1

INFORMATION OVERLOAD: AN INTERNATIONAL CHALLENGE TO PROFESSIONAL ENGINEERS AND TECHNICAL COMMUNICATORS

JUDITH B. STROTHER, JAN M. ULIJN, and ZOHRA FAZAL

> *People have become information junkies, and the very tools that cause Information Overload are also the tools that feed their habit.*
>
> Jonathan B. Spira
> CEO and Chief Analyst of Basex

1.1 Definitions, Causes, and Consequences of Information Overload

In today's information-driven economy, the ability to efficiently find, critically analyze, and intelligently use reliable information is a major factor, if not the key, to profit making. Ironically, however, overexposure to that critically valuable resource, information, leads to *information overload* and its detrimental effects.

1.1.1 Definitions of Information Overload

We have all experienced information overload and we know it when we encounter it—but how do we define it? Businessdictionary.com defines information overload as the "stress induced by reception of more information than is necessary to make a decision (or that can

Information Overload: An International Challenge for Professional Engineers and Technical Communicators, First Edition. Edited by Judith B. Strother, Jan Ulijn, Zohra Fazal.

be understood and digested in the time available) and by attempts to deal with it with outdated time management practices" [1]. In addition to using the standard definition of "too much information for one person to absorb," *PC Magazine* says that information overload includes "the excessively intricate and often indecipherable manuals that must be read to operate everything from a handheld device to a software application" [2].

1.1.2 Causes of Information Overload

PC Magazine cites the oft-quoted observation that "the volume of information that crossed our brains in one week at the end of the Twentieth Century is more than a person received in a lifetime at the beginning of it" [2]. IEEE *Spectrum* notes that "Information, the very thing that makes it possible to be an engineer, a doctor, a lawyer, or any other kind of modern information worker, is threatening our ability to do our work. How's that for irony? The global economy may run on countless streams, waves, and pools of information, but unrestrained, that tidal wave of data is drowning us" [3].

The development of the Internet quickened the pace at which information could be transmitted and received, and the advent of Web 2.0 went even further. With social networking tools, such as Facebook™ and numerous blog sites, anyone with a thought, an idea, or an opinion and access to the Internet can now become not only an author but also a publisher of information—and Web 3.0 and 4.0 are on the horizon. As an example, a simple Google™ search for *information overload* results in over 22,800,000 hits, while an article search using the more selective Google Scholar engine yields about 446,000 hits. The searcher is then left to sift through all the results to find the information being sought. While some forms of information and communication technologies provide solutions for information overload, for example through the use of search engines and gatekeepers, the further development of all kinds of communication support devices and software, such as Skype™, Twitter™, LinkedIn™, Facebook, YouTube™, iPhones™, and iPads™, provides additional sources of communication leading to information overload as well.

The general openness of Web communication poses a problem for all information seekers, who face the task of looking for valuable facts in a vast sea of information. For example, social media provide new avenues for corporations to communicate with their supply chain and their customers, but these same media can also engender a flood of feedback that corporations must cope with. Sometimes, businesses have access to so much information that they fail to distinguish between the information they can or cannot access. A commonly reported complaint at Hewlett-Packard was "If only HP knew what HP knows," reflecting the "growing gap between the potential and actual value of HP's collective intellectual assets . . . " [4]. This clearly demonstrates that large organizations face the challenge of keeping up with and organizing the volume of information that is produced, sent, received, and archived daily. As Edmunds and Morris [5] pointed out, the main problem is how to deal with the "paradox of a surfeit of information and a paucity of useful information."

Zeldes *et al.* [6] believe that one of the issues is that technology and organizational culture have not evolved at the same rate and therefore are often out of sync. Table 1.1 shows what is possible technologically versus what is actually done within the paradigm of most corporate cultures.

To add to the problem, much of the information that constantly surrounds today's information seeker is not reliable or comes from limited sources. While the system of careful peer review is still in place in academia, no longer are academic or technical publications the only information source one can find, nor are they the primary source for

Table 1.1 The Chasm Between Technology and Corporate Culture—Between Possibility and Practice [9]

Technological Reality (What Is Possible)	Cultural Paradigm (What Is Done)
Unlimited *accessibility* of everyone to everyone by many communication channels	Everyone is expected (by managers, peers, and self) to be *available* to everyone 24 × 7
Sending messages is easy to do and perceived as practically free of cost (monetary or other)	We sanction the unlimited sending of unsolicited messages ("freedom of speech")
Free, asynchronous access to everyone's attention queues	Interruption-driven, unnegotiated task management replacing plan-driven methodology
Queued messaging is available for most communication modes (e-mail, voice mail)	Expectation that message queues be emptied (including unsolicited messages)
Work from home technology is "as good as being in the office"	No clear understanding, much less a policy, of where to place the work–life barrier
Computers allow multitasking and rapid switching from task to task	Implicit expectation that all people are good at multitasking and can switch rapidly

even highly educated managers. In fact, too often, solid research is not accessed and used inside firms, where employees often depend on vendors or industry information to the exclusion of other sources, resulting in a biased view of the landscape. A practicing engineer, for example, may turn to "The Weld Guru" site instead of doing deep research for his or her needs in technical manuals or reports. Similarly, although news media continue to thrive, news is often broken, not by major newspapers but by individuals on social media such as Twitter and blogs. Commentary about the news, be it political, technical, or economic, is no longer limited to designated "experts"; rather, almost anyone can express opinions via the Web. Thus, the role of the information gatekeeper has been reduced significantly, for better or for worse.

In the workplace, information overload occurs not only when knowledge workers search for information but also when information searches for them. E-mail was once considered to be the efficient and cost-effective replacement for other nonelectronic forms of communication. Now, however, solicited and unsolicited e-mails fill up and clog inboxes, often significantly reducing the knowledge worker's efficiency. Smart phones are like minicomputers that allow employees and executives to receive not only calls and voice and text messages but also digital media, including full-length documents. Computer monitors and smart devices stream real-time business data as well as international news events. In short, knowledge workers are simply bombarded by information that constantly demands their attention. Indeed, information overload creates a problem for all information users, including practicing engineers, technical communicators, experts in information technology and computer science, and managers and business communication practitioners.

1.1.3 Consequences of Information Overload

Information overload "places knowledge workers and managers worldwide in a chronic state of mental overload. It exacts a massive toll on employee productivity and causes significant personal harm, while organizations ultimately pay the price with extensive financial loss" [6]. Hundreds of thousands of hours are lost in a typical organization—up to 25% of a workday—just from workers' attempts to cope with the flood of information [7].

As Spira notes, "Information Overload decimates work-life balance, decreases knowledge workers' effectiveness and efficiency, and causes diminished comprehension levels, compromised concentration levels, and reduced innovation" [7]. In their study of computer-mediated communication, Jones *et al.* [8] analyzed over 2.65 million postings to 600 Usenet groups. They found that the more overloaded the users were, the more likely they were to respond only to simpler messages, to generate increasingly simpler responses and to eventually terminate their active participation. (For a recent update of computer-mediated communication studies, see [9].) Zeldes *et al.* [6] added that information overload causes decreased mental acuity, leading to a reduction in "thinking, generating creative ideas, and effectively solving problems."

To prevent information overload, people sometimes avoid certain avenues of information, thereby missing opportunities. Although it is not easy to quantify these indirect costs of information overload, they add to the already significant direct costs, making information overload an expensive problem that must be addressed. Zeldes *et al.* attempted to quantify the costs of what they call *infomania*, "the mental state of continuous stress and distraction caused by the combination of queued messaging overload and incessant interruptions." Through their research at Intel, they concluded that infomania costs about US$1 billion per year for a 50,000-employee knowledge-intensive company—and noted that this calculation was conservative [8]. According to a Basex estimate, the total cost of information overload to the U.S. economy amounted to almost US$ 1 trillion in 2011 [10].

Resources for managing information overload currently include search engine filters and spam blockers, but not much more. While the computer industry tries to deal with the technical aspects of the problem, knowledge workers cannot do much except try to deal with the overload as well as they can while they also attempt to prevent themselves from contributing to the problem. Considering that end users tend to employ avoidance strategies, it is imperative that communication professionals employ a variety of strategies to avoid contributing to information overload for their clients and other audiences. At the same time, they themselves face the challenges of dealing with the ever-increasing flood of information that constantly surrounds them, increasing their own level of frustration.

Although there has been little solid research on the causes and consequences of information overload, it affects all of us. It can be especially troublesome and costly for practicing engineers and professional communicators who are considered subject matter experts (SMEs) and whom others tend to rely on for information. This volume addresses the needs of engineering and technical communication professionals in both academia and industry by focusing on the causes and consequences of as well as presenting strategies to deal effectively with the challenges of information overload, one of the most pervasive problems of the electronic information age.

1.2 Perspectives on the Concept of Information Overload

Decision makers of all kinds are often overwhelmed with information and lack the time management techniques to cope with the problem. The definitions of information overload given earlier provide a good start for studying the subject, but how do we deal with the elements that make information overload such an international and intercultural challenge for professional communicators in the engineering, scientific, technical, and business fields? To conceptualize the challenge, we consider information overload in terms of information and time management. How can professional communicators assist? In this

book, we argue that communicators need to know how their products are processed by their clients to help them minimize and/or avoid information overload. To gain this understanding, communicators must be intimately familiar with the supplier/producer/writer and client/user/reader perspective. In addition, the intercultural perspective has to be taken into account. Finally, a focus on innovation needs to be maintained to try and manage information overload.

1.2.1 An Information and Time-Management Perspective

If we assume that most consumers of information, for instance, as engineers or business and technical managers, have to find and use information within the real constraints of time to make decisions of all kinds, information overload is reduced to a matter of the management of *data* (facts without any interpretation), *information* (data interpreted meaningfully in a communicative chain of writers and readers), and *knowledge* (information that refers to a learning cycle) [11]. Knowledge comes in two basic forms relevant to engineering and technical communication: declarative, which addresses *what*, and procedural, which addresses *how* [12]. When it comes to decision making within the constraints of time, frustration may arise not only from information overload but also from its opposite—information underload—which occurs when there is not enough information available to make the right decision.

Information overload is closely linked to high *cognitive load*. According to Kelsey and St. Amant [9], "Cognitive load is the burden on working memory during information processing. It can be augmented by the individual's characteristics, but also by the content of the form and structure of the message. For example, a complex integration of modalities can elicit a cognitive load on the working memory so that the information is less remembered." A decision maker faces a cognitive load more when processing information for declarative knowledge than for procedural knowledge. An engineer or technician, for instance, might convert what he or she reads into an immediate action, requiring relatively little cognitive load. If the same information has to be stored in the brain to use for later application, then the cognitive load will be heavier. Therefore, reliance on memory can lead to the perception of information overload.

It is important for producers of information to keep in mind the time constraints that users face and create communication products that provide the right balance of information to prevent information overload—as well as information underload. At the same time, producers of information also need to package communication products according to the needs of the users, so as to prevent the perception of information overload.

1.2.2 A Supplier/Producer/Writer and Client/User/Reader Perspective

To prevent information overload, the suppliers, producers, or writers of information need to know who their audience is and how that audience processes a particular communication product. (For the sake of simplicity, we do not distinguish between the roles of suppliers, producers, and writers, as all are creators of information, or between the roles of clients, users, and readers, as all are audiences or receivers of information.)

Most technical communicators are trained well to keep the needs of their audience in mind, but with respect to cognitive load in particular, communicators must remember that the audience may be composed of multitaskers and cater to their needs. Biddix discusses how individuals relate in contemporary "networks," thanks to the possibility of multitasking through computer-mediated communication (CMC) [9]. Such multitasking

changes the wiring of our brain through the exposure to several simultaneous information flows throughout our lifetime [13]. The *homo zappiens*, natives of the electronic digital age [14], might think they can keep up with information overload in an easier way by multitasking; however, recent studies [15–18] strongly indicate that multitasking may not be the best road to efficient performance, at least for students. Nass and Brave [17] suggested that multitasking even affects our ability to be emphatic or expressive:

> New research is showing that such immersion can cause multitaskers to have more fractured thinking and trouble shutting out irrelevant information, and that even when they are offline, those problems persist.

Producers of information can implement certain strategies to help their multitasking audience. Two strategies were field tested to reduce information overload in student Web searches in biology and history. The first used work sheets and modeling examples; the second used rich representation such as mind mapping techniques [15]. Both appear to work equally well for students. We can reasonably expect these strategies to transfer to engineering and professional communication practice as well.

There is also an increasing need for information producers to write for audiences that do not have a clear human face, such as for search engines, as if they were information robots allowing easy data mining. A study by Killoran [16] explores the extent to which technical communication businesses with websites are attempting to reach an audience of prospective clients through an intermediary audience of search engines. It draws on a survey of 240 principals of these businesses, brief interviews with half of them, and an analysis of their sites. Results show that search engines are among the most helpful methods leading people to those business sites. In addition, higher levels of search engine helpfulness are strongly associated with higher percentages of clients who originate through these sites. Most businesses take search engines into account, and search engine optimization (SEO) is a booming business. However, meaningfully pursuing a specific audience requires ongoing investments that some professional communication businesses are reluctant to make.

Fragoso [18] made a strong plea based upon a discussion of the available search engines to return to the mass distribution mode in a Web many-to-many information distribution model, so that professional communicators can avoid creating information overload for those people who do not belong to an interested group. This implies that writers should clearly distinguish between information presented to the masses versus that presented to a target audience or community of professionals who share the same interests, professions, and culture. In this way, professional communicators could act as organizational gatekeepers [19] who monitor and regulate the flow of information in and out of an institution, through all media, including mass media [18, 20], to help prevent information overload for their audience.

The current business and technical communicator faces the challenge of preventing information overload not only in writing but also in the visual aspects of written text (think of color and image use in websites or in technical illustrations) and in oral modes, such as in presentations. Written, visual, and oral modes of communication need concise information that is clear and that has the right density so as to be useful to the audience.

Last, but not least, information producers should not forget readability measures that can help predict potential overload caused by complex writing. Presently, engineers and technical writers not only write but also manage information in the broadest sense. In this role, they have a special responsibility toward the information loads of their audiences, both individuals and institutions.

1.2.3 An International/Intercultural Perspective

All those working in today's global economy must be prepared to face intercultural differences. They might already face such differences in their own countries if they have to address the needs of diverse populations with cultural minorities, which is the case in many countries today. In addition to the national culture, communicators must adapt to the corporate or professional culture in which they work. Belonging to the same corporate or professional culture can actually help to reduce overload as those who are exchanging information share common vocabulary and frames of reference. Because the intercultural perspective is so important, this volume includes a full chapter on this topic. In addition, our authors bring diverse and international perspectives, as do our *Practical Insights* contributions from multinational corporations.

1.2.4 An Innovation Perspective

The information economy is based on the collection and exchange of data and ideas. We all either contribute to or use materials from the information economy in almost all aspects of our everyday lives. Few of us, however, understand all of the nuances of the information economy or the communication factors that affect its operations.

Innovation of products, services, or processes is an important source of change, be it radical or incremental, both in its exploration or R&D phase, where the engineer and/or technical communicator operates, and in the exploitation phase, where both technical and business communicators operate. There is a clear overlap between professional communication activities and information-management practices, and there are multiple opportunities to regulate the information flow through careful innovation [21].

Ulijn and his colleagues [22–25] have argued that professional communicators often play a crucial role in formulating strategic innovation targets of companies and helping them implement and assess this formulation process with guidelines suitable for the company's culture. They then use the various functions of the strategic targets with different professional cultures, such as engineering and marketing, and act as cross-pollinators in exchanging ideas and information between top, middle, and lower management. They might act then not only as external gatekeepers but also as internal regulators of information load (avoiding both underload and overload). Since information overload seems to be a matter of information and time management, all communicators should also act as information and knowledge managers for themselves and their companies, dealing with time constraints by multitasking as efficiently as possible.

1.3 Readers of this Book

This book addresses the ever-increasing problem of information overload from both the corporate and the academic perspectives. We hope to serve the following groups of readers.

- Practicing engineers and other technical professionals, who, as SMEs, would use the strategies provided in the book to reduce information overload, both for themselves and for their audiences
- Engineering communication and other technical communication practitioners, who would use the book to keep up with current strategies for reducing information overload

- Managers, who would use the book to reduce the negative effects of information overload in their organizations by making informed decisions regarding information management
- Educators who teach courses in engineering, management, technical communication, or business communication, who would use the book as a textbook or supplementary reading material in courses that address information overload
- Academics interested in information overload, who would use the book as a resource for research
- Students, who would use the book as a textbook or supplementary reading material and continue to use it as a professional reference or resource

1.4 Structure of this Book

In addition to this introductory chapter by the editors, this collection has 11 chapters from an international group of authors. Contributing authors represent various nationalities (including Germany, India, The Netherlands, Pakistan, Switzerland, Tanzania, the United Kingdom, and the United States) and have a variety of backgrounds and affiliations including academia, research organizations, and private corporations. Strategies and techniques that can be used to reduce information overload and minimize its effects are presented. For the academic audience, the concept and theoretical framework of information overload are presented along with suggestions for future research in this critical underresearched area.

In addition to the chapters, *Practical Insights* appear throughout this book to illustrate the best practices of various technical corporations for dealing with the challenges of information overload. These companies include IBM, Xerox, and Harris Corporation.

This volume is divided into two sections centered on key issues in the field of information overload.

- *Section I*: Causes and Costs of Information Overload
- *Section II*: Control and Reduction of Information Overload

1.4.1 Section I: Causes and Costs of Information Overload

Before a productive discussion can ensue on the topic of information overload, it is important that we define the term itself. In Chapter 2, on the evolution of information overload theories and concepts, Aikat and Remund situate information overload research within a larger intellectual context of communication and document the theoretical and conceptual development of information overload as it relates to communication in its many forms. Based on archival studies of communication history, meta-analyses of information concepts, and theoretical reviews of information overload, the chapter explicates the theory and concept of information overload and explores its historical evolution as well as identifies theoretical trends in information overload research, evaluates strategies for managing it, and delineates communication strategies to reduce and control it. In addition, the chapter assesses significant trends, important research findings, critical issues, and some knowledge management techniques. Finally, it identifies research directions to investigate information overload problems at a global level.

In Chapter 3, Vossen argues that human beings need information, continuously and increasingly, in order to master their environment. To satisfy this innate need, they are not only equipped with perceptual and cognitive functions but have also developed auxiliary facilities, from languages via books to modern digital media. However, the success of these artifacts has led to information explosion and pollution, making people feel overwhelmed and paralyzed by the very systems that should help them master their world. Vossen explores some of the symptoms, causes, and consequences of information overload from a multidisciplinary perspective and argues that current approaches to alleviate the problem—either educating human agents to become better information processors or developing more auxiliary systems to cope with the previous ones—are doomed to fail because they accept and thus aggravate the original problems. According to Vossen, the fallacy is to assume that information overload can be cured by still more information. Vossen suggests that basic research on all-inclusive information resource management beyond the simple solutions proposed up to now is urgently needed.

In Chapter 4, Caborn and Cooper argue that information overload is a mental mindset and a practical challenge for technical communicators. The chapter gives technical communicators insight into how their attitudes to information and information overload in the medical field might be influenced by developments in information technology and management and how these attitudes might influence the way they personally handle and disseminate information. The authors also consider how the human brain engages with information on screen as opposed to in print.

The influence of culture on information overload is the theme explored by Ulijn and Strother in Chapter 5. Too often, all communication genres are analyzed without recognizing the unavoidable impact of a communicator's cultural framework on either producing or receiving and attempting to comprehend the document. This chapter analyzes the impact of culture, primarily using Hall's high-context versus low-context model. In addition, Hinds' theory of reader versus writer responsibility for comprehension, the impact of professional culture, and the relative benefits of globalization and localization are also explored. Suggestions for dealing with cultural issues in technical communication are presented.

In Chapter 6, on the effect of color, visual form, and textual information on information overload, Alton and Manning observe that there is a distinct trend in current menu design, both in print and online, to overload the menu with too many separate entries, colors, flashing images, and so on. They argue that viewers have difficulty navigating such designs since information they may wish to locate is too often buried. Alton and Manning describe a coherent theory of information design and offer empirical evidence in support. They argue that there is no clear-cut boundary between "mere" document design issues and actual information-content issues. Color and form convey a spectrum of emotional information that, if deployed carelessly, interferes with propositional information conveyed by text. Furthermore, color, form, and text also provide *indicative* information; these elements tell viewers to perform specific actions of looking, focusing, dividing, and contrasting one visual element from another. The chapter offers specific advice on how to keep emotional, indicative, and propositional information in balance in order to avoid information overload.

Bidkar, in Chapter 7, puts forward a framework for calculating the cost of information overload in end-user documentation based on the concept of quality costs. Drawing upon Wilson's information behavior model and data from a user survey, Bidkar establishes end-user behavior. He then puts forward scenarios showing how information overload can increase the cost of failure for both the organization producing the documentation as well

as the end user. The chapter suggests a new approach to evaluate the factors that increase cognitive load and hinder information use. Engineers, technical communication practitioners, and managers can use the cost framework to analyze and calculate the costs of failure because of errors and deficiencies in the manual that result in increased cognitive load, and therefore in information overload.

1.4.2 Section II: Control and Reduction of Information Overload

In Section II, authors provide strategies for dealing with information overload.

Chapter 8 by Hoenkamp, on a human-centered approach to surviving the information deluge, starts with the assertion that the fear of imminent information overload predates the World Wide Web by decades. The chapter then focuses on the overload issues that have emerged with the advent of the Web. It further focuses on three ways to mitigate the issues, especially as they relate to search engines: being specific in what we ask, amending our requests when we do not find what we need, and making our retrieval techniques more human centered. Hoenkamp presents research that has been conducted in these three areas and shows that a human-centered approach substantially improves the retrieval results of algorithms underlying the search engine. All examples discussed have actually been implemented. Having built the applications, Hoenkamp presents an operational, not just an aspirational approach.

Calders, Fletcher, Kamiran, and Pechenizkiy focus on technologies for dealing with information overload in Chapter 9. The authors survey storage and querying techniques for semistructured data, data mining, and information retrieval for analyzing large data collections as well as stream processing techniques for online handling of continuously flowing data. They purport that since storage of the massive amounts of data is no longer an option, we need to rely on immediate processing to be able to distill information from the data. The chapter surveys the main challenges and gives some insight into recent developments in these areas.

Mengis and Eppler focus on reducing information overload through visualization in Chapter 10. The authors address the qualitative aspects of information, systemize existing findings from the literature on how these aspects cause information overload, and show how they can be addressed to reduce overload. The authors propose a solution to information overload that can be adopted by information producers and show, in particular, how visualization (the graphic rendering of information) can be used to improve the quality of information so that information overload can be reduced. They discuss why visualization is still not frequently used by communication professionals, even though its potential for reducing information overload is explicitly acknowledged. Mengis and Eppler also present the results of a survey of 636 International Association of Business Communicators (IABC) members regarding their views on visualization as a counterstrategy against information overload.

In Chapter 11, Remund and Aikat examine the effects of information overload within organizations and present strategies for improving knowledge transfer and decision making. The authors acknowledge that research about information overload largely focuses on individuals and that little attention has been paid to the aggregate effect of information overload within organizations. Drawing insight from scholarly and professional journals, this chapter emphasizes the principles of effective communication as a strategy for mitigating or reducing information overload within an organization. The chapter also stresses the need for organizations—and the individuals within organizations—to focus on information sharing that is situation specific and decision making that is actionable.

Finally, in Chapter 12, Verhoeff deals with the information paradox as an important issue that needs to be addressed and uses the backbone model to deconstruct the information paradox. He stresses that companies need managers who are capable of negotiating increased information symmetry between a company's internal and external stakeholders. In addition, he shows that the orientations of managers in daily life are not quite consistent with the new information reality. He recommends that managers and other readers of this book reflect on integrated relational and technical solutions for the information paradox.

REFERENCES

[1] *BusinessDictionary.com* [Online]. Available: http://www.businessdictionary.com/definition/information-overload.html Sep. 1, 2011 (last date accessed).

[2] PC. (2010, Oct. 19). *Definition of Information Overload* [Online]. Available: http://www.pcmag.com/encyclopedia_term/0,2542,t=information+overload&i=44950,00.asp Sep. 1, 2011 (last date accessed).

[3] N. Zeldes. (2009). "How to beat information overload," *IEEE Spectrum* [Online]. Available: http://spectrum.ieee.org/computing/it/how-to-beat-information-overload Sep. 1, 2011 (last date accessed).

[4] C. G. Sieloff, "'If only HP knew what HP knows': The roots of knowledge management at Hewlett-Packard," *J. Knowledge Manage.*, vol. 3, no. 1, pp. 47–53, 1999.

[5] A. Edmunds and A. Morris, "The problem of information overload in business organizations: A review of the literature," *Int. J. Inform. Manage.*, vol. 20, no. 1, pp. 17–28, 2000.

[6] N. Zeldes *et al.*, "Infomania: Why we can't afford to ignore it any longer," *First Monday*, vol. 12, no. 8, Aug. 2007.

[7] J. Spira, *Overload! How Too Much Information Is Hazardous to Your Organization*. Hoboken, NJ: Wiley, 2011.

[8] Q. Jones, *et al.*, "Information overload and the message dynamics of online interaction spaces: A theoretical model and empirical exploration," *Inform. Syst. Res.*, vol. 15, no. 2, pp. 194–210, 2004.

[9] S. Kelsey and K. St. Amant, Eds., *Handbook of Research on Computer Mediated Communication,* vol. 2. New York: Information Science Reference, 2008.

[10] J. Spira, *Information Overload: Now $900 Billion—What Is Your Organization's Exposure?* [Online]. Available: http://www.basexblog.com/2008/12/19/information-overload-now-900-billion-what-is-your-organizations-exposure/ Jan. 10, 2012 (last date accessed).

[11] I. Nonaka and H. Takeuchi, *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*. New York: Oxford Univ. Press, 1995.

[12] F. Machlup, *Knowledge: Its Creation, Distribution, and Economic Significance*, vol. 1. Princeton, NJ: Princeton Univ. Press, 1980.

[13] A. Gazzaley and M. Desposito, "Top-down modulation and normal aging," *Ann. NY Acad. Sci.*, vol. 1097, pp. 67–83, Feb. 2007.

[14] W. Veen and B. Vrakking, *Homo Zappiens: Growing up in a Digital Age*. London, U.K.: Network Continuum Education, 2006.

[15] A. Walraven, "Becoming a critical websearcher: Effects of instruction to foster transfer," Ph.D. dissertation, Open Univ. The Netherlands, Heerlen, The Netherlands, 2008.

[16] J. B. Killoran, "Targeting an audience of robots: Search engines and the marketing of technical communication business websites," *IEEE J. Prof. Commun.*, vol. 52, no. 3, pp. 254–271, Sep. 2009.

[17] C. Nass and S. Brave, *Wired for Speech: How Voice Activates and Advances the Human-Computer Relationship*. Cambridge, MA: MIT Press, 2005.

[18] S. Fragoso, "Seek and ye shall find," in *Handbook of Research on Computer Mediated Communication, Part 2*, S. Kelsey and K. St. Amant, Eds., 2008, pp. 740–754.

[19] D. M. White, "The 'gatekeeper': A case study in the selection of the news," *J. Quart.*, vol. 27, no. 4, pp. 383–390, 1950.

[20] M. Boardman, *The Language of Websites*. Abingdon, U.K.: Routledge, 2005.

[21] K. St. Amant and J. M. Ulijn, "Examining the information economy: Exploring the overlap between professional communication activities and information management practices," *IEEE Trans. Prof. Commun.*, vol. 52, no. 3, pp. 225–228, Sep. 2009.

[22] J. Ulijn, "Introduction," *J. Business Commun.*, vol. 37, no. 3, pp. 202–208, 2000.

[23] J. Ulijn and R. Kumar, "Technical communication in a multicultural world: How to make it an asset in managing international businesses, lessons from Europe and Asia for the 21st century," in *Managing Global Discourse: Essays on International Scientific and Technical Communication*, P. J. Hager and H. J. Scheiber, Eds., New York: Wiley, pp. 319–348, 2000.

[24] J. Ulijn, *et al.*, "Innovation, corporate strategy, and cultural context: What is the mission for international business communication?" *J. Business Commun.*, vol. 37, no. 3, pp. 293–316, 2000.

[25] J. Ulijn and K. St. Amant, "Mutual intercultural perception: How does it affect technical communication, some data from China, The Netherlands, Germany, France and Italy?" *Tech. Commun.*, vol. 47, no. 2, pp. 220–237, 2000.