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Mark I. Greenberg MLS, Ph.D.
Western Washington University, mark.greenberg@wwu.edu

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Open Access Publishing in Higher Education: Charting the Challenging Course to Academic and Financial Sustainability

Mark I. Greenberg

Abstract

The benefits, pitfalls, and sustainability of open access publishing are hotly debated. Commercial publishers dominate the marketplace and oppose alternative publishing models that threaten their bottom line. Scholars' use of open access remains relatively limited due to awareness and perceived benefits to their professional goals. Readership of open access publications is generally strong, but some people disagree that more readers leads to increased citations and research impact. Libraries have grown their influence by supporting and promoting open access, but these efforts come with significant financial costs. Today, open access has flourished most significantly as a philosophy: the belief that the world's scholarship should be freely available to readers and that publicly funded research, in particular, should be accessible to the taxpayers who paid for it.

Transforming a moral good into a sustainable publishing model rests with lawmakers, scholars, and institutions of higher education. Without laws designed to ensure participation by authors and publishers, Green Open Access cannot effectively replace journal subscriptions. Scholars need to call upon each other to archive their work, utilize open access repository web sites to find quality content, and embrace Gold Open Access journals as a professionally beneficial publishing venue. Institutions must allocate additional internal resources to spur more and better institutional and disciplinary archives, new Gold Open Access journals, and myriad other professional, technical, and financial services necessary to promote open access as a fiscally and academically sustainable publishing solution.

Introduction

For several decades, the cost of scholarly journals has grown far faster than the consumer price index and has outstripped most libraries' ability to pay. Compounded by the recent economic downturn, during which many library budgets shrank and have not yet recovered, even the best-funded colleges and universities cannot provide access to the rapidly growing body of published scholarship desired by their faculty and students. At the same time, an international movement has developed to offer alternatives to traditional

publishing models. Open access seeks to lessen the market influence of reader-pays (subscription) publishing for options that reduce overall journal costs to libraries and the institutions they support, offer scholars new avenues to disseminate their work, increase readership, and help fulfill the desire that research will educate and solve world problems.

Reality has fallen short of these goals, and the benefits, pitfalls, and sustainability of the various open access publishing models are hotly debated. Subscription-dependent publishers (primarily commercial vendors and scholarly or professional societies) still dominate the marketplace and often oppose alternative models that threaten their bottom line. Scholars' use of open access publishing remains relatively limited due to awareness and perceived benefits to their professional goals. Readership of open access publications is generally strong, but some people disagree that more readers lead to increased citations and research impact. Libraries have grown their influence on campus by supporting and promoting open access, but these efforts come with significant financial costs. The funds needed to provide continued access to the scholarship demanded by their users remain well beyond most libraries' available budgets. Today, open access has flourished most significantly as a philosophy: the belief that the world's scholarship should be freely available to readers and that publicly funded research, in particular, should be accessible to the taxpayers who paid for it. Transforming a moral good into a sustainable model for publishers, libraries, and scholars remains elusive and requires controversial approaches.

Current Commercial Publishing Models

In April 2012, Harvard University rattled higher education with a memo from its Library Faculty Advisory Council. "We write to communicate an untenable situation facing the Harvard Library," the communiqué began. "Many large journal publishers have made the scholarly communications environment fiscally unsustainable and academically restrictive." The Council referenced two publishers that had increased prices 145% during the previous six years and noted profit margins as high as 35% (Sample, 2012). According to Moghaddam (2009), Elsevier, one of the largest commercial publishers, enjoyed 25% profits in 2003 and 21% between 2008 and 2009. Not-for-profit (often scholarly or professional society) journals are less frequently seen as a source of the problem. University of Virginia Librarian and Dean Karin Wittenborg publicly stated in 2004 that society publishers' costs were "predictable and reasonable and they reinvest in the advancement of research and scholarship." They are the "good guys of scholarly publishing," she claimed (Frank, Reich, & Ra'anan, 2004, p. 284). The Association of Learned and Professional Society Publishers happily embraced this

sentiment. "All the evidence shows that non-profit journals are on average both less expensive and of higher quality," stated the group's chief executive in a 2005 article (Morris, 2005, p. 119).

Harvard's reaction to journal subscription prices was not new and has been well substantiated by other sources. In their report for the Association of Research Libraries (ARL), Kyrillidou and Young (2008) noted that between 1986 and 2006, its members experienced a 321% increase in journal expenditures but grew total titles by only 51%. While the Consumer Price Index increased a total of 57% between 1986 and 2002, journal costs climbed between 6% and 12% annually during that period (Chavez, 2010). Following the Great Recession, relatively few library budgets have returned to pre-2008 levels. Aggregate state spending levels for higher education in 2013 were nearly 8% below 2008 expenditures. According to Lowry (2013), an estimated 52% of ARL members saw flat or declining acquisitions budgets in 2012 with another 20% enjoying, at best, 3% increases. The overall effect has prevented libraries from keeping up with inflation on their current resources, never mind subscribing to the steady annual growth in new titles. It has become the norm for libraries to cut titles in order to balance their books.

In partial response to growing economic pressures on libraries and a commitment "to disseminating the fruits of its research and scholarship as widely as possible," in February 2008, Harvard University's Faculty of Arts and Sciences directed that its members place an electronic copy of the final version of their articles in the university's open access repository (often called an Institutional Repository, or IR) (Harvard Library, 2008). Other schools had previously recommended this action. Harvard was one of the first to require written permission to opt out of the depositing mandate. The move met with praise from open access advocates. Villanova University School of Law Professor Michael W. Carroll commented that it demonstrated authors' desire "to stand closer together instead of having to deal with publishers one on one." Publishers were less supportive. Director of Penn State University Press (PSUP) and President of the Association of American University Presses Sanford G. Thatcher called Harvard's policy "shortsighted" and feared it could result in lost subscription and reprint income for humanities and social science journals. Should PSUP lose significant journal income, he warned, "so too would our journals disappear from the face of the earth" (Guterman, 2008, n.p.). Several years earlier, in response to other open access initiatives, the executive director of the American Physiological Society complained that "articles should not be taken from those of us responsible for their creation" (Howard, 2008, n.p.).

The Open Access Movement

Harvard's open access policy, and that of nearly 500 other institutions by late 2014, grew out of a movement decades old (Lara, 2015; Suber, 2009). As early as 1989, the American Psychological Association sponsored a free, online, peer-reviewed journal titled *Psycoloquy*. As the Internet blossomed, other journals with a similar publishing model followed, as did open access archives. In August 1991, Paul Ginsparg founded arXiv to permit physicists, mathematicians, and computer scientists to upload their manuscripts before peer review for public dissemination. Van Noorden (2014) reported that at the end of 2014, the repository contained more than 1 million research articles. PubMed Central, established in February 2000 as a free full-text archive of the biomedical and life sciences, has grown from just two to several thousand journals (PMC FAQs, n.d.).

Anger with commercial journal pricing played a limited role in sparking these early initiatives but has increased dramatically over the last several decades, as evidenced by the 4,800 scholars who by early 2012 had pledged not to publish in Elsevier journals (Whitfield, 2012). "There are other good journals. And, long term, I'd like my library to be able to use its limited resources to better ends," stated one signatory to the boycott (Fischman, 2012, n.p.). Growing philosophical support for open access and advances in the technology needed to disseminate content drove change. UC Berkeley biologist Michael Eisen, co-founder of the open access Public Library of Science (PLOS), in 2003 stated, "We are not just another *Nature*, *Science*, or *Cell*. We are morally superior and what we are doing is better for the future of science" (Frank, Reich, & Ra'anan, 2004, p. 282).

By the twenty-first century, the growth of open access journals and manuscript archives, as well as mounting economic pressures on libraries, spurred a seminal event. On December 1, 2001, the Open Society Institute convened a meeting in Budapest, Hungary, of leading open access proponents -- an event C. W. Bailey has called the "constitutional convention" for the movement (Bailey, 2007, p. 252). The resulting February 2002 Budapest Open Access Initiative (BOAI) declaration codified existing thinking with lofty philosophical statements and far-reaching recommendations. The resulting document referenced "an unprecedented public good" made possible by "the world-wide electronic distribution of the peer-reviewed journal literature and completely free and unrestricted access to it by all scientists, scholars, teachers, students, and other curious minds." By removing access barriers to this literature, BOAI promised accelerated research, enriched education, shared and more useful learning between rich and poor, and a new foundation "for uniting humanity in a common intellectual conversation and quest for knowledge." The BOAI declaration also

referenced economic considerations: "Experiments show that the overall costs of providing open access to this literature are far lower than the costs of traditional forms of dissemination. With such an opportunity to save money and expand the scope of dissemination at the same time, there is today a strong incentive for professional associations, universities, libraries, foundations, and others to embrace open access as a means of advancing their missions" (Budapest Open Access Initiative, 2002).

To succeed in providing open access to scholarly journal literature, BOAI recommended two complementary approaches: self-archiving of subscription-based articles (commonly called Green Open Access) and subscription-free journals (Gold Open Access). For the former, BOAI acknowledged that scholars need tools and assistance to deposit refereed journal articles in electronic archives that conform to international standards and are thus discoverable at the article level by Internet search engines. For the latter, the declaration called for support to create new open access journals and to transition existing, traditional journals to open access. The new journals should not charge subscription or access fees but instead must turn to other ways of covering publishing expenses, specifically support from governments and foundations, universities and laboratories, funds released by the cancellation of traditional journals, "or even contributions from the researchers themselves" (Budapest Open Access Initiative, 2002).

Ten years later, in September 2012, buoyed by action following its 2002 meeting, the BOAI met again and established a far more extensive set of recommendations for the next decade: a Green Open Access policy at every higher education institution to include theses and dissertations; alternatives to journal impact factors to determine scholarship quality; requirements that publishers permit and faculty deposit their work in the institution's open access archive in order to be considered for tenure and promotion; and a mandate that every institution of higher education host its own Institutional Repository (IR) or at least provide researchers with an approved alternative (Budapest Open Access Initiative, 2012). To date, nearly 6,000 individuals and 730 organizations have committed themselves to the declarations' principles and goals.

In the wake of the first BOAI declaration, a flurry of broad governmental open access policies passed in the U.S. and abroad. The National Institutes of Health (NIH), the largest American provider of money for basic scientific research, requested in 2005 that scholars receiving its grants make their work available without cost to readers within one year of publication. At first only a small percentage of authors complied, and in 2008 the NIH made the policy mandatory. In late 2012, participation stood at 75%, and the NIH resolved to enforce the policy by blocking grant renewals when journal articles stemming from the award were not made openly accessible (Basken, 2012). The National Science Foundation (NSF) enacted a similar policy, and a law to cover all

federally funded research has been gaining momentum in Washington (National Science Foundation, 2013). Elsewhere, in July 2012, the United Kingdom accepted the recommendations of the Working Group on Expanding Access to Published Research Findings, which set a clear policy direction of Gold Open Access publishing (Finch, 2012). The controversial document met opposition from advocates seeking greater emphasis on Green Open Access (Abadal, 2013).

Advantages and Challenges of Open Access Publishing

The recommendations laid out by BOAI have seen, at best, uneven success. Over the last several decades, many scholars have become aware of open access publishing, but far fewer have shown a willingness to submit their research to these journals (Xia, 2010). In a large 2011 survey, Kenneway asked scholars worldwide to rate the importance of open access. Seventy-five percent stated they thought it was "important" or "very important" to offer their work online and free to readers. Only 2.4% claimed open access was unimportant (Kenneway, 2011). Ninety-two percent of authors choosing open access claimed in a 2004 study that they believed in the principle of making their research free to readers (Swan & Brown, 2004).

Supplementing positive attitudes toward open access, multiple studies have shown an open access citation advantage over subscription-based publications, though the correlation is not without controversy. Antelman documented the benefit for articles published in philosophy, political science, electrical and electronic engineering, and mathematics (Antelman, 2004). Hajjem, Harnad, and Gingras (2005) conducted a twelve-year, cross-disciplinary study of citation impact in ten disciplines and found between a 36% and 172% advantage for freely available scholarship. The following year, Eysenbach (2006) demonstrated that open access articles were twice more likely to be cited in the first ten months after publication than non-open access articles, with rates increasing further over the next six months. Laakso and Björk (2013) extended their analysis to articles not made openly accessible until a year or more after initial publication, and they still saw a significant citation advantage over traditional publishing models. In contrast, Frisch, Nathan, Ahmed, and Shidham (2014) looked at cytopathology journals between 2007 and 2011, but found comparable or only slightly higher citation rates for open access articles. Davis (2007, 2011) and Nieder, Dalhaug, and Aandahl (2013) distinguished between increased downloads and citations, acknowledging the existence of the former but questioning the validity and causality of the latter. Davis (2007) discovered, however, that news and popular science media were almost twice as likely to

feature open access articles, and they received nearly twice the number of news stories, than subscription-based scholarship.

The open access "citation advantage" and media exposure have motivated a growing number of scholars to adopt open access, but traditional publishing models still predominate. Though sources differ in their precise numbers, open access makes up a small percentage of journal titles and an even smaller proportion of total articles published. According to the latest *STM Report* (Ware & Mabe, 2015), there are roughly 28,100 active, scholarly, peer-reviewed journals publishing approximately 2.5 million articles annually. *STM Report* authors Ware and Mabe estimate an annual increase of 3% in researchers and journal titles and a 3.5% growth in articles during the last two centuries, but an accelerated rate in recent years. Among all journal titles, between 26% and 29% are now fully or partially open access, though open access articles make up only 12% of total journal content (Ware & Mabe, 2015). Other scholars, employing varying methodologies, have estimated open access at between 8% and 17% of total articles published annually and growing by about 1% each year (Abadal, 2013; Björk, Welling, Laakso, Majlender, Hedlund, & Guðnason, 2010; Laakso & Björk, 2012; Van Noorden, 2012).

Authors are not taking advantage of Gold Open Access in numbers proportionate with available options. In 2012, Björk looked at hybrid journals, which offer a combination of subscription and open access articles in the same issue. He calculated that the number of hybrid journals had doubled in the past several years from 2,000 to over 4,400 titles, which produced roughly 12,000 articles in 2011. Yet, only approximately 2% were published open access (Björk, 2012). A 2013 study concluded that open access articles comprised less than 1% in Elsevier journals (Poltronieri et al., 2013). At Oxford University Press, open access articles in hybrid journals dropped from just over 6% in 2007 to just over 4% in 2013. The decline was evident in all disciplines (Brothwell, 2014). Based upon these numbers, Björk concluded that the "hybrid experiment" among large commercial publishers has failed to significantly increase open access content (Björk, 2012, p. 15).

Reasons for the low adoption rates vary but are associated with cost, available options within a discipline, and perceived or actual journal prestige. In 2004, the large commercial publisher Springer began offering its Open Choice program with a $3,000 author publication charge (APC). APCs vary widely across publishers and disciplines, with a 2012 average of $904. Commercial publishers charged an average of $1,345; scientific societies, $461; and universities, $246. In biomedicine, author fees averaged $1,100 but were only $240 in the arts and humanities. Author fees for hybrid journals can be almost twice as high as for fully Gold Open Access titles. Globally, approximately 25% of all open access journals charge fees, but for titles of sufficient scholarly

reputation to have a journal impact factor, the figure nearly doubles (Shieber, 2009; Solomon & Björk, 2012; Ware & Mabe, 2012).

Scholars supported by grants (disproportionately in STEM fields) can build publication fees into their known expenses. This was true for 59% of all APCs paid in a large 2009 survey of open access authors, with another 24% of fees paid by the author's institution. Without grant funding or other institutional support, scholars face the unpalatable choice of paying the fees personally – some 12% experienced this situation (Solomon & Björk, 2012). A 2004 study revealed that 50% of authors would refuse to pay any publisher fees and 80% would not pay more than $500 (Regazzi, 2004). Seven years later, little had changed. Fifty-six percent of education faculty responding to a survey would not publish in journals charging fees (Shen, 2011).

For well-respected journals with high impact factors, including titles published by the Public Library of Science (PLOS), scholars have seen greater professional benefit to accepting the cost and thus are more inclined to pay the fee. In 2010, *PLOS Medicine*, with an author publication charge of $2,900, was ranked sixth highest among medical journals (McCabe & Snyder, 2010). "It is a testament to the power of journal imprimatur over immediate financial interest that authors are willing to submit their best work to such journals," noted one scholar (Shieber, 2009, p. 2). For less prestigious journals or other titles not likely to impress funding agencies or tenure and promotion committees, APCs are a major impediment to expanding open access scholarship, even for authors who oppose traditional, subscription-based publishing models (Warlick & Vaughan, 2007).

Scholars rarely incur a financial cost to self-archive their work, and thus their efforts show somewhat higher but uneven levels across disciplines. In 2006, 11.3% of all articles published that year could be found in subject-specific or institutional repositories or on authors' home pages, a figure little changed eight years later (Björk, Laakso, Welling, & Paetau, 2014; Björk, Roose, & Lauri 2009). In their 2010 study, Björk et al. found that 25.9% of earth scientists self-archived, a figure well above the 7.4% for chemists and chemical engineers (Björk et al., 2010). Economists' open access practices in 2006 revealed that 90% of articles published in the discipline's top fifteen scholarly journals could be freely accessed via Google, but self-archiving was barely 50% for articles in eighteen lower-ranked journals. Given fewer institutional subscriptions and, presumably, fewer readers of the less prestigious journals, self-archiving levels could not be attributed to scholars' expected rational desire to maximize readership. Instead, selection bias (scholars were more likely to self-archive if they expected higher citations), available information about self-archiving options, and peer group norms most influenced the decision-making process (Bergstrom & Lavaty, 2007).

Publishers' prohibitions against self-archiving -- estimated as high as 33% in 2012 and 25% in 2015 (Ware & Mabe, 2012, 2015) -- the time needed to self-archive, familiarity with IR or discipline-based software systems, and lack of understanding about author rights and copyright help explain why many authors do not self-archive unless required by their institution or grant funder (Van Noorden, 2013). The database SHERPA/ROMEO seeks to clarify author rights and publisher copyright policies. For example, a search for the *American Journal of Education* reveals that the publisher permits authors to archive their pre-print (manuscript prior to peer review) immediately and their post-print (final draft following peer review) or the publisher's version/PDF twelve months after publication. Other general conditions apply. Scholars' awareness of SHERPA/ROMEO as a helpful tool for self-archiving remains limited.

Graduate students and their faculty advisors have eschewed Green Open Access for fear that placing electronic theses and dissertations (ETDs) in institutional repositories diminishes future publishing opportunities. Ramirez, Dalton, McMillan, Read, and Seamans (2013) found that 82.8% of journal editors and 53.7% of university press directors polled in 2013 welcomed submissions of self-archived ETDs, but only if subsequently revised for publication. Smaller journals and university presses were disproportionately more reluctant to consider ETDs than larger publishers. Ann Donahue, senior editor at Ashgate Publishing Group, recommended that scholars not make their dissertation available online until after they have published it as a book (Howard, 2011). More recently, the Association of Writers & Writing Programs asked universities to exempt creative writing theses and dissertations from their IRs in order to protect students' future publishing options. At University of Iowa and Bowling Green State University, graduates now submit their creative writing thesis in paper form only (Sinor, 2014; Thomas & Shirkey, 2013).

There are a variety of impediments to Gold Open Access as well. Despite evidence of greater readership and citations for open access publications in many academic disciplines, scholars in art history, agriculture, business, and library and information science have questioned the effectiveness of Google at producing search results from open access journals and have bristled at low indexing rates in commercial databases for their open access work. Evans, Thompson, and Watkins (2011) wrote, "Increased indexing of open access art journals in the traditional, subject-specific indexes will be integral to their acceptance within the discipline of art history" (p. 168).

The vast Web of Science™ cross-disciplinary journal citation network further illustrates the incomplete indexing issue facing open access titles. The Web of Science™ Core Collection comprises "carefully selected and maintained" commercial, scholarly society, and open access publishers of the "most influential journals" in the world. It covers citations for over 12,000 "high impact" journals

in 232 subject areas from over 3,300 publishers in more than 60 countries – a total of 90 million records and in excess of one billion cited references. Of the more than 12,000 journals indexed, approximately 13% are open access (West, Bergstrom, & Bergstrom, 2013). Publisher Thomson Reuters maintains a list of these titles on its web site. Elsevier licenses Scopus, an alternative abstract and citation database with 22,000 peer-reviewed titles, 2,930 (or 13%) of them open access. In both cases, the percentage of indexed open access journals is lower than the total number published (Ware & Mabe, 2015).

These two selective, commercially available indexes offer an analytical tool – the journal impact factor (JIF) – which originally was designed to help publishers and librarians determine a particular journal's citation influence for the purposes of pricing and acquisition decisions. Thomson Reuters' Journal Citation Reports® (JCR) calculates the JIF using a proprietary citation algorithm for titles indexed in its Web of Science™ database. Specifically, Thomson Reuters determines a journal's impact factor -- and by extension its alleged prestige -- by dividing the number of citations to it in the reported year by the total number of articles published within it in the previous two years. JCR's complementary and more recently devised Eigenfactor® algorithm (formulated at the University of Washington) supposes that citations from high impact journals have greater scholarly influence than those from lower impact journals. A third algorithm, the Article Influence™ score, focuses on average influence of each of a journal's articles in the first five years following publication (Bornmann, Marx, Gasparyan, & Kitas, 2011; Eigenfactor metrics in JCR Web, 2012). The methods used to calculate JIFs and other scores have come under strong criticism as open to manipulation and ineffective evaluative tools, yet funding agencies and hiring and promotion committees commonly use them to inform their decisions (Bornmann et al., 2011; Elliott, 2014; Leydesdorff, 2012; Zupanc, 2014). Authors considering journals for which research impact cannot be determined may choose to publish elsewhere. Thus, the relative dearth of Gold Open Access journals with established impact factors disadvantages this publishing model.

Compounding uneven indexing and absent journal impact information, some scholars have questioned the quality of peer review and thus the professional benefits of submitting their work to open access journals. One scholar once asked, "Since payment of a publication fee is the route to being read, how does that differ from vanity publishing?" (Stevenson, 2004, p. 84). Charlotte Haug, council vice-chair for the Committee on Publication Ethics, recently wondered if new publishing models have "opened up opportunities to charge authors a fee to publish their papers with little or no quality control" (Haug, 2013, p. 792). Only half of education faculty surveyed in 2011 believed open access was as intellectually rigorous and prestigious as subscription-based publications. Yet, a survey of the more than 845 journals using Open Journal Systems to

publish open access scholarly works found that 45% accepted less than half of the articles submitted. Only 14% had acceptance rates above 80% (Edgar & Willinsky, 2010). In a 2004 study, scholars who chose subscription-based journals cited lower prestige, impact, readership, and little familiarity with open access titles to explain their decision. In that same study, 77% of scholars who selected open access noted that peer review was about the same as with traditional journals, and 13% of survey respondents indicated that they received greater feedback during the editorial process (Shen, 2011; Swan & Brown, 2004). For open access journals to succeed, they must offer authors a "good fit" in terms of their subject coverage, quality feedback through the peer review process, a respected "brand" as evidenced by their impact factor, wide visibility and readership among the author's peers, and low or no publication costs (Schonfeld, Wulfson, & Housewright, 2013, p. 59).

Individuals and institutions have taken different approaches in response to concerns working against the spread of open access. To help scholars make professionally advantageous publishing decisions and to guide tenure and promotion committees in assessing the quality of various publications, University of Colorado Denver librarian Jeffrey Beall maintains a list of publishers whose scholarly credentials, business management, integrity, or other practices raise concerns (Beall, 2016). Beall's controversial blacklist of "predatory publishers" has come under criticism from publishers and open access advocates alike – in part for Beall's personal ambivalence toward open access publishing -- and should be consulted in combination with other tools (Berger & Cirasella, 2015, pp. 132–33). The Open Access Scholarly Publishers Association (OASPA), a trade group established in 2008 to represent the interest of open access journal publishers, sets its own standards for excellence (OASPA Code of Conduct, 2016). The web site Eigenfactor.org correlates author fees and article influence scores (a measure of journal prestige) to help scholars derive the highest professional benefits when selecting an open access science journal. Ultimately, Haug (2013) has argued, scholars should concern themselves less with publication or financing models and more with publishers' transparency regarding their content and editorial processes.

In order to mitigate the impediments that author publication charges place on publishing open access, some universities have established special funds. At UC Berkeley, faculty asked the university to redirect money from library subscriptions, which they hoped would raise awareness about alternative publishing options and reduce overall costs for scholarly resources. When launched in January 2008, the Berkeley Research Impact Initiative (BRII) pilot project offered up to $3,000 to publish in Gold Open Access journals and $1,500 for hybrid journals. In its initial phase, BRII supported eighty-seven articles and estimated the initiative required $45,000 per year to continue (Eckman & Weil,

2010). The Compact for Open-Access Publishing Equity (COPE), established in 2009, includes UC Berkeley and twenty other research institutions committed to underwriting reasonable author publication charges for their scholars publishing in Gold Open Access journals (Compact for OA Publishing Equity, 2009). In a recent survey of librarians, 70% indicated that APCs paid by their libraries came from the existing collections budget, and this support to authors resulted in only a minimal impact on acquisitions (Lara, 2015). PLOS offers institutional accounts for direct payment on behalf of researchers seeking to publish in its journals. Currently in North America, only one U.S. institution, George Mason University, one Mexican, and four Canadian universities utilize this service. To advance open access scholarship in the humanities, the Mellon Foundation-supported Open Library of Humanities utilizes a different funding model. Its Library Partnership Subsidy system relies upon library consortium fees to cover publishing costs, thereby eliminating APCs for its authors (Eve & Willinsky, 2015; Library Partnership Subsidies [LPS], 2014).

To promote self-archiving, open access repositories have grown significantly over the last decade, from 128 in December 2005 to 2,714 in January 2015. Nearly 83% are hosted by a specific institution to showcase the research produced by its scholars (see, for example, CEDAR at Western Washington University), and just under 11% are cross-institutional subject-based repositories, such as arXiv (OpenDOAR, 2015). At colleges and universities, libraries often manage these efforts, and they engage specially trained information professionals to build, maintain, and promote the required systems. Some schools have adopted open source software solutions like DSpace and Hydra. Other institutions have turned to commercial products like Digital Commons® by Bepress for their IR.

Beyond efforts to promote self-archiving among their faculty, staff, and students, some libraries now host and/or publish Gold Open Access journals. The University of South Florida Tampa Library (USF), quite active in this arena with the Digital Commons® software system, currently provides access to seventeen titles. The *International Journal of Speleology* and *Genocide Studies and Prevention* had been subscription-based, but the scholarly society publishing the journal moved it to USF and asked the library to host its contents open access. In the case of *Alambique*, dedicated to science fiction and fantasy research and criticism originally written in Spanish or Portuguese, and the Hispanic arts and literature journal *Revista Surco Sur*, USF serves both as host and publisher. USF is far from alone. Using its software platform, Bepress lists well over 200 peer-reviewed Gold Open Access journals hosted or published by dozens of libraries. A 2013 survey of U.S. academic libraries revealed that over 50% offered or soon planned to launch an open access scholarly publishing service (Peterson, Emmett, & Greenberg, 2013).

Hosting or publishing an open access journal at a university can come with a hefty price tag. In 2010, Chavez calculated the three-year, single title cost for the USF Tampa Library at $7,900 in the first year and $5,400 in the last two, but his figures did not include staff or overhead expenses (Chavez, 2010). A 2005 estimate by Johnson, which did incorporate staff costs and overhead, suggested $206,300 to publish one scholarly society journal (Johnson, 2005). Other studies showed costs anywhere between $20,000 and $175,000 (Willinsky, 2005). Operating an IR without a journal publishing component is a costly proposition as well. Many libraries with institutional repositories have several professionals dedicated full-time to the enterprise, with others providing peripheral support. A small academic library considering a commercially hosted IR solution like Digital Commons® might conservatively budget $150,000 per year for the software license and staff. IR costs for libraries at large research institutions like the Massachusetts Institute of Technology and Cornell are considerably higher (Ware & Mabe, 2015).

The expenses incurred by libraries to support both Green and Gold Open Access compounds a longstanding irony. In a subscription-based publication system, institutions pay twice for access to research produced by their faculty and staff. Costs can include salaries and benefits, equipment, travel, space, and other overhead. Upon completion and publication of the work, many colleges and universities pay a second time by subscribing to the journal or purchasing the book in which that scholarship appears. With the advent of open access, many institutions are paying a third time: for the institutional repositories in which scholars self-archive their subscription-based publications and for subscriptions to hybrid journals, which contain a mix of licensed and open access content. The current open access double irony of triple payment is unsustainable for libraries and the institutions they serve.

The open access double irony is evident in the controversy over publishers' alleged double dipping when pricing their hybrid journals. Recall that hybrid journals contain a combination of subscription and open access content, often in the same issue. Springer, Sage, Elsevier, and Oxford University Press (among others) allow immediate and free reader access to specific articles when author fees are paid. The formula by which APCs reduce subscription prices has done little to bring down costs to libraries, however. Springer factored its Open Choice program (with an associated $3,000 APC) into hybrid journal pricing for 74 journals in 2013. Once Open Choice content made up at least 8% of total content, Springer lowered the journal's subscription price by an equal amount. When offset by "general price increases due to volume growth," libraries saw limited saving within their Springer packages from 2012 to 2013 and increased prices over three years (Goerner, 2012). Sage Premier currently employs a different discount model for its institutional subscribers, reducing APCs for that

institution's STEM authors from £1,600 to £200 and offering a global discount when more than 5% of articles are published open access. In 2015, this pricing plan will affect 10 of 645 Sage Premier titles (Kingsley, 2014).

The vast majority of libraries have enjoyed, at best, limited savings from the hybrid journal model. Some research-intensive institutions that heavily subsidize author fees actually saw their costs increase. Using the Springer Open Choice model as an example, a university that paid $3,000 in publication charges for twenty authors would need to receive a $60,000 subscription decrease just to break even. With anything less than $750,000 worth of discount-eligible titles in its subscription bundle, the institution would see no net benefit from Springer's 8% global discount. In its current form, the hybrid publishing model has been a "failed experiment" for both authors and subscribers, according to Björk (2012).

The largely unrealized hope of institutional savings from hybrid journals extends to journal cancellations as well, where "the marked changes brought on by the advance of open access has so far had little effect on the price of subscribed journals" (Van Orsdel & Born, 2008, n.p.). In 2006, Ware surveyed 340 librarians, primarily from academic institutions, on factors affecting their decision to discontinue a subscription. While 97% of librarians stated that a self-archived publisher PDF served as an acceptable substitute for the actual journal issue, only 9% found a pre-print a viable alternative. Three quarters of librarians indicated that 90% of a journal's content would need to be available open access before they would cancel a subscription, but only 16% of respondents could estimate content overlap between self-archived articles and their library's journal holdings. Concerns over the long-term availability of archival content, questions about completeness and integrity, faculty demand for the published version, and the inadequacy of pre- and post-prints led Ware to conclude that "repositories are clearly not seen by librarians as a substitute for properly managed journal holdings" (Ware, 2006, p. 3). Hoskins (2013) reported similar apprehensions in her 2013 survey of South African librarians. Looking to the future, in 2006, Ware noted that fully 80% of librarians in his study saw the availability of Green Open Access as an important or very important factor in cancellation decisions over the next five years, but in 2015 discernible savings remain unrealized. As less than 5% of total published articles are Gold Open Access, it is not surprising that there has been little impact on subscription cancellations (Henderson & Bosch, 2010).

Possible Solutions to Open Access Publishing

So what is the solution? The economics of scholarly publishing complicates discussions. Scholars disagree on concepts and definitions; they employ different and complex methodologies to derive per-article publishing costs; wide variability

between institutions and publishers influences costs; and commercial publishers remain reluctant to open their books so that scholars can assess for themselves the economic relationship between open access and journal pricing.

Consensus on the actual costs associated with publishing an article in both traditional and open access models has proven nearly impossible. In her article "The True Costs of Scholarly Journal Publishing," Morris (2005) included research, writing, refereeing, publishing, acquisition, preservation, and reading. Houghton et al. (2009) also took a broad view (but excluded reading) in their 2009 United Kingdom study. More narrow definitions do not include production costs, such as research and writing, and instead restrict analysis to the expenses associated with presenting the finished work; for example, peer review, copy editing, article layout, web development and hosting, printing, mailing, and promotion (Edgar & Willinsky, 2010). The distinction between electronic and/or print formats affects price, as does print run size (when applicable). Confounding easy cost comparisons, scholars writing on the economics of journal publishing employ different terms and economic concepts. Moghaddam (2009) wrote of fixed, variable, marginal, and first-copy costs. King (2007) referred to direct and indirect fixed and variable costs. Morris (2005) evaluated direct and indirect costs. Houghton et al. (2009) analyzed the costs associated with "overlay services." In these various models, specific expenses fell into different categories, and the inclusion and extent of overhead, like space and utilities, were difficult to discern.

Given varying terminology and methodologies, studies have produced widely varying per-article figures. For professional and scholarly society publishers, Morris (2005) estimated costs at $97,140 to $99,265 inclusive of pre- and post-production and only $10,015 for production. In 2007, King looked at hundreds of subscription-based publishers analyzed in multiple studies and reported total production costs between $2,670 and $4,600. Van Noorden (2013) estimated $3,500 to $4,000.

Most experts agree that Gold Open Access offers reduced costs, particularly if subsidized with institutional in-kind support. At the low end, Chavez (2010) estimated the per-article expenses to publish open access at the University of South Florida at $1,128 to $1,975 in the first year and $771 to $1,350 in subsequent years, plus overhead. To remain financially viable, *PLOS Biology* raised its initial $1,500 APC and now charges authors $2,900, with steep discounts for submissions from low- and middle-income countries. Author fees made up 97.5% of PLOS's total gross revenue and support in 2013 -- the rest generated by members, reprints and sponsorships, and advertising (Public Library of Science: Financial Statements, 2013). A survey of nearly 1,000 users publishing on the Open Journal System platform revealed a mean cost per article of $1,161.97 with average institutional subsidies of $15,000 per year (Edgar &

Willinsky, 2010). In their national report on alternative publishing models in the United Kingdom, Houghton and Oppenheim (2010) estimated subscription-based electronic-only article costs at £2,335 and open access at £1,525.

In response to strong criticism of their report from the publishing industry, Houghton and Oppenheim could barely contain their ire:

> If the publishers are confident about these criticisms, the way to deal with the matter is through normal scholarly discourse. Publishers should develop their own model and/or use the Houghton model with their own figures, to see how the figures pan out. But they would have to do this in a scholarly publication, so that others can read about their methodology and learn what data were input. Unsubstantiated anonymous sniping at a report does not contribute to constructive dialogue; the correct way is for publishers to publish their assumptions and results in an open and transparent manner so that scholars and other stakeholders can make informed assessment. (Houghton & Oppenheim, 2010, p. 52)

With large journal bundles, the commercial publishing norm and publisher-imposed non-disclosure clauses common despite growing library pushback, accurate subscription, open access, and hybrid cost comparisons remain difficult to achieve (Strieb & Blixrud, 2013).

Despite the various controversies outlined above, several things are clear. Traditional, reader-pay models of scholarly communication are unsustainable for libraries and the institutions they serve. Open access publishing offers numerous opportunities but as yet remains an unrealized goal for expanding readership, controlling costs, and meeting scholars' needs around career advancement. The path toward academic and financial sustainability may be more disruptive, at least in the short term, but here are important considerations: 1) More commercial journals need to move to a hybrid publishing model, funding agencies and institutions need to increase their support for author publication charges, and publishers need to institute reasonable, transparent pricing models; 2) more scholarly and professional societies currently distributing their journals by subscription should consider moving to full open access; 3) scholars who currently rely on commercial products to index and rank journals need to look to alternative evaluation metrics; 4) research funders, authors, and their institutions need to insist that subscription-based publishers permit post-print or, ideally, publisher PDF self-archiving, and many more authors need to participate if they don't publish Gold Open Access; and 5) institutions traditionally focused on the consumption of scholarship need to increase their role as publishers,

disseminators, and preservers of that scholarship. The approaches outlined above maintain a role for commercial publishers and their hybrid journals. They strengthen mandates for and participation in Green and Gold Open Access. They increase institutional capacity to host journals willing to leave a subscription-based model, and they respond to research growth with new open access titles. The approaches do, however, place pressure on faculty to engage more actively in self-archiving and to embrace open access publishing alternatives.

A lengthy discussion of all the challenges and threats associated with implementing these five calls to action awaits another essay, but evidence suggests that each could be achievable with concerted effort. If priced to lower annual costs to all subscribers rather than to increase profits for publishers, hybrid journals offer an opportunity to expand open access by incentivizing funding agencies and institutions to pay author publication charges. For the model to work, APCs and subscription prices need to be set transparently in relation to one another so that organizations that pay the fees see meaningful relief in their subscription prices. The Royal Society of Chemistry and Institute of Physics in the United Kingdom recently instituted this practice with the Research Councils UK and Wellcome Trust. At the same time, prices -- even when adjusted for "volume growth" -- need to decline globally as open access articles and APC income increase. Establishing new models around hybrid journal pricing may be difficult to attain but should lead to overall library savings -- as much as 25% in the Netherlands, according to one estimate (Neylon, 2014). Unless institutions decrease their business with subscription-based publishers who place high profits over sustainable pricing models (for example, Cornell University in 2003 and Dutch universities in 2014), it is not clear what might motivate publishers to act (Knight, 2003; Neylon, 2014).

Scholarly societies have successfully made the shift to open access. In 2012 the International Association of Genocide Scholars (IAGS) moved its subscription-based, print/electronic *Genocide Studies and Prevention: An International Journal* from the University of Toronto Press (UTP) to online-only, Gold Open Access, hosted in Digital Commons at the University of South Florida Tampa Library. IAGS made the choice after much discussion. "From the point of view of the IAGS and the Editorial Board, it is . . . of central importance for the successful development of the journal to obtain authorship and readership from the global south," wrote the editors in their first open access issue. IAGS's decision appears to have paid dividends.

> USF, Scholar Commons, and bepress have proven to be exceptional partners. It must be explicitly stated that their complete support is free of charge. As a consequence, IAGS is able to invest its means into supporting global scholarship without having to

> raise overall membership fees, which can prohibit many scholars, students, practitioners, and activists based outside of North America and Europe from participating in the IAGS. (Gatti et al., 2014, p. 1)

Ware and Mabe (2015) offer a selective list of other "flipped" journals in their 2015 *STM Report* (pp. 95-96).

For scholars seeking to discover new scholarship and to demonstrate the impact of that work, alternatives exist to commercial article indexes like Web of Science™ and journal-impact factors. These substitute tools are particularly well suited to the Internet and the open access publishing environment. To find new scholarship, many researchers rely heavily on Google Scholar, rather than licensed databases, as their search engine of choice. Discipline-specific web sites can supplement Google results. For example, the Social Science Research Network is committed to the dissemination of research results through its Abstract Database, which comprises nearly 600,000 records, and via an Electronic Paper Collection of nearly 500,000 full-text documents. The Education Resources Information Center (ERIC), which turned fifty in May 2014, now contains more than 1.1 million citations on education topics dating back to 1966. In the cross-disciplinary Digital Commons Network, researchers can search over 1 million open access journal articles, book chapters, dissertations, and other scholarly works deposited in the system by institutions worldwide. The Directory of Open Access Journals and OpenDOAR Directory of Open Access Repositories offer still other large databases of open access content.

To gauge research impact, though not necessarily quality, altmetrics can complement or replace oft-used measures with new, timely tools found in social media. A variety of web sites, such as Altmetric and ImpactStory, capture Tweets, blog posts, news stories, and other content that mention scholarly articles and can serve as an early predictor of future citations (Cave, 2012; Mounce, 2013; Thelwall, 2014). Google Scholar's free citation service enables authors to create personal profiles to manage, calculate, and track citations to their work. Google Scholar Metrics measures the "visibility and influence" of articles appearing in recent scholarly publications. Institutional Repositories and individual research pages offer download statistics and other analytics to document reader use. Although relatively new and still maturing methodologically, these alternative metrics should provide increasingly effective ways of indicating articles' scholarly impact in the future.

To advance open access nationally, in the 113th Congress (Jan. 2013 to Jan. 2015), proponents introduced the Fair Access to Science and Technology Research Act (FASTR). The proposed law followed the moribund Federal Research Public Access Act, which failed to come up for a vote in the three

previous congressional sessions. If passed, FASTR would require eleven federal agencies granting $100 million per year or more for research to ensure that recipients make their resulting scholarship freely available online within six months of publication. Acceptable versions and deposit locations include the final peer-reviewed manuscript or publisher PDF in a repository maintained by the agency (like the NIH's PubMed Central) or an institutional or disciplinary repository (Support the Fair Access to Science and Technology Research Act (FASTR), 2013). FASTR follows adoption of similar international policies, such as the United Kingdom's publicly funded Research Councils UK and privately supported Wellcome Trust. The proposed U.S. law is not without strong opponents, particularly in the publishing industry. FASTR proponents must sustain their pressure on lawmakers: Federal statutes in support of open access are essential to grow acceptance and compliance rates.

An increasing number of universities, led by their libraries, need to support Green and Gold Open Access initiatives with additional funding from grants, gifts, and/or by shifting existing financial resources and personnel. OpenDOAR provides a quality-assured list of over 2,600 repositories worldwide, including nearly 500 IRs in the U.S. (OpenDOAR, 2015). The library profession offers an extraordinarily wide array of useful tools to help librarians and their institutions adopt or expand open access projects. Numerous journal publishing tools exist in open source products, including Open Journal Systems and HyperJournal, and in commercial products like Digital Commons. Over 7,000 journals currently use OJS, and another 700 utilize Digital Commons (Busher, Kamotsky, & Taylor, 2014; OJS Map | Public Knowledge Project, 2014). For digital preservation, LOCKSS (lots of copies keep stuff safe), based in the Stanford University Libraries, offers libraries and publishers a low-cost, open-source toolkit to ensure perpetual access to subscription-based electronic content. Portico, an alternative digital preservation service provided by the not-for-profit ITHAKA organization, incorporates a significant electronic journal-archiving project, including JSTOR content (What Is LOCKSS?, 2014). These proven systems to protect against loss of publisher-supplied content could well serve the preservation needs of academic institutions publishing or hosting Gold Open Access journals.

Call to Action

In the end, the spread of open access publishing rests in large measure with lawmakers and scholars. Without laws designed to ensure participation by authors and publishers, Green Open Access cannot effectively challenge journal subscriptions as a sustainable access alternative. Federal legislation must offer

both incentives and risks. The incentive to archiving is external funding, both for the people conducting research and the organizations engaged in disseminating and preserving it. The risks for non-compliance might include withheld support and/or other financially undesirable outcomes.

Scholars and their institutions have their own important roles to play. Motivated by Harvard University's 2008 open access directive (Sample, 2012), and those of many other colleges and universities, researchers need to call upon each other to archive their work, utilize open access repository web sites to find quality content, and embrace Gold Open Access journals as a professionally beneficial publishing venue. Rewarding these behaviors when hiring, during tenure and promotion, and in other settings that recognize research excellence acknowledges scholars' rational self-interest when making publishing decisions and incentivizes their participation in open access. For their part, institutions need to allocate additional internal resources to support faculty who choose open access solutions. Whether directed by lawmakers, guided by peers, or persuaded by advocates, scholars' growing engagement with and demand for open access publishing options will spur more and better institutional and disciplinary archives, new Gold Open Access journals, and myriad other professional, technical, and financial services necessary to promote open access as a fiscally and academically sustainable publishing solution.

Open access has come a long way in the last fifteen years and in the process has stimulated discussion, action, and controversy. Much work remains if open access advocates are to advance effective scholarly communication options for researchers, address the untenable situation facing library budgets, and promote the moral good associated with the barrier-free global dissemination of knowledge.

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