Combating Misinformation and Disinformation Online: The "Battle of the Narrative"

We argue for a scientific approach to online misinformation and disinformation. Such an approach must be grounded in empirically validated theory, and is necessarily interdisciplinary, requiring insights from the social sciences, decision science, computer science, and systems integration. Relevant research has been conducted on the psychology of online narratives, providing a foundation for understanding why some messages are compelling and spread through social media networks, but this research must be integrated with research from other disciplines.

In the national security context, online misinformation has long been problematic: counterinsurgency campaigns acknowledge the crucial "battle of the narrative". For example, the U.S. Counterinsurgency Field Manual (FM 3-24) emphasizes the power of narratives to change population behaviors, noting that the "root causes of an insurgency are real or perceived grievances that insurgents use to mobilize a population…As conditions change, insurgent leaders create different narratives to mobilize a population." (p. 4-3). Similarly, military doctrine states:

> *For enduring interventions, there can be a continuing struggle to define the national and international debate/discussion on terms favorable to one side, causing a clash between the competing narratives of the actors involved. This is often what is referred to as the "battle of the narrative." A key component of the narrative is establishing the reasons for and desired outcomes of the conflict, in terms understandable to relevant publics.* (pp. ix-x.) Commander's Communication Synchronization Joint Doctrine Note (JDN 2-13)

This document notes that social media is an especially effective platform for propagating these narratives, stating that "Social media enables the rapid transmission of information and misinformation to domestic and international publics and communities of interest" (p. II-13).

Public health professionals face similar challenges. For example, the journal *Vaccine* devoted an entire special issue to the role social media plays in vaccination decisions (Betsch et al., 2012). Importantly, the consensus article in this special issue emphasizes the role of narratives, stating that "Narratives have inherent advantages over other communication formats…[and] include all of the key elements of memorable messages: They are easy to understand, concrete, credible … and highly emotional. These qualities make this type of information compelling…" (p. 3730).

Finally, the U.S. presidential election highlighted the popularity of "fake news" which, although factually inaccurate, may have been shared more widely on Facebook than vetted media sources (Silverman, 2016). Rather than take a partisan approach, we propose that the relationship between the perception of news as fake or genuine can be studied as a scientific problem, and, indeed, there are analogues in the literature (e.g., vaccination) that provide theoretical and empirical insight into the process of social and political influence through social media.

Social media have an especially wide reach. A recent Pew Center study (Perrin, 2015) indicates that more people get their news from social media than from any other source. Among millennials, this trend is even more pronounced: 61% of millennials get more than half of their news from social media. Furthermore, 71% of all online U.S. adults are on Facebook (Anderson & Caumont, 2014), and 30% of the U.S. population gets news primarily from this social media service. Finally, Facebook posts represent 81% of all article shares (Crum, 2015). Thus, social media enable the rapid increase in the speed and scope of narratives may affect behavior change.

Specifically, effective messages help readers retain the meaning of the message in memory and facilitate availability of the knowledge at the time of behavior. Fuzzy-Trace Theory (FTT), a leading theory of decision under risk, explains the popularity of online messages because of the search for meaning and the tendency to interpret events despite inadequate knowledge. For example, anti-vaccination messages are predicted to increase in popularity when cultural norms make certain ideas *plausible* (e.g., that the government would intentionally infect people) coupled with an increased prevalence of poorly understood health conditions (Kata, 2012; Reyna, 2012). Whereas government sites tend to focus on "how" vaccines work, anti-vaccination narratives focus on providing a causal (though not necessarily accurate) explanation for "why" vaccines are harmful and are consequently more comprehensible, influential, and memorable (Trope & Liberman, 2010; Fukukura et al., 2013). For example, a story describing how children developed symptoms of autism after having gotten vaccinated might allow one to conclude that vaccines cause autism. In fact, the symptoms of autism tend to occur around the same time as the CDC recommends that children receive vaccines. Similar spurious correlations underlie the false claims that exposure to the larvicide pyriproxifen (Vazquez, 2016) or receipt of the DTaP vaccine by pregnant mothers, rather than the Zika virus, causes birth defects (.

FTT's approach to online communication builds on the core concepts of gist and verbatim mental representations, modified and adapted from the psycholinguistic literature (Kintsch,

1974) in the light of more recent findings (see Reyna, 2012). According to FTT, meaningful stimuli such as narratives are encoded into memory in two forms: a verbatim representation (the objective stimulus or a decontextualized representation of what actually happened) and a gist representation (the subjective or meaningful interpretation of what happened; (Reyna, Corbin, Weldon, & Brainerd, 2016). Verbatim representations encode details, such as exact numbers (e.g., "4.5% of vaccinated individuals became ill"). In contrast, a gist representation encodes the essential meaning of the sentence. Furthermore, there may be multiple gist representations (e.g., "virtually none of those vaccinated became ill," "you can still get sick if you get vaccinated"). Gist representations are subjective, and depend on culture, knowledge, beliefs, and other life experiences (Reyna & Adam, 2003). However, in practice, coherent gist representations have been communicated to diverse audiences. Importantly, gist interpretations, rather than verbatim interpretations, tend to guide decisions and behavior. When making sense of text, gist representations form coherent, causal stories. These narratives "connect the dots," to offer a coherent account, and are more likely to be accepted. For example, more coherent stories such as those connecting adverse health outcomes (such as autism) to certain behaviors (e.g., vaccination) are more likely to be accepted because they provide an explanation for otherwise mysterious adverse events. We have successfully modeled FTT in the domain of risky decision-making and are developing related models for vaccination (Broniatowski & Reyna, 2016)

Studies in psycholinguistics have identified a narrative's *causal coherence* as a key factor driving a story's comprehensibility and long-term retention (Trabasso et al., 1982; van den Broek, 2010). Although several dimensions of narrative coherence have been proposed (Reese et al., 2011; Gernsbacher, 1996), there is a consensus within the literature that coherent narratives often provide a causal structure for the events described (Mandler, 1983; Trabasso & Sperry, 1985; Gernsbacher, 1990; Diehl et al., 2006; van den Broek, 2010), therefore conveying the *meaning,* or gist of the story. In contrast, incoherent stories contain a relatively weak causal structure. According to this theory, therefore, websites that produce more coherent and meaningful gist will be more influential (even if they are not factually accurate!).

Social media analytic techniques allow us unprecedented opportunities to test these hypotheses. For example, we examined FTT's predictions in the context of the recent Disneyland Measles Outbreak which began in December 2014 at Disneyland in California and led to 111 confirmed cases of measles in seven states (as well as Canada and Mexico). Although measles

was widely considered eliminated in the United States, reduced vaccination rates in some communities, due to concerns about vaccine toxicity, ultimately called attention to the issue of herd immunity – how slight reductions in vaccination rates can lead to epidemics.

This study was conducted in the context of an ongoing debate: Does including a narrative lead to more effective communication compared to presenting "just the facts" (i.e., statistical data)? In addition to the perceived effectiveness of narratives noted above, public health officials have been hesitant to include stories in their communications due to concerns of appearing biased or paternalistic. In contrast, FTT predicts that the verbatim details of a message (such as "measles can lead to pneumonia, deafness, lifelong brain damage, and even death, and almost 1/3 of children with measles have to be hospitalized") are incorporated separately from, but in parallel to, the gist of the message, (e.g., "not vaccinating means taking a risk that your child could get the measles and suffer serious lifelong health problems or death. Vaccination is the best way to protect your child"). According to FTT, narratives are effective to the extent that they communicate a gist representation of information (e.g., about vaccination or a political ideology) that then better cues motivationally relevant moral and social principles.

Our approach combined decision and computer sciences. We used Amazon's Mechanical Turk service to crowdsource the coding of 4,581 out of a collection of 39,351 outbreak-related articles published from November 2014 to March 2015. We asked coders to indicate whether each article expressed statistics (a verbatim representation) a story, and/or a "bottom line meaning" (a gist). Finally, we measured how frequently these articles were shared on Facebook.

Results were consistent with FTT's predictions – we found that expression of both a gist and verbatim details increased an article's likelihood of being shared at least once. In contrast, stories did not have a significant impact on an article likelihood of being shared after controlling for gist and verbatim, indicating that stories are only effective to the extent that they communicate a gist. Among those articles that were shared at least once, only the expression of a gist was significantly associated with an increased number of Facebook shares (articles with gists were shared 2.4 times more frequently, on average, than articles without gists). Articles expressing a gist that also expressed positive opinions about both pro- and anti-vaccine advocates were shared 57.8 times more often than other articles. This suggests that facts can be effectively shared if they acknowledge the concerns of those on the "opposing" side while still expressing the bottom-line meaning of the data. These results suggest a framework that may be used to communicate

effectively: in addition to describing verbatim facts, public communicators should endeavor to link those facts to a clear bottom line meaning (Broniatowski, Hilyard, & Dredze, 2016). Thus, future work should focus on testing these and other theoretically-motivated interventions.

FTT emphasizes the degree to which gists are culturally contingent. To construct effective messages, we must understand how narratives vary across audiences. To effectively counter messages that are harmful to national security and public health, officials must tailor their responses to groups' narratives and rationales (Hawkins et al., 2008). Determining how these attitudes and narratives are distributed within the population is a key challenge.

Validated techniques for eliciting group attitudes towards health behaviors rely on surveys, focus groups, and random-digit dialing of telephone landlines. They are therefore time-consuming, costly, and tend to under-sample young people and minorities who often have only mobile phone service. More novel techniques, based on social media data, are widely available in real-time, and easy to access (e.g., Aramaki et al., 2011; Culotta, 2010; Lampos et al., 2010; Signorini et al., 2011; Bandari et al., 2013). Also, young people and minorities are heavy users of social media (Brenner & Smith, 2013; Mislove et al., 2011). Thus, the strengths and weaknesses of social media and survey methods complement one another. We therefore aim to develop, for social media, the research norms and practices that characterize high quality survey research such that we can test hypotheses rapidly with very large samples.

In conclusion, national security and public health practitioners face similar challenges from narratives on social media. Online organized misinformation and/or disinformation campaigns can undermine public health and national security. We therefore aim to develop new techniques to assess how compelling and influential messages might be. Such techniques must be based on empirically validated theory while taking advantage of synergies between survey methods and social media data. Our approach also recognizes the key role of culture as a determining factor in how individuals attribute meaning to risky events. Thus, a productive research program would achieve a better understanding of the drivers of coherent gist communications in online messages and how these vary across sociodemographic groups. This research agenda requires a systems approach: combining the rigor of scientific psychology with the technological scope and scale of big data. We advocate research into how to implement relevant theories, such as FTT, so that they can be used to fight misinformation and disinformation online.

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