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HIERARCHICAL KNOWLEDGE RELATIONS AND DYNAMICS IN THE 'TOWER OF BABEL'

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Abstract

Acknowledging that the digital divide is becoming more of a knowledge divide, we invoke an image of the 'Tower of Babel,' evincing a vertical hierarchy of information and relations in which access to the top tiers is highly limited. Depicting the knowledge society itself, which encompasses a highly complex interconnected system of digital networks within which interaction among social actors occur and from which knowledge is created and diffused, we emphasize networks as a central factor determining access and posit the broader notion of the Digital Knowledge Network Divide (DKND) to better understand related structures and dynamics. In the face of concerns over democratizing trends and, more, general calls for expanding the science and technology workforce and increasing scientific literacy, access to knowledge is critical. Accordingly, an important challenge for the years to come will be to characterize the evolving and unique landscape of the knowledge society in order to inform and design effective policies and programs. Related research will require the development of measures and tools that capture the hierarchical relations and dynamics of the DKND and that, ultimately, will allow for the assessment of related spatio-temporal disparities and the determination of indicators of network connectivity to measure changes in overall access and participation in the knowledge society.

How can we capture the constantly evolving, highly complex landscape and unique features and relations of the knowledge society? The notion of the 'knowledge society' encompasses the innovation and technology driven relations that mark social interactions today and, according to all available evidence, will do so to an even greater degree in the future. Moreover, this knowledge society is a deeply networked society, characterized by growing complexity and diversification in information, communication, and related capacities. Some conceptions of the networked society posits a vision of a world in which telecommunications technologies contribute to the emergence of organizational and societal structures by which access and participation is uniformly available to all members and, consequently, traditional vertical hierarchies move towards obsolescence (cf. Castells 2000). However, to what extent can we really expect greater equality in opportunity and access to knowledge, especially as a means to societal goods, participation, and contribution?

This is an age-old question, renewed now in digital terms, but still defined within social, cultural, political, and economic parameters. Thus, for example, while various media reports might indicate that user-generated digital content is the ultimate expression of participation, reflecting the free interactive exchange of ideas and opinions by the 'common people,' such claims are not substantiated across the board. More to the point, if one were to envision the structure of the online content, a close analogy for its

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architecture might be that of kind of digital 'Tower of Babel' (TOB) with increasingly narrow layers stacked on top of the ones below them. Accordingly, this TOB represents a kind of vertical digital divide, reflecting real world hierarchies with all of the associated privileges and limitations associated with such stratified dynamics and relations. As many scholars and analysts have argued, access, broadly defined, to digital content will increasingly affect the ways in which people engage information at the most basic level for individual and societal benefit. Accordingly, one of the most important issues for the coming years will continue to be that of the digital divide shaped by differential access to the progressively higher levels of the tower.

In fact, it is increasingly acknowledged that the digital divide is becoming, more fundamentally, a 'knowledge divide,' to the extent that a situation of relative deprivation is growing in which, as in other societal domains, some individuals and groups reflect rapidly declining capacities to access knowledge for social advancement and broader contributions. While calls are being issued for a more highly educated and scientifically literate population and workforce, the game of 'catch-up' is at the same time intensifying for some groups, highly circumscribing their opportunities for scaling the TOB. Noting the contradictions that are inherent in these depictions, normative and cultural considerations are critical points of departure for related research. Moreover, we emphasize that networks are an integral feature of the knowledge divide. Invoking again the TOB analogy, one also can envision a vertical structure within which exists a complex system or systems of networks in which some individuals or groups are more central or have more influence and control over the creation and flow of knowledge and information. These structural relations and dynamics reflect networked disparities that can only be expected to increase, especially in light of the further commodification and monetization of knowledge (e.g., of and on the Internet) and in light of contextual and other factors that – directly or indirectly, intentionally or unintentionally – restrict the access and participation of certain segments of the population to the TOB. Accordingly, we refer more specifically to this problem as the *digital knowledge network divide* (DKND).

Basic Issues

The knowledge divide primarily has been addressed in the context of education technology, although it is gaining more attention as such in the wider literature. There also is a burgeoning body of work that considers the practical role of new technologies on, for example, social capital formation (cf. Lin 2002) and on broader epistemic community relations and the knowledge divide. However, not only technological, but also cultural, social, and political developments mark the parameters of the intensely networked knowledge divide. Accordingly, we must expand investigations of the institutionalized nature and conditions of digital knowledge networks in terms of social divides as a basic task in thinking about their broader impact on society as a whole – and on the world.

As is apparent, *access* is the primary dividing criterion determining network entry and participation. Access, while highly complex in implication and effect, can be cast in fundamental terms relative to at least four interrelated general issues: 1) physical and technical means to codified digital knowledge; 2) learning and cognitive means to understanding and engaging knowledge for productive purposes (in the sense of

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knowledge capital); 3) utilization preferences and styles as means to different types of knowledge and information (e.g., education, entertainment, shopping, business, correspondence, etc.); and 4) who has (or is allowed) the means to knowledge and information and what is the extent and nature of those means. Invoking notions of intrinsic as well as instrumental views of technology and knowledge diffusion, each of these issues speaks to how knowledge networks are engaged, referencing practical access to knowledge with possible implications for individual advancement, societal participation, and broader contributions and impacts. They also raise additional questions for research not only on gross disparities in conditions, but even in base opportunities to gain any redress on those conditions. For example, what are the new barriers to knowledge, and how are they related to earlier (and often still existing) barriers? More to the point, what research do we need to inform and develop effective policies?

The creation and diffusion of knowledge is a networked process, such that knowledge diversification and complexity will remain central topics on research and policy agendas not only in regard to capacity building, but also as basic democratizing issues. Networks of practice – a variant on the idea of communities of practice – are prominent in this depiction, constructed and sustained through active involvement of key members. Over the last several years, digital content has been growing at an astronomical rate. Indeed, according to one estimate, the planet's digital content grew by over 62% in 2009 alone.[1] With the increasing popularity and growth of social media and microblogging, along with email and other forms of interactive communication, daily digital content soon will have to be measured tens of petabytes (10^{15}) – and no one knows if there is an upper bound in technological operational terms. Moreover, much of this content is being created by users to the extent that social media itself can be conceptualized as a form of networked 'crowdsourcing.'

In fact, in reference to crowdsourcing, enhancements in communications, monitoring, and geo-processing technologies have facilitated its use as a means for collecting information. However, having said that, recent current events have highlighted how economic, political and cultural factors have precluded access to user-generated data networks, giving rise to distorted perspectives of reality and, ultimately, inaccurate or incomplete knowledge. The recent earthquake in Haiti offers a stark illustration, in which the dire lack of geo-coded information on Haiti (on the west side of Hispaniola Island) became dramatically apparent when viewed in terms of the number of user-generated placemarks relative to the Dominican Republic (on the east side of Hispaniola Island), which had a significantly denser collection of user generated data (Zook et. al. 2010).

This situation is just one example pointing to the need for investigations of local/global knowledge network properties, with implications for studying both top-down and bottom-up processes of knowledge sharing and diffusion. Moreover, both vertical and horizontal knowledge intensification and expansion also are basic considerations in this regard. Obviously, concerns about building science literacy must attend to such issues, looking to future possibilities for more inclusionary knowledge opportunities relative to a larger more diverse and vital workforce and society. Again, specific questions are highly relevant to these points: Are certain groups or individuals disproportionately negatively positioned in digital knowledge networks, thus diminishing

[1] http://www.guardian.co.uk/technology/2010/may/03/humanity-digital-output-zettabyte

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their ability to access or contribute to new knowledge. Alternatively, who are the gatekeepers and central participants? What are the characteristics and mobilizing frameworks for formal and informal social networks on the Internet? How and to what extent are certain groups excluded (or not) from participating in the development of such networks? What are the broader implications of that exclusion on, for example, learning outcomes? Furthermore, larger questions of governance are revealed in this scenario: Is a 'digital democracy' the actual goal? Is it a civic responsibility to provide more equal access to online networked communities and, if so, how can and should it be done?

In general, what are the implications of continued changes in telecommunications technologies and Internet architecture for individual, organizational, and institutional relations, rules, roles, and behavior? That is, how and to what extent can and will such changes play a role in affecting the digital knowledge network divide, especially in the face of broader societal structures and relations?

Approaches

Developing effective strategies, policies, and programs that are explicitly focused on the underlying determinants of the digital TOB will require systemic efforts aimed at changing deeply embedded historical biases and relations that cannot ultimately be treated separately or as if they occur in a vacuum. The digital TOB presents a difficult challenge because of its inherent complexities and contradictions. Untangling related problems of access may give us some purchase on the range of problems – and the range of solutions.

Given that we are proposing addressing the knowledge divide in its guise as interconnected systems of networks, there is a need to develop spatio-temporal content-based measures of centrality, influence, reach, and other related indicators characterizing global network topology. In addition to the fact that the discussion turns on general questions about effecting change, which is temporally dependent, the flow of information and knowledge, and the manipulation of information to create new knowledge, are dynamic processes. (Witness the way in which certain ideas go viral across the Internet.) Also, socio-geographical factors are particularly relevant to the issues discussed above. In this vein, we need to capture the contextual factors that influence access to and participation in digital knowledge networks, as so vividly illustrated by the situation in Haiti cited above. Another issue setting new tasks for research in this regard involves examining recent trends in the use of mobile devices and social media sites, and looking at how they are leading to new types of datasets for which existing analytical techniques are not appropriate.

All of these considerations emphasize the need for new measures and approaches to account for various technological changes and effects. To date, little rigorous and systematic analysis has taken place using, for example, computational methods applied to real data to explore newly emerging barriers that add to the complexity of knowledge networks. In addition, moving beyond uncovering such factors as topological properties and conversational themes of related networks, a more complex problem will be determining how (and should) certain information be extracted for analysis. Considerations of content is essential for understanding how and to what extent different actors (individuals or groups) contribute to new knowledge through their participation in digital knowledge networks or the types of information or knowledge to which they may

lack access. (It also can help to understand whether certain actors are more likely to be exposed to rumors or false information circulating on the Internet.) Finally, we must stress again that we propose moving beyond a conceptualization of the digital knowledge network divide in terms of a straightforward social network, but approach it rather as complex systems of networks.

General Comments

How can we develop measures and tools that capture the hierarchical relations and dynamics of the digital knowledge network divide and that, ultimately, will allow us to measure related spatio-temporal disparities and to inform and design policies aimed at facilitating participation in the knowledge society? We must remember that the digital knowledge network divide reflects a complex dynamic system that is also a complex *adaptive* system, suggesting a tension that must be addressed to understand the determinant techno-cultural dynamics. On the one hand, it can adapt to maintain the broadly institutionalized socially reflected divide. However, on the other hand, it can adapt to change the character of that divide, based on bridging and bonding strategies. Addressing this second issue, redesigning the architecture of the TOB will require long-term efforts aimed at aligning the normative and cognitive orientations of members of society, thereby fundamentally transforming the knowledge network divide. Current technological barriers may be turned into knowledge carriers as a democratizing activity. However, this turn of events depends largely on access, cognitively, normatively, and physically determined. Exploration of the ontology, structure, and legitimacy that mark institutionalized cultural, political, social, and economic relations will lead to the more in-depth understanding that is a first step in affecting change. As indicated in the discussion above, several continuing themes present themselves across different levels and units of analysis as critical dimensions of this overall research challenge, including relational and territorial digital knowledge network formation, characteristics, and effects; digital knowledge network opportunity structures and differentiation; and overall vertical and horizontal trends and patterns in the digital knowledge network divide. Understanding and affecting these issues present research tasks for the social sciences at their most robust, insightful, and relevant.

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