How Social Networks will Change Research

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Abstract: ***Social Networks have become an integral aspect of our lives in recent years. Developments such as the small-world phenomenon, social curation, and eCommunities are evolving as noteworthy game-changers in an emergent web ecosystem. This paper describes how the way of conducting academic research will change when the resulting omnipresent communication and sharing technology is taken into account. Researchers will have no choice but to embrace SN technologies to fully exploit the true potential of the emerging ecosystem.***

Index Terms: ***Social Networks, Small World Phenomenon, eCommunities, Social Curation***

1. INTRODUCTION

The web has brought about significant changes in the way we do research. Developments such as Google Scholar and its citation network, Google's massive digitization project and Massive Open Online Courses (MOOC) are enabling access to state of the art research materials, large collections of digitized books as well as specialized courses delivered by the best researchers in the world. Researchers are therefore able to gain access to vast amounts of knowledge in supporting various collaborative and cooperative efforts for expanding and advancing their research.

Being a researcher for the past 25 years and coming from a developing nation, I have seen a vast difference in the way research is being carried out. E.g. by standing on the shoulder of giants, upcoming or underserved researchers (particularly in under-developed nations) are able to level the field by bridging the ever-widening knowledge gap between the 'those who have' and the 'those who do not have.'

In the past, researchers worked within closed communities relying on meetings at conferences with a well-defined peer review mechanism for maintaining and measuring their research impact. The physical library used to be considered the major source of reference with large collections of books and audio-visual material. Things are fast changing with the emergence of new conference models [1]. Discourses surrounding the conferences can now be extended beyond the restrictions and boundaries of a geographical setting and its in-site interactions. Social Network (SN) tools such as Blogs and Twitter are widely being employed to extend these networks and to prolong discourse relating to conference themes. Emerging online journals are increasingly assimilating and mashing up [2] SN functions for enabling improved interactions with research communities. Also, web giants such as Google Scholar (along with its SN extensions), are fast replacing the need to visit the library via its expanding, authoritative, up-to-date, scholarly contents.

Notable technological advances that can be seen as defining future scenarios for research include:

i. The way in which eScience and eResearch is supporting multi-disciplinary research teams via shared workflows, libraries and infrastructure [3]
ii. The emergence of expertise oriented search engines such as AMiner [4] (as shown in Figure 1) facilitated by a scholarly social network [3], and
iii. The emergence of large scholarly networks such as Academia.edu and ResearchGate with 25 million researchers [5] and 7 million researchers [6] respectively.

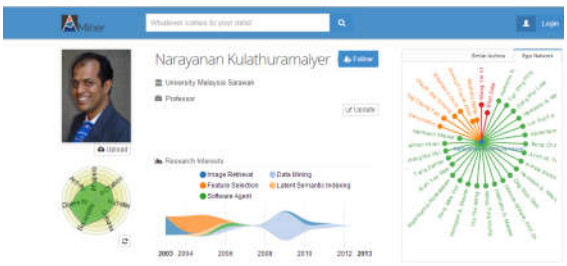

Figure 1: Expert Oriented Search Engine

In this way, SN tools are opening up many more opportunities for researchers to network

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and undertake collaborative research. Consequently, it has become difficult for one to imagine how tasks such as rapid literature review or the constant tracking of achievements, trends or expertise availability can ever be performed without the help of SN tools.

Hence, this paper focuses on the evolving SN landscape and its influence on the way we do research. It will demonstrate how the evolving massive global eCommunity along with developments such as Small World phenomenon and Social Curation are systematically playing a key role in the big scheme of things.

2. *Emerging SN Landscape*

The SN landscape[1] consists of numerous tools (see figure 2) that are enabling connections to researchers and research communities all over the world. The subsequent chapter will provide a layered view of this growing landscape.

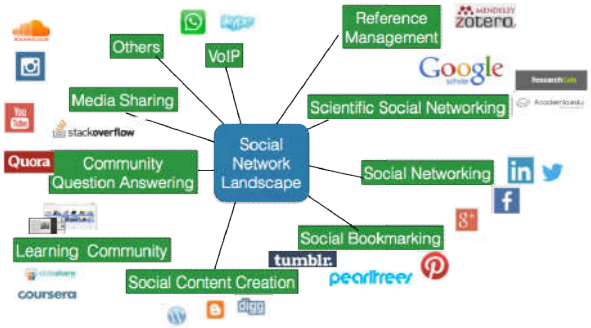


Figure 2: An Illustration of the SN Landscape

From a research perspective, the emergence of scholarly or scientific SN tools such as ResearchGate and Academia.edu are noteworthy. These tools are becoming widely used by researchers for managing their research and research groups. Though they are seen to be promising, they are yet to become the mainstream research vehicle [8].

These tools incorporate tracking and alerting mechanisms in keeping researchers informed on latest developments relating to activities of their own research networks. They employ mass collaborative systems as a means to register researchers and to discover, connect, and validate publications data for a large number of researchers.

3. *Massive Global E-Community*

The web has expanded to a stage where we now have over 2 billion users. There is a need to tap into the vast web resources being generated without users becoming totally overwhelmed by shallow information (trending media), or becoming victims of 'group think' [9].

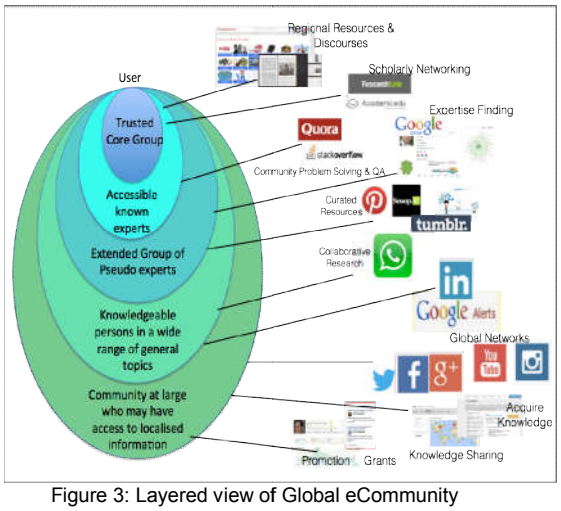


Figure 3: Layered view of Global eCommunity

There is a need for researchers to adopt a layered view of the massive eCommunity [10] to benefit from this landscape. One has to ensure that 'the right tool has to be used for the right purpose with the right audience in mind'. This also calls for a proper understanding of how each SN service functions as a component within the scheme of things.

Researchers can thereby chose to either work with a single SN tool in isolation, or with a number of connected SN tools in a cooperative manner. The SN landscape can be effectively harnessed by assimilating an appropriate series of social networking services in an orchestrated manner. Figure 3 presents the eCommunity segments that have been mapped to various SN tools according to specific research functions. Researchers can thereby select appropriate SN tools based on the target audience.

In this way, a simple strategy could be designed to engage one or more of the following segments:

- Focus group e.g. by using WhatsApp to facilitate discourses on localized or specialized themes with a closely knit core user community. This core group

[1] In this paper, we have taken an encompassing view of Social Networks (expanding from [9]) reflecting the current state of things. Social networks, in this sense, include typical Social Networking services (e.g. Facebook, Twitter, Google+, LinkedIn), Social Bookmarking/Curation services (e.g. Del.ico.us, Pinterest, Tumblr), Content Creation services (e.g. Blogger) Mobile Messenger services (e.g. Whatsapp, Skype, SnapChat), media sharing services (e.g. YouTube, Instagram,) document sharing services, (e.g. Google Drive, Dropbox), Community Question Answering systems (e.g. Quora, StackExchange) and scientific Social Networks (e.g. ResearchGate, Academia.edu).

will serve as a support group for linking with outer layers.

- Scientific research communities will serve a community of researchers and their partners and collaborators in focused research fields.
- Community Question Answer tools e.g. Quora to link to experts who have either become acknowledged for their contributions in answering questions in similar areas or for guiding others along problem solving steps.
- Social Curation tools e.g. Pinterest as a means of acquiring information and knowledge discovery through a targeted deliberation on specific topics.
- Professional networks tools e.g. LinkedIn as a means of identifying people suited for a task and has been widely used in recruitment tasks.

Researchers can also employ integrated strategies in future by fully engaging in with the SN landscape. Figure 4 reveals as illustration of an integrated strategy based on the explorations of the author.

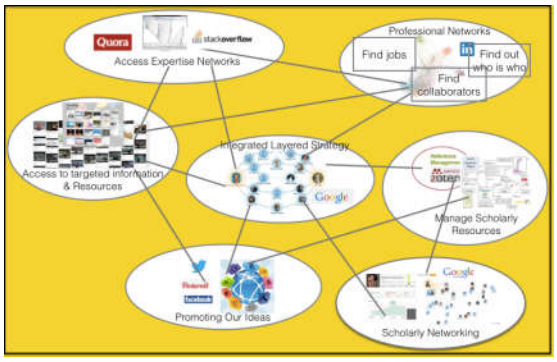


Figure 4: An integrated strategy for cooperative use of SN tools

In this paper we will discuss two important developments of the SN landscape to provide a deeper understanding of the rapid changes we are facing as well as to shed insights relating to the expected future impact on research. Two scenarios are presented to demonstrate the practical use of selective tools to benefit from these developments.

4. *Small World Phenomenon*

The small world phenomenon [11] describes the connected state of linking individuals to scholarly networks and stakeholders across the world according to their interest and capacity to mutually cooperate. In principle, this will enable the access to knowledge and resources beyond all traditional inhibitions or boundaries. Researches therefore become connected to a web of knowledge that cuts across the global 'eCommunities'. E.g. Research has shown that the shortest social connection between an arbitrary researcher and an expert in the field is less than six steps away. Hence, the landscape of SN becomes a platform to link researchers together for collective inquiry and explorations.

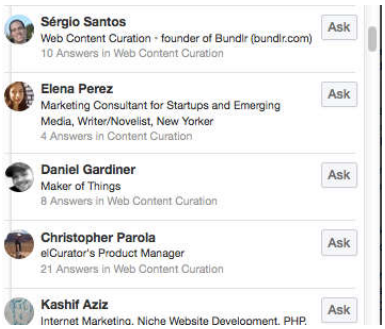
The small world enables researchers to gain access to expertise, and discover valuable resources according to specific needs. Apart from that, by finding influential individuals, researchers are able to identify and gain access to specific targeted information or to locate target local community to engage with.

As a first scenario, we present the situation where the author posted a question to the Community Question Answer tool Quora[2]: "What are the best curation tools for researchers?" The question, being specific in nature and of interest to a small group of users, received only two answers.

The first answer came from the founder of a company called Qureet, which curates feeds from Twitter in a way that enables the picking of selected tweets for any particular research focus. The second answer came from a librarian with an MSc in Information Science providing a link to another curation site that was also found to be useful.

This scenario revealed the ability to gain access to specialized sources of information. Apart from these answers, Quora listed names of experts who could be directly contacted (see Figure 5).

These names were selected from Quora's database of experts who answered the most number of questions for any given topic. This list included names of writers, web enthusiast, librarians, founders of curation companies, marketing consultants and product managers.



[2] https://www.quora.com

Figure 5: A partial list of Quora's proposed experts

Additionally, Quora also provided a list of topical words relating to the question posed in order to allow the author to perform further explorations.

The reputation management system in Quora makes it a powerful tool for identifying influential individuals capable of providing the best answers. Answers are ranked by the number of up-votes received. The best answers are then judged based on community feedback.

A point scheme mechanism is the incentive scheme or currency used in Quora, where points are deducted for questions asked and for making an endorsement. Users answering questions, that receive the highest possible number of up-votes, gain points and are recognized as experts in a special-interest group.

Another incentive scheme to intrinsically motivate experts involves the identification and recognition of top-writers based on the highest performing cumulative ranked answers in special-interest areas. For example: Mike Barnard with 400 over answers and 6 endorsements within the area is identified as a top-writer for Alternative Energy.

Community Question Answering tools are therefore building knowledge networks of experts, expertise and topic models, with an in-depth profiling of users, based on their crowd-endorsed high-impact contributions.

The implications of the small world phenomenon can therefore be summarized as follows:

- Enables users to access any research element including rare artefacts for coming up with interesting findings
- Enables content re-purposing and packaging of content tailored to suit a user's specific needs
- Enables access to expertise and knowledge from the best sources

5. SOCIAL CURATION

Social curation [12] refers to the efforts of users where useful web content are collected and stored in personal lists or folders. Content can come from a variety of sources (e.g. Facebook, Twitter, Blogs, Websites) via the use of one of many emerging social curation tools (e.g. Pinterest, Tumblr, Pearltrees, Scoop.it). Curated contents are then placed into user collections and can be used as objects of re-posting to iteratively enhance the curated collections.

We consider a second scenario where a researcher, who is a Web Science and Data Mining expert, wants to curate a personal collection. A number of boards may be created while searching through existing content from a number of related web resources. Apart from that, the researcher can explore the use of this space for creative expressions as well as to store and preserve ideas for future use. Based on these boards, the researcher will in future, be able to reuse these contents for performing specific tasks, e.g. to teach a postgraduate course. The researcher may also explore the use of this curation site as a basis for identifying and profiling individuals with a matching interest and profile.

In this respect, Pinterest[3] was used to enable an apparent 'just-for-me-space' for the researcher to focus on knowledge artefacts to creatively generate ideas and enrich the collection. The researcher's activities in searching and organizing the resources is enriched by other users who provide insights for discovering additional content relevant to the same user interest (and in many cases providing a fresh perspective). These collections then become personalized spaces for organizing ideas and allowing personal reflection on the associated themes (see Figure 6).

The potential of social curation is realized mainly due to the innumerable hours put in by such users in carefully collecting, categorizing and labeling, reflecting on content match to collection, engaging in communities to broaden perspectives and exploring new ideas in cooperatively organizing the Web.

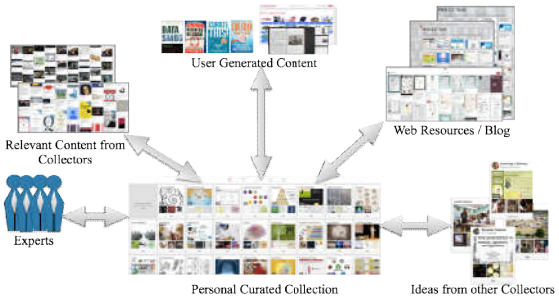


Figure 6: Curating Content from various sources

When the need arises, it is possible for this researcher to locate the best resources to teach a graduate-level course in an area of his interest. Rather than giving a single best answer, a collection of resources that could be used as a basis for building the course or workshop is provided by the system (see Figure 7).

[3] https://www.pinterest.com

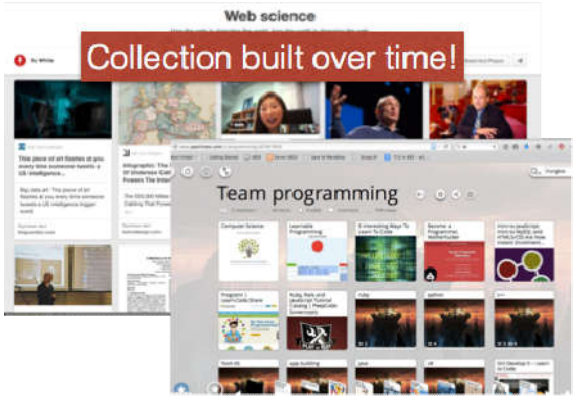


Figure 7: Social Curated Content in Perspective

This scenario illustrates the need to use curation software such as Pinterest, as opposed to entirely relying on Google search or Wikipedia. An exploration into various perspectives of curators is required to pinpoint the collection with the best match between the perspective of the content curator and information needs of the content seeker. The visual representation of pins serves as way of narrowing down search to matching perspectives.

Curation tools can also be used to actually enable creative expressions [13] [14] and overcome issues of distraction associated with typical use of SNs [15], [16]. In the process, these tools are able to support both divergent and convergent aspects in stimulating cognitive explorations and creative thinking. Divergence relates to the expansion of user roles and perspectives in allowing them to explore possibilities for inquiry. This also relates to users being able to defer judgment, internalize and reflect while having the explorative ability to build on ideas for generating original artefacts. Convergence on the other hand, describes the ability to make sense of various sources of information in enabling affirmative judgment that results in quality information suited for a specialized need or purpose.

6. *Multi-Tiered Social Content Curation*

Social curation sites manage content in a layered fashion; at the lowest level, we have content as media items that are curated by users who then add their own meta-level information (in some ways re-purposed by users to suit their own need). At a subsequent step, objects deemed useful are then organized into labeled collections.

In this way, Social curation can be seen as the next emerging platform for collective content creation and purposing. Users add value to Web content by deciding on content considered to be useful and by indirectly helping others facing the same situation to annotate and organize their content. Curation efforts of users in identifying and contextualizing relevant content (in serving a particular need) then become a source of invaluable resource for anyone else with similar needs.

This idea of multi-tiered curation can be used as the means of helping researchers deal with the SN information explosion is illustrated in Figure 8.

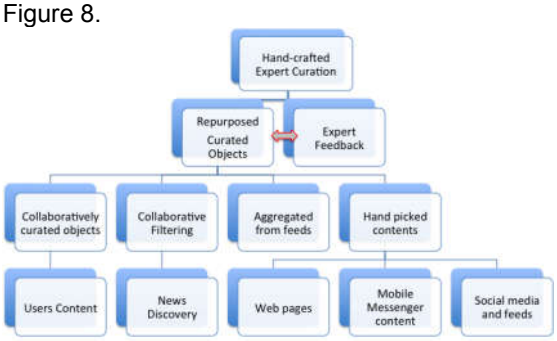


Figure 8: Multi-tiered Social Content Curation in Action

Layered content curation serves as the way of organizing the exploding amount of web content, with users helping to handpick and craft useful relevant content. The discovery of user profiles based on interests, perspectives and inclinations (that can be evolving over time) can be used as a basis to establish partnerships and collaborations.

In this respect, Pinterest is able to extract user profiles of individuals with similar interests and viewpoints based on their pinning behavior. As an illustration, a computer science practitioner teaching by using digital technologies was identified to be the author's 'twin' (see [17]).

7. *Conclusions*

SN landscape will undoubtedly play an important role in shaping the future of research. We have shown that it is possible for researchers to efficiently access relevant information and expertise even when these may not be currently available. We have also provided illustrations of how the emerging social networking landscape can actually support and help researchers manage their information and knowledge collection while maintaining a personal space for creative expressions and knowledge discovery.

The control of small world phenomenon can be exploited for helping researchers and research groups in performing many regular tasks such as expert finding (e.g. Quora), appraisal of researchers (e.g. Google Scholar ranks,

ResearchGate scores) and recruitment (e.g. LinkedIn).

Users cannot stay as passive receivers of information totally oblivious of the inner workings of SN tools. Those who just continue to treat the Web as a black box will not be able to cope with the information deluge that we are about to face. Much needs to be done for expanding on the potential of the SN landscape and to ensure equitable access for all.

What we are yet to see will be even more dramatic with new developments such as crowd funding organizations emerging as key funding agencies [18] with SN companies supporting as expertise sourcing agencies and knowledge arbitrators. This will open up numerous research opportunities for multi-dimensional, global-scale research projects.

REFERENCES

[1] Luce, R. E. A new value equation challenge: The emergence of eResearch and roles for research libraries." *No brief candle: Reconceiving research libraries for the 21st century*, pp. 42-50, 2008.

[2] Tang, J., Zhang, J., Yao, L., Li, J., Zhang, L., Su, Z., "Arnetminer: extraction and mining of academic social networks," *Proceedings of the 14th ACM SIGKDD international conference on Knowledge discovery and data mining,* ACM, pp. 990-998, 2008.

[3] https://aminer.org/ranks/

[4] https://www.academia.edu/about

[5] http://www.researchgate.net/

[6] http://www.unconference.net/

[7] Khan, M. S., Kulathuramaiyer, N. Maurer, H. A. (). "Applications of Mash-ups for a Digital Journal," *J. UCS*, *14*(10), pp. 1695-1716. 2008

[8] http://www.nature.com/news/online-collaboration-scientists-and-the-social-network-1.15711

[9] Aventurier, P., Agronomique, F. "Academic social networks: challenges and opportunities," Available: https://whatisdigitalmarketing.files.wordpress.com/2013/05/socialmediatoolsasperclassification11.jpg

[10] Lid, V "Why socializing doesn't scale," http://blog.viil.net/2010/02/why-socializing-doesnt-scale/, February 4, 2010.

[11] Travers, J., & Milgram, S., An experimental study of the small world problem. *Sociometry*, 425-443, 1969.

[12] Changtao Zhong, Understanding the How and Why of Online Content Curation, Crowdresearch blog, July 15, http://crowdresearch.org/blog/?p=7841, 2013.

[13] Linder, R., Snodgrass, C., & Kerne, A. (). "Everyday ideation: All of my ideas are on Pinterest," *Proceedings of the 32nd annual ACM conference on Human factors in computing systems* pp. 2411-2420. ACM, 2014.

[14] Zaman, T., Wee, A. Y., & Kulathuramaiyer, N. "Harnessing Community's Creative Expression and Indigenous Wisdom to Create Value," *Researchgate.net Tacit-Implicit-Explicit (TIE) Knowledge Creation Model*, 2011.

[15] Maurer, H. "Does the internet make us stupid?," *Communications of the ACM*, 58(1), pp. 48-51, 2014

[16] Kulathuramaiyer, N., Maurer, H., "A Survey of Communications and Collaborative Web Technologies," *CIT Journal of Computing and Information Technology*, 23(1), pp. 1-18, 2015.

[17] https://www.pinterest.com/helencaldwel/following/

[18] Fulton, S., (2013). Senate Report Opens a Window Into Hidden World of Data Aggregators, ACLU Washington Legislative Office, December 18, 2013, Available: https://www.aclu.org/blog/technology-and-liberty/senate-report-opens-window-hidden-world-data-aggregators

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