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Commentary O'Donnell on Bentley, O'Brien, & Brock [BBS 37(1), 2014]>

<CT>Big data in the new media environment

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<C-AB>**Abstract:** Bentley, O'Brien, & Brock (Bentley et al.) argue for the social scientific contextualization of "big data" by proposing a four-quadrant model. We suggest extensions of the east (socially motivated)–west (independently motivated) decision-making dimension in light of findings from social psychology and neuroscience. We outline a method that leverages linguistic tools to connect insights across fields that address the individuals underlying big-data media streams.

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Recent events, such as the Arab spring and London riots, demonstrate how the new media environment has recast the way that ideas spread and news is created. The breadth of participation and engagement, alongside the immediacy and complexity of these interactions, subvert the traditional notions of newsmakers and influencers, and they leave a large digital footprint ripe for the tools of big-data analytics. Bentley, O'Brien, & Brock highlight the proliferation of big data and the need to contextualize these data. They propose that social scientific methods can provide insight about individuals who comprise the populations under study, thereby making big data more meaningful. For example, the health behaviors (e.g., smoking habits, obesity/weight loss) of individuals one or two degrees of separation from a person in a directed local

social/friendship network predict whether that person will exhibit the same behaviors (Christakis & Fowler 2007). In other words, knowledge of local network structures can contextualize population data regarding behaviors. Bentley et al. provide a conceptual model with which to interpret big data and demonstrate the model's validity in the economics domain. We agree with the broad premise, and believe that insight and methods from social psychology and social cognitive neuroscience can further deepen our understanding and ability to leverage big data in broader contexts.

For example, the classification framework proposes an east-west dimension wherein the western edge of decision-making is described as entirely independent, and the eastern edge as entirely social. However, a large body of literature in social psychology and social neuroscience demonstrates that these distinctions are not so clear-cut. Within the brain, neural systems implicated in the retrieval of self-related knowledge are also frequently employed in social cognition (Decety & Sommerville 2003; Lieberman, 2010). Likewise, examples from everyday life challenge the notion that independent thinking and social thinking are placed at opposite ends of a single scale. For example, are decisions based on computer algorithms recommending products or services (e.g., Pandora, Netflix, amazon.com) considered *independent*, because no other live actors are necessary? Or are they considered *social*, because the data are derived from hypothetical or past actors? The category "social" itself includes face-to-face social interactions and interactions across different types of media, with no distinction between sources of social influence. Nor is there a discussion of how the type of social influence may differ based on the psychological closeness or "overlap" between self and target individual. Closeness is known not only to affect receptivity to social influence, but also

the neural systems involved in processing other-related information (Kang et al. 2010). Finally, when discussing human decision-making, the idea of "independence" is hard to clearly demonstrate; the human mind itself is social, even in the absence of actual or virtual social interaction partners. Imagined social interactions (e.g., about what others will think of us if we choose a particular product or enact a particular behavior) make it complicated to label a decision as truly independent versus social.

At the macro level, big data provides a record of a complex set of interactions and processes, with individuals creating and responding to social stimuli at each point. Bentley et al. utilize the science of complexity to describe and understand these systems. New combinations of tools are needed to incorporate insights from a wider range of social and biological sciences. As one example, we have begun to harness tools from computational linguistics to link individual psychology and neuroscience with population-level outcomes. Language samples can be obtained at individual, group, and population levels, as markers of individual differences and cognitive states (Pennebaker 2011), and also as carriers that spread ideas. We draw upon developments in sentiment analysis from natural language processing to link levels of analysis and to contextualize big data. Recent studies of online social networks, such as Twitter and Facebook, have applied such tools to richly-linked and socially-situated language data (Bakshy et al. 2011; O'Connor et al. 2010).

Falk et al. (2012) illustrated how these tools can link activity within individual brains to the broader spread of ideas. In a neuroimaging study, subjects were exposed to socially relevant stimuli with a goal of predicting the ideas' propagation. Automated linguistic analyses classified post-fMRI-scan verbal responses into more or less positive

evaluative sentiments. During initial idea encoding, there was greater activation in neural regions associated with self-related processing and social cognition (medial prefrontal cortex, posterior cingulated cortex), and greater memory encoding (hippocampus) was associated with more positive post-scan sentiments. More positive descriptions were associated exclusively with neural activity in the temporal parietal junction, a region often linked to perspective taking (Saxe & Kanwisher 2003). The implication of this latter finding for understanding the first stages of idea propagation (contagion or "virality") is that individuals may be socially motivated right from the moment they encounter a new idea or potential "meme." In other words, as we have noted here, even in the absence of others (the "independent" end of a classification scheme), we may rely heavily on assumptions of what others will think, feel, and believe as we take in new information and prepare to make it useful to others. The use of automated linguistic analysis to connect brain to behavior allows scaling from the first order (those exposed to the original idea) to the second (those exposed to word-of-mouth description from first-order individuals; Falk et al. 2013), and so on, providing novel insight regarding the underlying mechanisms involved in the spread of ideas (Berger & Milkman 2012).

In sum, although we question the east–west dichotomy of the dimensions proposed by Bentley et al., we fully agree with the underlying premise that tools from a range of social science disciplines are needed to more deeply ground our understanding of big data. We have presented initial examples of how social psychological and neural findings might add different perspectives to the framework proposed, and how linguistic tools can link levels of analysis. Additional research within these fields will further expand our ability to contextualize big data in the new media landscape and beyond.

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<RFT>References[Matthew Brook O'Donnell, Emily B. Falk, and Sara Konrath][MBO]

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Author bios

Matthew Brook O'Donnell, Ph.D., is an research assistant professor within the Annenberg School for Communication at the University of Pennsylvania based in the Communication Neuroscience Lab. Dr. O'Donnell's research seeks to combine the tools and insights from computational and corpus linguistics with neuroscience (fMRI and fNIRS), and with experimental and large-scale descriptive (text mining) methods, to examine how ideas and influence spread through online and offline social networks.

Emily Falk, Ph.D., is an assistant professor within the Annenberg School for Communication at the University of Pennsylvania. Dr. Falk's research integrates methods from cognitive neuroscience, psychology, and communication studies to understand media effects at the individual, group, and population levels. Falk's lab has conducted studies examining the spread of messages, and ongoing work examines how social norms, values, and culture spread through social networks. She received her bachelor's degree in neuroscience from Brown University, and her M.A. and Ph.D. in psychology from the University of California, Los Angeles (UCLA). See http://cn.isr.umich.edu for more information.

Sara Konrath, Ph.D., is an assistant professor at the Institute for Social Research, University of Michigan, and the director of the Interdisciplinary Program for Empathy

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