Information Overload: Threat or Opportunity?

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Editor's Message

In his book *Information Anxiety* (1989), Richard Wurman claims that the weekday edition of *The New York Times* contains more information than the average person in 17th-century England was likely to come across in a lifetime. This personalizes the oft-cited estimate that more information has been produced in the last 30 years than in the previous 5,000. Statistics like these highlight the phenomenon of an information explosion and its consequence: information overload or information anxiety.

Vannevar Bush raised a similar alarm more than 50 years ago in his *Atlantic Monthly* article: "Thus far we seem to be worse off than ever before—for we can enormously extend the record, yet even in its present bulk we can hardly consult it."

How real is the phenomenon of information overload; how should we measure it; what are its causes; can anything be done about it; and if so, what? This month Bernhard Jungwirth takes on a set of complex issues that call for careful analysis of technology and new literacy practices. He shows how the questions are not just abstract problems for technology theorists, but are also practical issues for anyone who wants to become literate in today's world.

In keeping with the international character of this journal and with that of the Internet, this month's column has already traveled the world. Bernhard lives in Vienna, Austria; the journal editors are in Brisbane, Australia; and the International Reading Association headquarters are in the United States. The work cited comes from France, Germany, and the United States. In the process of creating this column, at least 50 e-mail messages were sent around the world.

Original version published February 2002 in the *Journal of Adolescent & Adult Literacy*

Issue

Information Overload: Threat or Opportunity?

Direct access to uncountable relevant online sources, vast amounts of search results, and an increasing number of daily e-mails—these are all familiar experiences when we think of our work or the challenges students have to face. Do we really have to deal with an information overload, or are the developments in telecommunication just a great opportunity to become better informed? A more comprehensive sociotechnical, and even philosophical, perspective helps to reflect the significance of information overload in society and, therefore, in education.

In general, we have some sense of the increasing amount of information to which we are exposed. Many eye-catching numbers and comparisons help to confirm our assessment:

> Around 1,000 books are published internationally every day and the total of all printed knowledge doubles every 5 years.
>
> More information is estimated to have been produced in the last 30 years than in the previous 5,000. (*The Reuters Guide to Good Information Strategy*, 2000)

Threat or Opportunity?

More information—is it a threat or an opportunity? A way to begin this discussion may be to take an empirical view, although many statistical discrepancies offer room for interpretation. Such discrepancies include duplications (e.g., What is original and what is a copy? When should two pieces of information be considered as different and when as duplications?); compression and codes (e.g., a Word file is bigger than an ASCII file, even if it contains the same information); as well as data access (no data are available for many countries).

The size of the Internet—in particular of the World Wide Web—often illustrates the information overload in society today. However, to measure the Web we have to look at a major statistical problem, the so-called "invisible Web." It is made up of information stored in databases. Unlike pages on the visible Web, information in databases is generally inaccessible to the software spiders and crawlers that compile search engine indexes and determine the size of the Web (Sherman, 2001). This is a vital problem because information offered on the invisible Web tends to be qualitative (e.g., newspaper archives) and grows faster than the visible Web.

Bergman (2000) suggested that information available on the invisible Web is 400 to 550 times larger than that on the visible Web.

Due to these problems, valuable statistics are rather rare and often outdated. A widely recognized study is "Accessibility and Distribution of Information on the Web" (Lawrence & Giles, 1999). One of the major results of this study was that the publicly indexable Web contained an estimated 800 million pages as of February 1999, encompassing about 15 terabytes of information or about 6 terabytes of text after removing HTML tags, comments, and extra white space.

Differences Between the United States and Europe

Discussion about information overload brings up interesting differences between the United States and Europe concerning general public opinion and theoretical discourse. Europeans tend to be more skeptical and critical about technological innovations than Americans. *Wired* magazine talked about a new cultural war, U.S. exuberance against continental conservatism (Glenny, 2001). The early public perception of the Internet in Europe was highly associated with pornography or right-wing extremism, but the public opinions appear to have generated contrary theoretical opinions. Many U.S. thinkers are opposed to the public enthusiasm about technology, while theorists in Europe often counterbalance the widespread skepticism there.

Neil Postman is a famous technology critic in the United States and author of *Technopoly: The Surrender of Culture to Technology* (1993, Vintage). One of his basic assumptions is that uncontrolled growth of technology destroys the vital sources of our humanity. It creates a culture without moral foundation. As a consequence Postman named our society a "technopoly," where the primary—if not the only—goal of human labor and thought is efficiency, and where technical calculation is in all respects superior to human judgment. He added that one of the most ominous consequences of technopoly is the explosion of context-free information.

Postman also stated that technopoly flourishes in a milieu where the tie between information and human purpose has been severed (i.e., information appears indiscriminately, directed at no one in particular in enormous volume at high speeds, and it is disconnected from theory, meaning, or purpose). The "information glut" leads to the breakdown of a coherent cultural narrative, he argued. For without a meaningful context, information is not only useless but also potentially

dangerous. In an analogy to the old saying that to a person with a hammer, everything looks like a nail, Postman said that to a person with a computer, everything looks like data. Postman defined this glut as a cultural "AIDS" (Anti-Information Deficiency Syndrome). The culture's immune system is not capable of filtering any more information.

When traditional information filters no longer work, Postman explained, we turn increasingly to experts, bureaucrats, and social scientists who (abetted by computers) control the flood of data. This might be expected when a technical solution is called for, but as human relations have become "technicalized" there are also experts in social, psychological, and moral affairs. The result is that we look for technical solutions to human problems. Postman judged this approach as incapable of answering the most fundamental human questions and barely useful in providing coherent direction to the solution of even mundane problems.

Paul Virilio, a French philosopher, represents a somber perspective similar to that of Postman. Virilio's theories stem from the basic consideration that speed is the determining factor and acceleration the driving force for development in society (Kloock, 1997).

Virilio recognized three eras of speed in history. The first is the transportation revolution in the 19th century; the second is the media-transmission revolution (based on the speed of light) in the 20th century; and the third revolution, which is still ahead of us, is transplantation.

The second revolution is relevant in the context of information overload. Communication based on electromagnetic media (e.g., radio, television, Internet) was, according to Virilio, the start of a new world order. Because electromagnetic signals are transmitted with the speed of light they are able to reach the highest possible speed. This implies that space and time are overcome and a real-time society is founded in which everything is everywhere at every time. Therefore human perception gets swamped, and as a consequence Virilio predicts a process of dehumanization. The disappearance of space and time can be understood as another description of information overload, or information bomb as Virilio also called it.

Bill McKibben, a U.S. author, wrote *The Age of Missing Information* (1992), in which he compared his experiences watching 93 television channels in 24 hours with spending a day in the mountains. McKibben concluded that we are living in the age of missing information, a time when the vital knowledge that humans

have always possessed about who we are and where we live seems beyond our reach.

He lamented the loss of power found in unmediated experiences with nature and stated that the information explosion is drowning our senses and cutting us off from more fundamental information about our limitations and the limitations of the world around us. He judged mediated experiences of the world around us as a threat to the world itself. These are lessons that may be crucial to the planet's persistence as a green and diverse place and also to the happiness of its inhabitants—lessons that nature teaches but television cannot.

Richard S. Wurman stated that information has become the driving force of our lives, and the ominous threat of this ever-increasing pile of information demanding to be understood has made most of us anxious. This assumption has led Wurman to publish two books: *Information Anxiety* (1989) and *Information Anxiety2* (1989). He described information anxiety as a product of the ever-widening gap between what we understand and what we think we should understand. Information anxiety is a black hole between data and knowledge. It happens when information doesn't tell us what we want or need to know.

Interpreting the increasing amount of data as a threat is only one possibility. There is a broad variety of arguments opposed to that view—arguments that judge the environment of changing information as a new opportunity, or at least not necessarily as a threat.

Website of the Month

Lyman and Varian (2000) conducted the study "How Much Information?" and published the results on this website: http://www.sims.berkeley.edu/research/projects/how-much-info/index.html. It is one of the most comprehensive quantitative research approaches available and includes results such as this: The visible Web consisted of approximately 2.5 billion documents in October 2000, up from 1 billion pages at the beginning of the year 2000, with a rate of growth of 7.3 million pages per day. The study estimated that the total amount of information on the visible Web varied somewhere from 25 to 50 terabytes of information (HTML-included basis). Lyman and Varian also took e-mail into account. A white-collar worker receives about 40 e-mail messages in the office each day. Aggregately, there will be from 610 billion to 1,100 billion messages sent this year alone.

The study not only covers the Internet size but also represents an attempt to measure how much general information is produced in the world each year. Some significant numbers and insights are that the world produces between 1 and 2 exabytes of unique information per year, which is roughly 250 megabytes for every man, woman, and child on earth. An exabyte is a billion gigabytes. Printed documents of all kinds make up only .003% of the total. Magnetic storage is by far the largest medium for storing information, and it is the most rapidly growing, with shipped hard drive capacity doubling every year.

Lesk (1997) used a statistical approach to find out how much written information is produced in the world. Extrapolating from figures on paper production and the U.S. gross domestic product, he estimated 160 terabytes were produced each year. These are impressive numbers describing a sea of information. Will the growth of that sea create excessive demands on human culture as some have warned? Lyman and Varian (2000) concluded in their study,

> [I]t is clear that we are all drowning in a sea of information. The challenge is to learn to swim in that sea, rather than drown in it. Better understanding and better tools are desperately needed if we are to take full advantage of the ever-increasing supply of information.

Should the information age be characterized by the sense of drowning in a sea of information or by new opportunities arising from a better supply of information?

Other Views

There Has Always Been an Information Overload

Humans have dealt with a permanent information overload in every aspect of their lives and in every part of their history. Because humans are incapable of universal perception, what we perceive is inherently selective. Information overload affects every human's perception.

Historical examples support the view that information overload is not a new phenomenon. Ancient writers and writers in the Middle Ages produced so much data that there was a permanent threat of overfilled information storages, which led to the development of new information processing techniques (Giesecke, 1992). There were similar fears after the invention of the printing

press. Concerns with information glut are the result of uncertainty during navigation of newly constructed information spaces, but they do not really depend on the particular amount of information.

Reduction of Complexity by Social Institutions and Cultural Techniques

Jelden (1997), a German philosopher, argued that in modern societies the reduction of complexity is helped by the division of labor and the selection criteria constituted by various institutions that filter information. Therefore, it is advisable not to lament an information glut but instead to be aware of how these new institutions develop.

Jelden used insurance agencies as an example of complexity-reducing institutions and argued that we are not able to live without these institutions. Technical tools may be less obvious examples in comparison with insurance agents, but they also reduce complexity. With the help of technical tools we are able to control electrical, chemical, and physical procedures we do not understand. Handling this lack of knowledge about things we do every day can be considered cultural techniques we have developed over generations. Without these cultural techniques and institutionalized selection criteria—and relying on individual natural ability—we would be unable to deal with even simple situations in daily life. That's why Anders (1961) talked about "The Outdatedness of Humans." The reduction of complexity by institutions can be seen as a substitute for human instinct.

History shows that wherever new opportunities for acting and thinking occurred, appropriate institutional procedures developed as well. For example, journalistic skills and rules for how to select information are now replaced by relevance criteria technically implemented in Internet search engines. It is as important now to reflect on selection criteria in these search engines as it was to be informed about journalists' work practices in order to judge information offered in newspapers. The politics of search engines are discussed by Introna and Nissenbaum (2000).

Jelden also pointed out that we should not be surprised that new filtering institutions are not completely reliable, nor have they ever been. One prerequisite of division of labor in a society is trust. Trust can never be based on knowledge (then it would not be trust anymore); it must be based on experience (Luhmann, 1979). We still have to create this experience in the information society.

Philosophical Dimension and Weltanschauung

Neil Postman's observation and prediction of a breakdown of coherent cultural narratives may be right. We are experiencing a less important role of homogeneous world views, and the big systems that explain the world—religion, science, and art—are losing their power. In many Western civilizations the major religions are losing their attraction as people find more individual substitutions. Even science, with an image of absolute reliability and exactness, has to admit that the absolute formulations of many laws are wrong (famous examples of paradigm shifts are Einstein's Theory of Relativity and Heisenberg's relations of uncertainty as opposed to classic physics), and at some point everything is based not on truth, but on basic assumptions. This rising pluralism and decline of concepts insisting on absolute truth can also be observed in the arts. Abstraction and ideas of postmodernism leave the artwork consumer with multifaceted options for interpretation.

How are these considerations related to information overload? The Austrian media philosopher Hartmann (1997) pointed out that hypermedia environments allow the desired recombination of decontextualized pieces of information. This matches the changes in the dimension of *weltanschauung* (a personal concept of the world). Hartmann stated that these additional opportunities and not the so-called flood of information are the actual result of new technologies.

Technical Extension

Human history is often viewed as a history of the extension of man. Explaining technology in relation to the human body has a philosophical tradition. Kapp, who published the first systematic philosophy of technology in Germany, looked at the human body as a basis for every invention. Technology for Kapp (1877) was an imitation of the body (e.g., the hammer is an imitation of the arm; optical devices rely on how an eye functions). Even Sigmund Freud described a human being as a "god of prosthesis."

This thinking leads to the idea of technology as a means of dealing with information overflow—technology as an extension of the brain. We can already observe the use of simple implementations. Imagine that the World Wide Web is printed out on paper, and you have to find a certain term manually. It would be almost impossible to succeed, but with the help of search engines it is comparatively easy.

Technology has been and will be a useful tool for managing information glut. Just mentioning buzzwords such as *artificial intelligence* and *information agents* gives the impression of further development. Not only pure technology but also design-related disciplines become more important. The growth of information architecture faces the challenge of increasing information. It deals with the design of organization and navigation systems to help people find and manage information more successfully (Rosenfeld, 1999).

Cognitive Adaptation

Adaptation to the requirements of the information glut could take place not only on the level of cultural techniques or technology, but also on a physiological level, at least in the long term. According to Rötzer (1999), researchers have discovered a brain area that is responsible for multitasking. Practice in using this area could certainly increase the ability to handle information overload.

How You Can Participate

Do you want to manage your information overload? Fox (1998) offers the following concrete advice.

- Do it now. The first rule for improving efficiency is to act on every item the first time you see it, hear it, or read it.
- Make the trash can your best friend.
- Keep a "not to do" list. What overwhelms many people is what they intend to do but never get around to doing.
- Set up organizing systems that work for you.
- Don't try to remember. Remembering, thinking, and worrying about future meetings and deadlines only distracts you from what you're doing now. It's better to have a good reminder system.
- Practice weekly planning—a week is the most practical unit of time to plan.
- Fill in the gaps in your Information Age skills. Most of us need to improve our ability to gather, access, process, and share information.

Glossary

The American Standard Code for Information Interchange (ASCII): the most common format for text files in computers and on the Internet. In an ASCII file, each alphabetic, numeric, or special character is represented with a 7-bit binary number (a string of seven 0s or 1s). There are 128 possible characters.

Einstein's Theory of Relativity: In 1905 Albert Einstein published his famous Special Theory of Relativity and overthrew common-sense assumptions about space and time. Relative to the observer, both are altered near the speed of light: Distances appear to stretch; clocks tick more slowly. Einstein's General Theory of Relativity is a separate theory about a very different topic—the effects of gravity.

Heisenberg's relations of uncertainty: Heisenberg formulated the relations of uncertainty concerning the simultaneous precise measurement of the position and velocity of microscopic particles and, consequently, the unpredictability of their behavior.

Invisible Web: This is the portion of the Web not accessible through Web search engines. It mainly consists of a broad variety of databases. Its content tends to be more qualitative and larger in comparison to the visible Web. Sometimes it is also called the deep Web.

Megabytes, gigabytes, terabytes, exabytes: A megabyte consists of 1,024 kilobytes, 1,024 megabytes are one gigabyte, and 1,024 gigabytes are one terabyte. One exabyte in turn is 1,024 times 1,024 terabytes. One terabyte is about the equivalent to the textual content of a million books. The number 1,024 is a result of the fact that computers use binaries (1,024 is 2 to the power of 10).

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