Libraries and the network:
Some considerations on how libraries are affected by the network

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Abstract: While the effects of the internet on libraries was recognized relatively early, few works have addressed network dynamics in terms of library operations. This essay identifies some implications of the shift to a networked environment and its effects on library operations, with the express aim of initiating a dialog within the profession about its broader significance. Understanding this shift, with its threats and opportunities, is critical for planning the future of libraries.

Until the beginnings of the 1990s libraries functioned in isolation, notwithstanding numerous collaborative projects among libraries. The services in any one library were replicated in most others, while patrons accessed the contents and services by physically interacting with the local library. Redundancies that existed locally, regionally or nationally played no role in the patron's experience. Thus each library offered its own menu of services that were, by and large, identical to all the others, like islands in the sea of information. This situation changed dramatically once the internet linked these institutions to each other[1]. Since the 1990s, they have become players on the internet, and, in doing so, libraries became nodes in an information network.[2]

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[1] In the mid-1990s Crawford and Gorman still argued that "The role of libraries has not changed in the past 500 years and will not change in the future: acquisitions, curation, and making information available to our patrons however the information appears and helping users who want to access it…" Crawford, W. – Gorman, M. (1995): Future Libraries: Dreams, Madness and Reality, Chicago and London, American Library Association, 198 p.

[2] See: Kokas and Sennyey "Könyvtárak a hálózatban (Hogyan változtatta/változtatja meg a könyvtárak jelenét és jövőjét a számítógépes világhálózatba kerülés?)" *Tudományos és Műszaki Tájékoztatás* (November 2011 No 58).

The network's effects on libraries were recognized relatively early, by Lynch – ever the perspicuous observer of our field[3]. The scholarly literature on this topic can be grouped into works that have concentrated on library applications made possible by the network, like the works of Kroski[4], articles that focused on user behavior on the network, like the works of Gibbons[5], Shonfeld[6] and Palmer[7], and works on technological trends resulting from the network, like those of Dempsey[8]. But in the past decade a number of scholars, especially in physics and economics, have come to recognize that networks have a dynamic of their own, with predictable behaviors and effects. The works of Barabásy, Newman, Duncan and Jarvis, among others, are relevant in this area[9]. OCLC's *Libraries at Webscale, a discussion document*[10] is a critical document in raising some issues associated with webscale, but few works have addressed network dynamics in terms of library operations; there are no systematic studies of its effects, laws and how they affect libraries.

The purpose of this essay is to identify some of the implications of this shift to a networked environment and its effects on library operations, with the express aim of initiating a

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[3] Clifford A. Lynch, "The Academic Library in the Networked Information Age," Mark A. Luker, ed., *Preparing Your Campus for a Networked Future* (San Francisco: Jossey-Bass Publishers, 1999), pp. 15-28.

[4] Ellyssa Kroski "On the move with the mobile web: Libraries and mobile technologies" *Library Technology Reports* (vol 44, no. 5 July)

[5] Susan Gibbons. The Academic Library and the Net Gen Student: Making the connections. (Chicago, ALA. 2008)

[6] Roger C. Schonfeld and Kevin M. Guthrie, "The Changing Information Services Needs of Faculty," *Educause Review* (vol. 42, no. 4 (July/August 2007): 8–9). Schonfeld has also conducted a number of user surveys, which have informed his research.

[7] Palmer, Carole L., Teffeau, Lauren C., & Pirmann, Carrie M. "Scholarly Information Practices in the Online Environment: Themes from the Literature and Implications for Library Service Development". Dublin, OH: OCLC Research and Programs.(2009)

[8] Lorcan Dempsey has been prolific in this arena and is perhaps the preeminent authority in the matter in library sciences, see: "Always on: Libraries in a world of permanent connectivity" *First Monday* (Vol 14, no 1-5 January 2009), numerous monographs, conference sessions, and his blog at http://orweblog.oclc.org/

[9] Newman, Mark, Barabási, Albert-László, Watts, Duncan. *The Structure and Dynamics of Networks* (Princeton, 2006), Barabási, Albert-László. *Linked : how everything is connected to everything else and what it means for business, science, and everyday life* (Plume, 2003). Jeff Jarvis. *What would Google do?* (Harper Collins, 2009).

[10] *Libraries at Webscale. A Discussion Document.* (OCLC) 2011, which actually covers very different ground from our work.

dialog within the profession about its broader significance. Understanding this shift, with its threats and opportunities, is critical for planning the future of libraries. This essay will concentrate on academic libraries, this being the authors' expertise, though we believe that our observations are applicable to other types of libraries as well.

To consider the implications of this shift, this essay has three parts: Part I. will use the following axioms as a starting point:

a) The network catalyzes an abundance of information

b) On the network there are no boundaries

c) On the network the winner takes all

d) On the network flat structures predominate

Part II. evaluates potential now roles made possible by the network, and in Part III. we examine some of the uncertainties about the nature of the network. These uncertainties, underlie common assumptions held by the profession.

I.a. The Abundance of Information

Traditional library structures and workflows were optimized to manage an earlier environment of information scarcity. But on the network the creation, uploading, downloading, replication and transmission of information has become easier, cheaper and faster. Today, libraries operate in an environment characterized by information abundance. And in the midst of this abundance, most information needs of the user are easily met, the threshold of satisfaction is easily reached. At a surface level, searching has become a trivial undertaking, even if precision and efficient discovery remains a complex challenge. The result is a tension between simplicity

and precision as reflected in librarians' efforts to continuously strive for precision at the expense of simplicity, whereas patrons long ago decided that the emphasis should be on the opposite pole[11].

Finding information, even outside of the traditional boundaries of the library, has become easy[12]. The question is how to redirect patrons from the web towards library services and collections. Link resolvers and Google Scholar are steps in this direction, but linking the user back into the library's collection remains an unmet challenge. All too often, link resolvers lead patrons through a maze of links, which only further the tension between precision and simplicity. We must recognize that in addressing this conundrum, the profession has yet to make a breakthrough[13]. This is taking place even as libraries spend fortunes on collections for patrons who "live" in the Google-Facebook axis in their virtual existence, and whose first reflex is to search for scholarly information on Google before they turn to the library[14].

In the midst of this abundance, patrons face an unprecedented array of choices in the quest for information. And yet, cognitive psychologists have known that there is a point of diminishing returns when it comes of choices – a point that causes dissonance, rather than satisfaction[15]. Such environments call for filters and recommendation systems, subjects that deserves much attention from the profession. The questions then are who will filter and when? In effect libraries have been filters by virtue of their limited ability to purchase materials, but on the

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[11] "Only librarians like to *search*; everyone else likes to *find*." Roy Tennant, "Avoiding Unintended Consequences," *Library Journal* 126, no. 1 (2001): 38.
[12] See: "A Study on the Usage, Application and Value of Online Books on ScienceDirect in an Academic Enviornment" (Elsevier, Interim Results July 2010) (http://info.sciverse.com/UserFiles/A_Study_Usage_Application_Value_Online_BooksonScienceDirect.pdf) (add 10-20 words here summarizing the study's point/findings, for the reader.)
[13] An interesting example of such development is www.LibX.org, a browser plugin
[14] Alison J. Head and Michael B. Eisenberg "Truth be Told. How College Students Evaluate and Use Information in the Digital Age" *Project Information Literacy*. November 1, 2010 (The Information School, University of Washington).
[15] For a popular treatment of the issue see: Barry Schwartz's *The Paradox of Choice* (Haper Colling, 2004)

network, users can access information outside the boundaries of the library's collection and filtering has fallen on the shoulders of our users. The ongoing evolution in scholarly communications, made possible by the network, such as the proliferation of pre-print sites, e.g., www.ArXiv.org and www.RePEc.org, accentuates this shift of filtering. The opposite of this issue is the question of sufficiency: at which point is the information, and the choices, available to the patron sufficient?

The issue of web scale is critical, for the network has ushered in scales that were inconceivable in its absence. Libraries are having a tough time balancing protocols that fit the new scales. The best example of this is the Web 2.0 wave, which so many commercial entities capitalized on so successfully (like Amazon.com and Netflix). But in libraries, where there were so many experiments, Web 2.0 has remained an unfulfilled possibility. We suspect that one of the most important reasons for this lack of traction in libraries is that we have remained attached to the premise that libraries are islands: as if we were independent of each other; as if our patrons could not navigate between libraries; as if they were unique to each campus. And yet, Web 2.0 implementations require a certain critical mass, a scale that no single library is capable of tapping by itself. In effect we will only be able to tap on such a mass of users, if we are also willing to share data between ourselves. It will be interesting to pay close attention to the product development path of OCLC's WorldCat Local, since this is one library project that at least purports to target a web scale community from its inception.

Another aspect of the network is that advantage lay in the hands of the players that best understand the customers (users or patrons). Thus Google has been collecting user data for over a decade, and has an understanding of our habits and predilections, sometimes to remarkably personal (and eerie) levels. This is of strategic importance to Google (and all other network

players) since its products are built (and abandoned) based on this data. In an environment of abundance, filtering and recommendation systems are of critical importance, and yet they are not possible to implement without this detailed understanding of the patron community. Paradoxically, Facebook's struggles with this issue in the past few years shows that current users have a remarkably elastic tolerance to having their personal information shared on the network[16]. All the while, libraries remain attached to the notion that our patrons should enjoy complete privacy, so much so that our systems deliberately deny us the option of understanding them well enough to inform our strategic decisions.

Consequently, libraries barely know their users. It is only recently that anthropologists[17] have been hired in an effort to better understand our users, even though a treasure trove of information is deleted every time a patron returns a book. Might this not be an obsolete attitude? Might there not be nuances of privacy and of data usage that would allow libraries to better understand its patrons without compromising their legitimate claims for privacy? The days in which we can remain competitive without some compromises on this front seem numbered.

I. b. The Absence of Boundaries

There are no islands on the network. We now operate in an environment in which the transmission of information has become more important than the means of transmission, the storage location, or ownership. Historically collections distinguished libraries from each other. The size and quality of the collection reflected the uses and strengths of a given library, the caliber of the institution. The services that the library offered were a direct consequence of its

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[16] Danah Boyd and Eszter Hargittai. "Facebook privacy settings: who cares?" *First Monday* (Vol 15, no. 8 2 August 2010).

[17] Foster, Nancy Fried, Gibbons, Susan. *Studying students: the Undergraduate Research Project at the University of Rochester* (Chicago: Association of College and Research Libraries, 2007)

collection. But on the network, collections have become virtualized and a rich, well-organized, virtual collection, surrounded by relevant services, easily supplants the patina of even the oldest physical collection in the patron's experience.

On the network, collections have ceased to be the distinguishing characteristic between libraries. Instead collections have become homogenized, as most libraries can access very similar content – and in states with successful consortial initiatives, like OhioLINK, even the poorest libraries have access to research collections. In theory, even geographically isolated, financially disadvantaged libraries can offer their patrons collections of a size and depth that had not been possible hitherto.

The network forces a new calculus of the relative value of services by making it possible to deliver them locally or over the network. Today, the cost-benefit of offering a given service at a local level, as opposed to delivering it over the network, has to be computed. In other words, the first library that offers a virtual service to a networked community may render local service-providers unnecessary. Progress in this area has been uneven: the delivery of reference services has been halting, but it has been successfully implemented in the delivery of inter-library-loan. This introduces a tension between local and networked interests.

Likewise, if a collection has already been digitized, then there is decreasing value in digitizing it anew. It is simply senseless to replicate digital content on the network, unless the new version adds enough additional value over the previous to warrant the costs. Cataloging efforts fall in the same category, as do collection development carried out at the local level. Outsourcing has become common practice in the profession in many areas and the network allows this trend to be extended.

On the network , physical, geographical and political boundaries have become ambiguous. This is well illustrated by the fact that governments (democratic and authoritarian ones alike) are struggling to control the flow of information over the network, and their efforts have had mixed results. This fact is felt in libraries as information is now ubiquitous and yet legal limitations affect users' access differently. Even if information may be free and legal in one nation, it may be illegal and secret in another, though the network makes the transmission of information across political boundaries seamless. In such an ambiguous environment, the enforcement of laws, like copyright, becomes nebulous and its challenges are magnified by the divergence of local and global interests, since both are now playing on the same network. For example, efforts by smaller nations to protect their language and culture are in conflict with the interests of larger, more influential, and better financed players – whose heft allows them to dictate terms and their preference for global homogeneity.

I.c. The Winner Takes All Network[18]

Competition on the network is merciless. Before the network, libraries were a local monopoly where patrons who needed information had to learn the norms of the given library and abide by its rules, or go home without the needed information. This long-held monopoly disappeared in a mere two decades as new players now compete for patrons' attention and time. Many of these new players, like Google, have changed the landscape by innovating and challenging assumptions long held by libraries. In quick succession these players have reached remarkably strong positions in the market for information, creating not only powerful tools, but becoming associated with life style choices about which libraries had not even dreamt, much less participated in.

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[18] Frank and Cook. *The winner take all society* (Free Press, 1995)

The evidence suggests that the winner in this environment takes it all, though paradoxically the winner is also vulnerable, since the barrier of entry is low[19]. This contention has been controversial. On the one side are those who argue that a new idea, a new product or design, a new algorithm that meets a general trend may overwhelm the current market leader. On the other side are those who point out that in recent years network effects and the infrastructure investments that sustain market leaders, i.e., server farms, represent a sizeable barrier of entry. Nevertheless, the investments necessary for challenging a current leader may not that high, as witnessed by the meteoric emergence of a number of enterprises born in California garages or Boston university dorms[20]. On the network, incumbents have a huge advantage.

Libraries are now integral players in this competitive environment. But in retrospect, libraries have underestimated the emergent players – witness the scorn many librarians still level against Wikipedia, and the torrent of criticism against Google – but this professional haughtiness has not brought patrons back to the library. It seems many of our colleagues still do not recognize how thoroughly these new players have altered the marketplace of information where once libraries had comfortably established livelihoods. Yet these new players are expanding their activities into the realm of scholarly literature, i.e., Google Scholar; we better take them seriously.

I.d. The Flat Network

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[19] Nir Eyal argues in "The Next Secrets Of The Web" via TechCrunch on 6/23/2012 that "Software production doesn't offer scale cost advantages, the patent system is a mess startups can't afford to navigate, and spending on branding prematurely is foolish." see
http://techcrunch.com/2012/06/23/the-next-secrets-of-the-web/
[20] Chris O'Brien. "Google's grip on users is as firm as it is invisible" in Siliconvalley.com (posted on 10/1/2011). The case of Google's grip on the market will be settled in court in the ongoing case against it.

The network gives preference to flat organizational structures. Organizational hierarchies have two basic objectives: to maintain and to enhance the workings of the organization, and to control the flow of information and workflows within the organization. In fact, today it is not the flow of information that represents the main organizational challenge, but rather the timely consumption and processing of the torrent of information so easily accessible. With this, the balance between the benefits of hierarchies and the difficulty of hierarchical decision making, is swayed.

Similarly, in a networked environment the role of intermediaries is devalued. We should not lose sight of the fact that libraries are themselves intermediaries in a complex web of players that stand between the author and the reader. In a non-networked environment, these intermediaries were indispensable for the production, distribution, marketing and accessing of scholarly information. They were the ones who catalyzed and accelerated the dissemination of information, connecting the author to the reader. This characteristic of the network has been well illustrated by cases such as the role Netflix has played in dethroning local video rental companies, and the role Amazon.com is having on brick and mortar bookstores. Amazon is playing a similarly disruptive role with publishing houses, as it creates products that allow authors to self-publish.

II. New Roles?

Although our thesis is that the network has disrupted the landscape of scholarly information, we are not prepared to argue that libraries have reached an end point in their evolution. Rather, a more useful perspective might be to consider this an inflection point[21] at

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[21] Grove, Andrew. *Only the Paranoid Survive: How to Exploit the Crisis Points that Challenge Every Company.* (Random House, 1996). p. 32.

which structural changes are required for libraries find new roles and new purposes in the new environment. It is our conviction that the network opens doors to new opportunities.

Those who woke up to its possibilities early, and understood the new paradigm, have been rewarded by success. Amazon.com, Wikipedia, YouTube, Facebook are but a few examples of companies that have tapped into a larger user-base than libraries were ever able to reach in their long history. They are also willing to take on new risks and were willing to accept "good enough" solutions rather than being immobilized by a desire to accept only perfect solutions.

There is scant justification for the argument that libraries cannot compete, or cannot succeed, in a competitive environment. All academic libraries exist in an environment in which innovation and research are the norm. It is thus logical to surmise that academic libraries are well positioned to participate and take risks in order to compete in delivering services to researchers and instructors alike. This is a matter of leadership and professional attitudes rather than facts on the ground.

Let us consider a few such new roles:

1. The argument that academic libraries are guardians of the cultural patrimony also means that is incumbent on them to deliver those treasures in relevant ways. Libraries are not meant to become museums, much less museums of obsolete technologies for information delivery, like microforms, print journals and print books. Information is a dynamic, not static, asset. Services that link together the currently disjointed wealth of information to create novel forms of inquiry have a chance of being much valued by the academy.

2. The future of the network will likely lead much of scholarly information into the cloud following the journal collection. This does represent another shift in the terrain in which

libraries can devise new services and functions. Libraries are well positioned to take advantage of network effects, to the benefit of their patrons.

3. The tempo of digitization projects could be accelerated. Today's scanning technologies allow for millions of items to be digitized rapidly. It is not absurd to implement the digitization of a nation's entire cultural corpora in a few years. But for the end-product of such projects to be useful, metadata remains a critical, time-consuming, and expensive step, for which human intervention is still necessary. This should be delivered by librarians, whose expertise could be applied for such projects -- this is not to deny the need to carefully calibrate metadata by cost-benefit analyses, or to apply automation wherever possible.

4. Libraries also have a possible role to play in archiving and curating existing databases, such NanoHub.org or ArXiv.org. Similar centers of scholarship can still be developed in the many disciplines lagging in the adoption of digital information.

5. The network opens up the opportunity for libraries to join forces and establish collaborative initiatives both among libraries, and, with commercial entities. There are many precedents for both, but they are still not the norm, and best practices have not emerged. And yet, cloud computing, mobile technologies and the fast pace of technological development that drives so many facets of patrons' interaction with information, represent untapped possibilities for most libraries.

III. What We Still Cannot Know

We are aware that the sketches articulated above are based on a continuously changing environment. The network itself is young and immature leading to a host of questions. Among these, the following are worth closer examination:

Is the network flexible or brittle? It appears that the network is flexible (the original ARPANET was designed to survive a nuclear conflagration). It has grown by orders of magnitude larger than its original design and it has remained remarkably stable. But there are clouds in the horizon: the network, as is becoming increasingly clear, can also be used for military purposes where it has acquired strategic importance. It has become a tool for secret services around the world, as well as for illegal and terrorist activities. This list should include industrial espionage and sabotage, both privately and state sponsored (like the Stuxnet virus), state sponsored surveillance and censorship (like in China and in England)[22] etc. These are new and darker aspects of the network, which could darken its future for scholarly applications as well[23]. These suggest, that despite its stability and constancy, the trust we have laid on it may be misplaced, and that the network has a fragile facet as well. But it seems safe to state that for as long as these darker elements do not take over the network, its flexibility is one of its most important qualities.

Is the network safe or dangerous? Whether scholarly information be entrusted to live on the network over the long-term does not have a simple answer. It may appear to the uninitiated that the network is a secure means to store and transmit information and that for the foreseeable

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[22] James Bamford "The NSA is Building the Country's Biggest Spy Center (Watch What You Say)" in <u>Wired Magazine</u> (March 15, 2012). See also Juan Cole's reaction "America's new data center: The Biggest Big Brother of All (TBIJ) in Informed Comment Blog posted on 04/08/2012 see http://www.juancole.com/state-of-surveillance.

[23] This issue raises questions about the relationship between the state and the network. See David Eaves blog Eaves.ca **"The End of the World: The State vs. the Internet"** 18 June 2012 at http://eaves.ca/2012/06/18/the-end-of-the-world-the-state-vs-the-internet/

future it can be considered a reliable and trustworthy part of the infrastructure. But if we examine the amount of private information that is available about our virtual existence, the network suddenly appears less safe. The myth of freedom that surrounds the network engenders its own paradoxical opportunities for abuse – either at a private or a state level. Despite these clear risks, the amount of information that is uploaded onto the network continues to grow exponentially as cloud computing gains in importance. The amount of financial transactions that take place over the network is an illustrative example. For many commercial players, the network represents their lifeline as they have become dependent on it, amounting to a growing percentage of economic activity the world over. Given the constant improvements in security and the stakes in its continual safety, it seems worth the risk to place the scholarly record there. It is also important to remember that even physical libraries were not immune to dangers from natural disasters or wars.

Does the network depend on structured metadata for optimal performance? It is a central question whether the network is capable of working well without structured data, or whether it has to rely on structured metadata for optimal performance. The evidence suggests that despite many objections raised by librarians, the network can work just fine with unstructured data. To be more precise, the network is capable of functioning *well enough* without structured data. This has remained a painful issue for the profession, which continues to look askance at the imperfections of unstructured data, all the while desiring to replicate the perfection believed to have been attained in library systems. But we ought not lose sight of the fact that MARC and AACR2 are riddled with imperfections and compromises, that they are expensive, and, in many respects, obsolete. In this matter there may not be a perfect solution at all, only a continuum of improved performance.

The conundrum of metadata is well illustrated by Google's singular success. Obviously its search engine is not as perfect as it would be if all information were meticulously structured by the most rigorous metadata protocols -- thus our earlier recognition of the importance and value of metadata. Nevertheless, we can affirm that Google's automated indexing, with all its imperfections, has to be weighed against the costs of our hand-crafted metadata ideals. We must also recognize that our protocols were not designed for the scale of information that now exists on the web, and may therefore be altogether impossible to implement. At the end of the day, models that work well – however short of the ideal – are much better than perfect models that cannot be implemented.

Would libraries benefit or would they lose in case net neutrality were compromised? It is not altogether inconceivable that the concept of network neutrality will be breached. Such development would not only affect the threshold of entry into the market, solidifying the position of the current players, but libraries could also be the losers in such scenario. For libraries, have not had to pay extra for the considerable bandwidth its users take up for normal operations. This issue raises a number of questions that deserve closer attention by our profession. If net neutrality were to disappear, how would our patrons relate to the network, to libraries and to scholarly information? And what financial implications for the library budget would result from the loss of net neutrality?

How will the evolution of a network that knows no boundaries affect the evolution of national copyright laws? Copyright has been challenged in the networked environment with a direct impact on the flow of scholarly information. One must raise the question of whether the internet in fact damages authors' rights at all? Although the lawsuits initiated by the Authors' Guild against both Google and the Hathi Trust seems to suggest so, in the world of music, which

was a forerunner in experiencing the impact of the network, it was not musicians but rather the record labels and the distributors that suffered the consequences of a disrupted market. Musicians are doing just fine having found ways around their former intermediaries. Like musicians, authors are likely to find the network to be a boom by exposing their work to a market of unprecedented scale.

Libraries have advocated to a liberal interpretation of copyright law and for the adoption of Open Access, for many decades now, but might these not be risky moves for libraries? The breach created by such liberal interpretation of the law is filled quickly by opportunistic corporate interests. To mention one extreme case, the fate of GoogleBooks hinges on this issue, and its potential success would indeed be disruptive to libraries of all types. While access to such an immense digital collection would set any idealistic librarian aflutter, it would not do so to his/her employer. With that one move library collections would be pressed into the periphery of information consumption patterns. In contrast, if copyright law were tightened, libraries may remain one of the few entities left that can legally share much information with the public, allowing it a longer lease in life.

Does the web distribute information but concentrate knowledge? We have already seen that the network abhors duplicate work and that it opens the doors for efficiencies. It also allows for the distribution of information, even if they are accessed through a common portal, such as Europeana and RePEC. These portals connect the user to the content, like nodes on the network - - the content remains widely distributed but connected through some common protocol – in this sense ArXiv.org is a rare instance of a content repository that is centralized[24]. However, as discussed in section I.a., numerous businesses collect copious amount of user-behavior data. This

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[24] See Stevan Harnad's comment ("ArXiv's funding pains may be wake-up call: central versus institutional archiving" 2011-08-13) in Paul Ginsparg "ArXiv at 20" *Nature* (476, 11 August, 2011) pp. 145-147.

data constitutes a strategic asset to these companies, which treat both the data points and the information gleaned from them as trade secrets. In so doing, the network is creating knowledge concentrations to which access is restricted and yet critical in understanding network dynamics and user-behavior. And while this concentration is true in the broadest network (Google, Netflix and Amazon all do it), it is likely true in the narrower confines of the library world as well. It is almost inconceivable that Elsevier, JSTOR and others do not monitor user-behavior within their own databases, knowledge that informs their business decisions but to which neither libraries nor patrons have access.

Conclusions

If we examine the successful players on the network, we will notice that they are aggressively and relentlessly competitive. Their operations are highly efficient and automated, and transactions take place on an ever increasing scale of operations. The trend is towards low latency and high throughput operations[25]. Things move fast on the internet, rewarding nimble players. In the process, the network forces players to implement good enough solutions embedded with an on-going process of improvement.

The efficiencies that the network make possible, the replicative work's waning value, and the scales brought by the network paradigm, suggest that libraries face an inflection point[26] which will trigger fundamental changes if libraries are to remain relevant. There are precedents to such inflection points in the history of libraries, e.g., the shift from scrolls to codices, and the shift from manuscripts to printed books, also catalyzed reinventions of the library. And like

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[25] Luiz Andre Barroso's talk at Federated Computing Research Conference entitled "Warehouse-Scale Computing: Entering the teenage Decade." Doi:10.1145/2024723.2019527 (2011)
[26] Grove. *Only the Paranoid Survive.* (1996).

previous inflections, this one also offers a number of opportunities upon which we can build a future, and we believe that it can be a prosperous future. The profession has talked about a paradigm shift for over a decade -- it is time to recognize that the key to this paradigm shift lies in understanding the network itself.

This essay raises some questions about the conditions created by the network, but we do so in the hopes that it will yield a more systematic discussion about its effects, threats, and opportunities. It is the nature of inflection points to result in a realignment of priorities and goals. Without a thorough understanding of this new environment, the realignment of library priorities is unlikely to allow us to seize the opportunities we face.