The Challenge of Modern Academic Knowledge Exchange

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ABSTRACT

While over the last decade computing practitioners created new, innovative applications like online auctions, blogs, wikis, chat, social networks and social book-marking, computing academia has innovated much less. The resulting theory/practice divide in computing can be attributed to the effect on academic creativity of the myth that rigor is excellence. The use of publishing to appoint positions, promote for tenure and allocate grants supports the current "gatekeeper" academic publishing model. This is not only based on print-publishing limits that no longer apply, but also incorrect as it ignores the 'Type II" error of rejecting useful knowledge. Modern social computing suggests how to reinvent the academic knowledge exchange system (KES) to innovate and disseminate as well as discriminate. Building upon existing successful knowledge repositories like the Los Alamos archive suggests an open electronic KES that not only increases dissemination (by publishing all) but also increases discrimination (by rating all). This suggests that the Information Technology (IT) discipline should balance rigor and relevance to create knowledge growth, as do systems like Wikipedia, rather than follow the gatekeeper model, e.g. create an electronic portal open to all multi-disciplinary knowledge travelers at the nexus of technology use.

Categories and Subject Descriptors

General Terms

Management, Documentation, Design, Human Factors, Theory.

Keywords: electronic publication, knowledge exchange system, electronic archive, repository, rigor, relevance

1. INTRODUCTION

Academic journals or conferences can be considered *knowledge exchange systems (KESs)* which face three primary questions [1]:

1. Does it create new knowledge?
2. Does it contain valid knowledge?
3. Does it educate readers and disseminate widely?

A KES is any dynamic system, print or electronic, that innovates, discriminates and disseminates knowledge. The overall goal is to contribute to knowledge growth, so a knowledge exchange system can be likened to an orchard whose "fruit" is research. It is not enough to have new ideas if they are not checked for validity, i.e. are the arguments logical and the claims well supported by data? It is not enough to have valid and/or new knowledge if it is not disseminated widely and in a manner that ensures it will be read by many. Dissemination in turn results in creating both more new ideas and new critical challenges to correctness. Just as a garden needs a balance of planting, pruning and watering, so it is proposed that knowledge exchange needs to be open to new ideas, able to discriminate good from bad, and finally able to effectively pass knowledge to those who need to use it. However, for reasons that we will suggest, the academic publishing system today is focused not on growth but on selection, which has reduced its creative and educational roles. This outdated "gatekeeper" model, based partly on traditional print culture, has produced a system "under siege" from an increasing number of applicants seeking its benefits [2, p20]. Academics are finding themselves knowledge gate-keepers using rigor to defend elite knowledge castles, rather than what we believe they should be: *knowledge gardeners*. We argue firstly that these academic castles are disconnecting from common reality, and secondly that social computing applied to current successful repository designs like Los Alamos can and will re-invent the original academic goal of knowledge growth.

2. THE IS SITUATION

We take as our evidential case the current state of academic publishing in information systems (IS), though a similar case could be made in other fields.

2. 1 Bleeding Edge Theory

When a respected IS journal editor doubts that academic theory in his field is going in the right direction one should listen: "*Research publications in IS do not appear to be publishing the right sort or content of research*" [3 p194]. IS research has specific theories on relatively unimportant topics (like keystroke or mouse-click models), vague theories on important topics (like contingency theory) [4], but only few specific theories on important topics. One such is the Technology Acceptance Model (TAM), which

suggested that users assess technology by ease of use as well as usefulness [5]. Another is Media Richness Theory (MRT), which links "rich" media to rich interactions [6]. Both have been very influential in IS, but they are now well over 15 years old and showing their age, e.g. MRT's "richness" dimension suggests that people will not make friends via "lean" email texts, but in practice people do use pure text systems like chat and email to form online relationships. Either plain-text email is "multi-media" rich or MRT has over-simplified human communication. Likewise TAM predicts that technology acceptance involves just ease of use and usefulness, and omits criteria like security, reliability and privacy which are critical to today's Internet [7].

2.2 Leading Edge Practice

It is easy to forget how "obvious" inventions like the cell-phone and e-mail were not predicted by theory [8]. Breakthroughs like chat rooms, blogs, text-messaging, wikis and reputation systems are neither multi-media nor media rich. Yet these simple distributed products have become "killer applications", while touted co-located systems like IBM's Group Systems [9] have faded into irrelevance. It was Google with a simple white screen and one entry box that scooped the search engine field, not Yahoo with its multi-media graphics. The usability theories of the day, plus 25,000 hours of user testing, predicted that Mr. Clippy's friendly graphical help would be a huge success [10]. Yet Mr. Clippy and same concept Microsoft Bob were voted the third and first (respectively) biggest software flops of 2001 [11]. Microsoft still seems only dimly aware of the problem [12], i.e. that Mr. Clippy was impolite [13]. Asked why plain text products like email and chat succeeded, while multi-media, user-friendly products like Mr. Clippy flopped, mainstream IS theory is strangely silent.

2.3 Theory vs. practice

The current theory/practice divide runs deep. The *all power to the IT artifact* approach suggests that practice can and should "go it alone", and indeed practitioner readership of IS journals like MISQ has been in sharp decline for some time [14]. IS theorists increasingly meet a "*show me don't tell me*" response - if physicists had responded to Einstein the same way he would have needed to build a particle accelerator before his theories were heard. In the IS marriage of theory and practice, the partners are barely speaking to each other, with practice finding theory barren, and theory complaining that practice doesn't listen [15]. Yet computing today is creating a new online global society, a socio-technical system as complex as any space or nuclear program. It will not succeed by trial and error alone, any more than a space shuttle program can. We must know what we are doing both in theory, which today increasingly involves social concepts, and in technology practice. If theory and practice are the two legs of scientific progress how has the academic leg become paralyzed? We suggest the cause is the rigor problem.

2.4 The rigor problem

That rigorous work is less likely to be in error suggests that more rigor is inevitably better. This is the myth of rigor excellence. However it is not true because in research there are two error types, called Type I and Type II errors [16]. The first are errors of *commission* and the second are errors of *omission,* e.g. a Type I error claims a false result is true, while a Type II error rejects a true result as false. Likewise journals can err in two ways not one, by publishing what is later shown to have no value (commission), or by *not* publishing what is later shown to have value to progress (omission). In business the latter *opportunity costs* (value denied by an opportunity not taken) are a known cause of business failure [17], e.g. Word-Perfect no longer dominates word processing not from faults made but from an opportunity lost (to improve usability, as Word did). Similarly the hypertext academic community rejected Berners-Lee's World Wide Web idea on its apparent faults but failed to see its enormous potential [18].

Applying this principle to academic publishing means that as well as rigor journals must also assess relevance, defined as the probability of research usefulness. It is in this balance of rigor and relevance that the publishing of an academic discipline succeeds or not. The rigor problem occurs when too much rigor reduces overall performance. If journal rigor increases omission errors (rejecting useful papers) more than it reduces commission errors (accepting faulty papers), then rigor has become counter-productive to overall performance. In Eric Raymond's analogy, the cathedral of academia will then decline while the bazaar of practice will expand, because one is open to opportunity while the other is closed [19]. To see how this situation has arisen, we must consider the research motive.

2.5 The research motive

Since the rigor problem contradicts the quality requirements of science itself, one would expect it to be easily fixed. However this is not so because research progress is not the only goal of research today. Journal publishing is now the primary screening mechanism for appointments, grants and promotions [20] and critical to financial decisions in the big business of academia [21]. However is the loser here knowledge growth? A survey of 476 readers of 130 management journals suggests that 90% of academic articles are never read by any readers of those journals [22]. Why do authors publish if mainly *no one reads*? Perhaps because the goal is not to be read but simply to be published (and promoted).

Almost all top IS journals now accept only in single digit percentages, so at the top levels of academic knowledge exchange, submission failure is the norm. A university course with a 90% failure rate would be morally unacceptable, yet the academic primary publication system is set up in precisely this way. The expected lesson of a norm of failure is less innovation and more conformity. The current academic culture in computing has driven its anarchist innovators out into

practice to make breakthroughs there, e.g. the movement of automatic indexing from universities to commercial enterprises like Google [23]. As Lee Smolin says of the Physics discipline: "… *there is now the problem of making sure that young people have the freedom to wander across boundaries established by their elders without fear of jeopardizing their careers. It would be naïve to say this is not a significant issue"* [24, p183].

2.6 Trends

The traditional print publication process has authors submitting articles to editors who use reviewers to decide what is published for readers. This gatekeeper approach to knowledge exchange produces predictable trends for editors, authors, reviewers and readers.

Since scarcity reflects demand, journal editors use high rejection rate as a quality indicator. With rigor being easier to maintain for familiar content, it is in an editor's interest to maintain the status quo by select older topics, meaning that researchers interested in publishing in Tier 1 journals focus on issues facing practitioners a decade earlier [25]. Rigor is also easier to maintain for restricted content, so journals will prefer to specialize more narrowly. Yet cross-disciplinary areas are precisely where knowledge often expands. Moreover, gate keeping hinders timeliness. With journal cycle times typically measured in years, relevance is compromised. A long gestation period in today's climate, where timeliness is not an option but a requirement, means that the rigor trend reinforces top journals being exclusive in participation, restricted in scope, outdated in content and innovation averse.

Under a rigor bias, authors experience long review times with few acceptances. So publish or perish means it pays for authors to increase paper numbers rather than innovative paper content, to publish overlapping variants of the same work, to publish major works in "least-publishable-units", and to publish in groups. Frankly, the rigor trend encourages authors to flood publications with junk, to recycle old ideas with catchy new labels, or to submit minor "advances" to the gatekeeper's favorite theories (like TAM).

Reviewers who labor without payment and anonymously are usually over-worked, leading many to finish reviews efficiently by simply accept the paper, but if other reviewers find clear faults this proves to be professionally embarrassing. A safer option is to find enough faults to reject the paper as then the review is over, e.g. ignore the implications and just check the method section for faults. While to praise when others condemn implies naiveté, a scathing review within a cluster of praises can seem commendable rigor. In contrast spending time growing the paper by nurturing its ideas through thoughtful commentary is time consuming and risky. If the reviewer gives good advice and the authors ignore it, time and effort has been wasted, while if they take the advice, then the authors get credit for the reviewer's ideas. The rigor trend predicts increasingly negatively driven reviewing, based on denying rather than growing value.

Finally, the rigor bias affects readers who seek knowledge value for their effort. More rigor means more complex papers that take more effort to read but deliver less value. If rigor is causing the new ideas per paper to go down, and paper complexity to go up, academic readers are getting less bang for their cognitive buck. The rigor trend predicts readers will redress this imbalance by skimming abstracts, headings or conclusions rather than properly digesting academic papers.

The expected end-point of a rigor bias is journals that are more rigorous than relevant, authors more prolific than productive, reviewers denying not inspiring, and readers grazing but not digesting. The final vision, of journals as exclusive castles of knowledge manned by editor-sovereigns and reviewer-barons raising a barricade of rigor against the mass assault of peasant-authors, is not inspiring. It is time to change this paradigm, not just technically but also socially, and the following section suggests how this could be done.

3. OPEN ELECTRONIC KNOWLEDGE DISCRIMINATION

The issue addressed now is whether electronic support can improve knowledge creation, selection and dissemination and improve KES performance overall. The answer suggested is to develop currently successful E-repositories like Los Alamos by adding the tools and knowledge of socio-technical systems like Wikipedia, to produce a system that not only publishes all but also rates all submission effectively.

3.1 Socio-technical change

Socio-technical systems involve four emerging levels: of hardware, software, personal and social [26], so one can seek to change such a system at any of these levels. For example, using email to submit papers or reviews merely changes the technical hardware and software of the KES if people's attitudes and the social rules remain the same. In contrast general calls to participants to improve submission relevance [28] or quality [1] seek to change the KES by changing the attitudes of the people within it. Finally, changes in journal policies seek to change the social protocols of the fourth level, e.g. suggested changes to the journal rating system to include criteria like timeliness [29], citation rates [20], end-to-end times (submission to publication) [30] or measures like readership size and composition, reader rated usefulness or knowledge source influence [31].

Socio-technical change in contrast involves changing all system levels at once in an integrated fashion [27], in particular so that human and social goals are supported by technology, and that is what is proposed here. The aim is to change the current gatekeeper publishing model and use the new technologies pioneered by social computing to help do this. Note that in socio-technical

change trying to change social or technical aspects alone will not work. Our baseline is the open source software movement, which has created environments where critics and innovators work successfully together solve community problems [32]. We propose combining this approach with the traditional critical rigor of academic review. That the principle of openness can work well with academic publishing is illustrated by a quasi "experiment" in publishing carried out in 1999 when the Association for Information Systems introduced two online journals, the first a traditional double-blind peer review journal (JAIS) and the second the "lighter" Communications of the AIS which under Paul Gray offered authors the choice of a light (one person) or a full three person review. Strangely, in 2001 CAIS was rated significantly higher (18^{th}) than JAIS (30^{th}) in journal impact rankings [33, 34], and in 2003 while JAIS published 16 articles CAIS published 95, as about 80% of authors chose a light review. This suggests a simple conclusion - that opening academic systems increases KES performance.

Current e-journals certainly offer openness, as they reduce publishing costs by reducing printing, binding, and shipping costs, making *it economical to publish all submissions*. However they do this at the expense of discrimination. While e-journals reduce cycle times, increase throughput and support new formats, electronic publishing has not been the success it was expected to be, with some reviews questioning the: *"... extent [to which] introducing advanced technologies supports the ultimate objective of research – creating knowledge*" [35]. The ultimate objective of research requires rigor, and the question raised is whether e-journals deliver this. The problem is that while e-journals may improve dissemination, given the same reviewer system they lose discrimination. Hence they are seen as being of lower quality, i.e. too easy publishing devalues the academic currency of "being published". E-journals may overcome this by becoming more rigorous, but this is simply to return down the same path that print journals have trod. The challenge of online publishing is *to increase both dissemination and discrimination*, not to reinvent the rigor problem online.

In contrast to the limited success of e-journals, the electronic repository has been an unequivocal success. Paul Ginsparg created the Los Alamos bulletin board (http://xxx.lanl.gov) to share knowledge, and it is a truly successful electronic knowledge repository. Every morning theoretical physicists download new papers in their field and discuss them over morning coffee, long before they make it into print. When asked why this academic advance had not spread to other fields, Ginsparg suggested that: "*...physicists are self-selected to value eccentricity and novelty of ideas above all else, even at considerable professional risk to themselves*" [36, p179]. Now there are other disciplinary archives: CoRR (http://www.acm.org/repository/) in computer science, CogPrints (http://cogsci.soton.ac.uk) in the cognitive science, and PubMed (http://www.nih.gov/welcome/director/pubmedcentral/pubmedcentral.htm) in the biomedical sciences. There are ongoing efforts to improve open archives (see http://www.openarchives.org/). An IT effort in this direction is the Multimedia Educational Resource for Learning and Online Teaching (MERLOT) (http://www.merlot.org/merlot/index.htm) repository. With nearly 20,000 materials offered by educators from all disciplines and operating within Creative Commons License Conditions, MERLOT has over 60,000 registered students and teachers who share advice and expertise about education with expert colleagues. In addition to databases storing assignments and resources, MERLOT also connects to the Journal of Online Learning Teaching (JOLT), which in turn provides open access to its peer-reviewed, refereed articles. MERLOT illustrates a repository system that is combining with an academic review KES for mutual benefit.

Yet while over 100,000 papers in physics have been self-archived by authors since 1991 this remains a minute proportion of all papers in Physics since 1991 [37]. The limitation of repositories like Los Alamos is that they run *in parallel* to existing journal systems, so for authors to submit to them is always an extra effort. This is in contrast to e-journals which were expected to *replace* print journals, but did not. That repositories are succeeding suggests they add the value of more dissemination, but that neither they nor e-journals have replaced traditional journals suggests that selection is critical to KES performance.

This raises the question of whether an electronic system can support *both* selection and dissemination? The assumption that discrimination and dissemination inevitably trade-off applies to print-publishing, but we suggest that it does not apply to electronic knowledge exchange, i.e. *a KES can increase both dissemination and selectivity.* The key to achieving this, it is proposed, is to engage the power of social communities, of which the academic community is just one example.

3.2 Social information exchange

The top three levels of a socio-technical system correspond to three psychology-based information exchange processes, namely exchanging factual information, developing personal relationships, and forming a group identity [38]. As the World Wide Web has developed it seems to have evolved through these stages. Firstly web sites and browsers mainly exchanged information facts, making the web effectively an enormous library of information. Then email and other systems developed communications between people, making the web also a huge social network. Finally, today computing is beginning to support the forming of genuine communities with common identities, making the Internet the new social frontier. However this last stage requires group-to-group transmissions e.g. reputation systems let group members rate each other [39]. Such many-to-many communication is distinct from the one-to-many linkage of blogs, and the one-to-one or one-to-few linkage of email or chat. It is this new technical functionality, illustrated by sites like Slashdot and E-

Bay, that now allows the discrimination of all submissions as well as their dissemination.

Electronic repositories like Los Alamos already dramatically increase knowledge innovation and dissemination simply by letting more people contribute and view more knowledge. However apart from spam, both good and bad preprints are published equally, so this is done at the expense of discrimination. Hence repositories are not and cannot be the future of academic publishing. Yet could one rate repository submissions? If an academic KES did this, it would not only reveal the 90% of submissions that are currently never seen, but its many-point rating scale would offer more discrimination compared to the current accept/reject dichotomy.

A common response to the idea of publishing everything is that it is impossible as we don't have enough reviewers. Yet the current process already assesses everything submitted, as *to reject even the worst paper someone somewhere has to read it to some degree*. The difference is not that the current system assesses less but that it does so in private. It is not the *number* of assessments that is at issue, but the *visibility* and *quality* of those assessments. While a print journal can assess submissions badly and in secret, an open KES would transparently display both what it considers good and what it considers bad. Since all submissions are assessed anyway, why not do it openly? Simply to reveal what they reject would change most journals. Socio-technical methods like Slashdot's karma protocol suggest how an open KES could tap its community to rate submission quality. In this approach any registered academic can rate anything, given there would be ranks of junior, senior or associate reviewers based on experience and performance. While traditional publishing systems solve the problem of more submissions by reducing acceptance rates, what is proposed here is to allow more people to rate. Since the registered readers of an academic KES are themselves academics, why can they not rate and comment upon submissions? At the lowest level every reader "votes" for a submission simply by downloading or reading it, while high-level reviews would involve detailed criterion ratings and comments. Reviewer assessment and reader assessment are complementary not mutually exclusive, as each has a different perspective. Ratings by respected reviewers could direct readers to useful but hard to read papers, while heavy reader interest could focus attention on papers about important issues. Combining the two forms of rating helps combine rigor and relevance. Community involvement and sharing responsibilities like reviewing among the many rather than the elite few is the way to solve the current editor/reviewer bottleneck and its concomitant timeliness problems.

The details of what is being proposed are more than we can describe here. A fuller description can be read at http://brianwhitworth.com/Reinvent2008.doc. [49] Yet the goal should be clear: an online system that increases knowledge innovation, knowledge discrimination and knowledge dissemination overall by adapting social computing tools like reader commenting, reviewer reputation, view filters, same again functionality, social networks and version control to existing repositories. Certainly this will produce problems but it is a real opportunity to resolve current problems like lack of timeliness, insufficient innovation and declining readership. The general aim is to improve KES performance, by *increasing the flow of good knowledge*.

Note that for a socio-technical systems to succeed it must be responsive to social requirements such as legitimacy (that interactions are fair and beneficial to the parties involved); transparency (that what is done is visible); politeness (consideration of others) and freedom (the individual's right to make choices about themselves, such as privacy choices). Finally, socio-technical systems also need defenses against anti-social individuals who attack the social system.

3.2.1 WHO PAYS?

A common critique of open information exchange is to ask "Who will pay?" Yet if one applied the same criterion to the Internet today, asking "Who will pay for the Internet?" there would be no Internet. This is a non-question for the Internet and is equally a non-question for academic knowledge exchange. The academic vision of growing knowledge by open exchange and critique is a proven model that does not follow business rules. Academic publishing has succeeded not by looking for funding but by looking for value to the community. Note that most writing, reviewing, editing and communicating work is done by academics *gratis*. As technology reduces publishing costs, the new business model is the one the Internet illustrates. To the question "Who pays?" the answer is "Everyone", because everyone contributes in their own way. The analogy of open source software development practices here is not naïve, given recorded instances of commercial enterprises adopting open source method to produce both better products and profits [40-44]. Open source UNIX products created by unpaid communities now challenge commercial products. One principle invoked is that of *social synergy,* where benefits target communities not individuals. The real resistance to open knowledge exchange is not economic but power-based, because unlike e-journals it is a *competency-destroying innovation* [45]. Just as printing made obsolete the competency of scribes, so an open *knowledge exchange democracy* will upset the current competency status of those who control current knowledge castles. However this is not, and never has been, a good reason to hold back progress. Indeed the future of the Internet seems to be that "Here comes everybody", and academic ivory towers are not immune to this trend.

4. CONCLUSIONS

While scholarly journals originally aimed to develop, select and diffuse knowledge, today they are the primary basis for hiring, promotion, tenure and grant decisions. Similarly academic publications are as much

mechanisms for profit as for knowledge exchange. Academic purposes like the search for truth are increasingly subordinated to contradictory business purposes, e.g. publishers seek restricted access to increase dollar sales value but authors seek open access to increase research knowledge exchange values. Why write up research to lock it away in exclusive and expensive journals that most people outside universities cannot afford to access? As publishing now affects individual advancement, academic department rankings, research fund targeting and library fund allocations [46], academics are losing their way. Journals have become the gatekeepers of academic power rather than the cultivators of academic knowledge, and theories are now battle weapons in promotion arenas rather than plows in knowledge fields. We have argued that when these business purposes make "rigor" the primary criterion of academia, they become counter-productive, for both business and academia alike.

Hence rather than the current increasing specialization of disciplines in increasingly rigorous and separate fields, we propose forming a *meta-discipline* to support cross-over research at the expanding nexus of *technology use*. This is based on the principle that it is in the overlap of different specialties that knowledge growth will occur, i.e. the research future is at the boundary of disciplines. Terms like web science [47], socio-technical systems [48], informatics, ICT (information communication technology), IS and even IT describe the vibrant cross-disciplinary crossroads of modern technology use. Rather than the current virtual balkanization of knowledge about technology use, as researchers within engineering, health, education, computer science, psychology, sociology, business and other disciplines separately study social computing, why not combine these effort? This is an opportunity, which raises the question of who can create a universal electronic "knowledge portal" for cross-disciplinary travelers in the general field of IT use? Who will be the virtual "Singapore" of academic knowledge exchange in this emerging cross-disciplinary field? Note that a university setting up such a meta-disciplinary centre would not just seek faculty from different disciplines, but *seek faculty trained in more than one discipline,* just as its students would be trained in more than one discipline at once.

The vision proposed here is of dynamic online knowledge exchange that balances the requirements of innovation, selection and education. To achieve this vision in the field of IT usage academia should: 1. Replace the myth that rigor is excellence with a balanced rigor-relevance model; 2. Reduce subservience to business needs on the grounds that knowledge growth ***is*** good business; and 3. Use proven social computing tools to support open electronic knowledge exchange that accepts everything, rates everything and publishes everything. This is not abandoning the roots of academia but returning to its original goal of *publishing knowledge freely for mutual critique and benefit*. Such a system should be open not closed, dynamic not static, inclusive not exclusive, innovative not conservative and most of all, alive not dead. Social technology like wikis, social networks and online communities show that knowledge merging can be done. Open electronic knowledge exchange would attract people from far and wide, as it is clearly the future. It may make the job of promotion and tenure committees harder, but an open KES could also provide useful submission, review, comment and vote reports. Either way, our job as academics is to create, select and grow knowledge, not to serve business needs. If we do our job and let others worry about theirs the system will work. If however we abandon our role under outside pressure we may lose our raison d'être. Fundamentally, *the goal of academia is to grow knowledge not to guard it (gatekeeper model) or to profit from it (business model)*. The academic model of knowledge exchange which is based on the principles of open and objective self-critique is well founded. We should not abandon it under foreign pressure. An online knowledge exchange system that combines rigorous reviewing and open dissemination would reinvent this original approach, and could initiate a new generation of academic publishing. The first to establish an open electronic system that both discriminates and disseminates could claim the expanding middle ground of cross-disciplinary research into information technology use.

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