergency management needs to incorporate mechanisms within organizational processes for supporting and leveraging publicly-disseminated information. For technology design, the empirical work on social behavior provides a realistic understanding of the power of large-scale interaction from which to generate new tools and services. These implications for policy and technology development are driven by careful consideration of human needs and the power of large-scale social interaction." (page 78)

Title: Information Wars: A Window into the Alternative Media Ecosystem

Citation:
Starbird, K. (2017, March 15). Information Wars: A Window into the Alternative Media Ecosystem. Retrieved April 27, 2019, from https://medium.com/hci-design-at-uw/information-wars-a-window-into-the-alternative-media-ecosystem-a1347f32fd8f

Keywords: Misinformation; disinformation; crisis informatics; information diffusion

Commentary: This article covers Starbird's recent attempts to unpack the alternative media ecosystem, focusing on alternative narratives of crisis events, and to use Twitter data to map the structure of the ecosystem that drives those narratives. The researchers qualitatively analyzed websites promoting alternative narratives, and found that those websites collectively spread many different kinds of conspiracy theories. They suggest that future work is needed to assess the broader alternative media ecosystem and determine how influential these media and their messages are on U.S. and global perspectives of world events and science.

Intent, problem, objective:
Online rumoring and misinformation, including alternative narratives and fake news, are holding increasingly important roles in social media.

Findings:
- Alternative media were cited for supporting alternative narratives; mainstream media were cited for challenging them
- Botnets greatly amplified the alternative narratives of InfoWars and TheRealStrategy (domains)
- In alternative media domains, the major political orientation was towards anti-globalism (rather than standard left vs. right); could include anti-mainstream media, anti-immigration, anti-corporation, anti-U.S. government, anti-European Union. (some even anti-Semitic)
- Elaborate alternative news websites reference other alternative narratives, creating an ecosystem of deceivingly diverse sources, all referencing the same alternative narratives
- An intentional strategy by many alternative media websites to leverage rhetoric around fake news and critical thinking to further confuse and mislead readers by framing their content as truth and to empower users to choose for themselves.

Method notes:
Content, network analysis; Twitter
- Twitter collection focused specifically on shooting events, over 9 months; identified tweets that referenced alternative narratives (false flag, hoax, crisis actor)
- Created a network map of the internet domains referenced in these tweets (to see what websites were cited)
- Conducted an in-depth qualitative analysis of all the domains in the graph

Quotes:
"Though we often think of disinformation as being employed to convince us of a specific ideology, in a 2014 article titled 'The Menace of Unreality', Pomerantsev and Weiss describe how Russian disinformation strategies are designed not to convince but to confuse, to create "muddled thinking" within society. Their strategic argument is that a society who learns it cannot trust information can be easily controlled." (Section: "So Many Conspiracy Theories: Crippled Epistemologies, Muddled Thinking, and the Fingerprints of a Disinformation Campaign")

Title: Community intelligence and social media services: A rumor theoretic analysis of tweets during social crises

Citation:
Oh, O., Agrawal, M., & Rao, H. R. (2013). Community intelligence and social media services: A rumor theoretic analysis of tweets during social crises. Mis Quarterly, 407-426.

Keywords: Twitter, social reporting, social information processing, rumor theory, social crisis, extreme events, community intelligence

Commentary: This is a very good article covering reasons for rumor spread and more. It offers warnings on how to counteract rumor mongering during crises, among other in-depth analysis of ambiguity and anxiety crisis situations.

Personal note: How do citizens "rise up" to ensure accurate, localized situational information? And in what situations do connected citizens volunteer, and in what situations find a huge mess of inaccurate information? Most rumor theory papers cover how if left to their own collective processing, rumors will run abound and it will be a mess. However, in situations studied by crisis informatics papers, the event normally creates an online/connected community of volunteers helping to sort out accurate information.

Intent, problem, objective:
Many warnings have been raised about the reliability of community intelligence obtained through social reporting by the amateur online community.
This study attempts to answer two questions:
1. Under what conditions does collective social reporting function as a community intelligence mechanism to address crisis problems?
2. Under what conditions does social reporting degenerate into a rumor-mill?

Findings:
The authors have a number of key findings. First of all, content ambiguity does not contribute to rumormongering, but source ambiguity does so very significantly. Another key finding of theirs is that the effect size of anxiety on rumoring is much lower than that of source ambiguity (contrary to the consistently reported finding that anxiety is the most influential rumormongering factor).

Method notes:
The authors analyzed Twitter data from three crisis incidents (Mumbai terrorist attack in 2008, Toyota recalls in 2010, Seattle cafe shooting incident in 2012).

Quotes:
"...in cases of community disasters, emergency responders need to make extra efforts to distribute reliable information and, at the same time, control collective anxiety in the community to suppress rumor spread. That means, if unambiguous and localized situational information is not provided to the affected community in a timely manner, their collective information processing is very likely to encourage rumors. Therefore, emergency response teams need to put in place prompt response systems to refute the wrong information and provide citizens with timely, localized, and correct information through multiple communication channels... [doing so] may lead to successful threat management in partnership with voluntary online citizens." (page 421)

Bombings

Title: Rumors, False Flags, and Digital Vigilantes: Misinformation on Twitter after the 2013 Boston Marathon Bombing

Citation:
Starbird, K., Maddock, J., Orand, M., Achterman, P., & Mason, R. M. (2014). Rumors, false flags, and digital vigilantes: Misinformation on twitter after the 2013 boston marathon bombing. *IConference 2014 Proceedings*.

Keywords: Crisis informatics; Twitter; microblogging; misinformation; information diffusion; rumors; crowdsourcing

Commentary: A good example of how misinformation and corrections interact after a terrorist event.

Intent, problem, objective:
To inform solutions for detecting and counteracting misinformation using the social media crowd. Seeks to understand how misinformation propagates on social media and explores the potential of the crowd to self-correct, and how this correction functions and how it varies across different types of rumors.

Findings:
Alternative narrative rumors intersect with politicized content.

Rumor 1: girl killed while running marathon
- Of the tweets related, the misinformation to correction ratio was about 44:1.
- Peak correction did occur roughly within the same hour interval as peak misinformation, suggesting reactionary community response.
- Misinformation shown to be more persistent, continuing to propagate at low volumes after corrections have faded away.
Rumor 2: Staged attack, or carried out by the US government
- Misinformation to correction ratio 18:1.
- Lag between the spike in misinformation and the resulting rise in corrections.
- Misinformation continues to spread even after real names are released.
Rumor 3: Misidentification of student as the bomber
- Misinformation to correction ratio about 5:1.
- Corrections lagged behind misinformation, but grew steadily and eventually overtook misinformation.

Method notes:
Network analysis; Twitter
- Collected data using Twitter Streaming API using terms boston, bomb, explosion, marathon, blast.
- 10.6 million tweets, 4.7 million authors.

- Created a network graph of relationships of the most prevalent hashtags; each node a popular hashtag, sized by the log number of times appeared; each edge connects two hashtags that appear in the same tweet, sized by the number of times they occur.
- Examined three false rumors and conducted a systematic analysis of tweets that referenced them.
- Coded each tweet with categories: misinformation, correction, and other (unrelated, unclear).

Quotes:
"Misinformation on social media represents a challenge for those seeking to use it during crises. This concern has been voiced in the media and by emergency responders who are reluctant to depend on it for response operations." (page 655)

"Though misinformation and correction seem to rise and fall in tandem, they exhibit different magnitudes and a lag between the onset of misinformation and the correction. ... the frequency and wavelength of misinformation and correction are often aligned, but the amplitude can be exponentially different and there is often a delay in the correction signal. Additionally ... misinformation can persist at lower levels that no longer activate significant corrections." (page 661)

Hostage situation

Title: How information snowballs: Exploring the role of exposure in online rumor propagation

Citation:
Arif, A., Shanahan, K., Chou, F. J., Dosouto, Y., Starbird, K., & Spiro, E. S. (2016, February). How information snowballs: Exploring the role of exposure in online rumor propagation. In Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing (pp. 466-477). ACM.

Keywords: Rumoring; information diffusion; information contagion; crisis informatics; Twitter; disaster response

Commentary: A very useful methodology in deriving the source of tweets, and following the spread of certain kinds of information.

Intent, problem, objective:
The authors intend to expand on previously proposed approaches to quantifying rumor dynamics by emphasizing exposure to rumor content and illustrate the value of incorporating this perspective. They intend to characterize rumoring behavior on Twitter during a hostage crisis event using ideas of rumor volume, exposure, and content production to reveal how both message and user characteristics can change the information space surrounding rumors; as well as to offer a typology for characterizing rumoring behavior along dimensions of volume and exposure to highlight phenomena critical to understanding rumor propagation. (page 467)

Findings:
High derivative volume and high exposure (giant)– rumor-related information is mostly derived from the posts of individuals with very high direct reach.
High derivative volume and low exposure (snowball) – messages begin from an initial state of small significance and build upon themselves to become an information avalanche.
Low derivative volume and high exposure (fizzle) – accounts with high followers tweet information that is not repeated or spread by others, leading to low derivative volume.
Low derivative volume and low exposure (babble) – information is being added to the larger conversation but the source of that information has limited reach to others and content is insufficient to spark changes in volume.

Method notes:
Content, network analysis; Twitter
The "... research team collected data during the Sydney Siege event for the explicit purpose of examining rumoring behavior during crisis events. Data collection utilized the Twitter Streaming API to track specific event-related terms and phrases... Data collection started on December 15 and ended two weeks later..." (page 468)
- Identified 5 rumors by consulting media reports as well as exploring the Twitter data itself, refining the rumor definitions and then using a specific search query to produce a low noise but comprehensive sample of tweets for each rumor.
- Categorized/coded each tweet in the rumor datasets manually (Affirm, Deny, Neutral, Unrelated, and Uncodable).

Volume calculations, exposure calculations, content production calculations

Quotes:
"First, being aware of the different types of effects a post may produce can help to design and direct crisis-related information... Second, our approach highlights the fact that emergency responders should consider both messages and people when engaging with rumors. ... Moreover, it is important for emergency responders to understand how potential exposure may change over the course of the event." (page 475)

"...sociological studies of the more general case of rumoring behavior have a longstanding tradition, and can offer important theoretical contributions to understanding how these phenomena unfold online." (page 467)

"In the social sciences, rumoring behavior is regarded as a social process of collective sensemaking through which individuals can understand situations characterized by high levels of uncertainty, anxiety and a lack of official news; it is precisely in these situations that rumors are likely to emerge." (page 467)

"Quantifying rumoring behavior through the lens of volume helps measure a rumor's overall prevalence in terms of the sheer number of messages present in the information space at a particular point." (page 468)

"Rumoring behavior is not simply a function of the number of messages related to the story, but also the number of individuals involved. (page 469)

"...by considering the interaction between volume and potential exposure, we open spaces to interpret how different combinations of conditions might be impacting the information space in interesting ways. This might involve observing how a high potential exposure affirm tweet might be associated with a spike in volume occurring within the next minute but it could also point us to considering less observable effects." (page 469)

"... in the context of social media platforms, retransmission or serial transmission of content is a prominent propagation mechanism and distinct from content produced by the original poster." (page 469)

"While emergency responders may initially have low exposure, they may be able to design content aiming for snowballs. Moreover, exposure can be very dynamic and emergency responders could easily turn into giants overnight when extreme events occur." (page 475)

"...during crisis events Twitter users arrive at information through sources other than their social network ties, such as through search functions or external articles." (page 475)

"We often see fizzles [high exposure, low volume] at the end of the signature, when the information space is dying out and activity has declined. ... This suggests that while a fizzle tweet may not increase volume, it may prevent an individual from tweeting false information." (page 475)

"In the context of emergency response organizations, babble effects [low exposure, low volume] could be detrimental to response activities, because crisis-related information is much less likely to reach members of the public through a diffusion mechanism." (page 475)

Riot

Title: Beyond the geotag: Situating "big data" and leveraging the potential of the geoweb

Citation:
Crampton, J. W., Graham, M., Poorthuis, A., Shelton, T., Stephens, M., Wilson, M. W., & Zook, M. (2013). Beyond the geotag: Situating “big data” and leveraging the potential of the geoweb. Cartography and Geographic Information Science, 40(2), 130–139. https://doi.org/10.1080/15230406.2013.777137

Keywords: Geoweb, big data, Twitter, geotag

Commentary: This is another good article covering the many limitations of collecting data without understanding the context or situation a data point may have been produced in. It covers the different attributes and ways to analyze geoweb data, by examining the issues of each type and suggesting ways in which to avoid those issues.

Intent, problem, objective:
Big data is often used in studies to replace thinking, and are therefore limited in the value of their findings, and relies too much on geotags as a way of geolocating the data. There is too much focus on the data "speaking for themselves," and the data needs to be understood further to draw real conclusions from it. The authors propose a different approach to overcome these many limitations of big data, to better understand the geoweb.

Findings:
The authors propose many future directions for geoweb research, suggesting "...that a closer attention to the diversity of social and spatial processes, such as social networks and multi-scalar events, at work in the production, dissemination, and consumption of geoweb content provides a much fuller analysis of this increasingly popular phenomenon."

Method notes:
Network analysis; Twitter

Comparing different crises

Title: What to expect when the unexpected happens: Social media communications across crises

Citation:
Olteanu, A., Vieweg, S., & Castillo, C. (2015, February). What to expect when the unexpected happens: Social media communications across crises. In *Proceedings of the 18th ACM conference on computer supported cooperative work & social computing* (pp. 994-1009). ACM.

Keywords: Social media; emergency management; crisis informatics

Commentary: A very well-thought and complete examination on a diverse set of crisis situations, showing the differences in information broadcast during the events and dominant information sources, and how different events are related to each other.

Intent, problem, objective:
To aid in the understanding of how to effectively use social media as part of information gathering processes, for members of the public, emergency managers, and formal response agencies. What are the similarities and differences in Twitter communications that take place during different crisis events, according to specific characteristics of such events?
Solution found through studying the prevalence of different information types and sources of messages (tweets) under different types of crisis situations.

Findings:
Many similarities and differences between crises. Quotes section for more

Method notes:
Content, network analysis; Twitter
- "We determine a set of dimensions that allow us to characterize different crises: hazard type, temporal development, and geographic spread.
- We determine a set of dimensions to characterize social media messages during a crisis: informativeness, information type, and source.
- We collect Twitter data corresponding to 26 crises that took place in 2012 and 2013, using retrospective sampling on the 1% public data stream which is publicly available in the Internet Archive.
- We create, run, and evaluate a series of crowdsourcing tasks to perform content annotation on approximately 1,000 messages from each of the crises.
- We perform a statistical analysis of the dependencies between types of crises and types of messages." (page 995)

Quotes:
"We see two large clusters: first, the cluster on the bottom is dominated by human-induced crises, while in the one on the top there are only natural hazards. This indicates that, despite the significant variations we have shown, human-induced crises are more similar to each other in

terms of the types of information disseminated through Twitter than to natural hazards." (page 1003)

"While disasters take place often, and may be caused by similar hazards and/or human actions, each event is unique. Regardless of their distinct nature, and of variations in individual reactions and responses, commonalities across crises exist. Sociologists of disaster point out that despite the differences among disaster agents (e.g. flood, earthquake, bomb, fire), there are actions that planning and emergency response teams must take that are independent of these differences." (page 1004)

"... the types and amounts of information broadcast on Twitter differ across each of the 26 specific crises we studied. This can be viewed as a display of the uniqueness of each event. In some cases the most common tweet in one crisis ... was absent in another... Furthermore, even two events of the same type in the same country ... may look quite different vis-a-vis the information on which people tend to focus." (page 1004)

"Yet, when we look at the Twitter data at a meta-level, our analysis reveals commonalities among the types of information people tend to be concerned with, given the particular dimensions of the situations such as hazard category, hazard type, whether it is instantaneous or progressive, and whether it is localized or diffused." (page 1004)

"When grouping crises automatically based on similarities in the distributions of different classes of tweets, we also realize that despite the variability, human-induced crises tend to be more similar to each other than to natural hazards." (page 1004)

"... we can view Twitter as a medium through which the nuance of disaster events is highlighted or amplified; it is a tool that becomes incorporated into the social construction of the disaster event, and through which we can understand the detailed differences on a large scale when we look closely at Twitter data. At the same time, when we look at those same data at a higher level, we see commonalities and patterns." (page 1004)

"...the proportion of tweets that are relevant for a specific purpose will almost invariably be smaller than the proportion of tweets that are not." (page 1005)

"... tools to process social media in disasters should consider that there are broad classes of information that are likely to be prevalent, and can be anticipated to occur. At the same time, a substantial volume of messages will depend on specificities of every event, and tools must incorporate methods to adaptively detect and process them." (page 1005)

Title: When do extreme weather events generate attention to climate change?

Citation: Sisco, M. R., Bosetti, V., & Weber, E. U. (2017). When do extreme weather events generate attention to climate change? Climatic Change, 143(1–2), 227–241. https://doi.org/10.1007/s10584-017-1984-2

Keywords: Climate attention; social media; extreme weather

Intent, problem, objective:
Research on a more comprehensive range of climate-change-relevant weather events as well as more studies that examine their immediate impacts are needed to establish a more comprehensive understanding of how extreme weather experiences affect climate attention and attitudes. To better understand the immediate impacts on attention to climate change of a larger range of climate change weather events.

Findings:
The authors found that more weather events than previously examined can cause immediate attention to climate change. They also found that financial damage (i.e. the damage caused by the event) is less predictive of increased attention than expected. Additionally, the abnormality/degree of unexpectedness of the event is consistently predictive of increased attention.

Method notes:
Content analysis; Twitter
"Our analysis uses records of 10,748 weather events from December 2011 to November 2014. We measure attention to climate change using approximately 1.7 million Twitter messages emitted from local areas surrounding the weather events [flash flood, excessive heat, wildfire, heavy snow, tornado, hail, strong wind, extreme cold, coastal flood, and drought]. Changes in frequencies of messages about climate change are analyzed as a proxy for changes in attention to climate change. This is based on the simple assumption that when people's attention to the issue increases, they are more likely to post about it on Twitter. We assess the predictive value of events' financial damages and fatalities, as well as the effects of the abnormality of events' occurrences. We separately model and compare the effects of key weather features (temperature, wind speed, and precipitation) on absolute vs. relative scales." (page 230)

Quotes:
"Once abnormality was added to [our] model, the coefficients for the effects of the event types all lessened and, in some cases, became nonsignificant, such as in the case of droughts and excessive heat. This suggests that abnormality is generally relevant to the effects of weather events on attention to climate change and, in some cases, may be essential for an event to occur. It appears that the psychophysical law (Weber 1978) that relative changes in stimuli are more readily perceived by humans than absolute changes is relevant to the domain of extreme weather." (page 238)

"Personal experiences with weather events can cause attention to the issue of climate change." (page 228)

"[Previous studies' findings on individual perceptions and concerns with climate change] highlight the importance of expanding our knowledge of the effects of extreme weather experiences beyond temperature changes. Experiences with other weather events may be more influential because they may be less politicized; i.e., people may have fewer preconceived notions about them." (page 229)

"A better understanding of the effects of extreme weather on climate attention benefits short-term and long-term predictions about climate concern. Accurate short-term predictions can

allow policy makers and grassroots organizations to implement climate communications more strategically by capitalizing on time periods when people have heightened attention to climate change such as after recent extreme weather experiences. Long-term predictions about climate concern are more difficult to model with much certainty but can be used by policy makers to forecast the future favorability of climate policies." (page 229)

Coping during crises

Title: Challenges in the adoption of crisis crowdsourcing and social media in Canadian emergency management

Citation:
Harrison, S., & Johnson, P. (2019). Challenges in the adoption of crisis crowdsourcing and social media in Canadian emergency management. Government Information Quarterly, (April), 0–1. https://doi.org/10.1016/j.giq.2019.04.002

Keywords: Emergency management; crisis crowdsourcing; government crowdsourcing; social media; disaster management

Outside of the crisis context

Climate change

Title: Network analysis reveals open forums and echo chambers in social media discussions of climate change.

Citation:
Williams, H. T. P., McMurray, J. R., Kurz, T., & Hugo Lambert, F. (2015). Network analysis reveals open forums and echo chambers in social media discussions of climate change. *Global Environmental Change*, 32, 126–138. https://doi.org/10.1016/j.gloenvcha.2015.03.006

Keywords: Social network analysis; climate change; polarisation; echo chamber; opinion leader

Intent, problem, objective:
The authors aim to characterize social media (Twitter) discussions of climate change by mapping the structure of user social networks, measuring the distribution of user attitudes across those networks, and exploring user interactions and behaviors.

Findings:
Their analysis found a high degree of polarization in attitudes - those users who were most active in online discussions of climate change tended to have strong attitudes (activist or sceptic) and neutral views were strongly absent.

Method notes:
Sentiment, network analysis; Twitter
Identified representative hashtags included in climate change discussion. Constructed three types (follower, retweet, and mention) of social networks for each hashtag. Manually coded/classified each most active user as an activist or sceptic. Coded/classified sentiment (positive, negative, neutral) in mentions between activists and sceptics (not mentioned how). Analyzed frequency of interactions between different types of users to identify homophily within viewpoints.

Quotes:
"Overall, social media discussions of climate change often occur within polarising ‘‘echo chambers’’, but also within ‘‘open forums’’, mixed-attitude communities that reduce polarisation and stimulate debate." (126)

"...the public nature of communication on Twitter is likely to encourage users towards behaviours consistent with the image they wish to express. Following another user is a public decision to associate with and receive content from that user. Retweeting often implies (public) endorsement of either the individual tweet or its original author. Thus users are likely to follow/retweet others with views consistent with their own." (135)

"...most individuals engaged in online discussions are embedded within communities of like-minded users; such self-reinforcing ‘‘echo chambers’’ can prevent engagement with alternative viewpoints and promote extreme views. Partisan online communities may also act as selective filters that impede transmission of unfavoured ideas across the broader social network." (135)

Title: Comparing events coverage in online news and social media: The case of climate change

Citation:
Olteanu, A., Castillo, C., Diakopoulos, N., & Aberer, K. (2015, April). Comparing events coverage in online news and social media: The case of climate change. In Ninth International AAAI Conference on Web and Social Media.

Keywords: Climate change; news sources; news communication; online media

Commentary: Contains a useful methodology for identifying what types of news topics are more prevalent on mainstream vs. social media.

Intent, problem, objective:
An in-depth comparative study on how news are communicated through different types of online media, in particular mainstream news media and social media; to offer insight into how climate change, a complex and multi-faceted topic, is comparatively covered and framed in different media. "Why might some events or actors in the climate change discourse receive more attention in the mainstream media versus on social media, or vice versa? What are the types of news events that receive more attention in both? Ultimately, agenda setting serves to define the problems that are worthy of public attention, and we seek to understand and compare the agenda that emerges from traditional MSM attention as compared to the agenda that organically emerges on a social media platform." (page 288)

Findings:
- Mainstream media covers disasters much more than Twitter.
- Governmental/inter-governmental meetings and publications are given more attention in mainstream media, but legal actions and official statements are given more attention on Twitter.
- Actions by individuals appear prominently on Twitter; half of the individuals are not powerful, rich, or famous.
- Activists and advocates: high impact negative effects of climate change feature prominently across both types of media.
- Public relations or for-profit corporations: discussions about lawsuits circulate social media but do not appear prominently in mainstream media.
- Media organizations: social media and mainstream news are significantly aligned, but there are many gaps.

Method notes:
Content analysis; Twitter
Scope of the news considered: the presence of human activity as causes; effects in the global atmosphere; and variations of climate. A news article is about climate change if it operates

within the climate change frame: defining the problem, diagnosing its causes, making a moral judgement, or suggesting a remedy.
- Use GDELT to automatically discover relevant events with high mainstream media coverage
- Twitter's Sample API; search terms
In depth manual coding, classifying

Quotes:
"Twitter indeed allows those individuals [those who are not rich, famous, or powerful], in many cases, to generate peaks of attention as large as the ones that are obtained by large organizations or governments." (page 296)

Title: Interpersonal communication about climate change: how messages change when communicated through simulated online social networks

Citation:
Connor, P., Harris, E., Guy, S., Fernando, J., Shank, D. B., Kurz, T., … Kashima, Y. (2016). Interpersonal communication about climate change: how messages change when communicated through simulated online social networks. Climatic Change, 136(3–4), 463–476. https://doi.org/10.1007/s10584-016-1643-z

Keywords: Information propagation; social media

Commentary: The authors of this paper use a simulated interpersonal social network (similar to Facebook) to examine what types of messages about climate change spread more than others.

Intent, problem, objective:
The study of how different types of climate change information is spread through interpersonal social networks has been neglected in climate change communication research. What types of climate change communication 'survives' when passed between individuals via communication network chains?

Findings:
The authors found that statements centered on conventional climate change topics such as its impact on the natural world and human health survived longer in communication chains than those with less conventional topics, such as its impact on societal competence, development, or communality. Statements about gain frames (i.e. statements that focus on the benefits of climate change mitigation) survived more than those about loss frames (i.e. statements focusing on the harms of non-mitigation) initially, but loss-framed information survived more later in communication chains.

Quotes:
"...individuals can act as 'opinion leaders' who spread public messages through social networks via a 'two-step flow' of communication. This is particularly important because friends and relatives often trust sources of climate change information. [...] Communicating about an issue within social networks that hold shared values may increase an issue's perceived importance. Third, interpersonal communication can shape perceptions of ingroup norms, which influence

pro-environmental behavior. Finally, the transmission of secondhand information can be markedly different from the information received firsthand." (page 464)

"A key finding of serial reproduction research is that ideas perceived as being shared within a community (more 'conventional') are more likely to be passed on, while unconventional information is lost or changed. This process gradually leads to a conventionalization of messages, and can play a central role in the maintenance of cultures by reinforcing shared understandings and marginalizing unconventional ones." (page 466)

"Climate change is primarily perceived as an environmental issue. Thus, nature-focused messages that link climate change to natural disasters and other environmental effects are arguably more conventional than society-focused messages. This suggests that as messages pass through social networks, nature-focused messages may be more likely than society-focused messages to spread, due to their relative conventionality." (page 466)

Title: Online communication on climate change and climate politics: A literature review

Citation:
Schäfer, M. S. (2012). Online communication on climate change and climate politics: A literature review. Wiley Interdisciplinary Reviews: Climate Change, 3(6), 527–543. https://doi.org/10.1002/wcc.191

Keywords: Climate change communication; social media

Intent, problem, objective:
"A significant amount of scholarly work on the role of online media in climate communication has been assembled in the past years, albeit scattered across disciplines... it warrants a first review. The article at hand will provide that." (page 528) To identify the major themes of existing research on climate change communication, present their most robust findings, and outline what needs to be studied in the future.

Findings:
Very broadly:
Scientists and scientific institutions play a limited role in online climate communication;
NGOs communicate extensively online in regards to climate;
Knowledge about strategic communication from politicians, corporations, and others is limited;
The amount of online climate content is significant and increasing;
The quality of science communication online is considered poor;
Online debates on climate change are not 'better' than offline debates;

Method notes:
Literature review. The first part deals with different stakeholders' strategic use of online and social media in climate communication. Then the author describes what is known about the structure and characteristics of online climate communication, followed by studies on the uses and effects of this communication. Finally, the author mentions directions for future research.

Quotes:
"...it seems that even though scientifically correct presentations of climate change can be found online, on average, online media and blogs paint a picture of climate change that deviates significantly from the scientific view. What, if any, deviation from the scientific standpoint is deemed acceptable depends on the author's position." (page 533)

Title: Politicization of science: how climate change skeptics use experts and scientific evidence in their online communication

Citation:
Schmid-Petri, H. (2017). Politicization of science: how climate change skeptics use experts and scientific evidence in their online communication. Climatic Change, 145(3–4), 523–537. https://doi.org/10.1007/s10584-017-2112-z

Keywords: Climate change communication; climate change skeptics; misinformation

Commentary: This article covers the many different strategies that different actors use in online debates about science.

Intent, problem, objective:
In the public debates of political issues, science is often politicized and actors from both sides strategically use scientific knowledge or intentionally emphasize uncertainties to push for or avoid certain policy changes. "The aim of this study is to gain a more detailed knowledge on the communicative strategies used by climate change skeptics to tackle scientific consensus." (page 524)

Findings:
The authors found that the criticism strategy (i.e. criticizing opponents and discrediting research or scientists who represent the other side) is more commonly used than the legitimation strategy (i.e. legitimizing one's own standpoint or convincing someone of a certain point of view). They also found that the legitimizing strategy was more important for organizations. Additionally, by analyzing the type of experts that organizations use, they found that countermovement organizations rely on a broad network of scientists.

The authors covered implications for the different impacts of these findings on communication strategies. See below.

Quotes:
"[The communication strategies identified] help emphasize uncertainty as they promote controversy. Given its low access barriers, online communication offers many possibilities, particularly for countermovement actors, to campaign for their cause, especially to discredit their opponents. This finding gains relevance as more people search for information online. From a normative standpoint, this visibility online may be problematic since to the outside world, seeing the debate through the prism of the Internet, it would not be obvious that the mavericks were doing anything out of the ordinary in respect of their science." (page 534)

"...the criticism of experts, scientific institutions, or scientific evidence that represent the consensus regarding anthropogenic climate change is highly problematic for the experts themselves, as they bear the risk of losing their credibility within their own community or in the public debate the issue." (page 535)

"...inoculation [explaining to readers the special techniques that are used to create uncertainty and doubt in the scientific evidence about climate change] could be an effective way of neutralizing the effects of such misleading information about climate change and to protect the positive effect of the consensus message in the presence of counter information (van der Linden et al. 2017, p. 4). " (page 535)

Title: Climate change on Twitter: Content, media ecology and information sharing behaviour

Citation:
Veltri, G. A., & Atanasova, D. (2017). Climate change on Twitter: Content, media ecology and information sharing behaviour. Public Understanding of Science, 26(6), 721–737. https://doi.org/10.1177/0963662515613702

Keywords: Climate change; media ecology; semantic graphs; Twitter; information sources

Intent, problem, objective:
Social media is increasingly used to disseminate information about climate change and to mobilize support for action and inaction on climate change. Little agreement exists as to what methods can be employed to reliable study social media and what insights can be achieved. A mix of different but complementary theoretical frameworks may need to be used to guide analysis. To establish a theoretically meaningful and methodologically viable use of Twitter data for social scientific research in general and to better understand the representation of climate change on Twitter.

Findings:
The authors found that semantically, four thematic clusters emerged related to calls for action and awareness of climate change, its consequences and causes, and the policy debate about climate change and energy. They also found that content with high, arousing emotional value has a greater chance of being shared online, with the accompanying tweets mainly characterized by anger and sadness.

Method notes:
Sentiment, content, network
Automatic thematic analysis and semantic network analysis;
Classification of textual psychological processes;
Information sharing and media ecology

Title: Social media and the organization of collective action: Using twitter to explore the ecologies of two climate change protests

Citation:
Segerberg, A., & Bennett, W. L. (2011). Social media and the organization of collective action: Using twitter to explore the ecologies of two climate change protests. Communication Review, 14(3), 197–215. https://doi.org/10.1080/10714421.2011.597250

Keywords: Social media role

Commentary: This article brings up an important point that viewing Twitter as a communication update service may not distinguish the most intriguing dimensions of Twitter in contentious politics. They argue that an important question to ask is how social media embed and engage different ecologies of dissent.

Intent, problem, objective:
Sweeping assumptions and generalizations are not helpful starting points for examining the relation between social media and contentious collective action. To propose an approach that "locates Twitter and other social technologies in diverse contexts of use while opening up for more focused assessments of the differing roles these media might play." (page 198)

Quotes:
"This article has argued that critically examining the relation between transforming conditions for communication and collective action demands recognition of the ways in which social technologies infuse specific protest ecologies. The immediate question from this perspective is neither what Twitter does to contentious politics nor what specific actors do with Twitter. Rather, this approach looks to the roles of social technologies as organizing mechanisms (as organizational agents), and the traces of these technologies that may reflect larger organizational schemes in a protest ecology (as windows)." (page 212)

Title: The Hype Before the Storms

Citation:
Johnson, M. (2016, April 28). The Hype Before the Storms. Retrieved from https://thewxsocial.com/2016/04/28/the-hype-before-the-storms/

Commentary: One of the citations from the original proposal. It provides a succinct discussion of the issues raised by increased lead times (the amount of time before a severe weather event that people are given to prepare), and offers a solution: to provide consistent information regularly to prevent rumors from spreading.

Intent, problem, objective:
Before a severe weather event, coverage leading up to the event can be overwhelming, full of noisy information that buries more important information. The author's objective is to describe two aspects of the "hype" leading up to a severe weather event (lead time and misinformation

on social media) in order to better understand how to effectively get important messages to those at risk.

Findings:
The author's main suggestion to counteract false information is to "...provide consistent follow-up information and fill the communication void..." (second to last paragraph). He also concludes that longer lead time carries many benefits, giving people more time to prepare for the event.

Quotes:
"Will a potential severe weather event being discussed ad nauseam for a week elicit a better response than one covered for only 4 days? Or will there be some degree of “severe weather fatigue” due to the prolonged exposure to the hype." (paragraph 6)

"...an increase in lead time will allow more opportunities for the rumor mill to take off. As forecast details begin to emerge, professionals and amateurs alike take to social media to share severe weather forecasts and safety information. Some forecasts can be conservative while others may take to posting the most extreme outlier of all model solutions. These “social meteorologists”, as they are called, often do more harm than good." (paragraph 8)

News

Title: Affective News and Networked Publics: The Rhythms of News Storytelling on #Egypt

Citation:
Papacharissi, Z., & De Fatima Oliveira, M. (2012). Affective News and Networked Publics: The Rhythms of News Storytelling on #Egypt. Journal of Communication, 62(2), 266–282. https://doi.org/10.1111/j.1460-2466.2012.01630.x

Keywords: Affective display, Twitter

Commentary: This article is a little confusing on what exactly it is trying to conclude. The authors focus on a hashtag, and examine who is using it, and what kind of content it is found with, including the affect display of tweets. It does focus more on the political end of social media activity.

Intent, problem, objective:
News feeds produced by citizens acting as journalists complement and may replace mainstream media reporting. The "...rhythms of news storytelling on Twitter reveal emerging hybrid forms of journalism." (page 267) This article aimed to understand how news events turn into news stories on Twitter in crises, focusing on affective news streams that contain a mix of opinions, facts, and emotions.

Findings:
The authors observe in their study that "Tweets attain the drama of instantaneity, which is compelling and engaging for readers, but not necessarily compatible with fact checking processes of western paradigms of journalism." (page 279) They also find that Twitter creates a crowd-sourced form of leadership, where key users became leaders on the platform.

Method notes:
Network analysis; Twitter

Emotions

Emotions' effect on information transmission in media

Title: Arousal Increases Social Transmission of Information

Citation:
Berger, J. (2011). Arousal Increases Social Transmission of Information. Psychological Science, 22(7), 891–893. https://doi.org/10.1177/0956797611413294

Keywords: Information dissemination; social transmission; emotions

Intent, problem, objective:
The major explanation for the spread of rumors during crises has been generalized anxiety. This explanation is less useful in explaining the prevalence of rumors in positive situations. The links behind why emotions drive sharing and why some emotions boost sharing more than others remains unclear. The author aims to reveal that transmission (social transmission, i.e. social interaction) is driven in part by arousal, to suggest that high arousal emotions will boost sharing more than emotions characterized by low arousal.

Findings:
The author found: "...physiological arousal can plausibly explain transmission of news or information in a wide range of settings. Situations that heighten arousal should boost social transmission, regardless of whether they are positive (e.g. inaugurations) or negative (e.g., panics) in nature." (page 892)

Quotes:
"[These findings] suggest that arousal-inducing content should be shared more than content that does not induce arousal. Public health information, for example, might spread more effectively if it evokes anxiety rather than sadness. More broadly, the findings suggest how psychological processes might shape collective outcomes (i.e., culture): More arousing content should be more likely to spread quickly on the Internet and should be more likely to capture public attention." (page 892)

Title: Emotions and Information Diffusion in Social Media - Sentiment of Microblogs and Sharing Behavior

Citation:
Stieglitz, S., & Dang-Xuan, L. (2013). Emotions and Information Diffusion in Social Media—Sentiment of Microblogs and Sharing Behavior. Journal of Management Information Systems, 29(4), 217–248. https://doi.org/10.2753/MIS0742-1222290408

Keywords: Information diffusion; social media

Intent, problem, objective:
Little research has drawn attention to emotions as another potential driver of information diffusion in a social media setting, in particular regarding the user's information sharing behavior. The authors seek to fill the research gap by examining the potential relationship between sentiment articulated in social media content and its diffusions through online social networks..

Findings:
The authors "...show that sentiment (positive or negative) in social media-based content is correlated with information sharing not only in terms of quantity but also speed." They add the implication that "...as sentiment might have viral effects in social media communication, companies should pay more attention to the analysis of sentiment related to their brands and products in social media communication as well as in designing social media-based advertising content that triggers emotions because such content is more likely to be shared." (page 219)

Quotes:
"Emotional contagion may in turn have an influence on individual and group-level communication behavior in terms of information coordination and sharing." (page 223)

"Physiological arousal has been shown to be a driver of information sharing. On the one hand, content that evokes high-arousal, or activating, positive (awe) or negative (anger or anxiety), emotions is more viral. On the other hand, content that evokes low-arousal, or deactivating, emotions (e.g., sadness) is less viral." (page 223)

"...rumor research has agreed on anxiety as a key variable of rumoring in addition to informational ambiguity. In this anxiety-based formulation, the rumor is conceptualized as a verbal outlet to release emotional pressure (anxiety or concern) by rationalizing ambiguous information. ... it can be assumed that, also in the form of rumors, information dissemination may be driven by emotions." (page 223)

"...it can be assumed that the cognitive and arousal-related effects caused by emotions and their consequences regarding sharing behavior described above may also apply in the [computer mediated communication] context." (page 224)

"[Influential users in the Twitter network] tend to post more emotionally charged tweets. In doing so, their influence may increase even more because their emotionally charged content would be more likely to be disseminated. Second, they are inclined to expose their content to others by hashtag reference, in particular to users with different political alignments." (page 241)

Emotion dependency on weather

Title: What a nasty day: Exploring mood-weather relationship from twitter

Citation:
Li, J., Wang, X., & Hovy, E. (2014, November). What a nasty day: Exploring mood-weather relationship from twitter. In proceedings of the 23rd ACM International Conference on Conference on Information and Knowledge Management (pp. 1309-1318). ACM.

Keywords: Twitter; mood; weather; correlation

Commentary: "No guarantee that the methodology is well grounded. Scarce as it is, there has already been criticism for the validity of aggregate level mood/sentiment analysis based on data source from online social media." (page 1315)

This article's methodology is weak but offers interesting, yet shallow insight to the affect of meteorological characteristics on mood.

Intent, problem, objective:
Weather somehow affects an individual's emotions, and conclusions from psychologists are diverse. Can one use information in tweets to infer more details about weather-mood correlation?

Findings:
Positive/negative analysis:
- Temperature does not make significant contribution to mood state
- Mood state is significantly sensitive to temperature *change*
- Daily precipitation has negative influence on mood state, with influence increasing as precipitation increases
- Mood is significantly affected by the depth of snow, may help to explain the observation that snow aggregates SAD symptoms
- Mood fluctuates within the week, up on weekends and down on weekdays.

Dimensional analysis findings:
- Hotter temperatures lead to angrier moods
- Higher snow depth lead to Depression
- High temperature leads to tiredness

Method notes:
Sentiment analysis; Twitter
- Machine learning pipeline approach to select explicit mood expressing indicators
- Select the 1-2% of all tweets in 2010 and 2011 that are geotagged in 32 urban areas
- Meteorological data from NOAA
- Using OpinionFind (sentiment analysis software package) to distinguish between positive and negative mood states, and Profile of Mood States for distinct mood states: anger-hostility, fatigue-inertia, depression-dejection, and sleepiness-freshness

- Filtering out sentiment indicators induced by public events (movie releases, sports, public figures, natural disasters).
- Narrow tweet candidates matching bag of words from OpinionFind and Profile of Mood States
- Train a Max-Ent classifier to distinguish between positive, negative and non-mood-related tweets.
- Day to day sentiment scores by counting positive and negative messages
- General mixed model to capture the non-linear relationship between mood and climate factors.

Quotes:
"While correlational analysis between mood and weather has been conducted in multiple psychological researches, conclusions are amazingly diverse." (page 1310)

"Wang et al. proposed two plausible explanations for the possible discrepancy between status updates on social media and real mood of users (1) users disguising their feelings ... (2) failure of current machine learning analysis tools to correctly decipher an individual's mood or sentiment... There is also the bias of users deciding to report their moods." (page 1315)

Title: Tweetin'in the rain: Exploring societal-scale effects of weather on mood

Citation:
Hannak, A., Anderson, E., Barrett, L. F., Lehmann, S., Mislove, A., & Riedewald, M. (2012, May). Tweetin'in the rain: Exploring societal-scale effects of weather on mood. In Sixth International AAAI Conference on Weblogs and Social Media.

Keywords: sentiment; weather; mood; twitter

Commentary: Standard, sentiment analysis machine learning method application to finding the dependency of mood on weather and time.

Intent, problem, objective:
It is unclear whether the observed individual-level patterns translate into population-wide trends, which of the factors [weather factors; temperature, etc] dominate the population-wide signal, and how multiple factors interact to influence sentiment. To understand the influence of weather and time on the aggregate sentiment from Twitter.

Findings:
"We found that the well-studied dependence on time of day, season, location, and climate appear as population-wide trends, allowing the aggregate sentiment itself to be predicted with an ROC area of 0.78." (page 482)

Method notes:
Sentiment analysis; Twitter
- Standard Twitter data collection; machine learning techniques for sentiment analysis

---

Diffusion of sentiment

Title: Impact and Diffusion of Sentiment in Public Communication on Facebook

Citation:
Stieglitz, S., & Dang-Xuan, L. (2012, June). Impact and Diffusion of Sentiment in Public Communication on Facebook. In ECIS (Vol. 2012, p. 98).

Keywords: Social media; Facebook; sentiment; political discussion

Intent, problem, objective:
Research is needed to better understand the sentiment of political interactions on Facebook. The authors aim to find out whether politically relevant contributions or postings containing affective dimensions would receive more feedback in terms of comments, and whether emotional states or sentiment might spread or diffuse in social media-based discussions.

Findings:
They showed that political discussions particularly occur when owners of the pages make the post themselves. The posts tend to trigger much more feedback in terms of comments from their audience than those posted by other users. They "...found that while negative emotions articulated in Wall posts make them more likely to receive more comments, the opposite is true for posts featuring positive emotions. This finding suggests that, on public political Facebook pages, people might tend to participate more in discussion about politically relevant problems, issues or concerns along with negative effects associated with political parties or politicians." (Conclusion)
They also found that positive and negative emotions both might diffuse into the following discussion.

Method notes:
Sentiment analysis; Twitter
Focus on discussions that take place on public Facebook pages of large political parties and prominent politicians. Implemented a sentiment analysis and regression analysis.

Social media processing

Title: Social network analysis: An approach and technique for the study of information exchange

Citation:
Haythornthwaite, C. (1996). Social network analysis: An approach and technique for the study of information exchange. *Library & information science research*, 18(4), 323-342.

Keywords: Social network analysis, information exchange

Commentary: This article provides an introduction to social network analysis and how it can be used to study flows of information. The author describes how social networks can be evaluated according to five principles: cohesion, structural equivalence, prominence, range, and brokerage. The author also identifies the following properties of information that can be studied through social network analysis: information needs, exposure, legitimation, routes, and opportunities.

Method notes:
Network analysis; Social media

Factors affecting information propagation online

Title: Predicting the speed, scale, and range of information diffusion in Twitter

Citation:
Yang, J., & Counts, S. (2010, May). Predicting the speed, scale, and range of information diffusion in twitter. In Fourth International AAAI Conference on Weblogs and Social Media.

Commentary: This is a good, early, staple article on network analysis. The main takeaway from the authors' conclusions is that more user mentions generally means more information propagation overall.

Intent, problem, objective:
It is important to understand exactly how Twitter users are interacting with one another and how information propagates through Twitter. The authors build "interaction networks" in order to predict information propagation through these networks, focusing on the properties that predict the speed, scale, and range of information propagating through Twitter.

Findings:
For speed (how quickly a tweet produces an offspring tweet), the authors found that tweets "with the greatest amount of influence", i.e. those with the most number of user mentions, are more likely to propagate more rapidly. For scale (i.e. the number of child tweets a tweet can produce),they again found that the number of times a person is mentioned is the best predictor. Overall, the main conclusion is that "...the mention rate of the person tweeting is a strong predictor of all aspects of information diffusion through social networks in Twitter." (page 358)

Method notes:
Network analysis; Twitter

Title: Want to be retweeted? Large scale analytics on factors impacting retweet in twitter network

Citation:
Suh, B., Hong, L., Pirolli, P., & Chi, E. H. (2010). Want to be retweeted? Large scale analytics on factors impacting retweet in twitter network. Proceedings - SocialCom 2010: 2nd IEEE International Conference on Social Computing, PASSAT 2010: 2nd IEEE International Conference on Privacy, Security, Risk and Trust, 177–184.
https://doi.org/10.1109/SocialCom.2010.33

Keywords: Twitter; retweet; tweet; follower; social network; social media; factor analysis

Commentary: This is a simple paper that covers the properties and context of retweets' effects on how much that tweet is retweeted. It doesn't say anything remarkable.

Intent, problem, objective:
"Retweeting has become the key mechanism for spreading information on Twitter. Therefore, it is important to explore how retweet works to understand how information is diffused in the Twitter network." (page 178) "In this paper, we examine a number of features that might affect retweetability of tweets." (Abstract)

Findings:
The authors find that tweets with URLs and hashtags are retweeted more often. With that, they also conclude that the number of followers and followers affect retweetability. The number of past tweets do not predict retweetability of a user's tweet.

Method notes:
Content analysis; Social media

Virality

Title: What makes online content viral?

Citation:
Berger, J. (2012). What makes online content viral? Strategic Direction, 28(8), 90–91. https://doi.org/10.1108/sd.2012.05628haa.014

Keywords: Word of mouth, viral marketing, social transmission, online content

Commentary: This article simply shows how emotions and the type of online content affect its virality. They suggest further research into how audience size and situational factors moderate what and how people share.

Intent, problem, objective:
It is clear that social transmission is both frequent and important, but less is known about why certain pieces of online content are more viral than others. To examine how content characteristics affect virality - with a focus on how emotion shapes social transmission.

Findings:
The authors find in their results that positive news is more viral than negative. They also find that content that evoked high-arousal emotions was more viral, regardless of the positivity/negativity, and deactivating emotions (like sadness) were less likely to be shared. They demonstrate that more practically useful, interesting, and surprising content is more viral.

Method notes:
Sentiment analysis; News
Combines a broad analysis of virality in the field with a series of controlled laboratory experiments to document characteristics of viral content and to discover what drives social transmission.

Quotes:
"People often e-mail online content to a particular friend or two, but in other cases they may broadcast content to a much larger audience (e.g. tweeting, blogging, posting it on their Facebook wall). Although the former (i.e. narrowcasting) can involve niche information (e.g. sending an article about rowing to a friend who likes crew), broadcasting likely requires posting content that has broader appeal. It also seems likely that whereas narrowcasting is recipient focused (i.e. what a recipient would enjoy), broadcasting is self focused (i.e. what someone wants to say about him- or herself or show others). Consequently, self-presentation motives, identity signaling (e.g., Berger and Heath 2007), or affiliation goals may play a stronger role in shaping what people share with larger audiences." (page 202)

Title: The Role of Social Networks in Information Diffusion

Citation:
Bakshy, E., Rosenn, I., Marlow, C., & Adamic, L. (2012). The Role of Social Networks in Information Diffusion. (January). https://doi.org/10.1145/2187836.2187907

Keywords: Social influence, tie strength, causality

Commentary: This is a good article on information contagion considering information diffusion between Facebook friends of differing strength of ties (how much they interact with each other). It limits its conclusion to Facebook, but has the interesting implication that weak ties are the main driver of information contagion.

Intent, problem, objective:
The fact that social networks may influence an individual's behavior while also reflecting the individual's own aspects of their personality make it very difficult "...to determine through observational data whether any particular interaction, mode of communication, or social environment is responsible for the apparent spread of a behavior through a network." (PDF page 8) The authors aim to examine the role of exposure to signals about friends' information sharing in online information diffusion, to determine the causal effect of the feed on the spread of sharing behaviors.

Findings:
The authors find that those subjects who are exposed to signals about friends' sharing behavior (i.e., the subject's news feed contains a post of a friend sharing an article or external link) are several times more likely to share that same information, and share sooner than those who are not exposed. Specifically, they find that while strong ties (i.e. exposure to those friends the individual has more overall interactions with) are *individually* more influential, most of the influence of information sharing stems from users' 'weak ties' (i.e., exposure to those friends who the individual has less overall interactions with), implying that "...most information diffusion on Facebook is driven by simple contagion." (PDF page 9)

Method notes:
Network analysis; Facebook
"We use an experimental approach on Facebook to measure the spread of information sharing behaviors. The experiment randomizes whether individuals are exposed via Facebook to information about their friends' sharing behavior, thereby devising two worlds under which information spreads: one in which certain information can only be acquired external to Facebook, and another in which information can be acquired within or external to Facebook. By comparing the behavior of individuals within these two conditions, we can determine the causal effect of the medium on information sharing." (page 2)

Quotes:
"Our results suggest that in large online environments, the low cost of disseminating information fosters diffusion dynamics that are different from situations where adoption is subject to positive externalities or carries a high cost." (PDF page 9)

Traffic accidents

Title: From Twitter to detector: Real-time traffic incident detection using social media data

Citation:
Gu, Y., Qian, Z., & Chen, F. (2016). From Twitter to detector: Real-time traffic incident detection using social media data. Transportation Research Part C: Emerging Technologies, 67, 321–342. https://doi.org/10.1016/j.trc.2016.02.011

Keywords: Incident detection; social media; natural language processing; geocoding; data mining; crowd-sourcing

Commentary: The main conclusion to note from this paper is that tweets can be used to find real-time incidents. It provides a good methodology using NLP techniques and standard Twitter crawling methodology.

Intent, problem, objective:
Real-time detection of incidents on Twitter is challenging due to the short length of tweets, typos, and varying differences in language used. This paper aims to create a methodology to crawl, process, and filter tweets in real time, for the purpose of incident detection.

Findings:
The authors conclude that a small amount of tweets cover most of the incidents reported in the existing data set (that the city uses for reporting incidents), and that more incidents can be identified through analyzing tweets.

Method notes:
Content analysis; Twitter
The authors use NLP techniques to extract incident information from two case studies: the Pittsburgh and Philadelphia metropolitan areas.

Analysis of the technology itself

Within the crisis context

Overview of technologies and methodologies

Title: Processing Social Media Messages in Mass Emergency: A Survey

Citation:
Imran, M., Castillo, C., Diaz, F., & Vieweg, S. (2015). Processing social media messages in mass emergency: A survey. *ACM Computing Surveys (CSUR),* 47(4), 67.

Keywords: Social media research

Commentary: Lengthy, in-depth article summarizing the different methods for studying disasters from the perspective of information processing and management, specifically methods for processing social media content. It is a very good overview of how social media research and processing is done: including Data Acquisition, data availability, data preprocessing (including NLP, feature extraction, deduplication, filtering), geotagging/geocoding, archived vs. live data processing.

Intent, problem, objective:
"The goal of this survey is to provide computer science researchers and software developers with computational methods that they can use to create tools for formal response agencies, humanitarian organizations, and other end users, giving htem a way to successfully identify, filter, and organize the overwhelming amount of social media data that are produced during any given crisis. Such tools can help stakeholders make time-critical – and potentially life-saving – decisions." (page 67:2)

Findings:
The authors suggest deepening data processing capabilities – the common systems for processing social media are focused mainly on situational awareness, which is not enough for emergency decision-making. Therefore new systems should be designed with decision making in mind. These new systems of data processing should also extend to various types of media, not just Twitter, and undergo verification to filter out non-credible content.

Governments should also improve communication with the public in crises:
"An effective use of hashtags has also been encouraged by the United Nations Office for the Coordination of Humanitarian Affairs [UN OCHA 2014]. Computational methods can be used not only to help formal response agencies choose which hashtags to use but, more generally, to help them design and evaluate effective communication strategies in social media (see Veil et al. [2011] regarding best practices for crisis communications using social media)." (page 67:30)

Method notes:
Sentiment, content, network analysis; Social media

Quotes:
"The role of the public in disaster response efforts is critical; with the growing use of social media to gather and disperse information, organize relief efforts, and communicate, members of the public who can play a valuable role in these situations are no longer limited to those in the area of impact." (page 67:5)

"Overall, the information any individual, group, or organization finds useful and seeks out in a disaster will depend on their goals. Is it a group interested in providing food to children? Is it an organization that can set up a field hospital? Is it an individual living in a foreign country who is concerned about one's family? The different types of information sought by these different stakeholders may be broadcast on Twitter, but to find it quickly, users rely on technological methods to sift through the millions of tweets broadcast at any given time to find useful information." (page 67:6)

"In any of these [social media] platforms, an increase in social media communications can be triggered by a variety of causes, which can be divided into endogenous and exogenous [Crane and Sornette 2008]. Endogenous causes refer to phenomena in which an idea or "meme" gains popularity by a process of viral contagion or information cascade, in which content spreads rapidly through a network, potentially reaching a significant fraction of all the users [Chen et al. 2013]. Exogenous causes refer to large-scale events, usually happening in the physical world, of wide interest to social media users. Emergencies and mass convergence events are examples of an exogenous cause; during such events, we know that communications activity increases." (page 67:8)

"However, the underlying (although sometimes explicitly stated) claim behind this line of work, that is, that this research is useful for the public and/or formal response agencies, that it has the potential to save lives and/or property during an emergency, remains to be seen. While there are notable exceptions including the American Red Cross, the US Federal Emergency Management Agency (FEMA), the UN Office for the Coordination of Humanitarian Affairs, and the Filipino Government, the use of social media is still experimental for many organizations and not yet part of their normal, day-to-day operations." (page 67:29)

Title: Social Media in Crisis: When Professional Responders Meets Digital Volunteers

Citation:
Hughes, A. L., & Tapia, A. H. (2015). Social media in crisis: When professional responders meet digital volunteers. *Journal of Homeland Security and Emergency Management*, 12(3), 679-706.

Keywords: Crisis informatics; digital volunteers; social media

Commentary: Very good and in depth description of the challenges faced by the digital volunteers (the people contributing social media data) and emergency responders, and recommends ways in which the emergency response institutions and these volunteers can work

together to make their communication and interaction during crises seamless and more effective.

Intent, problem, objective:
This article intends to explore ways to improve coordination and collaboration between professional emergency responders and digital volunteers. This article's purpose is to "examine the socio-technical impact that social media have had on cooperation" between the emergency responders and digital volunteers. (page 680)

Quotes:
"Shortly after the 2010 Haiti earthquake, emergency responders began to recognize that the information and services digital volunteers provide could be helpful. Due to the existence of mobile phones and cellular service following this earthquake, the affected population in Haiti sent hundreds of thousands of messages requesting assistance, informing of developments and seeking news of loved ones. Digital volunteers collected, aggregated, analyzed, translated, and mapped this mobile information quickly and sent it back to the formal responders; the crisis map provided by digital volunteers was the most comprehensive and up-to-date map available to the humanitarian community (Meier 2011)." (page 687)

"Though the objectives of emergency responders and digital volunteers seem to be in alignment, and cooperation between the two would appear beneficial, the two groups have encountered several socio-technical challenges when attempt- ing to coordinate." (page 688)

"Data quality is one of the most important issues in determining the use of social media data by responding organizations. Due to the perceived lack of authentication, large-scale responders have been reluctant to incorporate social media data into the process of assessing a disaster situation, and the subsequent decision-making process to send aid workers, resources, and supplies to disaster locations." (page 689)

"Other significant challenges digital volunteers face when trying to work with emergency responders are issues of organizational need and fit. Data, no matter how high the quality, will not be used by a professional response organization if the data are not provided at the time, form, and the confidence level that the organization requires for each decision type." (page 689)

"The key difference between professional response organizations and digital volunteer groups is their approach to information as either closed or open, respectively. Among digital volunteers the goal is collective networked intelligence, which often requires sharing complete datasets openly with the entire network. This environment requires a high level of trust in network members to curate, edit and process the data toward the goals of the overall project. Processes and standards must also be open and transparent to network members for the action to be coordinated and collective. Since membership in these groups are often open and there is little funding, economic and legal discussions rarely happen. Digital volunteers collect and analyze data based on the needs of a crisis-affected community, event, or issue. " (page 698)

"If professional response organizations seek to take advantage of the data and products produced by digital volunteers they must begin working with these groups between times of crisis. They will need to be forward-thinking and present wish lists of products and data that could be used in future times of crisis. These responders will need to expose their processes

and procedures for making decisions at various stages of crisis so that volunteer groups can provide data and products in the forms necessary to serve as input to those decisions." (page 699)

"Professional organizations will need to see their own data as open and shareable with outside organizations, opening themselves up to exposure to errors. This openness of organizational data may require new agreements with taxpayers, donors, and centralized officials to enable openness. Professional groups must share accountability and liability with volunteer groups when using data and products from outside the organization." (page 699)

Title: Social Media in Disaster Communication

Citation:
Palen, L., & Hughes, A. L. (2018). Social media in disaster communication. In Handbook of disaster research (pp. 497-518). Springer, Cham.

Keywords: Crisis informatics;

Commentary: This article provides another great, comprehensive overview of crisis informatics. It references a large amount of research on case studies and methodologies regarding understanding and using social media in crises. It ends with an explanation on the important distinction that must be made between different types of crises (e.g. terrorist attacks versus weather events)

Intent, problem, objective:
"We... aim to clarify an issue about the differences in social media behavior arising from natural hazards versus criminal events – an issue that has confused researchers and readers... We call this the social media and crisis confound, and we believe that foregrounding this issue will support better communication of crisis informatics knowledge to the interdisciplinary audiences that might engage with it." (page 498)

Findings:
- The distinction and differences between endogenous (criminal, terrorism; in our control) crises and exogenous (weather, natural disasters; out of our control) is very important, but is often overlooked in social media research.
- Endogenous and exogenous events have very different ranges of collective behavior, differing levels of need for public participation, and differing levels of danger in regards to misinformation; These events need to be studied individually and separately, and conclusions from one type of event may not apply to the other

Method notes:
- Brief history of the use of social media in crises
- Review of the "socio-technical innovations that arose with the advent of social media"
- Describe activities by the public and demonstrate how social media have shaped perceptions on how members of the public can participate in emergencies

- Discuss how social media communications are being treated and explored as data sources (to contribute to situational awareness), and the challenges in processing the data
- Applications to emergency management

Quotes:
"... emergency management organizations seek to respond to the new content and these new communication platforms: the initial focus on developing and executing best practices for outward communications is now giving way to discussions about augmenting response efforts with inclusion of data from the public." (page 497)

"Researchers of crisis informatics investigate the nature of socio-behavioral phenomena in mass emergency mediated by social media environments and devise new methods for its investigation." (page 497)

"Members of the public made use of new opportunities for participating in crisis response and recovery efforts, which made newly visible the socio-behavioral phenomena that were always present – that of a public who informally participates in disaster response. Emergency managers had to consider not only the new role social media would play in outgoing communications, but how they would participate in the digital information ecosystem." (page 499)

"The ability to broadcast messages to wide or selective audiences and provide commentary on events through blogs and public forums continues to reinforce the idea of highly localized but widespread 'journalism' and 'sensing'." (page 500)

"Network analysis, which examines social media behavior in the large, concurs with qualitative examination, showing that people who have a close relationship to the region where an event is taking place make use of social media differently than those who are global onlookers." (page 501)

"Citizens may also provide geographically-tagged localized and distributed reports – known as volunteered geographic information – of crisis events through social media. This geographic information can then be ... mapped by volunteers..." (page 501)

"An important contribution social media offer in times of crisis is their potential to enhance situational awareness ... Situational awareness, in the emergency domain, describes human perceptions of the multifaceted circumstances around a crisis event that allow for interpreting situations, making decisions, and predicting future outcomes." (page 504)

"Despite the free, unregulated production of information in [social media], researchers have found that much of the information provided over social media is self-regulated, meaning that members of the community will question and correct the information ... Starbird and Palen ... found that retweeted messages tended to correspond with information that was accurate or contributed to spatial awareness." (page 504/505)

"... Starbird and colleagues have employed computational and qualitative methods to identify false rumors and misinformation in social media streams and examine how they spread during crisis events. This line of research has found recent evidence that "official" accounts (such as

those of formal emergency responders) can help to slow the flow of misinformation during a crisis event through their social media posting behavior." (page 505)

"Emergency managers continue to face mounting pressure from members of the public to use social media; if emergency managers do not provide adequate social media information around a crisis event, citizens may obtain their information elsewhere." (page 506)

"Research around the 2013 Boston Bombings discovered that ... emergency officials needed to tailor their Twitter communications to both a local audience seeking help and guidance as well as a remote audience wanting to know more about the attacks." (page 506)

"Social media studies of collective action of bombings and hurricanes are reported side-by-side, and so it is up to the reader to consider the differences ... we worry that the very idea of "social media" flattens the many meanings of "crisis" and "emergency" for which social science fields have worked to provide insight. ... we refer to this ... as the social media and crisis confound." (page 507)

"With exogenous events, the culprit is beyond reach, and unstoppable [e.g. natural disasters]. With endogenous events, the suspect lies within [e.g. crime, terrorism]. Therefore, organizing features of the communication are distinctly different, because the source(s) of the problem(s), the nature of their solutions, and the ability for the perception of the collective control of the outcome are different." (page 508)

Title: Fifteen years of social media in emergencies: A retrospective review and future directions for crisis informatics

Citation:
Reuter, C., & Kaufhold, M. A. (2018). Fifteen years of social media in emergencies: A retrospective review and future directions for crisis Informatics. *Journal of Contingencies and Crisis Management*, 26(1), 41-57.

Keywords: Crisis informatics

Commentary: Comprehensive overview of social media use; provides a large amount of related literature on social media studies.

- Table 1, page 43 shows an overview of selected cases and sample studies in the literature of social media use in crises
- Discusses different studies that cover citizen-citizen, authority-citizen, citizen-authority, and authority-authority communications during crises
- Table 2, page 49 shows the various roles that were given by different researchers to the publics involved in social media response to crises
- Table 3, page 50 shows the various roles that were given by different researchers to the authorities/organizations involved in social media response to crises

Intent, problem, objective:
To contribute to the development of providing a compilation of existing cases of social media use in emergencies, covered in section 2. To analyze the state of the art for different use patterns, covered in section 3. To analyze the different role patterns that have been identified, covered in section 4. To elaborate on the perception patterns of authorities and citizens, covered in section 5. And to discuss the future of crisis informatics, in section 6. To derive the regular ways in which social media is used in different cases, what roles have been observed and how the use of social media is perceived, through a broad overview of the literature of the last 15 years.

Findings:
- Studies of social media use in crises were focused initially on the USA, while studies from other continents are catching up.
- Most of the studies focus on Twitter, due to the ease of data selection
- Various "role patterns" are discovered in both the real and the virtual realms, among both the publics and the authorities
- Social media is perceived in different ways by authorities and citizens, and both see challenges of trust, or misinformation, or a lack of information, but citizens expect the authorities to monitor social media.

Method notes:
Literature review

Quotes:
"While many [social media use studies] had a focus on the USA initially, studies from other continents are catching up allowing more comparative and systematic analysis across different circumstances and types of emergencies." (page 51)

"Still, most of the studies focus on twitter; we suggest this is based on the ease of data selection there." (page 51)

"... different usage patterns, including the communication among citizen (C2C), with concepts of self-coordination and help, emergent groups and (digital) volunteers; the communication from authorities to citizens (A2C), including concepts of crisis communication; from citizens to authorities (C2A), including concepts like big data- or social media analysis, crowdsourcing and crowd tasking; and among authorities (A2A), including interorganizational social networks." (page 51)

Title: Mobile applications in crisis informatics literature: A systematic review

Citation:
Tan, M. L., Prasanna, R., Stock, K., Hudson-Doyle, E., Leonard, G., & Johnston, D. (2017). Mobile applications in crisis informatics literature: A systematic review. International Journal of Disaster Risk Reduction, 24(November 2016), 297–311. https://doi.org/10.1016/j.ijdrr.2017.06.009

Keywords: Mobile applications, crisis informatics, disaster communication, disaster management

Commentary: This article provides a good review of the role of mobile applications in crisis management. They suggest the following for future research: to acknowledge that apps used during disasters can be general-purpose or built-for-disaster-purpose, so research must focus on integrating disaster management capacities into general-purpose apps and attracting interest and retaining continued use for built-for-disaster-purpose apps; to engage in citizen-centered studies to gain more insights into users' needs, motivations, expectations, experiences, and limitations when using disaster apps; and finally, research is needed to investigate and ensure the usability of mobile apps for disasters (regarding the presentation and visualization of information in the mobile apps' interface.).

Intent, problem, objective:
The purpose of this article (review) is to summarize the involvement of mobile applications in crisis informatics literature and to scope needs and opportunities for further research on citizen's use of mobile apps during disasters. The authors raised the following broad questions: are mobile applications represented in crisis informatics literature? What purpose do they serve in disaster situations? What interactions do mobile apps foster? What are the roles of the public when using these apps? In which stage of the disaster management cycle do the apps contribute?

Findings:
The authors found, in their review of crisis informatic literature on mobile applications, answers to their research questions: The articles reviewed revealed five thematic purposes for built-for-disaster-purpose apps: crowdsourcing, supporting collaboration, alerting and providing information, collating information, and notifying. They found that disaster apps promote different interaction dynamics between one and many, but the largest proportion of apps focusing on the "one-to-many authority centric flow. The review also found that the public has multiple roles as users of mobile apps: victims, information receivers, in-situ sensors, or as offsite volunteers. Finally, they found that apps can assist in various parts of the disaster management cuycle, but the majority of the apps discussed in the articles covered in this review are designed for the response stage.

Method notes:
The authors review a total of 49 articles in the crisis informatics literature to examine the role of mobile applications in disasters.

Title: A Work-In-Process Literature Review: Incorporating Social Media in Risk and Crisis Communication

Citation:
Veil, S. R., Buehner, T., & Palenchar, M. J. (2011). A Work-In-Process Literature Review: Incorporating Social Media in Risk and Crisis Communication. Journal of Contingencies and Crisis Management, 19(2), 110–122. https://doi.org/10.1111/j.1468-5973.2011.00639.x

Keywords: Risk communication

Commentary: This article provides a good review showing that social media can be used in disaster situations by organizations, highlighting the many benefits that exist in its use, in addition to a number of concerns regarding online information gathering.

Intent, problem, objective:
The purpose of this literature review is to give an oversight in the incorporation of social media in risk and crisis communication.

Findings:
"The analysis shows that social media can be used to assist organizations in following best practices in risk and crisis communication." (page 118)

Title: Mining location from social media: A systematic review

Citation:
Stock, K. (2018). Mining location from social media: A systematic review. Computers, Environment and Urban Systems, 71(May), 209–240. https://doi.org/10.1016/j.compenvurbsys.2018.05.007

Keywords: Social media, geographic information

Commentary: This article is an enormous review of social media literature, and is practically comprehensive in identifying trends, including gaps, in social media research. It contains a huge number of articles that may be of future interest.

Intent, problem, objective:
A large amount of research has explored the potential of social media to provide useful geographic information. Many existing literature reviews focus solely on Twitter. To provide a systematic review of social media literature to compare different aspects of research and to identify gaps and future research potential, focusing on the different social media platforms, the methods used to extract location information, and the applications of data extracted from social media.

Findings:
The author found that Twitter is the most frequently used social media platform for geospatial research, despite having less global users than other platforms that aren't used as much for research (e.g. Facebook).

Method notes:
Systematic literature review of 690 papers.

Title: Crisis informatics, introduction

Citation:
Hagar, C. (2010). Crisis informatics, introduction. Bulletin of the American Society for Information Science and Technology, 36(5), 10–12.

Keywords: Crisis informatics

Commentary: This short paper acts as somewhat of a progress report of crisis informatics papers, giving a snapshot of some of the research in the field. It is very brief and does not offer much that isn't already covered by other crisis informatics overviews.

General critique of methodology/data

Title: Crisis Informatics – New data for extraordinary times

Citation:
Palen, L., & Anderson, K. M. (2016). Crisis informatics—New data for extraordinary times. *Science*, 353(6296), 224-225.

Keywords: Crisis informatics

Commentary: This article brings up important points and criticisms in data science approaches to social media research, and argues that social science is necessary to provide complete analyses of behaviour on social media.

Intent, problem, objective:
In this article, Palen and Anderson criticize the over-use and importance of social media as a tool in disaster response. They reveal the shortcomings and point out the mistakes involved in the use of social media research (data science) on crisis events, and highlight the importance of social science research in creating a comprehensive study of social media data.

Findings:
The authors point out many flaws in the pure data science method of analyzing social media for disaster response. They argue that data scientists commonly focus too much on the correlations returned in their work on large data sets, and claim finding these correlations is only the first step in describing behaviour. They claim that social science offers valuable analysis on human behaviour that is overlooked by data science: "When the focus is on volume, rigor in data collection becomes an afterthought." (page 225). Another limitation stated relates to the minimal geotagging that occurs on tweets (1 to 2%). They add that collecting tagged tweets returns single tweets that may be parts of long conversations – research therefore studies tweets in isolation, as single statements without context.

Quotes:
"Too much importance is attributed to social media as a tool instead of to the behaviors that underlie it. At the same time, too little attention is granted to examining the “corners” of social media spaces where interesting forms of work and coalitions of helpers are found, e.g., to help people struggling in the recovery after the 2010 Haiti earthquake by “topping off” their phones with minutes and offering language translation of texts, or after Hurricane Sandy with pet-family reunion." (page 224)

"Data scientists are relatively new to the disaster–social media research space and are knowledgeable about the management and analytics of large-volume data. But their knowledge and, hence, their questions commonly focus on the highest-level correlations that come about when comparing available large data sets. This work is welcome and relevant but is only the beginning of a set of questions that need to be asked about behavioral phenomena." (page 224)

"Social science research recognizes often ignored, but critical, distinctions between human behaviors that result from endogenous hazards that can be captured (e.g., crime- based events) versus exogenous hazards that cannot (e.g., weather events that give rise to natural disasters). In social media research, these differences are often flattened, even though they lead to different interpretations and outcomes. Marginalization of these critical fields in data science is worrisome: inclusion of social science would allow for more robust computational social science." (page 224)

"Social media is inherently about participation. Social media data do not necessarily represent all of a population evenly, but they do represent a range of behaviors, ideas, and opinions that have a role to play alongside traditional disaster response." (page 225)

"Even when data is available, we are limited by the data delivery format. For example, Twitter makes data available in the JavaScript Object Notation (JSON) format, with each JSON object containing a single tweet without its conversational context. Yet we know that people speak with continuity across their posts without repeating terms that are most likely to be keywords. As a result, most research studies tweets in isolation as single statements without the monologic context, never mind the conversational context. This, we find, renders most of them useless in terms of understanding their value. But, in context, they are often enlightening. Furthermore, it is difficult to reacquire that context as it requires substantial post processing... In this way, the data format influences how researchers conceptualize what can be done." (page 225)

"Collecting on broad terms like #Sandy samples the “global” population of curious onlookers, but for sampling the “local” popu- lation, which shares and seeks information differently, one has to rely on highly localized terms. Geotagged tweets can help determine a user’s proximity to an event; however, only 1 to 2% of tweets are geotagged." (page 225)

Title: Data hubris? Humanitarian information systems and the mirage of technology

Citation:
Read, R., Taithe, B., & Mac Ginty, R. (2016). Data hubris? Humanitarian information systems and the mirage of technology. *Third World Quarterly*, 37(8), 1314-1331.

Keywords: Conflict and security; ICT and digital economy; participation and power; humanitarianism data

Commentary: This article tries to bust the myths that using big data is the be-all-end-all of understanding human behavior.

Intent, problem, objective:
"This article argues that, rather than the 'actionable data' that [humanitarian response] requires, often 'inactionable' data is produced, and that its role and status are worth exploring more fully." (page 1315) What the authors mean here is that data collection in data science often produces useless data, or "data for data's sake" (page 1315), rather than creating useful knowledge.

Findings:
The authors find, with evidence, that resources are wasted on gathering information and suggest that humanitarian organizations focus more on data processing rather than data collection, including dialing back on collecting excess information. They also claim that big data and its processing is not the ultimate solution to finding statistical truth.

Method notes:
This article cites a good number of examples in recent history of technology in humanitarian response, showing what each got right and wrong.

Quotes:
"The earthquake in Haiti in 2010 is most commonly given as the step change or turning point for digital humanitarianism. ... Data management capabilities barely compensated for all the frustrating and disappointing lack of coordination displayed by [the Haiti 2010 humanitarian response]. Nevertheless, the Haitian crisis highlighted the fact that real time data could now feature in humanitarian responses." (page 1319)

"Much of the optimism has centred upon mobile phone technology, which grew by almost 400% between 2005 and 2011 in the top 20 recipients of humanitarian aid yet there is a danger that these technologies may replicate existing power asymmetries, a ‘digital divide’, as those without access to these technologies tend to be the most marginalised, calling into question the claims about empowerment made for them." (page 1322)

"Furthermore, it must be noted that these technologies themselves can also pose challenges to the operation of humanitarians: ‘Modern digital platforms allow information to move fast, help disinformation to spread, and undermine the capacity of aid organisations to control security incidents’." (page 1322)

"The processes of mapping and data visualisation, in and of themselves, have significant effects on how spaces of intervention are understood and what our relationship to them is. ... Looking at World Health organization (WHO) maps of ebola, it is clear that they enabled the very dramatic representation of the epidemic – and its potential to become a fully fledged pandemic. Circles of outbreaks peppered the three West African countries most affected in a manner which hinted at the overwhelming of their entire populations – a form of graphic rhetoric which was not commensurate with the actual number of casualties relative to the other victims of other illnesses." (page 1323)

"They go on to point out that ‘interpretation is at the center of data analysis’; however, without a deep understanding of the complex meth- odological processes involved, interpretation is not possible. This represents a key problem with the potential of big data in humanitarian action to contribute to improved efficiency or effectiveness: there is insufficient understanding of the methodological tools necessary for collection and analysis of big humanitarian data." (page 1323)

"Arguments can be made that data technologies are empowering, especially as high technology falls in price and becomes more accessible or indeed demotic through crowd sourcing. ... Yet, in order to assess the extent to which data might be empowering, it is prudent to examine the context-specific socio-cultural relationship between people and data technology. ... Not only do

people need access to technology (not a given in many conflict and disaster-affected contexts) but they also need to be convinced that such technology could be useful to them and their communities." (page 1324)

"Although cloaked in the language of empowerment, data technology may be based on an ersatz participative logic in which local communities feed data into the machine (either through crowdsourcing, or by being enumerators or subjects in most traditional surveys) but have little leverage on the design or deployment of the technology. It is worth asking: where does power lie in the deployment of humanitarian information systems?" (page 1324)

"Technology can have a self-reinforcing logic whereby one set of technologies (for example, information gathering) leads to another set of technologies (for example, information processing). This becomes potentially problematic if technologies become naturalised and mainstreamed to the extent that they are not subject to fundamental questioning, or they exclude other methodologies." (page 1325)

"Our analysis suggests that declarations of emancipation via a data revolution are premature. There is a danger that much of what we see is the same information being processed more quickly. Content analysis of data, even if that data is collected by local actors on the ground, is rarely conducted in local languages. The data revolution risks reinforcing technocratic specialists who are often based in headquarters. Greater connectivity has produced greater demands from humanitarians to support their own connectivity." (page 1325)

"Ultimately we conclude that the new aspiration towards hubristic big data processing is just another step in the same modernist process of the production of statistical truth." (page 1326)

Title: Crisis Informatics: Perspectives of Trust – Is Social Media a Mixed Blessing?

Citation:
Hagar, C. (2013). Crisis informatics: Perspectives of trust–is social media a mixed blessing? *School of Information Student Research Journal*, 2(2), 2.

Keywords: Crisis informatics; Trust

Commentary: Brief summary of the role of trust in information propagation online during crises.

Intent, problem, objective:
"This paper highlights one of the key concerns in the emerging area of crisis informatics: issues of trusted information in crises/disasters and how the unregulated nature of social media affects information creation and dissemination." (page 1) What sources of information do people trust? Which information providers do people trust?

Quotes:
"Crisis informatics is an interdisciplinary area of study. ... is broadly defined as the interconnectedness of people, organizations, information, and technology during crises. It examines the intersecting trajectories of social, technical, and information matters in

crises/disasters and explores the full life cycle of a crisis: preparation, response, and recovery. ... Within this complex information environment, trusted information takes on greater significance during a crisis." (page 1)

"In a crisis situation when there is much uncertainty, trust influences the way people seek information. Bucher (2002) identifies knowledge uncertainty as a key element of crisis situations; those experiencing the crisis do not know enough to understand what is happening and lack knowledge about how to respond to the crisis." (page 1)

"The sources of information which are trusted are often influenced by existing relationships with the information provider. Deciding which sources of information to trust and which information providers to trust in crises are critical because acting upon trusted information can shape and influence the nature of the crisis profoundly." (page 2)

"In years gone by, rumors circulated by word-of-mouth and were slow to spread. With the increased use of social media tools, rumors spread at a greater pace, creating a major challenge for crisis information management. Social media is an important platform to disseminate information locally and globally during crises." (page 2)

"Social media enhances citizen engagement and allows citizens to become content generators and disseminators and to become “citizen journalists” to mobilize and spread their messages." (page 3)

"The combination of a vast amount of official sources of information, and the citizen-generated content created and disseminated via social media, adds to information overload in crises. This increases uncertainty and the difficulty of making decisions about whom and what are trustworthy sources of information. When formal channels of information do not answer questions, informal channels fill the gap. In a crisis, informal channels of information become even more important as people seek information from people who they know and trust." (page 3)

"Not only have social media tools the capacity and power to inform, to provide real-time information, facilitate recovery efforts, and save lives, but they also have the potential to spread misinformation and rumor, and to create panic. During Hurricane Sandy, rumors and fake images of the storm were virally shared, including a picture of a shark swimming in a front yard in Brigantine, New Jersey and a rumor claiming that the floor of the New York Stock exchange was three feet under water. “Retweets” allowed the further spread of these rumors." (page 3)

Title: The limits of crisis data: analytical and ethical challenges of using social and mobile data to understand disasters

Citation:
Crawford, K., & Finn, M. (2015). The limits of crisis data: analytical and ethical challenges of using social and mobile data to understand disasters. GeoJournal, 80(4), 491–502. https://doi.org/10.1007/s10708-014-9597-z

Keywords: Critical data studies, crisis informatics, privacy, ethics, disasters

Commentary: This article presents a solid argument of the many limitations of social media and mobile phone data, including examples to back up their arguments from the Haiti earthquake. It is a useful resource to learn an overview of the many critiques involved in using this data - relating to the way disasters are understood, the way Twitter and other social media platforms operate, and the ethical challenges involved in the use of the data.

Intent, problem, objective:
Social media and mobile phone data are commonly used to analyze disaster events - but these datasets have limitations that, if not sufficiently understood and accounted for, can produce specific kinds of analytical and ethical oversights. This paper addresses the ontological, epistemological, and ethical challenges that arise when social media datasets are used to understand crisis events, building on critiques of big social data to consider the limitations in the framing, collection and deployment of data in crisis contexts.

Findings:
The authors argue many limitations to using social media data. In their analysis of the ontological limitations of social media data, they argue firstly that delimiting time around a disaster can overlook or make it difficult to comprehend long term issues that may have lead to the disaster. In addition, they claim that social media analysis may only pay attention to the most sensational stories (i.e. those tweets and users who receive the most attention during a crisis.). In their analysis of the epistemological limitations, the authors ask multiple questions concerning issues that affect how a dataset is interpreted. They question how researchers can account for how Twitter and its algorithms shape and influence the way tweets are created and retweeted - arguing that information circulating on Twitter has its own biases in addition to offering only a reduced view of communications during a crisis, as well as the large presence of bots on the platform. Finally, they mention the question of ethics, of how the mass collection of social and mobile data is often justified for the greater good, regardless of the usefulness of the data, resulting in overly intrusive data without informed consent.

Method notes:
The authors make their claims and arguments, and provide examples to back up these claims.

Quotes:
"The way that disasters are defined can strongly determine how social media datasets are operationalized during a crisis event, and vice versa. According to its classic definition, a disaster is a temporary break from the norm. Delimiting time around a disaster can often make it difficult to comprehend long term structural issues that led to the traumatic event, and to track how long recovery takes." (page 493)

"Social media datasets depict a specific time period, typically defined by the spike in Twitter messages or the use of particular hashtags. This can make it difficult to understand both the causes of disaster and the entire period of aftermath where the impact is realized... In this sense, the analysis of social media during and after a disaster can resemble traditional media coverage, which has been often accused of paying attention to only the most sensationalized stories in a truncated time frame. Additionally, looking at social media data within a short-term disaster framework does not provide the context of long term communicative practices that allow

researchers to understand the meaning of the spike in social media activity for individuals or communities." (page 493)

"Several issues are invoked by the imbrication of technologies and practices associated with crisis mapping 'in the context of vulnerable populations during a crisis': the trustworthiness of crowd-generated maps from the perspective of humanitarian actors; privacy, liability and intellectual property laws; concerns about fair access to datasets; and ethical considerations." (page 494)

"...the use of social media data to analyze a crisis can reproduce a problematic 'emergency imaginary'...an image of sudden, unpredictable and short-term phenomena, when the reality commonly involves longer-term development, considerable predictability, and a duration through decades." (page 494)

"...how do researchers account for the role that Twitter's platform plays in shaping and influencing the messages that people choose to tweet and retweet? How can they distinguish between human activity and non-human agents like bots? How should they account for the cultural specificities of how people use Twitter, including their location, age, economic status and language? Finally, there are questions about demographic skew - should Twitter users to be taken as representative of the population at large?" (page 495)

"By considering Twitter data alone, specific voices will be heard and others will be missing entirely. Twitter use still skews to younger, more urban demographic groups, even in wealthy nations like the US. In effect, this means older, less affluent and more vulnerable communities are often the least likely to be self-representing on a platform like Twitter." (page 496)

"It is critically important for researchers to assess and account for the gaps in their dataset. This includes determining which kinds of individuals and communities are excluded, asking what kinds of communications circulate on social media platforms, and, crucially, recognizing that these communications are also created for - and shaped by - the platforms where they appear." (page 497)

"A concern with the current use of crisis data is that the ends may be seen to justify the means. If drawing together all available data sources can assist in building better crisis maps, or verifying claims of damage more quickly, issues of consent or possible risk often fall into the background...Similarly, in the context of crisis data, data collection from as many sources as possible is often justified for 'the greater good' regardless of the biases or gaps in the data, or whether the data use produces any material improvements in crisis recovery. The result is data sets that can be overly intrusive, collect personally identifying information with informed consent, and may have serious unintended consequences, particularly when brought together with other kinds of personally identifying data." (page 499)

Title: Social Media in Disaster Risk Reduction and Crisis Management

Citation:
Alexander, D. E. (2014). Social Media in Disaster Risk Reduction and Crisis Management. Science and Engineering Ethics, 20(3), 717–733. https://doi.org/10.1007/s11948-013-9502-z

Keywords: Social media; disasters; emergency management; ethics; Twitter; Facebook

Commentary: This paper is another big data critique, pointing out both the good and the bad about social media in disaster situations, including ethical considerations.

Intent, problem, objective:
Is social media actually useful in emergency situations? This article covers everything regarding social media in disasters: different ways it is used, its benefits, its drawbacks/the issues, ethics, successful use cases.

Title: Challenges in the adoption of crisis crowdsourcing and social media in Canadian emergency management

Citation:
Harrison, S., & Johnson, P. (2019). Challenges in the adoption of crisis crowdsourcing and social media in Canadian emergency management. Government Information Quarterly, (April), 0–1. https://doi.org/10.1016/j.giq.2019.04.002

Keywords: Emergency management; crisis crowdsourcing; government crowdsourcing; social media; disaster management

---

Social media platform bias issues

Title: Information Movement Across Social Media Platforms During Crisis Events

Citation:
Hughes, A. L., Starbird, K., Leavitt, A., Keegan, B., & Semaan, B. (2016). Information Movement Across Social Media Platforms During Crisis Events. CHI'16 Extended Abstracts., 1–5. https://doi.org/http://doi.org/http://dx.doi.org/10.1145/2851581.2856500

Keywords: Social media; social computing; information dynamics; crisis informatics

Commentary: This article acts as a sort-of recommendation/proposal for future research on social media, claiming that studying multiple platforms at once is necessary for social media crisis informatic research.

Intent, problem, objective:
"...studies that focus on a single platform–as most research in the crisis domain does–provide a problematically limited view of the dynamics of information movement. A cross-platform perspective will offer insight into how variations in platforms' affordances and user behaviors contribute to the movement of information and the mobilization of audiences." (pdf page 2) To propose a new research agenda that will examine, conceptualize, and assess information movement across multiple platforms during crisis events such as natural disasters, extreme weather events and acts of terrorism.

Findings:
"These insights will inform strategies for emergency responders to target, tailor, and monitor messaging across the information ecosystem. This work will also identify practices that those affected can use to bridge platforms and circulate information in effective ways. For platform designers, this research will identify and articulate implications for supporting interoperability, information integration, and situational awareness during crisis events." (page 3)

Method notes:
"We propose to address [the challenges of dynamically changing data across multiple social media] through the development of infrastructure that takes advantage of the multi-platform approach and the distributed nature of our collaborative team." (page 3)

"We propose exploring automated and human-in-the-loop solutions for event detection and curation of event collections (i.e., for helping researchers adjust search parameters as events change and different keywords, geographic areas, etc. become salient)." (page 3)

Uses a mixed method approach: employ quantitative methods of analysis to describe large-scale patterns, identify anomalies, and determine appropriate samples for follow-up qualitative analysis.

Quotes:
"To fully understand how information moves (or is moved) through online spaces during crisis events, researchers must adopt a multi-platform approach, integrating digital traces from various sites. This approach would enable researchers to account for information propagation dynamics related to the conversational shifts from one platform to another, as well as echo effects and false perceptions of triangulation when information appears to exist independently in multiple sites." (page 2)

"[Considering multiple sites at once] provides an opportunity for precise comparison that will reveal how the affordances of different sites shape information sharing practices and the resulting information propagation dynamics. It will also enable researchers to further unpack the roles that specific individuals and applications play by purposefully migrating information from one site to another." (page 2)

Title: The role of information visibility in network gatekeeping: Information aggregation on Reddit during crisis events

Citation:
Leavitt, A., & Robinson, J. J. (2017, February). The role of information visibility in network gatekeeping: Information aggregation on Reddit during crisis events. In Proceedings of the 2017 ACM conference on computer supported cooperative work and social computing (pp. 1246-1261). ACM.

Keywords: Network gatekeeping; visibility; crisis communication; aggregation; breaking news; information flows; trace ethnography

Commentary: This article serves as an introduction to how important disaster-related information, in the form of submissions on reddit, rise in visibility, taking into consideration the structural design choices of the website, the roles of moderators and administrators in choosing which content to keep and which content to delete, and the perceptions and experiences of users themselves.

Intent, problem, objective:
"... the visibility of information [in online sociotechnical systems] continues to be a practical – and theoretical – issue, not only for people finding information but also for people producing information during crisis events. For designers as well as users, it is important to know how information visibility impacts how these contributors do their work." (page 1246) RQ1: How does the design of a social media platform impact the visibility of information during the network gatekeeping of a crisis event?
RQ2: How do people who share information about these events account for issues of visibility in their crisis communication work?

Findings:
- Gatekeeping actions–whether originating from individual decisions of participants or the mechanisms of the platform's technical design–shape the visibility of particular types of information.

- Usefulness of a platform like reddit "...depends on if the platform's design affordances can be adapted in the moment for particular needs, and if the behavioral, structural, and relational constraints of gatekeeping actors can synchronize toward common goals with a set of shared values." (page 1256)

Method notes:
- A trace ethnography analysis of reddit contributors and participant observation
- Results organized related to tensions of affording information visibility: behavioral tensions (participants' perceptions, expectations, and choices), structural tensions (unintended consequences from the constraints of designed technology), and relational tensions (human decisions from privileged accounts with particular control over deletion and promotion of other users' information).

Quotes:
"Visibility remains an important dimension of information systems, because as users in social media platforms increasingly create immense amounts of information year after year, attention increasingly becomes a commodity, since people vie for stardom, popularity, and accumulated metrics." (page 1248)

"...negotiations around the visibility of information constrain how participants produce information and make gatekeeping decisions. As gatekeeping actors – both people and software – mediated information visibility, the expectations of peer information aggregation participants adapted to optimize for the best ways to get information to audiences." (page 1257)

"In this situation, a distinct separation of political power remained between the ordinary users, algorithms, and moderators/administrators. However, the ability for mods and admins to directly change the code (e.g., by choosing to promote one live thread to the reddit front page) actually helped gatekeepers in this situation achieve their goal, instead of complicating it." (page 1257)

"Especially in the case of crisis situations, when particular people need to see specific information, visibility can have significant consequences. Reddit presents a novel way to surface relevant information – through crowd voting – but a variety of filtering algorithms and the power of moderators and administrators (in addition to unexpected collective behaviors) may impact the information visibility expected by the community." (page 1258)

"... scholars should strive to focus on information visibility as a framework for both how people react to crisis events as well as participate in information aggregation about them. Network gatekeeping provides a strong framework for understanding the factors that lead to decisions about information visibility, but further investigations must understand the negotiations that occur around points of tension. This paper introduces one framework of visibility that can help reveal points of tension in the values of different gatekeeping actors within larger sociotechnical systems." (page 1258)

Title: Seeking the trustworthy tweet: Can microblogged data fit the information needs of disaster response and humanitarian relief organizations

Citation:
Tapia, A. H., Bajpai, K., Jansen, B. J., Yen, J., & Giles, L. (2011, May). Seeking the trustworthy tweet: Can microblogged data fit the information needs of disaster response and humanitarian relief organizations. In Proceedings of the 8th International ISCRAM Conference (pp. 1-10). Lisbon, Portugal: ISCRAM.

Keywords: Humanitarian; relief; NGO; disaster; twitter; microblogging; trust

Commentary: This article serves an insight into the slow uptake of using microblogging as reliable data in humanitarian relief organizations.

Intent, problem, objective:
Organizational use of microblogged data is blocked by functional and structural barriers of the organization, due to real-time message data contributions being deemed as unverifiable and untrustworthy. The authors propose three socio-technical solutions to surpassing these barriers, and for organizations to adopt real-time messages.

Findings:
The authors found that sources of the perceived mismatch between microblogged data and the needs of humanitarian relief organizations fell into two overarching categories: data untrustworthiness and organizational structure and function mismatches.
The authors conclude that the data themselves are problematic for humanitarian organizations: they cannot make use of them in their traditional way.
Organizations have already decided that microblogging served only as a dissemination function and not a data gathering tool – they have separate departments for emergency response and public information.
Data is less likely to be trusted to outside sources; data needs of the organization are very specific and critical.
The organizations do not recognize any organizational value to microblogged data, so they do not allocate resources to support its use.

Method notes:
Conducted 13 interviews from 13 distinct international humanitarian relief organizations

Quotes:
"There is a fundamental tradeoff between the authoritativeness of information and its timeliness. Humanitarian information systems have traditionally favored authoritativeness and so have lagged events. New real-time informational sources threaten this equilibrium, but the issue of validation remains the single biggest challenge in organizational information seeking and decision-making." (page 3)

Title: What is Twitter, a social network or a news media?

Citation:
Kwak, H., Lee, C., Park, H., & Moon, S. (2010). What is Twitter, a social network or a news media? Proceedings of the 19th International Conference on World Wide Web - WWW '10, 591. https://doi.org/10.1145/1772690.1772751

Keywords: Twitter, online social network, reciprocity, homophily, degree of separation, retweet, information diffusion, influential, PageRank

Commentary: This is an early article, but offers a solid, extensive methodology on how to build a network for a network analysis, rank users, and study information diffusion of retweets. It is very methodology-focused.

Intent, problem, objective:
This article claims to be the first quantitative study on Twitter. The goal of the authors is to study the topological characteristics of Twitter, by asking the questions: "How are people connected on Twitter? Who are the most influential people? What do people talk about? How does information diffuse via retweet?" (page 591)

Method notes:
Network, topic analysis; Twitter
They crawl millions of user profiles and tweets, and over a billion social relations, building a network for network analysis, observing the trending topics, and finally examining the information diffusion properties of retweets.

Title: Assessing the Bias in Communication Networks Sampled from Twitter

Citation:
Gonzalez-Bailon, S., Wang, N., Rivero, A., Borge-Holthoefer, J., & Moreno, Y. (2012). Assessing the Bias in Communication Networks Sampled from Twitter. SSRN Electronic Journal, 44(0). https://doi.org/10.2139/ssrn.2185134

Keywords: Digital media; political protest; social networking sites; dynamic networks; graph comparison

Commentary: This paper reveals a bias in the two different Twitter data collection APIs. It is an important note to make when using these in research.

Intent, problem, objective:
"The type of access the [Twitter] API offers to the underlying database of Twitter has changed over the years, becoming increasingly more sensitive." (page 3) "How do the data collected through the two [Twitter] APIs compare to each other? And if the set of messages retrieved through the APIs is not a random sample of all Twitter activity, what is the nature of the bias?" (page 3)

Findings:
The authors found that "...the search API, which has higher limitations in data collection, might be a less appropriate tool for periods of low activity or information streams that are not very abundant. ... most differences are generated by peripheral users... the fact that RTs (retweets) networks are slightly more similar means that the search API returns better data for more central users [those that are mentioned or retweet more times], and more clustered regions of the network." (page 14)
Additionally, "...this bias might still be underestimated if the large sample is also biased towards more central users compared to the full stream." (page 17)

Method notes:
Network analysis; Twitter

Quotes:
"...the implications of this bias will vary with the research question, but it is particularly relevant for the study of core-periphery dynamics and, in the context of online collective action, the emergence of a critical mass. Peripheral users do not have many connections, and they do not offer the important voices in terms of impact or reach; but their superiority lies in the numbers: most users qualify as peripheral and they are the mass that is activated when political protests are successful. The bias in the data means that it is difficult to assess how large that periphery is and, by extension, how long it takes to activate them; it also undermines the study of diffusion dynamics because it shrinks the actual size of the population of interest." (page 18)

Participation online, perspectives, and media perceptions

Title: Towards social resilience: A quantitative and qualitative survey on citizens' perception of social media in emergencies in Europe

Citation:
Reuter, C., & Spielhofer, T. (2017). Towards social resilience: A quantitative and qualitative survey on citizens' perception of social media in emergencies in Europe. *Technological Forecasting and Social Change*, 121, 168–180. https://doi.org/10.1016/j.techfore.2016.07.038

Keywords: Citizen; Europe; Social Media; Survey; Quantitative; Qualitative

Commentary: This survey only covered citizens from Poland, Slovenia, Germany, and the United Kingdom, so the results may be skewed based on demographics of each region.

Intent, problem, objective:
This article notes the lack of research on the attitudes and perspectives of citizens regarding the use of social media during emergencies, and therefore the authors intend to explore these attitudes.

Findings:
The authors' study shows that many European citizens already use social media during emergencies, and that they expect to increase their usage in the future. The use of social media also depends on the demographics of the citizen: younger citizens and women are significantly more likely to use social media both to look for and share information, while men and those older than 50 are less likely. They also found that most citizens were not aware of Twitter Alerts and Facebook Safety Checks, and that more and more citizens expect emergency information to be communicated via social media.

Method notes:
Survey of 1034 citizens, asking for demographic details and attitudes toward social media especially in emergencies.

Quotes:
"This study has shown that many citizens across Europe are already using social media to share and look for information during emergencies and that they expect their usage to increase in future." (page 176)

"The survey also showed that use of social media for private purposes and in emergencies was not uniform demographically and that particu- lar types of citizens are more likely to do so than others. This means that younger citizens and women are significantly more likely to use social media both to look for and share information, while men and those aged 50 or above are significantly less likely to use social media for this purpose (Fig. 16: Facts 2 and 4). As the results of the survey showed, this was exacerbated by the fact that almost a third (29%) of those aged 50 or above do not use a smartphone which is a necessary prerequisite for using social media while not at home. " (page 176)

"The implications of this is that while social media use is widespread and increasing, some groups are in danger of being excluded from any support, advice or instructions provided via social media before, during or after emergencies from emergency services or other citizens. This could mean that those most vulnerable in an emergency – older or disabled citizens – may be least likely to benefit from an increased use of social media by emergency services." (page 176)

"It seems that the general awareness of [Twitter Alerts and Facebook Safety Checks] depends on the frequency of emergencies someone is confronted with – something other studies also suggest (Reuter, 2014a). In other cases it is likely that such tools are just used if they are integrated in daily used media, such as Facebook." (page 176)

"The current study has also shown that accompanying many citizens' increased use of social media in emergencies is a growing expectation for emergency services to communicate with citizens via social media and to make use of information shared by citizens via social media. ... However, a recent survey conducted in the same project (Reuter et al., 2016b) has shown that even though many emergency services sometimes use social media to share information with the public, only very few often make use of data on social media during emergencies." (page 176)

Title: Emergency services' attitudes towards social media: A quantitative and qualitative survey across Europe

Citation:
Reuter, C., Ludwig, T., Kaufhold, M. A., & Spielhofer, T. (2016). Emergency services′ attitudes towards social media: A quantitative and qualitative survey across Europe. *International Journal of Human-Computer Studies*, 95, 96-111.

Keywords: Attitudes; emergency services; europe; social media; survey; quantitative; qualitative

Commentary: May contain all the biases that come with surveys: derives conclusions from responses, which may not be accurate.

Intent, problem, objective:
"The main aims of the survey were to explore the attitudes expressed by emergency service staff towards social media for private and organizational use as well as the levels and main factors influencing the current and likely future use of social media in their organizations." (Abstract, page 96) "Within this article we sought to explore the attitudes of European emergency service staff towards social media for private and organizational use as well as the levels and main factors influencing their current and likely future use in their organizations." (page 97)

Findings:
The majority of emergency services have positive attitudes towards social media. It is used (by staff) mostly to share information, as well as to receive messages. A future increase is expected, especially for organizations already using it. They also find that while most emergency services think social media can be useful in raising situational awareness or to obtain an overview of the situation, only a third of those emergency services actually used social media for that purpose.

Method notes:
Survey of 761 emergency staff across 32 countries; asking for demographic details, attitiudes towards social media, the use of social media by one's own organization, and questions on expected changes in the future use of social media.

Quotes:
"Although 66% (Q7) of emergency services think social media can be used to obtain an overview of the situation and to raise situational awareness, actually only 23% have often or sometimes used social media sites for this purpose. Such results clearly show that there is a huge gap between rhetoric and reality in the use of social media by emergency services within emergency management." (page 103)

"European emergency service staff uses social media for different purposes within different phases of an emergency: (a) Before, they tend to use it to release preventive information and recommendations; (b) During an emergency, organizations disseminate tips, safety advice, status updates, and warnings, or they monitor social media activity. Moreover, social media is sometimes used for internal communication and sharing experiences; (c) After emergencies, it is used to share reports enriched with multimedia content or to coordinate clean-up activities through social media. Problems discussed here are the unequal reachability of citizens, as lower social classes or older generations potentially have no or only limited access to social media." (page 107)

"To ensure wide use [of social media], trained personnel, appropriate knowledge and excellent communication skills are required. On the technical side, it demands an available and reliable Internet infrastructure, including software artefacts that support a user in dealing with multiple social networks. A positive attitude and examples of good practice could influence the use of social media positively." (page 107)

Title: From e-government to we-government: Defining a typology for citizen coproduction in the age of social media

Citation:
Linders, D. (2012). From e-government to we-government: Defining a typology for citizen coproduction in the age of social media. Government Information Quarterly, 29(4), 446-454.

Keywords: e-Government; social media; crowdsourcing; coproduction; government as a platform; open government; government 2.0

Intent, problem, objective:
This paper provides a basic typology for categorizing "citizen coproduction initatives", to help public administrators and researchers better understand, compare, and guide implementations by recognizing the variability and appropriate applications of different coproduction designs. How are the advantages offered by social media and online collaboration platforms able to impact the government-citizen relationship, if at all?

Findings:
"...the advent of social media and web 2.0 interactivity indeed appear to enhance and expand the viability of and capacity for citizen coproduction, not only in tradition citizen-to-government arrangements, but also in arrangements whereby the government informs, assists, and enables private actions or whereby citizens assist one another, with IT replacing government as vehicle for collective action." (page 451)

Quotes:
"Advancements in ICT...has enabled [increased citizen coproduction] by offering promising new vehicles for (a) collective actions as always-on connectivity and open government provide an unprecedented mechanism for real-time, community-wide coordination and (b) collective intelligence as mobile-equipped citizens can today complement digital sensors for real-time reporting and comprehensive situational awareness, presenting tremendous opportunities for data-driven decision making, improved performance management, and heightened accountability." (page 451)

"...the black-or-white question of 'government or not' presents a false dichotomy; rather, it is about how responsibilities can be best shared [between the government and citizens]." (page 451)

Title: Is extreme social media skewing our perception of extreme weather?

Citation:
Antal, R., & Kubashek, J. (2016, August 27). Is extreme social media skewing our perception of extreme weather? Retrieved April 27, 2019, from https://leaderpost.com/news/saskatchewan/is-extreme-social-media-skewing-our-perception-of-extreme-weather

Keywords:

Commentary: This article simply refutes the common belief that because more storms are being reported, more storms are happening in general. However, they claim it is because there are more eyes on the sky, and people have better access to finding and sharing information.

Intent, problem, objective:
Better technologies and increased visibility produces the misconception for regular people that the world (disasters, crime) is getting worse, when in reality increased reports and visibility of storms online is not necessarily an implication of that. Is our access to information inflating our perceptions of frequency of natural disasters?

Quotes:
"As information becomes readily available, it can be easy for that information to lead to the belief that the weather is becoming more extreme. It is a trend that has been observed since the early days of television and it is seen outside of weather."

"For the average citizen that enjoys taking pictures of storms as they roll through the area, or sharing photos others have taken, there is the feeling that today's mass media and social media is skewing the view in regards to extreme weather."

"There is a good and bad side to [ease of access to a multitude of weather information and alerts]. If people think there is more adverse weather, they may plan ahead for it. On the flip side, if there are too many alerts, people may become desensitized to it."

Title: Extreme weather events and climate change concern

Citation:
Konisky, D. M., Hughes, L., & Kaylor, C. H. (2016). Extreme weather events and climate change concern. Climatic Change, 134(4), 533–547. https://doi.org/10.1007/s10584-015-1555-3

Keywords: Climate change perception

Intent, problem, objective:
Studies on the question of association between extreme weather events and individual beliefs in climate change have mixed results. How does the frequency and severity of local weather events affect individuals' opinions concerning the seriousness of climate change? Is public concern about climate change associated with short-term or long-term experiences with extreme weather activity?

Findings:
The authors find a positive relationship between experience of extreme weather activity and expressions of concern about climate change - only for recent extreme weather. They find that these weather experiences do not have as strong of an affect as socioeconomic factors such as ideology and political partisanship. They also suggest that extreme weather occurring over longer periods does not affect public opinion, although the more severe the weather event, the greater its influence on opinion over longer periods of time.
"...our findings suggest that ideology, partisanship, and other attributes are more important than experiences of extreme weather events in shaping individual opinions regarding climate change. Our results also suggest that the marginal effect of a single event is small and short lived, but that a substantial increase in the frequency or severity of extreme weather-related episodes has a nontrivial effect on individuals' climate change concerns." (page 546)

Title: Metaphors Matter: Disaster Myths, Media Frames, and Their Consequences in Hurricane Katrina

Citation:

Tierney, K., Bevc, C., & Kuligowski, E. (2006). Metaphors Matter: Disaster Myths, Media Frames, and Their Consequences in Hurricane Katrina. The Annals of the American Academy of Political and Social Science, 604(1), 57–81. https://doi.org/10.1177/0002716205285589

Keywords: Disaster response, disaster management, media reporting on disasters, public response to disasters

Commentary: This article reads more like a chapter of a book, but examines how mass media played a huge role in the Hurricane Katrina aftermath, informing official decisions and raising tensions.

Intent, problem, objective:
"...the mass media play a significant role in promulgating erroneous beliefs about disaster behavior." (Abstract) The authors use preliminary observations of the mass media during Hurricane Katrina to emphasize "...the images conveyed by the media during [Hurricane Katrina] left indelible impressions on the public and also provided the justification for official actions that were undertaken to manage the disaster." (page 60)

Quotes:
"However, even while engaging extensively in both reporting and public service, the media also presented highly oversimplified and distorted characterizations of the human response to the Katrina catastrophe. Ignoring the diversity and complexity of human responses to disastrous events, media accounts constructed only two images of those trapped in the disaster impact area: victims were seen either as 'marauding thugs' out to attack both fellow victims and emergency responders or as helpless refugees from the storm, unable to cope and deserving of charity." (page 73)

"...initial evidence suggests that the media's relentless adherence to disaster myths and to frames emphasizing civil unrest and urban insurgency, along with the strategic response measures these reports justified, had a number of immediate negative consequences." (page 75)

Title: Odds Ratio Forecasts Increase Precautionary Action for Extreme Weather Events

Citation:
LeClerc, J., & Joslyn, S. (2012). Odds Ratio Forecasts Increase Precautionary Action for Extreme Weather Events. Weather, Climate, and Society, 4(4), 263–270. https://doi.org/10.1175/wcas-d-12-00013.1

Keywords: Risk communication; odds ratios

Commentary: The main takeaway from this research is that the way in which forecasts are phrased does have an effect on the actions taken - in their findings, using "odds ratio" forecasts has a higher chance of getting respondents to anticipate the effects of the forecasted weather event.

Intent, problem, objective:
"Effectively communicating the risk of rare but extreme weather events poses a challenge to forecasters." What is the best way to communicate the risk of rare but extreme weather events?

Findings:
The authors find results that indicate using odds ratios in forecasts (e.g. "The odds are 80 times greater tonight compared to a normal winter night that the temperature will be less than freezing.") can be very effective in convincing people to take necessary actions.

Quotes:
"Thus, for low-probability situations such as this, odds ratios clearly do a better job of encouraging precautionaryaction.Morethan80%ofthoseusingoddsratios applied special salt on target trials above the 17% likelihood threshold. However, it is important to note that those using odds ratio forecasts also inappropriately applied special salt more than other participants when the probability of 08F was only 10%, suggesting that any elevation in the odds over previous trials is regarded as reason to take action. Therefore, forecasts expressing increase in odds over climatology must be used with care." (page 269)

Government summary

Title: Social Media and Disasters: Current Uses, Future Options and Policy Considerations

Citation:
Lindsay, B. R. (2011). Social Media and Disasters: Current Uses, Future Options and Policy Considerations. Congressional Research Service, 1--10. Retrieved from http://fas.org/sgp/crs/homesec/R41987.pdf

Keywords: Social media, emergency management

Commentary: This article is a very broad overview of using social media in disasters, including the best practices, uses, considerations for ethics and policies.

Intent, problem, objective:
This report was written to inform Congress: Social media has played an increasing role in emergencies and disasters, and how to successfully use it in disaster situations has "...spurred congressional interest and discussion concerning how social media might be used to improve federal response and recovery capabilities." (Summary) To summarize "how social media have been used by emergency management officials and agencies. It also examines the potential benefits, as well as the implications, of using social media in the context of emergencies and disasters." (Summary)

Outside of the crisis context

General critique of technologies/methodologies

Title: Big data and human geography: Opportunities, challenges and risks

Citation:
Kitchin, R. (2013). Big data and human geography: Opportunities, challenges and risks. Dialogues in Human Geography, 3(3), 262–267. https://doi.org/10.1177/2043820613513388

Keywords: Big data, data deluge, human geography, methodology, praxis, theory

Commentary: This article succinctly describes big data objectively, as well as identifies the good and bad of its use in studies. It acts as a sort-of "state of big data in geography".

Intent, problem, objective:
"Big data...poses a number of challenges and risks to geographic scholarship and raises a number of taxing epistemological, methodological, and ethical questions." (Abstract, page 262)
To describe the challenges of big data, and to emphasize necessary considerations geographers must make while handling big data.

Findings:
The author starts with the positive side of big data, and the opportunities it offers. He then specifies the challenges of it, including the need for new methods of handling and analyzing datasets, the need to accompany technological solutions with careful qualitative analysis, and the issue of data access and the ethics of detailed user-generated data. Finally, he specifies the risks of big data, including the fact that the over-obsession with it can lead to the rejection of smaller studies, as well as overlook more complex dynamics or relationships in the data.

Quotes:
"As Floridi (2012) notes, big data raises fundamental epistemological questions about the organisation and practices of science: certainly, coping and extracting useful, valid information from the data deluge and making sense of it is not simply a technical issue that can be dealt with by technological solutions alone. Rather it requires careful rethinking with respect to the philosophy of science (Leonelli, 2012)." (page 264)

"...big data is mainly generated by privately owned businesses and government. Unless access can be negotiated to such data, geographers will be cut-off from a rich seam of potential studies. Where access is gained, there are a number of ethical and security challenges of working with such data, given that they are highly resolute, providing fine-grained detail on people's everyday lives." (page 264)

Title: Data-driven geography

Citation:
Miller, H. J., & Goodchild, M. F. (2015). Data-driven geography. GeoJournal, 80(4), 449–461. https://doi.org/10.1007/s10708-014-9602-6

Keywords: Big data, GIScience, spatial statistics, geographic knowledge discovery, geographic thought, time geography

Commentary: This article is yet another critique of big data. It emphasizes the importance of being aware of the downfalls of big data.

Intent, problem, objective:
There is a lot of potential in the use of big data, in addition to many challenges. To explore the implications of the questions raised on the role big data plays in research and geography.

Findings:
The authors provide words of caution regarding the impact of big data-driven geography on society. They emphasize that we must be hyper-aware of where research occurs, prioritize privacy, stay aware of the correlation-causation problem, and finally use big data to support and not replace human decision making.

Title: Analysis tool or research methodology: Is there an epistemology for patterns?

Citation:
Dixon, D. (2012). Analysis tool or research methodology: Is there an epistemology for patterns? Understanding Digital Humanities, 191–209. https://doi.org/10.1057/9780230371934

Keywords: Critique

Commentary: The note to remember from this article is that we need to ask ourselves the question: are we seeing a pattern where none exists?

Title: Big Questions for Social Media Big Data: Representativeness, Validity and Other Methodological Pitfalls

Citation:
Tufekci, Z. (2014). Big Questions for Social Media Big Data: Representativeness, Validity and Other Methodological Pitfalls. 505–514. Retrieved from http://arxiv.org/abs/1403.7400

Keywords: Big data

Commentary: This is another big data critique, focusing on various methodological and inference issues of big social media data. It offers practical steps at the end to improve upon the many issues it discusses throughout the paper.

Intent, problem, objective:
There are many challenges involved in the usage of big data for research and policy purposes. This article examines two key issues of big data: the methodological issues, and the question of what researchers can infer validly from these datasets.

Findings:
The main methodological issues brought up, broadly summarized, are the following: there is not enough attention given to structural biases of the platform in study; "Selecting on dependent variables with requisite precautions"; vague, unclear or unrepresentative sampling; and finally, "the prevalence of single platform studies which overlook the wider social ecology of interaction and diffusion." (page 505)
The main issues with regards to inference are as follows: online interactions (like retweets, clicks, links, etc) are "complex social interactions with varying meanings, logics and implications, yet they may be aggregated together"; users may interact with content by ways that are not captured by extraction algorithms (such as screenshotting to reply); "network methods from other fields are often used to study human behavior without evaluating their appropriateness"; social media data focuses mostly on node-to-node interactions; and finally, "human self-awareness needs to be taken into account; humans will alter behavior because they know they are being observed, and this change in behavior may correlate with big data metrics." (page 505)

Volunteered geographic information

Title: How good is volunteered geographical information? A comparative study of OpenStreetMap and Ordnance Survey datasets

Citation:
Haklay, M. (2010). How good is volunteered geographical information? A comparative study of OpenStreetMap and Ordnance Survey datasets. Environment and planning B: Planning and design, 37(4), 682-703.

Keywords: digital volunteer; volunteered geographic information; mapping

---

Title: Researching Volunteered Geographic Information: Spatial Data, Geographic Research, and New Social Practice

Citation:
Elwood, S., Goodchild, M. F., & Sui, D. Z. (2012). Researching Volunteered Geographic Information: Spatial Data, Geographic Research, and New Social Practice. Annals of the Association of American Geographers, 102(3), 571–590. https://doi.org/10.1080/00045608.2011.595657

Keywords: Volunteered geographic information, geospatial web, neogeography, spatial data infrastructure, web 2.0

Commentary: This article is a good article that summarizes and considers everything about VGI. It is somewhat broad and very theoretical.

Intent, problem, objective:
"...we hold that the case of collectively generated geographic information mediated through Web 2.0 presents new challenges and necessitates further research." (page 572) "...we examine the content and characteristics of VGI, the technical and social processes through which it is produced, appropriate methods for synthesizing and using these data in research, and emerging social and political concerns related to this new form of information."

Findings:
The authors conclude that "...VGI could serve as a potential data source to address research questions across geography." (page 585)

Quotes:
"Diverse VGI contributed by citizens via a bottom-up process complements, and in some cases integrates well with, the spatial data infrastructure constructed by authoritative sources via a top-down process. Scrutinizing the social and political dimension of VGI could further advance our understanding of the political economy of the Web. 2.0 era." (page 585)

Title: Citizens as sensors: The world of volunteered geography

Citation:
Goodchild, M. F. (2007). Citizens as sensors: The world of volunteered geography. GeoJournal, 69(4), 211–221. https://doi.org/10.1007/s10708-007-9111-y

Keywords: Geographic information; Web 2.0; virtual globe; privacy; citizen science

Commentary: One of the sources cited in the original proposal. It covers different specific examples of applied volunteered geographic information, while relating the examples to the bigger picture of VGI. It is more of a descriptive study of the state of VGI.

Title: Assuring the quality of volunteered geographic information

Citation: Goodchild, M. F., & Li, L. (2012). Assuring the quality of volunteered geographic information. Spatial Statistics, 1, 110–120. https://doi.org/10.1016/j.spasta.2012.03.002

Keywords: Geographic information; crowdsourcing; data quality; volunteered geographic information

Commentary: One of the sources cited in the original proposal. It covers the different mechanisms which check and correct the accuracy of volunteered geography.

Intent, problem, objective:
Volunteered geographic information varies no assurance of quality. The focus of the paper is on how to assure the quality of VGI in its applications.

Findings:
The authors discuss three alternative approaches to quality assurance of VGI: crowdsourcing, where the group validates and corrects errors than an individual makes as well as the group converging towards the truth; social, which relies on a hierarchy of trusted individuals who act as moderators or gatekeepers; and geographic, which relies on the comparison with an existing body of knowledge.

Quotes:
"The crowd-sourcing approach is attractive but appears to be less effective for geographic facts than for other types of information, because such facts vary from the very prominent to the very obscure, and errors in geographic facts can clearly persist even in heavily populated areas. The social approach is also attractive, and has proven effective when projects are sufficiently popular and well-structured, and supported by extensive social networks. The geographic approach is attractive to geographers because it taps the heart of geographic knowledge, and motivates a comprehensive effort to formalize such knowledge; and it offers the possibility of automated triage." (page 119)

Social media platform biases

Title: Without you, I'm nothing: performances of the self on Twitter

Citation:
Paracharissi, Z. (2012). Without you, I'm nothing: performances of the self on Twitter. International Journal of Communication, 6(0), 1989–2006. Retrieved from http://ijoc.org/index.php/ijoc/article/view/1484

Keywords: Twitter users

Commentary: This is more of a psychological analysis - examining and describing how people tweet, what kind of tweets they post and why, etc.

Participation online, perspectives, and perception

Title: Social media use and participation: a meta-analysis of current research

Citation:
Boulianne, S. (2015). Social media use and participation: a meta-analysis of current research. Information Communication and Society, 18(5), 524–538. https://doi.org/10.1080/1369118X.2015.1008542

Keywords: Social media; social networking; politics; social movements; research methodology

Intent, problem, objective:
Meta-analysis of the differences in existing studies on how social media might affect citizens' participation in politics.

Findings:
The meta-analysis finds that studies employing a random sample of youth are more likely to report significant effects. It also reveals we do not know the causal effects of social media use on participation. Finally, it concluded that a greater use of social media did not affect people's likelihood of voting or participating in the campaign.

Title: Twitter and the rise of personal publics

Citation:
Schmidt, J.-H. (2014). Twitter and the rise of personal publics. Twitter and Society, 3–14.

Keywords: Twitter, microblogging, personal publics

Commentary: This article provides a good discussion of Twitter from a sociological point of view, arguing that it provides a communicative space which is formed by particular technological features, by emerging social and textual relationships, and shared norms and expectations guiding the use of Twitter. It discusses the emergence of the personal publics, which allow people to express and work on aspects of their own identity while maintaining and expanding social connections and managing information around them through personal and social filter mechanisms.

Intent, problem, objective:
Twitter is the lead microblogging platform in most parts of the world, and requires an analysis of its connections between its use practices and how they change our understanding of the public. To describe Twitter as a communicative space, framed by the three dimensions of software, relations, and rules.

Findings:
Twitter contributes to the emergence of the personal public, "...a publicness which consists of information selected and presented according to personal relevance, shared with an (intended) audience of articulated social ties in conversational mode." (page 11)

Quotes:
"To argue, as Keen (2008) has done, that personal publics promote a “cult of the amateur”, where trivial babble dominates over thoughtful knowledge of the experts, is to miss the point. We should, rather, acknowledge the potential for inclusion and participation inherent in these new ways of communication, expression, sharing, and socialising." (page 12)

"This convergence of the public and the personal is already pointing to the second main consequence of the rise of personal publics: they contribute to the shift in our understanding of mediated privacy and publicness (exemplary for the debate on this deep and complex change, see the debate between Ford, 2011, and Jurgenson & Rey, 2012). As users are selecting and sharing information of personal relevance based on the central norm of authenticity with an intended audience composed of articulated social ties, they are making information accessible that might be considered private, such as holiday stories, impressions from family events, one’s current location or emotional state, etc." (page 10)

Perception of climate change

Title: Communicating climate change: Why frames matter for public engagement

Citation:
Nisbet, M. (2009). Communicating climate change: Why frames matter for public engagement. Environment, 51(2), 12–25. https://doi.org/10.3200/ENVT.51.2.12-23

Keywords: Framing

Commentary: This article covers the topic of framing in US politics, regarding the controversial battle over climate change. It identifies several different types of frames that can help to overcome barriers in the debate, as well as those frames which aim to mislead or hinder progress.

Quotes:
"Framing—as a concept and an area of research—spans several social science disciplines. Frames are interpretive storylines that set a specific train of thought in motion, communicating why an issue might be a problem, who or what might be responsible for it, and what should be done about it.13 Framing is an unavoidable reality of the communication process, especially as applied to public affairs and policy. There is no such thing as unframed information, and most successful communicators are adept at framing, whether using frames intentionally or intuitively." (page 15)

Title: Extreme weather events and climate change concern

Citation:
Konisky, D. M., Hughes, L., & Kaylor, C. H. (2016). Extreme weather events and climate change concern. Climatic Change, 134(4), 533–547. https://doi.org/10.1007/s10584-015-1555-3

Keywords: Climate change perception

Intent, problem, objective:
Studies on the question of association between extreme weather events and individual beliefs in climate change have mixed results. How does the frequency and severity of local weather events affect individuals' opinions concerning the seriousness of climate change?
Is public concern about climate change associated with short-term or long-term experiences with extreme weather activity?

Findings:
The authors find a positive relationship between experience of extreme weather activity and expressions of concern about climate change - only for recent extreme weather. They find that these weather experiences do not have as strong of an affect as socioeconomic factors such as ideology and political partisanship. They also suggest that extreme weather occurring over

longer periods does not affect public opinion, although the more severe the weather event, the greater its influence on opinion over longer periods of time.
"...our findings suggest that ideology, partisanship, and other attributes are more important than experiences of extreme weather events in shaping individual opinions regarding climate change. Our results also suggest that the marginal effect of a single event is small and short lived, but that a substantial increase in the frequency or severity of extreme weather-related episodes has a nontrivial effect on individuals' climate change concerns." (page 546)

Title: Vulnerability and public perceptions of global climate change in the United States

Citation:
Brody, S. D., Zahran, S., Vedlitz, A., Grover, H. (2008). Vulnerability and public perceptions of global climate change in the United States. Environment and Behaviour, 40(1), 72–95. https://doi.org/10.1177/0013916506298800

Keywords: climate change; vulnerability; public perceptions

Intent, problem, objective:
Little research has focused on the role of place and proximity in shaping perceptions of global climate change. The authors "...test the degree to which a person's level of physical vulnerability to climate change influences his or her perception of this risk." (page 73)

Findings:
The authors find that "...respondents appear to register climate change risk when the threat or sense of vulnerability is most overt... Thus, physical position and proximity characteristics lend themselves to increased public perceptions of the potential negative impacts of climate change." (page 89)

They also found that "...the members of the public tend to calculate their risk level based on a limited understanding of the impacts of climate change." (page 89)

Method notes:
Use geographic information system analytic techniques to map and measure survey respondents' degree of physical risk associated with climate change at the local level of spatial resolution and precision.

Quotes:
"Public participation fosters increased ownership over environmental problems and leads to a greater sense of responsibility for mitigating adverse impacts." (pae 90)

"For example, personal efficacy is one of the strongest predictors in our model of risk perception associated with climate change,where a unit increase on the efficacy scale corresponds to almost half of a point increase in risk perception." (page 90)

"Public involvement related to climate change may also strengthen the social network attached to this issue, thereby broadening risk perceptions. Public participation usually involves

information sharing, education, communication,and discussion about a problem. This process can facilitate network interest which, based on our results, may increase public recognition of the severity and geographic impacts of potential climate change." (page 90)

Title: Weather, Climate, and Worldviews: The Sources and Consequences of Public Perceptions of Changes in Local Weather Patterns

Citation:
Goebbert, K., Jenkins-Smith, H. C., Klockow, K., Nowlin, M. C., & Silva, C. L. (2012). Weather, Climate, and Worldviews: The Sources and Consequences of Public Perceptions of Changes in Local Weather Patterns*. Weather, Climate, and Society, 4(2), 132–144.
https://doi.org/10.1175/wcas-d-11-00044.1

Keywords: Perception

Commentary: This article covers the extent of ideology and culture in shaping perceptions of climate change through local weather changes. The authors find that they play a significant role in some situations, notably floods and droughts, but not in others, such as temperature change perceptions.

Intent, problem, objective:
Perceptions of local weather might be of substantial consequence for public views on climate change. Human perceptions of local weather patterns are prone to selective attention and biased assimilation of information. To evaluate the relationship between Americans' perceptions of weather changes and actual changes in local weather over the past several years. Where do they get these perceptions?

Findings:
The authors' findings suggest the contentious nature of the climate change debate has influenced the way in which Americans perceive their local weather. Arguments over temperature are complex because the term "global warming" has been integrated into arguments. Ideology and cultural orientation significantly shape perceptions of changes in flooding and drought, but is weaker in shaping perceptions of temperature changes.

Method notes:
Employ survey data collected in an online and a nationwide telephone survey.

Quotes:
"...in efforts to characterize the ongoing and predicted changes in local weather, focusing on temperature is more likely to raise the identity defenses that cultural orientations (and ideologies) can mount. On the other hand, focusing on changes in patterns of drought and flooding may well gain greater purchase and, by implication, contribute to a more nuanced understanding of larger pattern of changes in the global climate." (page 143)

Title: User comments on climate stories: impacts of anecdotal vs. scientific evidence

Citation:
Hinnant, A., Subramanian, R., & Young, R. (2016). User comments on climate stories: impacts of anecdotal vs. scientific evidence. Climatic Change, 138(3–4), 411–424. https://doi.org/10.1007/s10584-016-1759-1

Intent, problem, objective:
Climate change is a polarizing topic in the US. User comments are a complicating factor in the processing of climate stories. This paper "...examined whether comments dissenting from or supporting the premise of the climate story alter story reception, and it investigated how exemplification theory functions in the typically disruptive space of reader comments." (page 412)

Findings:
The authors found that scientific comments diminished story credibility and reduced perception of climate change risk among more conservative participants, while anecdotal comments had the opposite effect. Comments did not have any effect on people who identify as liberals.

Quotes:
"Consistent with the tenets of exemplification theory, which posits that beliefs are modified by exposure to anecdotal occurrences, climate change risk was perceived to be greater when more conservative participants were exposed to comments that used anecdotal evidence, whether or not the comments agreed with or dissented from the article." (page 419)

Media’s effect on perception

Title: Media(ted) discourses and climate change: A focus on political subjectivity and (dis)engagement

Citation:
Carvalho, A. (2010). Media(ted) discourses and climate change: A focus on political subjectivity and (dis)engagement. Wiley Interdisciplinary Reviews: Climate Change, 1(2), 172–179. https://doi.org/10.1002/wcc.13

Keywords: Climate change perception

Commentary: The note to remember from this article is that media plays a role in citizens' perception of climate change.

Intent, problem, objective:
This article examines the relation between citizens discursively constructed political subjectivity and the possibilities of participation in the politics of climate change.

Findings:
The main conclusion of the article is that it is worth investigating the roles of the media in the process of political disengagement in relation to climate change.

Quotes:
"...many other factors may constrain people’s sense of political agency or willingness for political participation, including a widespread disillusion with democratic politics, media alarmism, and the sheer magnitude of climate change in spatial and temporal terms. Moreover, as Shanahan and McComas have maintained, the wider media(ted) culture permanently appeals to values such as ‘progress’ and materialism, contribute to maintaining the status quo, and dissuade audiences that they can or should play a role in solving environmental problems." (page 176)

Title: The great divide: understanding the role of media and other drivers of the partisan divide in public concern over climate change in the USA, 2011-2014

Citation:
Carmichael, J. T., Brulle, R. J., & Huxster, J. K. (2017). The great divide: understanding the role of media and other drivers of the partisan divide in public concern over climate change in the USA, 2001–2014. Climatic Change, 141(4), 599–612. https://doi.org/10.1007/s10584-017-1908-1

Keywords: Polarization, misinformation, perception

Commentary: This article confirms the media's role in strengthening the beliefs of their viewers, supporting echo chamber effects and "extremifying" viewpoints, growing the partisan divide in the issue of climate change.

Intent, problem, objective:
There is a growing partisan divide in aggregate public concern over climate change. To assess the explanatory power of a set of factors that may help explain the growing partisan divide in aggregate public concern over climate change.

Findings:
Findings from their analysis of studies provided some evidence that partisan media plays a role in driving concern about the issue of climate change, in addition to support for echo chamber effects, by strengthening the views held by their audience when the framing is consistent with the audiences' pre-existing beliefs.

Method notes:
Longitudinal analysis