The Googlization of Universities

By Siva Vaidhyanathan

Siva Vaidhyanathan, a cultural historian and media scholar, is an associate professor of media studies and law at the University of Virginia and a fellow at both the New York Institute for the Humanities and the Institute for the Future of the Book. He has taught at Wesleyan University, the University of Wisconsin–Madison, Columbia University, and New York University. Vaidhyanathan earned a Ph.D. in American Studies from the University of Texas at Austin, after five years as a professional journalist.

Vaidhyanathan is the author of Copyrights and Copywrongs: The Rise of Intellectual Property and How it Threatens Creativity *(New York University Press, 2001) and* The Anarchist in the Library: How the Clash between Freedom and Control is Hacking the Real World and Crashing the System *(Basic Books, 2004). His most recent book is the edited (with Carolyn de la Peña) collection,* Rewiring the Nation: The Place of Technology in American Studies *(Johns Hopkins University Press, 2007).*

Vaidhyanathan has written for many periodicals, including American Scholar, The Chronicle of Higher Education, The New York Times Magazine, MSNBC.COM, Salon.com, openDemocracy.net, Columbia Journalism Review, *and* The Nation.

The relationship between Google and the world's universities is more than close. It is uncomfortably familial. Google has moved to establish, embellish, or replace many core university services such as library databases, search interfaces, and e-mail servers. Its server space and computing power opened up new avenues for academic research. Google Scholar has allowed non-scholars to discover academic research. Google Book Search radically transformed the vision and daily practices of university libraries. Through its voracious efforts to include more of everything under its brand, Google fostered a more seamless, democratized, global, cosmopolitan information ecosystem. But it also contributed to the commercialization of higher education and the erosion of standards of information quality.

These events occurred at a time when cost pressures on universities and their students spiked and when public support for universities waned. Google capitalized on a "public failure." A "public failure" occurs when a state reduces its commitment and resources to a public good or need. Such a retreat provides an opportunity for an ambitious firm to secure a market

advantage by assuming control of a service. The ubiquity of Google on campus has generated opportunity and anxiety. Unfortunately, universities allowed Google to set the terms of the relationship. This essay calls for a reversal of that trend. Universities must impose their values and interests on Google as the company assumes greater control over many aspects of information distribution.

A COMMON CULTURE

Universities gave birth to Google. So, there is a strong cultural affinity between the corporate cultures of Google and academia. Founders Sergey Brin and Larry Page met while pursuing Ph.D.s in computer science at Stanford University.[1] Page retains strong ties with the University of Michigan, where he was an undergraduate. Many visionary Google employees, such as University of California, Berkeley economist Hal Varian, suspended successful academic careers to join the company. PageRank, the foundational concept behind Google Web Search, emerged from an academic paper coauthored by Brin and Page in 1999.[2]

So it's not surprising that Google's corporate culture reflects much of the best of academic worklife: unstructured work time, horizontal management structures, multidirectional information feedback flows, an altruistic sense of "mission," recreation, and physical activity integrated into the "campus," and a surprisingly relaxed dress code. For decades, observers instructed American universities to "behave more like businesses." In Google's case, a stunningly successful firm behaves much like a university.

The core value that Google incorporated from academia: peer review—the notion that every idea, work, or proposition is contingent, incomplete, and subject to criticism and revision. This devotion is not specific to Google. All open source and free software projects, and much of the proprietary software industry, owe their creative successes and quality control systems to peer-review practices. In fact, the Internet is built on technologies emerging from peer-review processes. But Google, more than other firms engaged in public distribution of software and information, owes its existence to an embrace of peer review.

Google owes its success to the dominance of its Web search engine and to its ability to run simple auctions that place paid advertising spots alongside seemingly organically generated search results. Let's say you type "shoe store" into a Google search box. Google's PageRank algorithm sorts through Web pages containing the phrase "shoe store." It ranks these pages based on the number of other pages that link to those pages.

PageRank weights some sources of incoming links higher than others. The result, which takes mere seconds, is a stark list of sources based on relative popularity. Popularity stands in for quality assessment, but this is not merely a vulgar, market-based value at work. The same principle guides academic citation review systems. While working on citation analysis projects, Google's founders came up with the idea of applying such a weighting system to the chaos that was the World Wide Web.[3]

Nonetheless, "bibliometrics"—determining the value of a work by its echoes in others' citations—turned out to be an effective method of filtering and presenting Web search results. Google, Harvard law professor Yochai Benkler explains, became the market leader among search engines by outsourcing editorial judgment to the larger collective of Web authors—or, as Benkler puts it, to "peer producers."[4] Back in the late 20th century, every other search engine combined embedded advertising (site owners paid for good placement within searches) and "expert" judgment (search engine staff decided if a site was worthy of inclusion in the index). Google's search engine, notes Benkler, "treats links from other websites pointing to a given website as votes of confidence."

> Whenever one person's page links to another page, that person has stated quite

> explicitly that the linked page is worth a visit. Google's search engine counts these links as votes of confidence in the quality of that page as compared to other pages that fit the basic search algorithm. Pages that themselves are heavily linked-to count as more important votes of confidence, so if a highly linked-to site links to a given page, that vote counts for more than if an obscure site links to it. By doing this, Google harnessed the distributed judgments of many users, with each judgment created as a by-product of making his or her own site useful, to produce a highly valuable relevance and accreditation algorithm.[5]

The principle of bibliometrics is a controversial, troublesome topic within academic culture.[6] Widely used in the sciences for decades, its expansion to measure the presumed "impact" or "value" of humanities scholarship has generated widespread criticism, as much of the best work is published in books rather than a stable set of indexible journals.[7]

Including peer review in Google's corporate culture need not have come directly from university life. It could have come as easily from another field that shares a common ancestor with Google: the free and open source software world. Applications emerging from widespread, multi-author, collaborative environments have reshaped every element of the information creation and dissemination processes. Innovators built almost all e-mail systems, most Web servers, and an increasing number of Web browsers and computer operating systems without proprietary claims or controls. Promoting an ideology of open flows, constant peer review, and general freedom within a commercial structure, free and open source software advocates call for remuneration for services rendered rather than computer code delivered. The emergence from academia of many early free and open source software innovators explains the ideological continuity among Google, academic computer science departments, many profitable software firms, and powerful amateur communities that built and maintain the Internet and the World Wide Web.[8]

THE GOOGLIZATION OF STUDENTS

Paradoxically, the reliance on the principle of peer review within Google and its PageRank algorithm has undermined an appreciation for distinctions among information sources—at least among university students. Commercial Internet search services dominate students' information-seeking strategies, note two user studies conducted in the United Kingdom. The studies found that 45 percent of students choose Google as their prime search technology. Only ten percent made the university library catalogue their first choice. Students cited "ease of use" to justify their choice of a Web search engine over more stable, refined search technologies. They also expressed satisfaction with the results of the searches done with these search engines.

These results are not surprising. But one conclusion should trouble anyone concerned about the influence of Google on the information skills of university students: "Students' use of [search engines] now influences their perception and expectations of other electronic resources." Higher-quality search resources and collections are unlikely to attract students—and will frustrate students who stumble upon them—unless they replicate the reductive simplicity and cleanliness of Google's interface.[9]

How universal is the shift toward Google as a first and last stop in research? "Nearly three-quarters (73%) of college students," notes a 2002 study, "said they use the Internet more than the library, while only 9% said they use the library more than the Internet for information searching."[10] But phrasing and framing the question this way sets up a false distinction because most academic libraries already offered online access to library resources (especially journals) via "the Internet." Since 2004, in fact, many libraries have facilitated access when connected to a university network by

linking Google Scholar to their library collections. The notions of "library" and "Internet" have merged significantly for university students in the United States.

But we still lack a definitive verdict on the role of Google in student research behavior. A 2007 study conducted at St. Mary's College in California produced a contrasting set of results. "A majority of students began their research by consulting course readings or the library's Web site for online access to scholarly journals," the study showed. "To a lesser extent, students used Yahoo!, Google, and Wikipedia as first steps." Students found bibliographies and other aggregated or subject-based research resources the most fruitful places to start. Research assignments significantly challenged St. Mary's students, who considered themselves frustrated by unclear expectations and an inability to discriminate among sources for quality and relevance. "A majority of students were not as reliant on search engines, as prior research studies have suggested," wrote the study's author. "Only about one in 10 students in our survey reported using Yahoo! or Google first when conducting research. Only two in 10 students in our survey used search engines as a second step."[11] Students, these studies show, need substantial guidance through the information ecosystem. But universities are not yet providing the tools. Whether students start from course materials, Wikipedia, or Google, they need to know where to go next and why.

Tara Brabazon describes the research habits of her students in a substantial argument for better information literacy. "Google, and its naturalized mode of searching, encourages bad behavior," writes this University of Brighton (UK) professor.[12] Its seductive power—students perceive Google as comprehensive and authoritative—fools them into thinking that a clumsily crafted text search yielding a healthy number of results qualifies as sufficient research. Google may link students to millions of heretofore-inaccessible documents, Brabazon adds. But it does not teach them how to use the information they discover or how to distinguish between the true or false, dependable or sketchy, and polemical or analytical. Simple Web searches favor simple, well-established Web sites, so students are unlikely to discover peer-reviewed scholarship unless they access the obscure Google Scholar service. Even then, they must have the proper institutional affiliation to acquire the articles they find.[13]

These expressions of "operational literacy" encourage students to be "code breakers" of complex, multimedia works. But, Brabazon adds, these search engines do not nurture other important modes of literacy. One example: "critical literacy"—the ability to judge and distinguish among pieces of information and assemble them as new coherent works. Universities should not uncritically embrace the ideology of "access" and "findability," Brabazon concludes. Instead, they should supplement Google's ubiquitous power with curricular changes emphasizing critical literacy. "Critical literacy remains an intervention, signaling more than a decoding of text or a compliant reading of an ideologue's rantings," she writes. "The aim is to create cycles of reflection." Producing sound arguments, interpretations, and analyses, she concludes, is more challenging in the age of constant connectivity and information torrents.[14]

There is no reason to believe that Google will recede in importance in students' lives. Nor should we celebrate Google's pervasive influence as an unadulterated boon to the learning process. Understanding what this new information menu offers students (and the rest of us) requires research leading to more effective strategies for living well in this new environment.

THE GOOGLIZATION OF SCHOLARSHIP

Google Scholar—a broad but shallow access point to academic work released in 2004—is a side project for the company. Google convinced hundreds of suppliers of electronic scholarly resources to open their indexes to its "spiders," thereby allowing the included articles to

be scanned, copied, and indexed. Publishers benefit because non-academic reading communities gain exposure to their articles (as do academic institutions lacking contracted access to the home-grown search engines). Google Scholar offers something unique among academic resource search engines: The same keyword search offers links to works in areas as diverse as materials science, biophysics, computer science, law, literature, and library science. Vaidhyanathans, for example, publish in all these areas.

But Google constructed Google Scholar with the company's usual high level of opacity and without seriously considering the needs and opinions of academic librarians. The library community criticizes the lack of transparency about how the engine ranks and sorts works, the unevenness of collections and the undependability of results, and the lack of granular detail that librarians and scholars often demand of a search interface to find a needed article. The greatest and most interesting strengths of Google Scholar are breadth of coverage and ease of use. But these strengths generate its greatest flaws: lack of depth and precision.

The service is a boon to students and lay researchers but of limited utility to scholars. One study of its collection and service discovered that Google Scholar lagged almost a full year behind indexing works published in the leading PubMed collection. "No serious researcher interested in current medical information or practice excellence," the study concluded, "should rely on Google Scholar for up-to-date information."[15] North American publishers have been most aggressive at including their works within Google Scholar (or perhaps vice versa). Many non-English works therefore fail to show up on the initial pages of it search results. Literary and social science scholarship in German, for instance, significantly suffers among users of Google Scholar.[16]

Research and citation behavior also change as more journals move online. Scientific literature cited fewer and newer sources between 1998 and 2005, notes a 2008 study, as more journals came online. Forcing scientists to peruse bound volumes of old journals encouraged serendipity and a deeper acknowledgement of long-term debates within fields. Researchers are now more likely to echo prevailing consensus and to narrow the imagination on which research relies.[17] Google Scholar intensified this problem.

The mystery of why one paper appears above another in Google Scholar searches does not help. "Google Scholar aims to sort articles the way researchers do," the "About Google Scholar" website explains, "weighing the full text of each article, the author, the publication in which the article appears, and how often the piece has been cited in other scholarly literature. The most relevant results will always appear on the first page."[18]

This explanation is insufficient for three reasons. First, the principle at work biases science and technology works above articles in the social sciences and humanities. The lattice of article citations makes up a more solid structure in the sciences than in the humanities, where influential work often appears in books.

Second, citation counts do not indicate absolute value, even in the sciences. A high number of citations might indicate that an article stands as prevailing wisdom or consensus within a field, and thus serves as foundational. Or, just as likely, a high citation count might suggest that an article is suspect and open to question. These articles do not have equal absolute value, and Google should not imply that their rankings result from the same intellectual process.

Third, results are likely to come from divergent fields because Google Scholar uses full-text indexing and searching. A search for "human genome project" yields many meta-scholarly articles—works that describe or analyze the human genome project from many perspectives. The articles on the first page of results are from or about major figures in the field, such as James Watson and Frances Collins. But the initial results do not yield scientific articles

employing the human genome database. One must search a specific term or gene to identify those articles. A search for "whale oil" could yield results from agriculture journals, ecology journals, or an article about Herman Melville's *Moby Dick*.

Studies comparing Google Scholar to other commercially available search indexes for scholarly material consistently demonstrate Google's inadequacies. But the company will remain front-and-center among faculty and students.[19] This position makes information assessment skills more important than ever. Google Scholar ranks serve as proxies for citation analysis to assess impact of scholars on their fields. Google, therefore, might directly affect the future employment of tenure-track researchers. Google Scholar makes the role of librarian central to and more visible within every part of the academic mission. The more we use Google Scholar, the more librarians must help us stumble through the fog of data and scholarship that it offers.

THE GOOGLIZATION OF BOOK LEARNING

Google Scholar is a clever experiment and a value-added feature that helps democratize specialized information for a broader readership. But Google Book Search is a monster project that has radically altered the roles of publishing and librarianship. Since 2004, Google has scanned in millions of books from academic libraries around the world, including copyright-protected books. Lacking the permission of copyright holders, the company faced a potentially massive number of cases of willful infringement.[20] In late 2008, Google settled lawsuits brought by the American Publishers' Association and the Authors' Guild. The settlement absolved Google of the potential liability for infringement. It also gave the company a virtual monopoly on the electronic distribution of many millions of out-of-print yet in-copyright books from the 20th century.[21]

The Google Book Search settlement leaves Google as the only viable player in the book-scanning game. Academic libraries had participated in ad-hoc efforts to scan, preserve, and open their book collections to a wider readership since the 1980s. Microsoft and Yahoo had helped the not-for-profit Open Content Alliance scan books from a small number of academic libraries.[22] But it has been hard, if not impossible, to argue for a diverse array of participants once Google entered the race in 2004 with a financial commitment exceeded only by its ambition. After the settlement, in which the company effectively set the price for royalty distribution to copyright holders for books downloaded from the system, Google stands alone.

The effects on universities are twofold: First, there is now no legal risk in permitting Google to scan copyrighted books in their collections. Second, Google has pledged to place "Google Book Search" terminals in public and university libraries across the U.S. Many libraries lacking the funds or space to build large book collections will enjoy electronic access. But we must watch out for significant secondary effects to these changes. Many libraries could remove books from their collections if they consider electronic access via Google to be sufficient. There is a greater concern: the possible inclusion of a Google-owned and operated electronic bookstore with a vending machine in every otherwise non-commercial U.S. library. The commercialization of academia is not a new story. But it remains a troubling one. Inviting Google into the republican space of the library challenges its core purpose: to act as an "information commons" for the community in which it operates.

THE GOOGLIZATION OF RESEARCH

Google's major advantage over almost every other information firm is its massive server space and computing power. The scale of Google's infrastructure is a company secret. But giving two gigabytes of server space to each Gmail user for storing e-mail archives suggests that its formidable server farms are of historic proportions. Google's remote storage

space is large enough and its computing power fast enough to host and contribute to massive academic research projects. In October 2007, Google and IBM established a server farm devoted to research projects demanding huge data sets and fast processors. The University of Washington was the first computer science department to use the Google-IBM resources. Carnegie Mellon University, the Massachusetts Institute of Technology, Stanford University, the University of California, Berkeley, and the University of Maryland soon followed. Researchers at Washington use servers equipped with suites of open-source software to run complex analyses of Web-posting spam and geographical tagging.[23] In March 2008, the National Science Foundation agreed to vet research proposals for projects that employed the Google-IBM service.[24]

The benefits to researchers and their universities are that no single university can afford the servers and processors needed to conduct scientific analysis on this scale. Researchers can collaborate and coordinate their efforts globally by computing in "the cloud"—using distant servers accessible through inexpensive personal computers connected through Internet-like networks. Combining the brain and computing power of Google, IBM, and universities promises faster and cheaper big science.[25]

The benefits to Google and IBM are that these two companies and academic researchers hope to solve many of the same computational problems. This project gives the companies easy access to the body of knowledge researchers generate while using these systems.[26] In keeping with Google's traditions and values, nothing about this project suggests that the company claims exclusive rights to work done with its help. But university officials often must sign non-disclosure agreements ensuring that Google's competitors do not obtain a clear picture of co-sponsored activities.

Computing in "the cloud" is empowering, yet worrisome. One downside is the tangle of rights claims that a widespread collaboration among individual researchers, university technology-transfer offices, and two or more major computer companies can generate.[27] A confusing, complicated set of claims risks years of litigation *and* anti-trust scrutiny.

Wired, the magazine that regularly generates such hyperbole, declares cloud computing and massive, distributed computation the next great intellectual revolution. The ability to collect and analyze almost unimaginable amounts of data, writes editor Chris Anderson, almost renders the standard scientific process of hypothesis-data collection-testing-revision-publication-revision obsolete. "Sixty years ago, digital computers made information readable," Anderson continues. "Twenty years ago, the Internet made it reachable. Ten years ago, the first search engine crawlers made it a single database. Now Google and like-minded companies are sifting through the most measured age in history, treating this massive corpus as a laboratory of the human condition. They are the children of the Petabyte Age."

> The Petabyte Age is different because more is different. Kilobytes were stored on floppy disks. Megabytes were stored on hard disks. Terabytes were stored in disk arrays. Petabytes are stored in the cloud. As we moved along that progression, we went from the folder analogy to the file cabinet analogy to the library analogy to—well, at petabytes we ran out of organizational analogies.
>
> At the petabyte scale, information is not a matter of simple three- and four-dimensional taxonomy and order but of dimensionally agnostic statistics. It calls for an entirely different approach, one that requires us to lose the tether of data as something that can be visualized in its totality. It forces us to view data mathematically first and establish a context for it later. For instance, Google conquered the advertising world

> with nothing more than applied mathematics. It didn't pretend to know anything about the culture and conventions of advertising—it just assumed that better data, with better analytical tools, would win the day. And Google was right.[28]

Anderson's techno-fundamentalism belies his vested interest in the narrative of the revolutionary and transformational power of computing. But he stepped out beyond the pop sociology and economics that usually dominates the magazine. "Correlation is enough," Anderson claims.[29] The process of generating scientific (or, for that matter, socially scientific) theories and modestly limiting claims to correlation sans causation is obsolete and quaint. Given enough data and enough computing power, Anderson argues, you can draw strong enough correlations to claim you have discovered knowledge.

The risk is more than intellectual hubris, something all too present in the academy. The passions and promotion of such computational models for all types of science heightens the risk of diverting precious research funding and initiatives away from the hard, expensive, plodding laboratory science that has worked brilliantly for three centuries. Major university administrations are already shifting resources from lab space to server space. The significant, valuable, and potentially revolutionary knowledge generated by massive servers and powerful computers should not come at the expense of tried-and-true methods of discovery that lack the sexiness of support from Google and an endorsement from *Wired*.

HOW SHOULD UNIVERSITIES MANAGE GOOGLE?

So far, Google has called the shots. Every few months, it seems, the company approaches universities with an initiative that promises stunning returns for the academic equivalent of "no money down." Since 2006, Google, Microsoft, and Yahoo have competed to take over university e-mail services. The winning company locks in students as lifetime e-mail users. It can also mine the content of e-mails for clues about consumer preferences and for techniques for targeting advertisements.[30] Relieving universities of the cost of running e-mail servers that limit user storage space to a few megabytes is almost too attractive to pass up. But we should not let one rich, powerful company set our research and spending agenda because we—unlike Google—are strapped for cash. The long-term costs and benefits should dominate the conversation. We should not jump at the promises of quick relief or returns.

The story of Google's relationship with universities is not unlike the tragedy of Oedipus Rex. Since its birth, Google, overflowing with pride, has been seducing its alma mater—the American academy. If Google is the lens through which we see the world, we all might be cursed to wander the Earth, blinded by ambition.

NOTES

[1] Stross, 2008, 8-10.

[2] Page, 1999.

[3] Battelle, 2005.

[4] Benkler, 2006.

[5] Benkler, 2002.

[6] O'Connor and Voos, 1981; Kosmopoulos and Pumain, 2007; and Hendrix, 2008.

[7] Al, Sahiner, and Tonta, 2006; Archambault and Gagné, 2004.

[8] Weber, 2004.

[9] Griffiths and Brophy, 2005.

[10] Jones and Madden, 2002.

[11] Head, 2007.

[12] Brabazon, 2007, 16.

[13] Ibid, 45.

[14] Ibid, 28-30.

[15] Vine, 2006, 97-99.

[16] Mayr and Walter, 2007.

[17] Evans, 2008.

[18] "About Google Scholar," 2009.

[19] Callicott and Vaughn, 2006; Jasco, 2005.

[20] Vaidhyanathan, 2007. For the opposing argument on the infringement question, see Bracha, 2007.

[21] Grimmelmann, 2008; Lessig, 2008; and Netanel, 2008.

[22] Open Content Alliance, 2008. Microsoft withdrew support in 2008.

[23] "Google and IBM…," 2007.

[24] "NSF partners with Google…," 2008.

[25] Young, 2008.

[26] Lohr, 2007.

[27] Young, 2008.

[28] Anderson, 2008.

[29] Ibid.

[30] Young, 2006.

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