

# The Wisdom of the Cloud: Hyperconnectivity, Big Data, and Real-Time Analytics

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In a hyperconnected world, transactions and communication do not happen in a vacuum. Every message, every purchase, every sensor reading, web click, lab test, highway toll, quick response (QR) code scan, mobile-phone location, credit card transaction, and inventory movement is captured and stored at a granular level in databases throughout the world. And, increasingly, savvy leaders are recognizing that these data are interrelated and interconnected through previously undetected relationships and patterns. The data may be collected and stored in silos, so analyzing them in discrete ways can be a challenge. A holistic, integrated approach that mirrors how organizations think, operate, and respond is the most appropriate way to tap that resource. One cell carrier's call-completion rate feeds not only revenue analysis but also quality metrics and regulatory reports. It also drives marketing retention and churn-prevention campaigns. In fact, 15 of the top 17 industry sectors in the United States have more data stored *per company* than the US Library of Congress (which has collected 235 terabytes of data).<sup>1</sup>

## COLLECTIVE KNOWLEDGE: THE WISDOM OF THE CLOUD

What many have failed to recognize is that the rapid accumulation of massive data volumes—by itself—is a fairly uninteresting proposition. *Adding* to the data is not so important; it is what you *take away* from the data that matters.

All the data are there, and they are useful if we can assemble them in the right ways to increase our *collective knowledge*. But *without analytics*, we will not be able to close the gap between *what the data know (collective knowledge)* and *what we know*. Organizations therefore must develop and deploy new technologies that integrate the data and provide smarter tools for analysis, visualization, and distribution of these massive data volumes. With the convergence of hyperconnectivity, “big data,” and next-generation analytics, we can turn the “wisdom of the crowd” into a transformational “wisdom of the cloud.”

Many claim that data usage merely amounts to an infringement of privacy. Although some skepticism and concern is entirely appropriate, we cannot escape the fact that big data offer meaningful social and economic benefits that mitigate these legitimate concerns because of the hugely favorable social and/or economic impact they impart—on private commerce, international economies, and economic development. Certainly data security issues are important, but if big data are to become the currency of the future, we need governance, transparency, and security, as opposed to reactionary plans to lock up the data and throw away the key. As with any currency, suppression is not a sustainable way forward.<sup>2</sup>

With proper tools and processes, companies and governments can unlock important benefits from these

**Box 1: Data: How valuable are they?**

How much value is hidden in the world's existing data sources? Consider these facts:

- US\$300 billion is their potential annual value to US healthcare.
- €250 billion is their potential annual value to Europe's public-sector administration.
- US\$600 billion is their potential annual consumer surplus from using personal location data globally.
- 60 percent is their potential increase in retailers' operating margins possible with big data.

**Source**

Taken from Manyika et al., 2011.

massive data stores. The result is more productivity and greater competitiveness that create substantial economic and social value for companies, governments, and consumers (see Box 1). Ultimately, the promise of big data will be realized only with more open data that allow more people to analyze and find value in them. For example, opening government or public-sector data up to others to sift through should engage more eyes and ideas to spot potential value.

As we will see, this new trend in analyzing large, hyperconnected data sources ultimately allows us to close the gap between how much knowledge is available and how much a single person or organization is able to comprehend alone and without assistance.

**SOCIAL MEDIA: THE NEW BIG-DATA SOURCE**

Interestingly, social media is the big-data trend that did not start in the enterprise. It has been driven by hyperconnected individual users—hundreds of millions of them from almost everywhere in the world. Whether the individual medium is Facebook, Twitter, Flickr, YouTube, blogs, wikis, or other media, people—and, increasingly, sophisticated companies—are engaging in literally billions of conversations and interactions. Twitter recently crossed the threshold of 50 million tweets in a year; Facebook has more than 500 million users worldwide, a number that many expect to double within the next year. The average amount of time consumers spent on social networking sites increased 82 percent last year.<sup>3</sup>

Social media offer an unprecedented plethora of opportunities for corporations and government agencies to engage—immediately, in real time—with millions of people around the world, around the clock. They are sending out messages, experimenting with offers, and strengthening their brands. But, perhaps far more important, effective social media are about listening, understanding, and responding. Consumers can now talk to each other, criticize or recommend products, share

feedback with their chosen providers, and generally shape the nature and scope of their preferred brands.

But unlike standard, structured data—with its neat rows and columns and tables, fixed fields, and predictable, validated formats—social media present their data in loosely structured formats, making it far more challenging for public- and private-sector organizations to tap into the undeniably large value it holds. Ad hoc interactions and responses are a dead end. Instead, companies need systematized ways to capture, analyze, and respond to the mountains of social media data sources that are rightfully taking their place alongside traditional structured data.

Of course, the real value comes when these new, unstructured data sources can be combined with traditional data to help make decisions that will benefit the organization, its stakeholders, and the broader global economy (see Box 2).

**LEVERAGING UNSTRUCTURED DATA FOR EXPONENTIAL BENEFIT IN KEY SECTORS**

Who will benefit from the collective knowledge in this new hyperconnected world? Virtually every sector of the global economy will see changes and improvements, but we anticipate some of the largest benefits to be gained within healthcare, the public sector, and consumer-facing businesses.

**Re-engineering healthcare**

Our hyperconnected world—driven by a broader set of data sources, including text-based safety data and clinical progress notes—has rewritten the rules for patient-centric healthcare from diagnosis through treatment to payment. These new systems create cost efficiencies, but they also empower the patient to take control of life-threatening diseases through accessibility to support networks and better understanding the nature of their ailments. The technology components enabling such a system are the remote sensors, videos, doctors' virtual access to patient medical records, high-quality diagnostic images, and other connectivity services such as social media. It is no exaggeration to assert that there has been a massive data explosion in the medical field that has significant implications for patients, providers, and payers.

Consider, for instance, the “fog of war” that can overtake epidemiologists when confronting a fast-moving, lethal virus that can have a profound public health impact before it is recognized, understood, and responded to. While Hollywood thrillers might overdramatize the scenarios, it is safe to say that the threat is best described as a massive and diverse data challenge. Bio-surveillance involves data that reach well beyond government health departments.

Using SAS Analytics technology and consulting with experts, the National Collaborative for Bio-Preparedness

(NCB-P) in the United States has demonstrated the ability to perform such analyses. By combining actual data from an outbreak with data from sources such as poison control, agricultural livestock and crops, food supply chain, weather and climate, veterinary databases, and others, they can increase situational awareness and detect a syndrome, no matter where in the biosphere it first appears.

Bio-surveillance means capturing and text-mining the first responder's notes and 911 telephone transcripts to zero in on spikes in chatter about certain symptoms. It means overlaying data with maps to visualize disease outbreaks. For instance, a rise in influenza-like symptoms in emergency medical technician notes and 911 calls in a cluster of ZIP codes can indicate the onset of a flu epidemic.

Hyperconnectivity is revolutionizing health systems all over the world by improving the collective knowledge about the patient and the disease. There is a vast amount of structured and unstructured data and images being stored in hyperconnected healthcare systems. Analytics is the key to drawing insights and actionable intelligence from these data.

Total health expenditures in the United States has reached US\$2.5 trillion, which translates to US\$8,086 per person, or 17.6 percent of the nation's GDP.<sup>4</sup> If US healthcare could use big data creatively and effectively to drive efficiency and quality, McKinsey pegs the potential value to be more than US\$300 billion every year, two-thirds of which would be in the form of reducing national healthcare expenditures by about 8 percent.<sup>5</sup>

One of the keys to that efficiency is simply obtaining knowledge about what other clinicians and researchers are doing. Today a far greater level of coordination is needed to share results, prevent overlapping research, and build on synergistic opportunities.

Successful examples abound. A research hospital in Canada is automating the gathering, management, and updating of critical research data and applying analytics to speed childhood cancer research. In Denmark, healthcare providers are using predictive health systems with advanced telemetry to monitor elderly patients in their homes and share data instantly. And in the United States, a new initiative enables individuals and families to store and track their health information and stream data from medical devices.

For the Stockholm County Council (SCC), Sweden's second-largest health system, patient safety is a top priority. The SCC has implemented a text-mining system that lets medical staff automate a systemic medical review that sifts through both structured and unstructured data to review charts, search for specific triggers, or locate indicators of adverse events. Since its inception in January 2010, the program has spread across the country. Today regulators are planning to award bonuses based on patient safety quantified by these reviews. If

### Box 2: 10 ways organizations can benefit from social media data

The natural question arises: are social media data—with their soft measurements and difficult-to-quantify characteristics—somehow inherently less valuable than traditional data? On the contrary, they comprise a trove of unscripted, often unfiltered information on all aspects of an organization's operations. They constitute feedback that can be highly influential in a market, making it imperative for the organization to understand and respond to them. Social media can help an organization in multiple ways. For starters, it can help:

- protect a brand,
- engage the most influential voices in a market,
- understand what trends lead to sales,
- identify an untapped market,
- enhance market research,
- understand the impact of industry changes,
- gather competitive intelligence,
- improve warranty analysis,
- create a better customer experience, and
- manage a crisis.

the results at the SCC are duplicated countrywide, the system could slash annual healthcare injury costs in Sweden by SEK 2 billion and reduce deaths caused by injuries by up to 50 percent.<sup>6</sup>

The Public Health Agency of Canada is another interesting example of hyperconnectivity. Its Global Public Health Intelligence Network is an Internet-based early warning system that gathers preliminary reports of public health significance in nine languages, around the clock. It relies on news aggregators to scour 20,000 media sources—from wires to websites to blogs. Every 15 minutes, its software pulls articles and assigns them a relevancy score based on keywords and syntax. Expert analysts further parse the material, which ranges from infectious diseases to natural disasters and product safety.

Is privacy a concern? It certainly has to be front and center with respect to virtually any effort connected to healthcare data. However, some experts are gradually adopting a somewhat contrarian view on this topic, believing that our society must move past the fear of data and privacy breaches. Many technological innovations that have revolutionized medicine might not have been possible without sharing data. Any data—electronic or paper-based—are vulnerable. But here, too, hyperconnectivity will enable new tools to fight crime, fraud, and abuse.<sup>7</sup> Yet those who are suffering from dreadful diseases are the least concerned about their data being combined in aggregate with other data sources to find health-related answers. They are much more interested

### Box 3: Five ways to balance customer intimacy and data privacy

1. Create symmetry of information between customers and institutions.
2. Treat the customer as a whole person.
3. Incentivize employees on positive customer interactions.
4. Understand the trade-off between data and judgment.
5. Use caution when using customer data.

in finding cures than in protecting the privacy of their data. But one does not need to be sacrificed for the other (see Box 3).

Pharmaceutical makers are also interested in finding cures, and leaders in this industry have realized the power of social media in a hyperconnected world. Many prominent pharmaceutical companies use social networking for branding, marketing, and advertising. They have also started to communicate directly with the public to engage in conversations on wellness, address unmet medical needs, and explain prospective new medicines and treatments.

Pfizer, for example, has strong presences on Facebook, YouTube, and LinkedIn to bring together patients and clinical researchers studying a particular condition, creating reciprocal relationships where tailored information is used to establish deeper bonds. Patients find others who share the same condition and can share tips and techniques and support to improve their clinical outcomes.

The same is true for Eli Lilly and several other pharmaceutical companies. Online user-group comments can become a sort of parallel trial that can bring to the surface more rapidly various side effects, treatment responses, and other “soft” results that can nonetheless heavily influence a clinical trial. Using hyperconnectivity to enable preventive care holds great promise as well, and is a use that will result in a marked improvement in the quality of life.

As indicated by the NCB-P example mentioned earlier, governments too can benefit from hyperconnected systems to increase awareness about healthcare initiatives and seek feedback from their citizens. They can also use the health/disease data streaming from the remote corners to run disease and drug surveillance programs. For instance, India uses weekly healthcare data from more than 600 districts to run an integrated disease surveillance program that acts as an early warning system to prevent and control disease outbreaks. During the H1N1 outbreak in 2010, the Internet famously played a starring role by illustrating how the epidemic was spreading. Today, a group including researchers

from City University London, the European Centre for Disease Prevention and Control (ECDC), and Britain’s National Health Service are teaming up ahead of the 2012 London Olympics to develop ways to detect and respond to epidemics via Twitter.<sup>8</sup>

### Transforming the public sector

Seeking citizen input and collaboration to solve problems is not new to government. But today the scale and reach of social media are transforming those processes. Good governance demands greater transparency and improved collaboration and participation. Successful government policy and operations depend on public perception and sentiments. At a time when public finances are under tremendous strain, hyperconnectivity, big data, and analytics are well positioned to drive innovation and improve the value returned to taxpayers.

According to Charles Leadbetter of Demos, a British think tank, social media make it easier than ever for people to voice their views, connect to others, learn to see the world from new vantage points, and gather information on their own terms, creating what he calls “a civic long tail”: a mass of loosely connected, small-scale conversations, campaigns, and interest groups that occasionally coalesces into a mass movement. As more conversations between citizens and government move online, masses of data on citizens’ views and preferences will be created. The civic long tail creates big data to make government more intelligent and responsive.<sup>9</sup> The impact of social media on public-sector governance can take numerous forms.

Thanks to hyperconnectivity, the Hong Kong government, for example, connects with citizens in real time, addresses complaints, and responds to public inquiries. The Hong Kong Efficiency Unit, the government’s interface for public inquiries, gathers insights about the social messages hidden in the data, so that various departments can respond before they become serious issues. This also helps the government determine priority areas for citizens. The Efficiency Unit uses robust, powerful text processing and mining solutions to uncover trends, patterns, and relationships inherent in the complaints.<sup>10</sup>

The general elections in Singapore in May of 2011 saw social media play a major role. Analysts counted more than 40,000 topical blog posts, tweets, and Facebook updates during the month before the election because some candidates used social media to reach the masses, making a compelling business case for governments to integrate social media in their campaigns. Social media analytics can help governments and candidates understand the likes, dislikes, and positions of citizens regarding housing, healthcare, the environment, and other major issues.

The US Geological Survey’s Twitter Earthquake Detector gathers real-time Twitter updates during seismic activities—faster than scientific equipment can be tapped

for more precise measurements and alerts. These data report on earthquakes at an anecdotal level—not to replace but to complement scientific analysis.<sup>11</sup>

Government also has a duty to be the best possible steward of taxpayer monies by rooting out fraud, waste, and abuse in various government programs. In one program, the Washington State Department of Labor & Industries has deployed a comprehensive system to review the thousands of unemployment and disability claims it processes each month. The system displays graphical reports that compare data over various time periods. It even scours social media sites and platforms to detect fraud. For instance, one disability claimant was nabbed after he posted a video on YouTube showing himself atop Mt. Rainier.<sup>12</sup>

Likewise, a federal tax-collection agency uses a fraud-detection system to detect, resolve, and prevent criminal and civil non-compliance and reduce issuances of fraudulent tax refunds. A scoring database examines structured and unstructured data using a hybrid scoring model that combines standard rules, predictive analytics, anomaly detection, and social-network analysis to supply answers within a 24-hour processing window. During peak periods, the system can examine as many as 15 million personal and business returns in a single day. The result is a reduction in fraudulent refunds, the ability to discover new fraud patterns, and an increase in tax collections.

In another example, text mining of unstructured data is used to increase value-added tax collections in the Philippines by collecting short message service (SMS) texts from the public, promoted by a state lottery.

### CREATING INTELLIGENT INTERSECTIONS BETWEEN BUSINESSES AND CONSUMERS

We turn now from healthcare and public-sector programs to consider how the private sector too can utilize the hyperconnected world to benefit corporations and customers alike. By combining and analyzing multiple data sources—including social, text-based, and point-of-sale data—companies in every sector are seeking to understand the needs of customers and meet those needs in real time. This section provides examples of ways real-time analytics from the retail, telecommunications, and banking sectors are yielding transformational insights.

Massive data volumes comprise both threat and opportunity for marketers and retailers, depending on whether the organization can draw timely benefits from its growing mountain of big data. There are more sources, more attributes, more unstructured data—and more questions—than ever before. Fortunately, hardware processing power has largely kept pace with this growth, meaning that marketers have access to new generations of sophisticated tools to answers to questions before those questions themselves are obsolete.

Today, a business analyst, corporate controller, or divisional vice president cannot wait for weeks or even days to process terabytes of data to answer key questions. They need answers in minutes—or no more than a couple of hours—not next month. For instance, Catalina Marketing, the company that provides targeted coupons at the grocery check-out lane, performs high-speed analytics on 2.5 petabytes of consumer data to provide the right coupon for every customer at thousands of grocery stores—a stunning achievement in real-time analytics that would not be possible without the massive improvements in processing power and software design.<sup>13</sup>

The fact is that companies should not be settling for less-sophisticated analysis just because they have more data. If the size of the data is choking the analytics tools, the problem is not too many data, but an inadequate analytics environment, and analytics deserves an IT environment supported by a full platform or suite of integrated technologies for data access, integration, analytics, and reporting. In other words, real-time analytics is more than simply running analyses faster (although that is certainly a desired outcome). It is also concerned with analyzing problems that simply were not solvable before. This understanding opens up a wide array of new possibilities and enables organizations to unleash analytics on previously untouchable challenges.

For instance, a large insurer might want to strengthen its fraud detection by analyzing *all* of its datasets, instead of analyzing random samples of the data. After all, a mere sample of claims data may not show all the anomalies that indicate potential fraud. Since traditional computing techniques might require days to analyze all of those data, without real-time analytics on the full dataset the insurer settles for samples and decreased accuracy, and pays fraudulent claims.

In another example, a well-known online shoe/clothing retailer is a leader in using social media for sales and customer service. The challenge was simple and daunting: they were being overwhelmed by the amount of data from customer interactions. In a typical day, customer service representatives faced 6,000 phone calls, 400 live chats, and 1.1 million social networking site interactions. From all these data, the company was able to understand only a fraction of what was being said about its products, services, and brand.

With a social media analytics solution, this company can now understand its customers' shopping experiences, using data that extend far beyond its basic website metrics (e.g., page views and transactions). Analysts now have real-time analysis of what current and potential customers are expressing about the company's brand, products, and services through various social media outlets (Facebook, Twitter, etc.). The result is a comprehensive understanding of what customers are saying, the sentiment behind their messages, and emerging trends and preferences. This deeper customer insight allows for

far more effective marketing campaigns and strategies. It is timely knowledge that allows for real-time, individualized interactions, bringing Web 2.0 to life.

Like retailers, telecommunications companies are also finding ways to increase profits and better understand customers by analyzing hyperconnected and text-based data sources. One of Japan's largest telecommunications services providers noticed that better results could be achieved through community marketing and by "influencing the influencer." Specifically, it saw that customers were several times more likely to turn to a different provider in the weeks after a friend switched. To combat this dynamic, the company sought to analyze relationships and lifestyles in the communities created by customers in order to refine its one-to-one marketing efforts and its customer-retention program. That meant combining unstructured social data, musical tastes, and self-defined customer profiles. The company initiated behavioral targeting of its higher usage/higher influence customers with digital content—such as its "new artist content campaign," which garnered a response rate that was 250 percent higher than that of similar/typical campaigns.

The value lies in being able to act quickly through trial campaigns and capitalize on positive discussions. It is a superb example of using social network analysis to drive product innovation and create immediate responses to any competitive threat or trend.<sup>14</sup>

Sometimes, the challenge of real-time analytics lies not in combining different types of data, but in integrating traditionally separate types of analytics to find answers that benefit the business. For example, one large European retail banking subsidiary wanted to integrate enterprise-wide risk analysis with single-customer-view capabilities. To integrate all three areas—risk, customer insight, and finance systems—the bank built a next-generation analytical risk and banking platform.

This single view of the risk and the exposure across all organizational units and risk types eliminates the problem of fragmented views of data from different sources. It also enables the bank to score each individual customer and generate the risk-weighted performance for each customer—scanning 10 million records in 55 seconds as opposed to three months. The result is a unique competitive advantage: instant credit approvals. Instead of waiting 24 to 48 hours, a customer gets a decision in seconds. Company executives estimate the savings from fraud alone could reach hundreds of millions of British pounds. The system enables sales and marketing to work off of the same data, so employees can develop stronger relationships with their 25 million customers while reducing risk and fraud at the same time.

## CONCLUSION

Regardless of industry sector, it is clear that the integration of unstructured data with traditional structured data opens up a range of powerful possibilities for organizations of all sizes and stripes. Reflecting on the many examples discussed in this chapter, we see that the wisdom of the cloud—the combination of hyperconnectivity, big data, and powerful analytics—benefits patients, citizens, governments, businesses, and consumers in three key ways:

- **The ability to know.** Although an almost limitless amount of knowledge is available in these massive, fast-growing data stores, there is a gap between the brain's ability to linearly absorb/synthesize information and the data that are available. Sophisticated analytics and data mining let companies know more than ever before about market trends, economic factors, competitors, customers, and more. Likewise, doctors can learn more and know more about their patients and ask better questions as they pursue treatments and offer specific recommendations.
- **The ability to dialogue.** Hyperconnectivity means not just knowing things *post-facto*, it means engaging in real-time dialogue with the audience. Social media has been at the forefront of this movement, helping healthcare patients, government constituents, and business customers get their voices heard.
- **The ability to innovate.** Companies can apply their newfound knowledge and insights from their dialogues toward faster, more effective action, thus changing their operations and processes and improving their results.

As unstructured data—such as the vast pools of data from hyperconnected social media platforms like Facebook, Twitter, and YouTube—continue to grow, they represent a critical source of meaningful information that can augment and complement our world's traditional databases and files, along with our traditional ways of gaining insight. This new big data source offers a new way to tap into the wisdom of the cloud by filling in the gaps, uncovering new insights, making new connections, and identifying unseen patterns.

When we can all draw from that knowledge—citizens, governments, and companies alike—the benefits to society are clear. Individually, we are all limited in what we can know, but together hyperconnectivity makes it possible to overcome those individual limitations and mine different types of data to find insights that will improve our health, increase the efficient use of public resources, best serve the needs of customers, and help drive the innovation needed to maintain strength and profitability in our global economies.

## NOTES

- 1 US Library of Congress, available at <http://www.loc.gov/webarchiving/faq.html>.
- 2 See Hagstrom 2011 for more on this debate.
- 3 Harvard Business Review Analytic Services 2010, p. 2.
- 4 See <https://www.cms.gov/NationalHealthExpendData/downloads/highlights.pdf>.
- 5 Manyika et al. 2011.
- 6 SAS Institute 2011.
- 7 Hagstrom 2011.
- 8 Parr 2008; Red Orbit 2010.
- 9 Leadbetter 2011.
- 10 SAS Institute N.D.
- 11 Recovery.gov, available at <http://recovery.doi.gov/press/us-geological-survey-twitter-earthquake-detector-ted/>.
- 12 Hammersburg 2010.
- 13 Henschen 2011.
- 14 SAS Institute 2010.

## REFERENCES

- Hagstrom, M. 2011. "Q4 2011 Intelligence Quarterly: The Battleground for the Future." *The Corner Office*, November 21. Available at <http://blogs.sas.com/content/corneroffice/2011/11/21/battleground-for-the-future/>.
- Hammersburg, C. 2010. "Nailed: A Fraud Prevention and Compliance Blog." August 17. Available at <http://nailed.lni.wa.gov/post/967374960/we-are-building-a-state-of-the-art-employer>.
- Harvard Business Review Analytic Services. 2010. "The New Conversation: Taking Social Media from Talk to Action." Harvard Business Review Study sponsored by SAS. Available at [http://www.sas.com/resources/whitepaper/wp\\_23348.pdf](http://www.sas.com/resources/whitepaper/wp_23348.pdf).
- Henschen, D. 2011. "Catalina Marketing Aims for the Cutting Edge of 'Big Data'." *techweb*, September 13. Available at <http://www.techweb.com/news/231600833/catalina-marketing-aims-for-the-cutting-edge-of-big-data.html>.
- Leadbetter, C. 2011. *The Civic Long Tail*. London: Demos. Available at <http://www.demos.co.uk/publications/thecivlongtail>.
- Manyika, J., M. Chui, B. Brown, J. Bughin, R. Dobbs, C. Roxburgh, and A. H. Byers. 2011. *Big Data: The Next Frontier for Innovation, Competition and Productivity*, May. McKinsey Global Institute. Available at [http://www.mckinsey.com/Insights/MGI/Research/Technology\\_and\\_Innovation/Big\\_data\\_The\\_next\\_frontier\\_for\\_innovation](http://www.mckinsey.com/Insights/MGI/Research/Technology_and_Innovation/Big_data_The_next_frontier_for_innovation).
- Parr, B. 2009. "HOW TO: Track Swine Flu Online." April 29. Available at <http://mashable.com/2009/04/25/track-swine-flu/>.
- Recovery.gov. July–September 30, 2011. *Track the Money*. Available at <http://recovery.doi.gov/press/us-geological-survey-twitter-earthquake-detector-ted/>.
- Red Orbit. 2010. "Could Twitter Provide Early Warnings for Epidemics?" April 14. Available at [http://www.redorbit.com/news/health/1849564/could\\_twitter\\_provide\\_early\\_warnings\\_for\\_epidemics/index.html](http://www.redorbit.com/news/health/1849564/could_twitter_provide_early_warnings_for_epidemics/index.html).
- SAS Institute. N.D. "Text Mining Improves Hong Kong Government's Ability to Anticipate and Address Public Complaints." *Customer Success*. Available at <http://www.sas.com/success/hongkongeu.html>.
- . 2010. "KDDI Chooses SAS to Advance Customer Analytics." Press Release, August 10. Available at <http://www.sas.com/news/releases/kddi-pblshk.html>.
- . 2011. "Identifying and Measuring Injuries in Health Care." *Intelligence Quarterly: Journal of Advanced Analytics* Q1 (11): 35–38.

Smith, T. 2011. "Contagion: Wash Hands after Reading." *State and Local Connection*, October 25. Available at <http://blogs.sas.com/content/statelocalgov/2011/10/25/contagion-wash-hands-after-reading/>.

US Library of Congress. *Web Archiving*. Available at <http://www.loc.gov/webarchiving/faq.html>.