



Metaphors of Big Data

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Metaphors are a common instrument of human cognition, activated when seeking to make sense of novel and abstract phenomena. In this article we assess some of the values and assumptions encoded in the framing of the term *big data*, drawing on the framework of conceptual metaphor. We first discuss the terms *data* and *big data* and the meanings historically attached to them by different usage communities and then proceed with a discourse analysis of Internet news items about big data. We conclude by characterizing two recurrent framings of the concept: as a natural force to be controlled and as a resource to be consumed.

Keywords: *data, big data, conceptual metaphor, semantics, science, technology, discourse analysis*

Introduction

The media discourse around big data is rife with both strong claims about its potential and metaphors to illustrate these claims. The opening article of a 2011 special issue of the magazine *Popular Science* reads: "A new age is upon us: the age of data" ("Data Is Power," 2011). On the magazine's cover, the headline "Data Is Power" appears next to a Promethean hand bathed in light. In this and similar accounts, big data is suggested to signal the arrival of a new epistemological framework, a Kuhnian paradigm shift with the potential to displace established models of knowledge creation and do away with scientific tenets such as representative sampling and the notion of theory (Anderson, 2008; Mayer-Schönberger & Cukier, 2013; Weinberger, 2012). Although such views are consciously phrased to be provocative in their novelty, they point to the widely held hope that data can be effectively harnessed to better approach a wide range of societal issues, from economic growth and development to security and

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health care, with far-reaching implications (European Commission, 2013; UK Department for Business, Innovation & Skills, 2013; UN Global Pulse, 2012).

The features of the scientific and technological paradigm that big data claims to stake out are still in a period of interpretative flexibility and of ongoing contestation over their exact meanings and values (Bijker, 1997; Pinch & Bijker, 1984). Whereas researchers in emerging fields such as computational social science and the digital humanities stress the scientific potential of big data (e.g., Howe et al., 2008; Lazer et al., 2009; Manovich, 2012), the response seems mixed in the more traditional branches of the social sciences and humanities, where issues such as lack of theoretical grounding, nonreplicability of findings, and the decontextualization of heterogenic and imperfectly understood phenomena have at times been criticized (boyd & Crawford, 2012; Gitelman & Jackson, 2013). The proponents of big data infer a degree of scientific authority from the sheer abundance of information available, while its critics argue that big data poses significant methodological challenges, at times trading large scale for reduced depth (Burgess & Bruns, 2012, Mahrt & Scharrow, 2013). Whereas in the proponent view, big data will make it feasible to better predict a wide variety of natural and social phenomena, in the critical perspective it offers little on an explanatory level, but threatens to become an instrument of control (Bowker, 2013). Big data research, from this vantage point, can be regarded as centering on the intricacies of handling data rather than the relation of data to the world it is assumed to represent.

This article focuses on the role of metaphor for the conceptualization of big data, and on the implications of this conceptualization for the role that big data may play in the future. Our analysis follows similar accounts that apply contemporary theories of metaphor analysis to discourse on technology, particularly in the media. We first examine definitions of data and big data and review current approaches to conceptual metaphor, to then turn to applications of metaphor theory, specifically in relation to political discourse and technology. We proceed by describing the BIG DATA IS A FORCE OF NATURE TO BE CONTROLLED and the BIG DATA IS NOURISHMENT/FUEL TO BE CONSUMED metaphors through a series of excerpts from the business and technology press and argue that both metaphors reflect and influence the perception of big data as an object of commodification and consumption. We conclude by discussing the cultural implications of this conceptualization.

Etymologies of *Data* and *Big Data*

Before turning to how the mass media frames big data metaphorically, it is useful to examine the origins of the terms *data* and *big data*. Words change their semantics due to a confluence of social, cultural, and linguistic factors, shedding old meanings and acquiring new ones (Aitchison, 2001; Hickey, 2003; Sweetser, 1991). English *data* is derived from Latin, where it is the plural of *datum*, which is in turn the past participle of the verb *dare*, "to give," generally translated into English as "something given." Sanskrit *dadāmi* and ancient Greek *δίδωμι* are related forms. While *data* (piece of information) and *datum* (calendar date) are separate lexemes in contemporary English, their association is not accidental; medieval manuscripts frequently closed with the phrase *datum die* (given on . . .), effectively time-stamping the preceding text. Early uses of *data* in English in a theological and mathematical context are attested for in the 17th century. Issue number 17 of the *Philosophical Transactions* (1693) contains four early uses, occurring twice in the sense of a mathematical variable and twice to describe historical events.

According to Rosenberg (2013), the principal sense of *data* shifted during the 18th century from anything widely accepted as given, granted, or generally known to the result of experimentation, discovery, or collection. In the 18th and 19th centuries, the usage of the word not only increased quantitatively but also established itself firmly in economics and administration, beyond its early use in mathematics and natural philosophy. Rosenberg notes an early modern attestation of the term in Joseph Priestley's *Lectures on History and General Policy*, published in 1788, in which historical data is discussed, finding his use of the term to be surprisingly modern (p. 15). Rosenberg points to the rhetorical origin of data as "that which is given prior to argument" (p. 36) and as an accepted basis of debate. Similar issues are raised in *The Federalist Papers*, written in the same year. In them, Alexander Hamilton compares making predictions on the future of the union on the basis of data to forming judgments on the planet's history on the same basis:

Though it is easy to assert, in general terms, the possibility of forming a rational judgment of a due provision against probable dangers, yet we may safely challenge those who make the assertion to bring forward their data, and may affirm that they would be found as vague and uncertain as any that could be produced to establish the probable duration of the world. Observations confined to the mere prospects of internal attacks can deserve no weight. (Hamilton, 1788, para. 4)

We will later return to the characterization of data as a physical object that can be *brought forward*. A notable aspect of Hamilton's use is how he highlights issues of data quality, a recurring theme in records discussing data. Hamilton appears quite skeptical regarding the potential of data in its present form to make reliable predictions for the future of the union, though he acknowledges data in principle as a legitimate basis for argument, but only provided it is not "vague" and "uncertain."

Data became firmly entrenched in science, business, and administration in the 19th and 20th centuries, while both its frequency and use contexts expanded significantly. A criticism of the quality of economic data quite similar to the one voiced by Hamilton is articulated by Fritz Machlup in *The Stock Market, Credit and Capital Formation* (1940). Machlup acknowledges the need for what he calls "a statistical narrative," but calls its feasibility into question:

These and other questions ought to be answered in a statistical narrative. But it cannot be done. No information is available that would enable us to get even near a satisfactory answer. The statistical data we do have contain far less information than has often been believed. Naive interpretations have led to conclusions which prove untenable on closer inspection. (Machlup, 1940, p. 311)

In Machlup's characterization, information is something to be extracted from data, which is obtained by measurements conducted by a human analyst. Like Hamilton, Machlup questions both the comprehensiveness and quality of data, and at the same time warns of "naive interpretations." Both how well data reflects reality and how skillfully it is analyzed have a significant impact on the quality of the interpretation.

In the 1940s, the uses described above were supplemented with the use of the word *data* to describe any information used and stored in the context of computing. This development coincided with the ascendancy of the term with regard to word frequency, which begins with the 20th century, showing a sharp rise from the 1960s onward (Rosenberg, 2013, p. 23). With the shift from paper records to digital information, *data* was increasingly used to refer to digital objects that can be manipulated using a computer rather than generally accepted facts or the outcomes of experimentation or observation. As computing matured, data also increasingly left laboratories and offices to play a role in new, domestic environments. As contexts expand and frequencies increase, lexemes are subject to semantic bleaching (Sweetser, 1988)—that is, their meaning becomes less specialized and more general as they are used in broader cultural contexts.

The understanding of data as any stored piece of digital information “given” by computational storage marks a departure from previous understandings, a shift with implications for established memory practices in science and scholarship (Bowker, 2005). In the first view, the processes of giving and interpreting appear to be highlighted; in the second, data comes into being by being recorded. Whereas the understanding of data as rhetorically constructed and sparse places an emphasis on its interpretation, computational interaction with data opens the possibility for new forms of usage other than interpretation. Data in the computational sense serves a variety of purposes, of which scholarship is just one. The social and cultural processes that the researcher seeks to study are assumed to be reflected to a certain extent by data, but the representation is always incomplete (Gillespie, 2014). Perhaps the most pronounced difference between the two viewpoints is the aspect of agency in data creation. Bowker notes a shift in agency when remarking on techniques for comprehensive self-surveillance in the context of the so-called quantified self movement that “the interpretative work is done inside the computer and read out and acted on by humans” (2013, p. 170). The self that is qualified by human interpretative work, rather than quantified by numeric information, is obviously a less definitive one from the vantage point of observation, but only if one places trust in the quality of data and is, unlike Machlup, not concerned with “naive interpretations.”

In contrast to the etymology of the word *data*, the genesis of the term *big data* lies firmly in the business world. Although the early discourse on data processing technologies in business closely reflected this necessity—for new tools allowing companies to deliver faster search results or store larger volumes of customer data more cheaply—it has since evolved into a discourse centered on using the collected information for analytical purposes, specifically for predictive modeling. The history of data mining and business analytics reaches back to early industrial capitalism, but such approaches became firmly established as a result of the broad introduction of computers into the corporate world of the 1960s. Prefiguring much of the technology press’s discourse today, the emphasis in this period was on the broad availability of a new technical infrastructure capable of capturing and storing larger volumes of data than was previously possible, and the in-built capacity to also interrogate the stored information systematically to make predictions. Similarly, contemporary social media data analytics approaches (sentiment analysis, latent semantic analysis) seek aggregate meaning in very large volumes of messages (Kennedy, 2012).

A crucial point for the popularization of the term *big data* in the media was the launch of the Accel Partners Big Data Fund (Gage, 2011) at industry event Hadoop World in November 2011. Accel

pledged \$100 million to startups involved in big data on some level, either as data generators (Facebook, Etsy, Groupon) or by providing data solutions (Cloudera, CouchBase, or Comscore). The framing of the term in opposition to traditional data in this and other business contexts was largely technical as well as a form of branding: Big data marked a suggested shift from relational database management systems to platforms that offered long-term performance advantages over traditional solutions. An important enabler of big data in this technical sense is the Apache Hadoop framework, a set of open-source tools derived from Google's MapReduce and Google File System projects, both of which were launched to respond to growing needs to process large volumes of data across computing infrastructures.

As with other terms originally used entirely in the context of technology and business, big data appears both on the academic agenda and in the context of applied industry research in relation to the growing availability of user-generated content (Lazer et al., 2009). Big data frequently refers to born digital information that is either user-generated or both collected and stored by computers. A growing number of computational studies utilize user-generated content to make a wide range of inferences—for example, on the temporal evolution of social networks, consumer preferences, and electoral behavior. In such accounts, big data tends to describe both particular kinds of data (usually the variety that is available in great abundance, either by measurement or by being user-generated) and specific procedures associated with its analysis. Whereas the data that Priestly, Hamilton, and Machlup had in mind was collected by humans, was relatively sparse, and could largely be manually processed and interpreted, big data from the onset requires specialized tools to be captured, stored, analyzed, and interpreted (and the step of processing, which precedes interpretation, takes on a crucial role in analyses of big data). Big data is more abstract than traditional data by virtue of its quantity, its mode of collection, and the requirements for its analysis, all of which require computational tools. It also points decidedly toward application beyond scholarly inquiry and argument.

We have argued that the historical trajectories of *data* and *big data* are marked by a shift toward ever greater computability and commercialization—that is, the very idea of what constitutes data becomes more dependent on how it can be processed and stored. Additional layers of abstraction have come into play through increasingly sophisticated tools for the processing and analysis of data that enable these new forms of interaction. This relevance of growing data quantity is also reflected in language. Whereas *data* is still prescriptively used as a count noun with distinct singular and plural forms, *big data* is grammatically a mass noun, a conceptual shift of emphasis from single units of information to a homogeneous aggregate.

Applications of Metaphor Analysis to Science and Technology

Beyond its stylistic significance in poetry and literature, the analysis of metaphor has attracted increased attention in several fields in recent decades. Black (1962) and Davidson (1978) discuss metaphor as a problem for philosophy and linguistic semantics, highlighting some of the conceptual issues associated with metaphor. Knorr-Cetina (1980), Maasen (1995), and Maasen and Weingart (2002) relate metaphor to the sociology of science and identify it as a core instrument for the negotiation of scientific knowledge in and among different academic disciplines.

Metaphor is also a popular instrument in mass media discourses on digital technology and the Internet. A typical recurring usage is to soften its technical and abstract nature and the resulting sense of “instability and uncertainty” that the early Internet evoked (Wyatt, 2004, p. 244). In a similar vein, Wilken (2013) points to the importance of metaphors to “capture techno-social complexity” (p. 638) in relation to the Internet and mobile phones. Nunes (1995) describes an abundance of spatial and geographical metaphors that are used to explain the early World Wide Web to magazine readers in the 1990s, another strategy to make an abstract technology more tangible. Maglio and Matlock (1998) found that early Web users predominantly described their experience of being online in terms of navigating in a physical space. Markham (2003) discusses three distinct metaphors for relating to the Internet—as a way of being, a place, and a tool—arguing for a conceptual progression from the net as transformative technology for redefining the self (the cyberspace of science fiction literature) to a space in which to search for information to a tool for managing aspects of everyday life. Markham argues that Al Gore’s metaphor of the Internet as the information superhighway was chosen deliberately to demonstrate the utility and everyday nature of the Internet over the utopian vision of cyberspace that had informed its early development. Also addressing the highway metaphor, Stefik (1997) warned that the Internet’s development could be constrained by the transportation imagery and its conceptual limitations, while Blavin and Cohen (2002) found conceptual metaphors of the Internet to significantly impact its framing in legal contexts. A notable theme in all these sources is the danger of overgeneralization: Some of the properties of libraries and highways hardly corresponded with the experience of using the Internet, even in the 1990s. Another theme is the discrepancy of power between those strategically employing such metaphors and the audiences for which they are chosen. We will enlist a cognitively grounded view of metaphor that highlights strategies of metaphor choice, referred to by Hellsten (2002) as “the politics of metaphor.” The first aspect allows a more plausible explanation of what kinds of metaphors resonate with their intended audiences, and the second informs the decisions of those who choose them.

During the last two decades, new approaches to metaphor analysis have gained significance in cognitive linguistics and have found applications in a range of fields, such as discourse analysis, media studies, communication studies, and political science (Harrison, Todd, & Lawton, 2008; Kress, 1989; Ritchie, 2003; van Dijk, 1997). Central to the cognitive theory of metaphor (Lakoff & Johnson, 1980, 1999; Lakoff & Turner, 1989) is the assumption that abstract concepts are understood through embodiment—that is, by relation to basic experiential categories such as orientation. Metaphor, in the cognitive view, is an important conceptual tool that enables us to understand abstract concepts in terms of more familiar and concrete ones. A core tenet of conceptual metaphor theory is that metaphor does not merely represent conventionalized or idiomatic language use, but instead points to the cognitive salience of analogy. Linguistic manifestations of conceptual metaphors are ubiquitous in everyday communication—for example, in the common characterization of time in spatial terms (in expressions such as “the distant past,” “the near future”) or in the way that abstractions are associated with physical structures (“building an argument,” “raising a question”). Other, even more common examples are expressions describing orientation in association with positive and negative physical and emotional states (feeling “up” or “down”), which are sometimes so entrenched that they are considered “dead” or demetaphorized. Conceptual metaphors are assumed to share similarities across languages by virtue of being governed by similar underlying cognitive principles that relate embodied human experience and abstractions by means of analogy, though these principles are also sensitive to social and cultural factors. Subsequent related

approaches, such as semantic analogy and conceptual blending, also describe the cognitive process of bridging different conceptual categories and the reflection of this process in language (Fauconnier & Turner, 1996; Sweetser, 2001).

According to Lakoff and Johnson (1980), metaphors map across domains, creating a bridge between a source domain from which a concept is drawn and a target domain to which it is mapped. Metaphorization describes this mapping process, which usually occurs in the direction of concrete and familiar concepts to abstract and novel ones (e.g., LOVE IS A JOURNEY, ARGUMENT IS WAR, IDEAS ARE BUILDINGS). Lakoff and Turner (1989) differentiate between orientational, ontological, and structural metaphors that function on different levels of conceptual entrenchment. Genuine conceptual metaphor differs from creative metaphor in that the latter is both used deliberately and is clearly identifiable as metaphor, as is the case in poetic language, while the former is at least partly subconscious (Forceville & Renckens, 2013, p. 161). A crucial aspect of conceptual metaphor theory is that it does not imply that metaphors are exclusive, nor that they shape thought in linear or predetermined ways. Rather, specific metaphors such as ARGUMENT IS WAR are seen as indicative both of how verbal conflict is consciously conceptualized, and what source domains (e.g., WAR) are particularly salient. The strategic component of metaphor choice is explicitly acknowledged by Lakoff and Johnson (1980) when they state that "the very systematicity that allows us to comprehend one aspect of a concept in terms of another (e.g., comprehending an aspect of arguing in terms of battle) will necessarily hide other aspects of the concept" (p. 10).

Adaptations of conceptual metaphor theory outside of cognitive science stress the question of agency in how metaphors are strategically chosen, integrating this aspect into (critical) discourse studies (Fairclough, 1995; Kress, 1989; van Dijk, 1993, 1998). Where Lakoff and Johnson discuss metaphors first in relation to the mind as the environment for metaphors, Maasen and Weingart (1995) define discourse as an environment (or perhaps an arena) for the negotiation of metaphors. How suggestive an issue is framed or "linguistically engineered" (Nerlich & Jaspal, 2012, p. 131) and who is in the position to frame it is an issue of power in this perspective. Discourse metaphors (Zinken, Hellsten, & Nerlich, 2008) are recurring linguistic metaphors in ongoing debates, particularly in the media that function as framing devices within a particular discourse, both reflecting and shaping the debate through the features and constraints they impose.

Political discourse metaphors in the mass media occupy a mesoposition between creative metaphor and conceptual metaphor. Journalists rely on an interpretative repertoire (Potter & Wetherell, 1987) shared with their readers to construct salient narratives. Koller (2004) provides an example for this type of bias in metaphor choice on gender stereotypes in business magazines, finding a large variety of metaphors describing businesswomen in terms of the predominant binary gender paradigm and using a narrower choice of metaphors than in depictions of male managers—a strategy that Johnston (2009) refers to as "norming ideas" (para. 7). In the same vein, Koller (2005) argues that metaphors act as "an interface between the cognitive structure underlying a discourse, on the one hand, and the ideology permeating it" (p. 206). For example, conceptualizing argument as war rather than as a dance has implications for how argument is conducted and for the kinds of strategies that are considered legitimate when arguing.

Koller (2005) examines the metaphors used to describe corporate mergers and acquisitions, distinguishing between three central conceptual metaphors of fighting, mating, and feeding, which she argues combine into a "scenario of evolutionary struggle" (p. 218). Companies are characterized as living organisms subject to the natural forces of evolutionary struggle, an image that is also salient in many other contexts. Koller finds the dominant metaphors in business discourse to be strongly masculinized, corroborating specific forms of aggressive behavior as normal. The choice of a source domain that is both familiar and negatively connoted is a widely used strategy in the media that masks obvious negativity while still being rhetorically effective.

In a study of media discourse on immigration, Santa Anna (1999) identifies the conceptual metaphors *IMMIGRANTS ARE ANIMALS*, as in "ferreting out illegal immigrants" (p. 201) and "to catch a third of their quarry" (p. 200), and *IMMIGRANTS ARE WEEDS*, as in a "new crop of immigrants" and "to weed out illegal aliens" (p. 204). Flood and disaster metaphors are also extremely salient negative metaphors. Charteris-Black (2006) identifies the *BRITAIN IS A CONTAINER* and *IMMIGRATION IS A NATURAL DISASTER* metaphors in his analysis of depictions of immigrants in the British news media, and provides historical precedence for flood metaphors in relation to xenophobic attitudes. He finds that in right-wing political discourse, physical change (in terms of movement of peoples) is typically associated with social phenomena such as rising crime, terrorism, social anarchy, and the breakdown of orderly civil society (Charteris-Black, 2006, p. 571).

Technology metaphors initially appear quite different from these characterizations, but as in Koller's description of mergers and acquisitions as an evolutionary process, they, too, frequently naturalize their target by choice of a physical source domain that evokes natural threats that must be curbed by human intervention. Whereas the societal metaphors described above ostensibly explain complex cultural phenomena such as immigration, metaphors related to computing and the Internet address technological complexity by applying urban imagery (highways, libraries) and sublime natural forces (tsunamis, avalanches). Consequently, technological metaphors are critiqued with regard to their potential to hide certain aspects of technology as a result of metaphor choice while making others appear natural (Wanick, 2004, p. 269). Another feature is their ubiquity: Metaphors are so widely used in computing that Lombard (2005) notes that "one of the greatest challenges in conducting this research was the difficulty in finding linguistic expressions pertaining to the topic of computer networking that were not metaphorical in nature" (2005, p. 181). Ryall (2008) calls metaphors in relation to technological and scientific innovations a "double-edged sword" (p. 364), warning that "a false picture arises when metaphor used in these areas begins to be literalized" (p. 364). Wilken (2013) notes that technological metaphors are "never innocent" and, when deployed as part of deliberate rhetorical strategies, have the potential to profoundly shape cultural and social practices (p. 642). Given that big data is focused on technological applications and commercialization, the scrutiny of the discourse metaphors surrounding it appears particularly fruitful.

Two Conceptual Metaphors of Big Data

We have argued that the cognitive salience of metaphor makes it cognitively and culturally indispensable for the understanding of complex and novel phenomena. The complexity of big data lies in the increased abstractness of the means by which it is created and used. In contrast to commonly

accepted rhetorically constructed knowledge ("givenness" in the early sense of *data*) or the outcome of collection and interrogation by a scientist (in the modern sense of the word), big data grows seemingly by itself in environments designed specifically for its cultivation. Its individual units are indistinguishable and form a mass of information in which exploitation is scalable. Rather than being recorded and analyzed by human analysts in relatively clearly bounded settings, big data exists ephemerally in the cloud. Metaphor is used both subconsciously and strategically in these contexts by journalists, company executives, lawmakers, and academics in an attempt to give a familiar shape to something abstract, but this conceptualization introduces a number of problems. Some uses can be considered idiomatic and conventionalized "dead" metaphors, but many of the examples that we provide appear motivated in ways comparable to Charteris-Black's findings on flood metaphors in relation to immigration policy and Koller's analysis of natural selection metaphors in relation to mergers and acquisitions.

We use examples from news items posted on the websites of *The Wall Street Journal*, *Forbes*, and *Business Insider* (all popular business and management journals), *Wired* and *Computerworld* (technology), *The Chronicle Herald*, *USA Today* (newspapers), World Future Society (nonprofit organization), and Booz & Company (consulting company). All news items contain reference to big data and were published in 2012. Although the limitations of this small sample should be taken into account, we find both metaphors to recur frequently in other sources.

"BIG DATA IS A FORCE OF NATURE TO BE CONTROLLED"

In everything from the weather forecast you catch on your Smartphone to the way your kids are educated to the texts you send to keep in touch with them, you are swimming in an ocean of data that surrounds our lives, and keeps rising. (Raasch, 2012, para 3)

Data science experts . . . are able to make sense of the torrent of digital information. (Bundale, 2012, para. 4)

A formidable transformation is taking place beneath the placid surface of the telecommunications industry. . . . This presents telecom operators with a major challenge: They must invest more and more capital in next-generation networks that can absorb this wave of data. . . . [W]here will the money come from to build the networks needed to handle the coming data tsunami? The answers to these questions lie in the ability of operators to monetize the huge volumes of data that are flowing and will continue to flow over their networks. (Booz & Company, 2011, para. 2)

Data is a powerful natural resource that if used wisely can drive U.S. economic competitiveness and lead to rewarding careers in the future dedicated to building a smarter planet. (Groenfeldt, 2012, para. 10)

One false promise that some proponents of Big Data hold out is that somehow vast oceans of digital data can be sifted for nuggets of pure enterprise gold. (Rooney, 2012, para. 16)

In contrast to *data*, which describes distinct units of information or observations, big data is characterized as a uniform mass. In the historical examples cited, the word *data* could be replaced with *records* or even *claims*—in other words, with terms that point to the human agency of their creation. Big data, by contrast, is a force to be curbed and controlled, as the examples above illustrate. The new presumed naturalness of digital technology creates a distinction to the experience of early computing as cumbersome and difficult. At the same time, this trope evokes the image of conjuring forces too powerful to control, another recurrent theme in technology metaphors. The challenge implicit in the examples is to control big data to successfully turn it into a resource. The language in the examples suggests that the situation lamented by Machlup has been reversed: Before, we were starved for data; now we are drowning in it. Another change seems to be the shift from solid to liquid state. The allusion to water supports the notion that data is all at once essential, valuable, difficult to control, and ubiquitous. Although the association with water is chiefly positive, there is also the danger of “torrents” of data in which one can “drown,” “floods” that overwhelm us, and “tsunamis” that leave destruction in their wake. Water is also neutral in the sense of having no very specific taste or color properties. Finally, water is a naturally occurring resource of universal cultural relevance that exists without human intervention, and its potential can be harnessed through the use of appropriate technology (dams, irrigation).

The problems of the analogy lie in inferring certain properties of the target that the source possesses but that do not map onto the target. The excerpts above treat big data as a force of nature that can be turned into a valued commodity to be uncovered, claimed, valued, and traded in ways that distinguish it markedly from the older conceptions of data. The givenness of data is analogized through the givenness of natural resources, which can be mined or grown and which can act as a form of capital with no persistent ties to their creator. Data is not a natural resource that replenishes itself, but in social media platforms it is created by users with intentions entirely unrelated to its use as a valued commodity. It is created by humans and recorded by machines rather than being discovered and claimed by platform providers or third parties. At the same time, it is generally not used for the purpose for which it was collected. Its mass makes it easy to deliberately ignore individual items in favor of aggregate properties. A second issue is that of scale: A natural resource such as water has predictable qualities across quantities, whereas big data has not. Sheer quantity does not automatically improve the quality of predictions in the same sense that more water will irrigate more crops.

Finally, the image of big data as a value-neutral resource is misleading in two ways. First, the value of big data differs for different parties (users versus traders). Second, the value is inscribed by analysis rather than being inherent in some sort of natural form of consumption. This distinction maps very imperfectly onto the source domain of natural resources, because those seem by comparison much more universally valuable than data outside any particular context. The metaphor of refining can be regarded as obscuring the assignment of meaning that is actively performed when “sifting” takes place, or whenever “noise” is eliminated (Bowker & Star, 2000). Suggesting that the intrinsic meaning of data is, like nuggets of gold, already there, just waiting to be uncovered, means distancing the interpretation from the interpreter and her subjectivity. Data can be relied on as a driver of economic growth only if its value is both predictable and stable rather than the result of ongoing interpretation and negotiation, but the value of big data seems extremely difficult to predict.

“BIG DATA IS NOURISHMENT/FUEL TO BE CONSUMED”

Beyond that, however, lies the promise of a style of computing that more closely mimics the functioning of the human mind as it takes in data from many different sources, forming thoughts and making decisions in real time. (Webster, 2012, para. 11)

Big companies like Tesco that traditionally operated with a very central nervous system are going to become like dinosaurs with the brain at the end of a very long neck if they don't develop more distributive nervous systems. (Nisen, 2012, para. 4)

Data driven decisions have consequences. There can be political and cultural fallout. This is a gating condition that you need in the beginning. You have to say, this might [anger] x, y, z, and know that in the beginning. Not just outside the organization, but within. You need to know the political consequences of any given data-driven decision and who that decision will tick off. (Tucker, 2012, para. 9)

What do companies do with the monstrous amount of data available to them across a variety sources? Just about every movement a person makes online can be tracked—but what is valuable and what is just noise? (Wilms, 2012, para. 2)

Proceeding from the first to the second metaphor, once it has been curbed, the natural force turns into a natural resource to be consumed. Two images emerge in this context: one similar to Koller's feeding metaphor and another evoking the image of data as fuel driving a vehicle. The image of consumption can be tied to an evolutionary and a technological metaphor. In the first, business competition is analogized with Darwinism and data becomes a resource to be consumed in order to survive; in the second, businesses are vehicles fueled by data. Both food and fuel must be consumed to exist and to move forward rather than being consciously used. The fuel metaphor can be linked to the THE PLANET IS A MACHINE metaphor identified by Nerlich and Jaspal (2012). The car's consumption of fuel is comparable to human consumption of food and water.

Using data as a basis for inevitable actions (data “driving” decisions) draws onto early utopian visions of cyberspace as well as imageries that rely on mappings between nature and technology, using one as a model of the other (Condit, 1999). A computational nervous system is one that “takes in data from many different sources,” processing it and “making decisions in real time” (Webster, 2012)—in other words, acting very much like a living, sentient organism. The analogy to feeding points to Koller's observations on corporate mergers and acquisitions—the consumption of data strengthens the company or institution while requiring no or very little conscious interpretation or reflection. What data means is evident and can be communicated via visualization and summarization techniques. What it shows is evident, and it gives the observer insights about the observed that the object itself lacks (in other words, that are unconscious).

Data is a powerful tool in the accounts provided above, in which the data scientist is merely the accomplice. Data is also framed as at times being incompatible with other ways of knowledge generation,

and the consequences of decisions driven by data are depicted as having to be socially resolved. The consumption metaphor furthermore suggests that information that has been consumed is also no longer available to competitors, enforcing its value. Making decisions in real time based entirely on data analysis is framed as being superior to the slow decision making conducted by subjective individuals in complex organizations with strict social hierarchies. Metonymical metaphors (analogies that describe part-whole relationships) have a long tradition of use to describe social and political systems—for example, to depict the state as a body (Kövecses, 2006, p. 137). A data organism is one that possesses the power and reach of a complex organization, but with greater dexterity as a result of its diet. Such an organism is also able to adapt to a new environment more easily than a traditional organization. Again, big data metaphorically fits into the frame of competition and consumption outlined above, in which it has been assigned the role of the informational analogy to a scarce natural resource.

Conclusion

This article has discussed the meaning of *data* and *big data* as contested and evolving terms, argued for the relevance of metaphors both for making complex phenomena meaningful and in shaping the meanings of these phenomena, and it examined two recurring metaphors used to frame big data as an economic resource and an epistemological paradigm. In some of the accounts provided, data accurately reflects nature, society, and culture; the units in which it is packaged are comparable; and similar results can be produced under similar circumstances. The path of interpretation between the data and its meaning is short, and conclusions are independent of a particular context of the subjective views of the analyst. Through the use of a highly specific set of terms, the role of data as a valued commodity is effectively inscribed (e.g., “the new oil”; Rotella, 2012), most often by suggesting physicality, immutability, context independence, and intrinsic worth.

We agree with van Dijk’s contention that “metaphors are crucial narrative tools in the popularisation of knowledge; they provide prototypes for imaginary creations” (1998, p. 22). Because of the degree of abstractness of science and technology, conceptual metaphor is particularly salient in these domains. Science is often associated with metaphors of discovery and adventure, with “findings” being “uncovered” rather than explanations for natural phenomena articulated by researchers in the rhetorical fashion Rosenberg (2013) ascribed to early natural philosophy. Scientific facts are, like data, regularly framed as givens that are valid outside of a particular context rather than simply being pieces of discourse that are ascribed to specific actors and embedded in a specific context (Latour & Woolgar, 1979).

We find the high degree of metaphorization in media discourses of big data to signal the need to latch on to familiar concepts, even if these concepts map imperfectly. These imperfections have political consequences: Koller (2005) finds that “Metaphorically constructing a social practice as natural and inevitable precludes change and struggle over definitions” (p. 218), and Charteris-Black (2006) argues that, in addition to embodied experience, “the cognitive heuristics of metaphor are equally active in creating politically influential representations of society and change” (p. 580). Another key contention is that the metaphors we have described thoroughly disguise the agency of data creation by evoking natural source domains. In social media platforms, data is generated inadvertently—likes, shares, tweets, and posts *become* data in the sense we have described when they are something else entirely from the

viewpoint of their creators and addressees. What Bowker (2013) refers to as "interpretative work" (p. 170) applies especially to social media platforms, which are filled with signs that have unclear and frequently self-referential meanings before they are even quantified. It is clear what tweets, shares, and likes *look* like, but it is unclear what they *mean*; yet it is exactly their formal homogeneity that makes them interesting research data from a computational perspective. The lack of clarity in creation overlaps with a lack of clarity in interpretation; procedures such as sentiment analysis make it possible to extract meaning from data that is otherwise considered unstructured, while social media platforms are built in ways that specifically facilitate the creation of (meta)data to then be analyzed computationally.

Social media has shifted the conceptual grounds on which the Internet is imagined from a dominant spatial metaphor to a discourse metaphor. Much of the framing of social media services relies on discourse as its conceptual sources: Blogs are described as giving a voice to political dissidents, and Twitter was criticized in an early market research study for consisting mainly of "mindless babble" (Pear Analytics, 2009). Crawford (2009) points out that the discourse metaphor is only partially adopted. Whereas sending messages (in the form of tweeting and posting, and, by extension, liking, sharing, and pinning) is a part of the metaphor, receiving (or listening) is framed as much less important, because it leaves behind no digitally visible traces. By contrast, actively using social media such as Twitter produces vast volumes of data to be mined and analyzed, making it a pertinent object of predictive analytics (Sullivan, 2013). Social media data is one of the most hyped areas of big data analytics, in both marketing and in computational social science; the rhetoric surrounding it contains many examples of the metaphorical framing sketched above. But rather than being recorded by technical instruments in controlled situations or collected as part of a carefully constructed study design, social media data constitutes a collection of disparate messages and meaning that diverge considerably from one community of users to another. The seeming uniformity and comparability of these meanings is the result of a highly constrained form, instances of which are stored in relational databases.

Integrating big data created in the computational paradigm that we have described into traditional academic research creates numerous challenges for researchers across the humanities and social sciences, who must adjust to a set of new and unfamiliar computational methods. Mahrt and Scharrow (2013) have conducted a thorough critique of the methodological shortcomings of approaches that use large volumes of user-generated data in a social science paradigm. They lament issues such as deficitary sampling, nonreplicability of results, and a lack of theoretical grounding, noting that often data volume is traded for quality. Another issue is that of validity; often the generalizations made on the basis of big data take a degree of confidence, if not creative imagination, to be acceptable, because they tend to operationalize communicative acts in ways unforeseen by communicators. Much of the academic criticism of the implicit ideology of big data stems from the conflict between a new computational research paradigm that integrates data as a resource and an older one that assumes it to be socially constructed (Anderson, 2008; boyd & Crawford, 2012). The shift in how data is created from the traditional scientific record to social media underpins this hybridism: Big social data *becomes* data only by the means used to handle and process it, not by ontology. In the new paradigm, big data affords shared observation and a transparent rather than negotiated reality. It remains to be seen whether, when, and how the metaphors used to conceptualize big data will stabilize.

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