

The Inevitability of Open Access

David W. Lewis

Open access (OA) is an alternative business model for the publication of scholarly journals. It makes articles freely available to readers on the Internet and covers the costs associated with publication through means other than subscriptions. This article argues that Gold OA, where all of the articles of a journal are available at the time of publication, is a disruptive innovation as defined by business theorist Clayton Christensen. Using methods described by Christensen, we can predict the growth of Gold OA. This analysis suggests that Gold OA could account for 50 percent of the scholarly journal articles sometime between 2017 and 2021, and 90 percent of articles as soon as 2020 and more conservatively by 2025.



Open access (OA) has emerged as an alternative to subscriptions as a business model for scholarly journals. Many open access advocates are optimistic that it will enhance scholarly communication by making content broadly available and by providing relief to libraries from continuing large price increases of subscription journals. Open access has made an impact in a relatively short time. As Richard Poynder puts it, "What is remarkable about the open access (OA) movement is that despite having no formal structure, no official organization, and no appointed leader, it has (in the teeth of opposition from incumbent publishers) triggered a radical transformation in a publishing system that had changed little in 350 years. Most notably, it has demonstrated that it is no longer rational, or even necessary, for subscription paywalls to be built between researchers and research."¹

An important question for scholars and librarians is whether open access will

challenge subscriptions as the primary method for the distribution of scholarly journal articles and, if so, how quickly might this occur. The pace of change will determine how long libraries will be burdened by high subscription costs and how long large portions of the scholarly record will be inaccessible to many who could benefit from it.

This article will explore this question using the lens of business theorist Clayton Christensen's work on disruptive innovation.² It will be argued that open access, especially in its pure Gold form, is a disruptive innovation and that given this we can anticipate that it will become the dominant model for the distribution of scholarly journal content within the next decade.

Defining Open Access

Open Access comes in two major forms—Gold and Green. Gold comes in several flavors. Direct Gold OA refers to journals that provide all of their articles free to

David W. Lewis is Dean of the IUPUI University Library; e-mail: dlewis@iupui.edu. © 2012 David W. Lewis, Attribution-NonCommercial (<http://creativecommons.org/licenses/by-nc/3.0/>) CC BY-NC

readers at the time of publication.³ Some subscription journals make their articles open access after some period of time. This form of Gold OA is referred to as Delayed OA. Other subscription journals provide the alternative for authors to pay a fee to make their particular article freely available. This is referred to as Hybrid OA.

Green OA refers to self-archiving of a version of the article, often not the final published version, on the author's personal Web site or in an institutional or subject repository.

For the purposes of this analysis it is important to note the differences between forms of open access. Green OA sits alongside the subscription journal system and does not attempt to replace it. Rather, it is a supplement that provides a version of the content to people who would not otherwise have had access to it. Delayed and Hybrid OA can be thought of together, as they are both open access options offered by subscription journal publishers who maintain their subscription business model. Among open access strategies, Gold OA is the only one that exclusively uses a different business model, one that does away with the overheads associated with restricting access to content and for collecting money from readers or their libraries.

Markets for Scholarly Journals

As we assess how open access and subscription-based journals will fare in the future, it is important to understand that journals compete in two different markets. The first is the market for readers', or their libraries', dollars. The second, and ultimately more important, market is for the right to publish the best scholarly works.

Open access journals and their subscription counterparts offer different value propositions in these two markets. For the reader, open access journals have a clear advantage. Articles in open access journals are easily available at no cost to anyone with an Internet connection.

Subscription journals might be free to the reader if their library has a subscription, but access controls will inevitably cause at least some inconvenience. In addition, subscription journals, again because of access controls and copyright constraints, are harder to share with colleagues, students, or friends.

The market for the best articles is more complex and, as noted above, more important. One interesting aspect of this market is that authors do not exchange their work for money; instead, they trade it for prestige, a much less tangible commodity. Enhancements in prestige then make it possible for authors to earn tenure and promotion or to compete for grants or better jobs. Because it takes time for a journal to establish a reputation, today most high-prestige journals are subscription-based. Authors wishing to enhance their reputations often feel compelled to publish in these established, highly thought-of venues and, especially before tenure, are unwilling to risk exploring other alternatives. Established scholars have generally been successful with subscription journals and often feel no need to change their publishing choices. Currently, inertia favors subscription journals.

Open access journals claim two advantages: the first is pragmatic and the second is principled. The pragmatic advantage that open access claims is that, by being freely and easily available to anyone connected to the Internet, the author's work is available to the widest possible audience. The work is not restricted to those whose libraries can afford the prices of high-prestige subscription titles. This in turn leads to more use of the work and more citations to it. The sharing of open access articles is also easy and not constrained by access controls or copyright restrictions. The open access argument is that, over time, the advantage of openness will lead to an advantage in prestige. Whether or not open access actually leads to more prestige is a matter of debate. Nearly all studies show that open access leads to more downloads, but the case for a

citation advantage, which is the accepted proxy for prestige, is less clear. Many studies show an increase in citation with open access, while others argue that this is the result of confounding variables.⁴ There is some evidence that faculty are beginning to accept open access options. Rajiv Nariani and Leila Fernandez found that authors did not believe publishing in open access journals would be a barrier for promotion and tenure as long as open access journals had high-impact factors and were indexed. They also found that the accessibility open access provides mattered, especially when publishing with international collaborators.⁵

The principled case for open access is based on the observation that many subscription journal publishers, particularly for-profit publishers, have used their position as monopoly providers to charge excessive prices and that these pricing policies are at odds with the interests of scholars and their universities. George Monblot in a *Guardian* article makes the argument in its bluntest form: "The knowledge monopoly is as unwarranted and anachronistic as the corn laws. Let's throw off these parasitic overlords and liberate the research that belongs to us."⁶

History and Current Status of Open Access Journals

Mikael Laakso et. al. have recently documented the history of Gold OA journals.⁷ They overcome the limits of earlier studies by using a robust sampling methodology to estimate the demographic characteristics of open access journals over time. This is an important study as it provides methodologically strong data on the growth of open access. Importantly, they focus on articles, the more important metric, as well as titles. They divide the history of open access into three periods: the "Pioneering Years" (1993 to 1999), the "Innovation Years" (2000 to 2004), and the "Consolidation Years" (2005 to 2009).

The "Pioneering Years" were characterized by experimentation. Individuals or small groups of scholars developed

most of the early journals. The technology used was simple, often just Web pages. There was rapid growth from a very small base both in the number of journals and articles. Many of these initial efforts did not survive.

The "Innovation Years" coincided with the rapid movement of all types of journal content to the Web. These years were characterized by strong growth, both in the number of journals and the number of articles and in the development of new business models, most notably author charges. BioMedCentral demonstrated that open access was compatible with for-profit publishing, and the *Public Library of Science (PLoS)* demonstrated that open access journals could be of high quality and prestige. Advocacy for open access became important during this period.

In the "Consolidation Years" the number of journals and articles continued to expand, and the average number of articles published by open access journals per year increased. The infrastructure to support open access publishing became well established. The Public Knowledge Project's Open Journal System open source software, which provides an inexpensive and relatively easy to deploy publishing platform, became widely used. The *Directory of Open Access Journals (DOAJ)* documented and then indexed open access journals. Google and Google Scholar provided a means of discovery. Creative Commons licenses made managing rights easier.

Laakso et. al. estimate that in 1993 there were 20 open access journals that published 247 articles. By 2000 they estimate there were 741 journals that published 35,519 articles. The figures for 2005 were 90,720 articles in 2,837 journals and, for 2009, 191,851 articles in 4,767 journals. In terms of articles, this represents a 155.4 percent increase between 2000 and 2005. Between 2005 and 2009 there was a 111.5 percent increase. They estimate that the 2009 figure for articles represents 7.7 percent of the scholarly articles published in that year.⁸

A Simple Extrapolation of the Future from the Past

If we assume that the Laakso et. al. estimates are accurate, we can extrapolate the expected portion of the scholarly literature that will be Gold OA in the future. If we use the 7.7 percent figure for 2009 and assume a 3.0 percent annual increase in the number of scholarly journal articles and then do straight-line extrapolations on the increase in the portion of articles that will be Gold OA, we get the results shown in figure 1.⁹ The solid line shows the estimates made by Laakso et.al. The dotted line uses a straight-line extrapolation based on the 2000 to 2009 figures and indicates that, by 2025, the Gold figure would be 19.6 percent. If the extrapolation were based on 2005 to 2009, where the rate of change increases, the portion of articles in Gold OA journals would be 20.9 percent in 2020 and 26.8 percent in 2025, as shown by the dashed line.

While the finding that between a quarter and a fifth of all scholarly journal articles might be Gold OA in the next

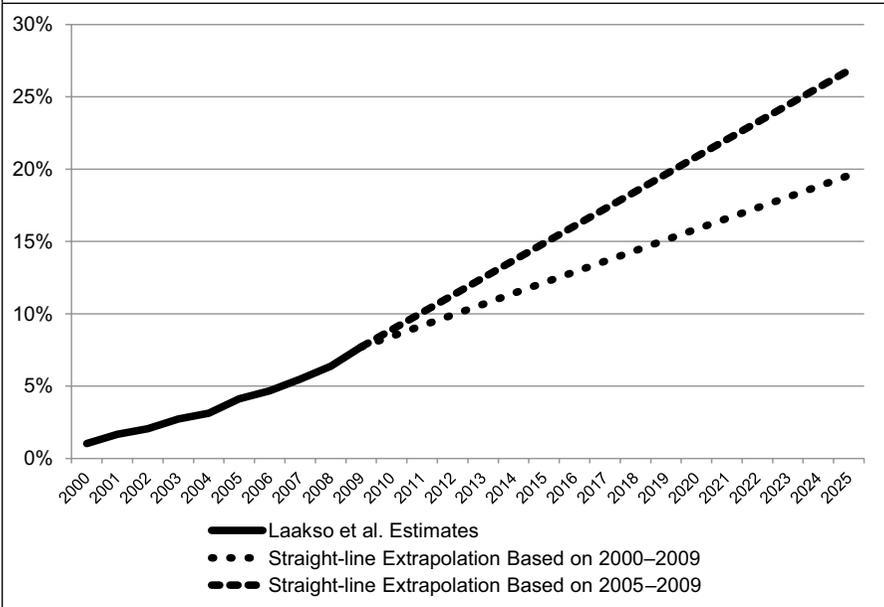
decade could be viewed optimistically, it would still leave the vast majority of articles published in subscription journals and would offer little relief to libraries as they attempt to pay for their journal collections.

Fortunately, as will be argued below, Gold OA is best viewed as a disruptive innovation and as such it can be expected to have a growth curve quite different from the straight-line extrapolations shown in figure 1.

Disruptive Innovation

In his many books and articles, Clayton Christensen has developed a rich theory of disruption.¹⁰ When established firms confront disruptive innovations, they nearly always fail to adapt and are often forced out of business. However, for customers, disruptive innovation is the mechanism that brings products and services that had previously been available only to those with special skills or the ability to pay high prices. Disruptive innovation is the mechanism that makes products cheaper and easier to use.

FIGURE 1
Straight-line Extrapolation of Direct Gold OA Share of Scholarly Articles



Ironically, disruptive innovations rarely begin life as a superior product. In fact, they almost always start out inferior to the products sold by established firms in established markets. Even though they start this way, disruptive innovations generally have two distinct characteristics. First, they bring a new value proposition to the market. This new value proposition is almost always the application of a new technology using a new business model. Second, disruptive innovations usually make it possible for customers who had not been able to access a service or product to acquire it. The fact that the disruptive innovation is inferior does not matter to these new customers, as it is better than what they had before, which was nothing. Over time, the disruptive innovation improves and becomes suitable for some of the less demanding customers of the established product. The new technology and business model embedded in the disruptive innovation provides a cost advantage that draws these customers from the established product to the disruptive one and the established firm loses market share. As time goes on, the disruptive innovation gets better and better and eventually it attracts more and more customers and comes to dominate the market. This pattern has been repeated a number of times in the computer industry; it can also be seen in the disruption of the American automobile industry by the Japanese and then the Koreans. Additionally, it can be seen in the disruption of the integrated steel mills by mini mills and in the services sector by the disruption of stockbrokers and travel agents by Internet services.

One might expect established firms to be able to react to disruptive innovation. They are, after all, leaders in their industries and they did not achieve this position by accident. But, as Christensen documents, this rarely happens. Established firms have succeeded because they have established successful business models and values that reinforce these models. It turns out that business models and organizational values don't change easily, and

it is thus nearly impossible for established firms to quickly adjust to take advantage of new technologies in disruptive ways. Established firms often see the new technologies and their potential advantages, but their reaction is to attempt to cram the new technology into their existing business models. They are unwilling to use the technology in the inferior applications that it is initially suited for. This is largely because their current customers cannot use the inferior product, and it cannot be sold at margins that the established firm's business model requires. As the disruptive innovation develops and some less demanding customers are lost, established firms typically retreat up the market, sacrificing the lower-end customers and making better and more expensive products for their best customers. But eventually this strategy fails because the high-end runs out and the disruptive product serves all or most of the market.¹¹

Christensen also observes that disruptive innovations rarely plug into the commercial systems of the established product. In most cases, suppliers, wholesalers, retailers, and aftermarket services are disrupted along with the maker of the established product. For example, Sony's transistor radios and televisions not only disrupted the producers of vacuum tube radios and televisions, they also disrupted the appliance stores that sold and serviced them. At the time, appliance stores made much of their income replacing vacuum tubes and had no interest in a product it could not service in the aftermarket. Sony sold their products through Kmart and similar discount stores that had no capacity to provide service in the aftermarket. But since transistors did not burn out, this did not matter. In the end, Sony and Kmart survived and vacuum tube manufacturers and appliance stores did not. The whole vacuum tube commercial system was disrupted.

Gold OA as a Disruptive Innovation

Gold OA has all of the attributes of a disruptive innovation. It combines a new

technology, digital distribution of content using the Internet, with a new business model, free distribution to the reader with cost paid by the author or through other means. This model has several inherent cost advantages. First, unlike subscription journals, Gold OA journals do not have to incur the costs associated with protecting content from unauthorized use. These costs include access control mechanisms, which require more complex computer systems and help desks to assist customers in using them, and legal fees when access controls fail to discourage unauthorized use. Second, Gold OA journals avoid the costs associated with subscriptions. They do not need to negotiate licenses or bill customers. Marketing costs are also likely to be lower as the need is only to raise awareness, not, as is the case for subscription journals, to make sales. Gold OA publishers provide their content at no cost to readers, one of the benefits of doing so being that readers impose little or no cost on them.

The value proposition Gold OA offers to readers is clearly superior. It is hard to compete with free unencumbered access and easy and free linking and sharing. For authors the value proposition is less clear, but, as noted above, it is potentially at least as compelling. Having your work a click away from everyone should in the end be better for authors than having that work locked up, even if the lockbox is currently prestigious. It seems likely that this potential advantage will grow as postpublication comment and review and other social media functions are attached to scholarly publication systems. Conversations about an article will be more interesting and valuable if all interested scholars can participate. As Peter Suber frames the argument, "Authors need OA to reach all the readers who could build on their work, apply it, extend it, cite it, or make use of it. Readers need OA to find and retrieve everything they need to read and to allow their software prosthetics to process everything they need to process... Authors who can't [take advantage of

what OA offers], unfortunately, are in the hard spot of betting their livelihood against the [I]nternet."¹²

A final part of the value proposition that Gold OA brings is to universities and other institutions that support the scholarly enterprise. Subscription journals cost these organizations large amounts of money. In 2008–2009, the 122 members of the Association of Research Libraries spent \$881,547,511 on current serials.¹³ Mark Ware and Michael Mabe estimate that annual revenues generated from English-language STM journal publishing to be \$8 billion in 2008, up 6 to 7 percent from 2007.¹⁴ Universities paid much of this. If some of this money could be redirected into more cost-effective ways of distributing scholarship, such as institutional subsidies for open access publishing ventures or author charges to open access journals, this would be a benefit. Research funders may see similar advantages. Many allow author charges to be included in research grants, and many mandate some form of open access to research results.

As we might expect with a disruptive innovation, Gold OA did not start out by producing journals in the top tier. Many initial Gold OA titles were in niche fields. If we look at the countries where Gold OA was initially adopted, we find that many are not part of the mainstream of scholarly publishing. In 2005, among the top 15 countries or origin for titles listed in the *Directory of Open Access Journals* were Brazil (3rd), Chile (7th), India (9th), Venezuela (11th), Turkey (13th), and Mexico (15th).¹⁵ William H. Walters and Anne C. Linvill's study confirm this finding.¹⁶ For scholars in these countries, open access publishing provided an opportunity, which probably would not otherwise have been available, to get their work in front of scholars from around the world. The importance of this is borne out in a number of studies.¹⁷ Over time some Gold OA journals became top tier. BioMedCentral and the *Public Library of Science* both have high-impact titles. In June 2011, the

Howard Hughes Medical Institute, the Max Planck Society, and the Wellcome Trust announced that they would support a new, top-tier, open access journal for biomedical and life sciences research.¹⁸ Shortly thereafter, the Royal Society announced *Open Biology*, the Society's first open access journal with a strong pitch to authors on the benefits of publishing in an open access journal.¹⁹

The response of the established publishers to Gold OA is what Christensen would predict. They have trouble seeing how the disruptive innovation could be successful because of the values and business model lenses through which they view it. Many of these business models and values date from the world of print. Ware and Mabe are typical. In their industry-funded report, they express doubt that Gold OA is sustainable given that author fees are below industry averages for the cost of producing articles, without recognizing that these averages might not apply to Gold OA publishers. They also express skepticism that top-tier journals can survive in a Gold OA model without philanthropic support, without recognizing that philanthropic support is an expected and appropriate part of the Gold OA model.²⁰ Some librarians, seeing the world through similar lenses, have also expressed skepticism. Charles A. Schwartz concludes his review of open access by stating, "The subtleties and complications of open access for the scholarly communication system will take years to emerge."²¹ But as Outsell, Inc., a consulting firm focused on the information industry, puts it in the conclusion of their 2009 report on open access, "Indeed, it is worth considering that (gold) open access is an efficient means of exploiting such a digital world as it was born out of it. It directly monetizes the one thing through which publishers will always add value: their ability to filter authors' content. In a world of too much information and finite time, this is a truly valuable proposition."²²

The Hybrid and Delayed OA models that have been adopted by some subscrip-

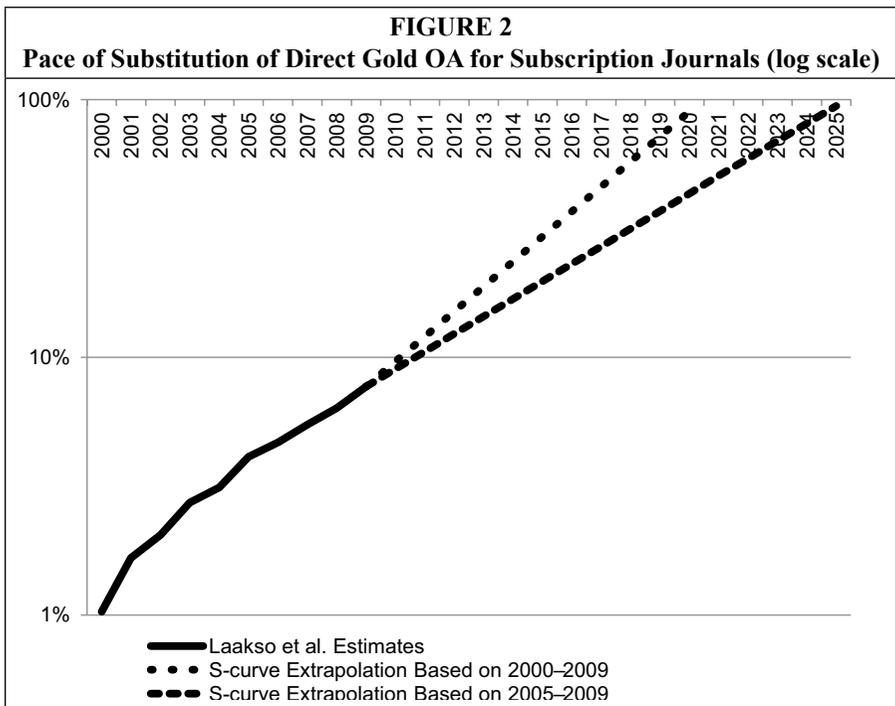
tion journals appear to be an attempt to cram open access into the subscription model in a way that potentially offers authors the advantages of open access without threatening subscription income or reducing the cost associated with the subscription model. Subscription publishers' tolerance of Green OA may also be viewed as an attempt to provide authors with the advantages of open access without impacting subscription income. Elsevier's position makes this clear. As Alicia Wise, Elsevier's Director of Universal Access has said, "We believe the voluntary posting of manuscripts is an acceptable practice for authors, and that both institutions and publishers should respect their choices. The systematic posting of manuscripts, for example because of a mandate to post, is only agreeable if done in ways that are sustainable for the underlying journal."²³ The challenge for subscription journal publishers will be to allow authors to take advantage of open access alternatives in ways that do not undermine their subscription income. It is in their interest to allow authors some latitude, but where and how to draw the line will be increasingly difficult. As noted above, the market for good scholarly articles is the key competitive arena and subscription journal publishers will need to avoid restrictions that antagonize authors while at the same time limiting uncompensated access to content.

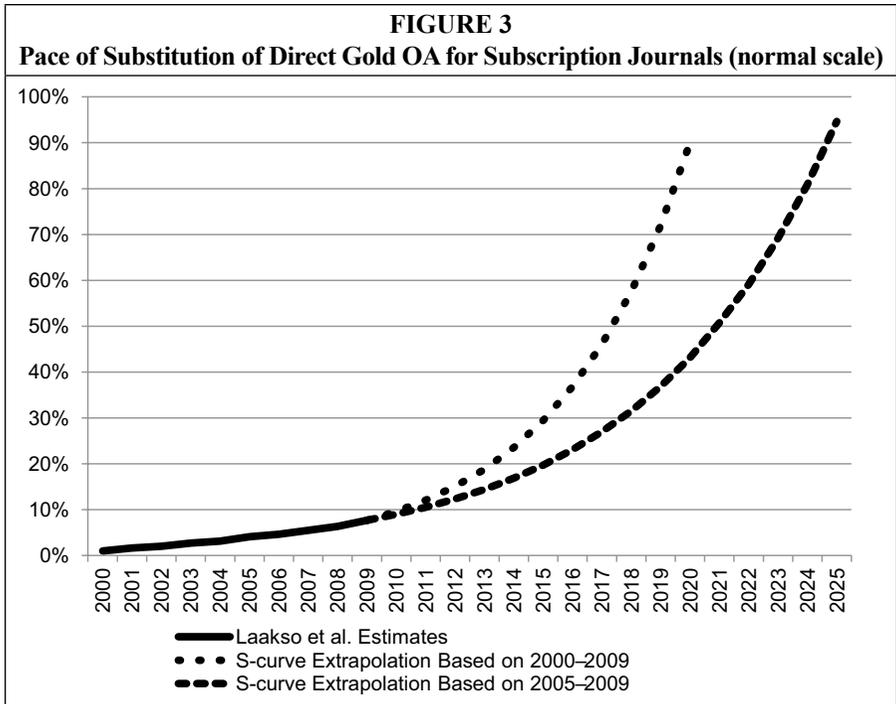
Finally, we can observe that open access has brought about its own commercial system. The Open Journal System and similar open source software products provide the platforms for open access journals; the *Directory of Open Access Journals*, Google, and Google Scholar provide new discovery mechanisms; and the Creative Commons provides a legal framework. As Christensen would have predicted, traditional players in the commercial system for subscription journals, from serials vendors to indexing services to libraries, at least in their role as information providers, are not players in the commercial system of open access journals.

The Future of Gold OA as a Disruptive Innovation

If, as I have argued, Gold OA is a disruptive innovation, then we need to think differently about how it is likely to progress in the marketplace. Christensen argues that the substitution of the disruptive innovation for the established product does not follow a linear pattern. Rather, the substitution pattern is almost always an S-curve. The temptation is to project from the flat bottom part of the S-curve, as I did in earlier in this paper, and assume that the innovation will not be important any time soon. The problem is to predict when the curve will flip and the pace of adoption of the disruptive innovation will accelerate rapidly. This is hard to do when the disruptive innovation has only a small share of the market. To take one of Christensen's examples, digital photography spent a decade incubating on the flat part of the S-curve and then in a few short years replaced nearly all film-based photography. But because there was so little market penetration early on, it was hard to see the change coming.

Fortunately, there is a way to forecast the flip. You plot the ratio of the market share held by the disruptive innovation divided by the share held by the established product on a logarithmic scale. When plotted this way, the data will fall on a straight line if disruption is occurring. You can then extend the straight line (on the log scale) into the future to get a sense of how the pace of substitution is likely to progress.²⁴ If we use this methodology and the estimates of Gold OA articles made by Laakso et al., we get the logarithmic plot shown in figure 2. When this is converted to a normal scale, the pace of substitution is as shown in figure 3. I have made two estimates. The first, shown by the dotted line, is based on data from 2000 to 2009. The second, more conservative estimate, shown by the dashed line, takes into account only the data from 2005 to 2009. It is here where the data clearly form a straight line as Christensen would predict for a disruptive innovation.²⁵ Table 1 shows the same results.





Assuming Christensen's methodology is correct and the data produced by Laakso et al. is a good approximation of past Gold OA growth, then, based on the first estimate, using the 2000 to 2009 data, it is likely that Gold OA journals will publish half of all scholarly articles by 2017 and will publish 90 percent of the articles by 2020. The second estimate, based on 2005 to 2009, shows that 50 percent of scholarly articles would be Gold OA by 2021 and over 90 percent by 2025. At some point the rate of substitution will slow and the curve will bend back forming the top of the S-curve. Even the more conservative estimate suggests a radical shift in the nature of scholarly journal publishing in the next decade.

This is a bold claim. It is important to recognize that my argument is not based on whether or not open access provides a citation advantage, or greater author prestige, or makes knowledge more accessible, or that it is better for libraries, though I believe all of these things to be

true. Neither the particulars of how Gold OA develops nor the motivations of the players are important to my argument, though they are interesting. My argument is simply that Gold OA is a disruptive innovation and, based on Christensen's work, this is the way disruptive innovations behave.

Discussion

Impact on Authors

Authors should find a system dominated by Gold OA journals to be to their advantage, as their work will be widely distributed and available to all who have a need for it. Open systems will also more easily adapt to systems of postpublication review and comment, which, though not yet fully developed, are likely to lead to productive conversations about and critiques of work. As open access comes to dominate the scholarly communication system, the current concerns about publishing in this venue, often related to promotion and tenure decisions, will diminish.

TABLE 1
Pace of Substitution of Direct Gold OA
for Subscription Journals

	Laakso et al. Estimate	Extrapolation Based of 2000–2009	Extrapolation Based of 2005–2009
2000	1.0%		
2001	1.7%		
2002	2.0%		
2003	2.7%		
2004	3.1%		
2005	4.1%		
2006	4.7%		
2007	5.5%		
2008	6.4%		
2009	7.7%		
2010		9.6%	9.0%
2011		12.1%	10.5%
2012		15.1%	12.3%
2013		18.8%	14.4%
2014		23.6%	16.9%
2015		29.4%	19.7%
2016		36.8%	23.1%
2017		46.0%	27.0%
2018		57.5%	31.6%
2019		72.0%	36.9%
2020		89.9%	43.2%
2021			50.7%
2022			59.2%
2023			69.2%
2024			80.9%
2025			94.6%

Impact on Readers

For readers, the news could not be better. Students, researchers, or anyone else whether they are living in societies blessed with great libraries and universities or in parts of the world where poverty is widespread and development lags, all will have access to the wealth of human discovery and learning. They will be able to use it to benefit themselves and their communities.

Creating effective discovery and filtering will be challenging. Some will question whether it is wise to let everyone have access to so much knowledge, fearing it will be misused. But, in the end, the result will be more democratic access to much more information. This will prove a great benefit.

Impact on Libraries

For those who are frustrated by the failings of the subscription journal system, the finding that open access will be the dominant model for scholarly journals is encouraging. Outsell estimates that a publishing system with a “high take-up of OA” would shrink the market value of the publishing industry by 57 percent.²⁶ One way to think about this is to view it as a nearly 60 percent decline in revenues publishers will be able to extract from the market. Again, as Christensen shows, disruptive innovation is the mechanism for making products cheaper and easier. For libraries, this development would mean relief from the decades-long battle to pay for scholarly journals.

Libraries need, though, to recognize that among the changes that the rise of Gold OA will bring is a commercial system that does not include them, at least in their role of providing content to readers. This will certainly change expectations and could easily impact budgets.

Some libraries have begun playing a role in the production side of open access by hosting the Open Journal System software and providing other support for journal editors on their campuses. In doing so, libraries may end up disrupting academic publishers, potentially including university presses. Taking on this role, especially at scale, could be culturally and politically complex.

Impact on Established Subscription Journal Publishers

Publishers of established subscription journals will find themselves in a difficult

position. Their business model is based on the ownership of content. As the Outsell, Inc. report puts it, "Such models do not play well in the networked economy, which favours [sic] participatory models that exploit interconnected information and people."²⁷ They are also in a bind in both of the markets in which they must compete. As Open Access grows, libraries will find the high prices of subscription journals harder to justify, and this will lead to cancellations. As subscription volumes fall, prices will need to rise; this will likely lead to further cancellations and still higher prices. This spiral will eventually make many subscription journals economically unsustainable.

It is also likely, as the litigation between Cambridge University Press et al. and Georgia State University over electronic reserves illustrates, that publishers will be under increasing pressure to fight what they view as inappropriate use of their content.²⁸ University presses suing universities over the use of scholarship should strike us as odd, but it points out the inevitable contradictions of the subscription model in the digital world. As open access grows, faculty and students will find increasing amounts of scholarship available for free. It will seem odd and annoying that some articles can be easily accessed, used, and shared while others come with severe restrictions. This will be especially disconcerting as most of the content that publishers will be fighting to protect, restrict, and extract revenue from will have been produced by the scholars themselves and paid for by universities or funding agencies.

In the market for the best articles, as more Gold OA journals establish themselves in the top tier, authors will see them as a better alternative. This will especially be the case if open access mandates form funders and institutions become common. This could also lead to a downward spiral for subscription journals in terms of the quality of the work they can attract.

It is also likely that open access will lead to a disaggregation of the journal into

its component articles. After all, it is the individual article that the reader wants, not the journal. In an open environment with Web scale discovery tools such as Google Scholar, this disaggregation may have already happened in the mind of the reader. For open access publishers, disaggregation does not matter because they are not selling anything. For subscription journal publishers, it matters because they are. They need readers and librarians to think of and pay for the whole package. Articles can be sold one at a time, but this is supplemental income that is unlikely to be sustaining in the absence of subscriptions.

Impact on Scholarly Societies

Scholarly societies are responsible for a large portion of scholarly journal publishing. These journals generally date from the print era and are predominantly subscription based. Receipt of the society's journal has traditionally been seen as one of the major benefits of membership. Many societies also use their journal income, especially from library subscriptions, to support other programs. In some cases, journal operations have been outsourced to for-profit publishers in exchange payments to the society.

These factors will make it difficult for scholarly societies to embrace open access for their journals. If the journal is freely available to anyone, why join the society? If there is no subscription income, where will the society find the resources to subsidize other programs? Hard as this will be, I believe in the end the value to members of the free and open distribution of scholarship will win out as it is, after all, one of the most important parts of any scholarly society's mission. This was what happened with the Association of College and Research Libraries (ACRL). As Joseph Branin, the editor of *College & Research Libraries*, put it in his editorial announcing the switch to full open access, "It was interesting being caught in the middle of this discussion and debate about going open access, with concerns about the hard reality of economic vi-

ability weighing in against the growing acceptance of open access to scholarship as a high professional value."²⁹ That this decision was difficult for ACRL, which has a strong professional interest in the success of open access, indicates that it will not be easy for scholarly societies in general to make this move. However, in the long run, those who do not make this choice risk a decline in the importance of their journals and, in turn, their relevance.

Impact on Other Forms of Open Access

Hybrid and Delayed OA are unlikely to have much long-term impact, as they are really attempts by subscription journal publishers to force open access into their established business models. Neither strategy changes the cost structures these publishers face. They may provide some of the advantages to authors of Gold OA, but neither will change the way libraries view the subscription costs. Hybrid OA may in fact lead libraries to demand lower subscription prices, as some of the articles in these journals should be free. This dynamic will likely lead some Hybrid OA journals to switch to Gold OA to take advantage of its more efficient business model. The same dynamic might come into play for Delayed OA, especially if funder or institutional mandates require the deposit of versions of articles that libraries can use as a substitute for a current subscription.

Green OA presents some interesting questions. Today, Green OA is clearly a useful means for providing access to content published in subscription journals to which many readers do not otherwise have access. Green OA sits beside the system of subscription journals; and, while it is of concern to many established publishers, they tolerate it as long as it is not a fully adequate replacement for their products. One could argue that Green OA, by offering the benefits of open access

to authors and readers without reducing the fiscal burden on libraries, continues the system that many view as dysfunctional. In a fully Gold OA world, Green OA becomes unnecessary as a primary means of distributing scholarly content. Some Green OA will likely remain, as subject repositories could be useful for discovery and institutions may wish to manage and preserve scholarship produced by their faculty. If this is the case, Green OA will continue as a supplement to Gold OA, but the role will be secondary.

Final Word

For as long as I have been a librarian, one of the most difficult problems I have confronted has been how to pay for a scholarly communication system based on ever more expensive subscription journals. As Christensen frames it in the context of healthcare, this is the wrong question.³⁰ The question should not be how do we afford the system we have, but rather how to create a system that we can afford.

There will be many who will object to the decline of the subscription journal. Publishers of these journals will certainly take this stance, especially for-profit publishers hoping to preserve their lucrative income streams. They will argue that the resulting changes will be detrimental to scholarship. Quality will suffer. But in the end, none of these arguments will matter. Disruptive innovations bring disruption. Disrupted institutions fail, and the disrupters succeed. The disruption results in cheaper and easier products that are available to a wider audience. For scholars and those who support the scholarly enterprise, Gold OA is a disruptive innovation that we should embrace. We should do everything we can to encourage and support its growth, because in the end it is a disruption whose success will make our world better.

Notes

1. Richard Poynder, "Suber: Leader of a Leaderless Revolution," *Information Today*, 28 (July/Aug. 2011), available online at www.infotoday.com/it/jul11/Suber-Leader-of-a-Leaderless-Revo-

lution.shtml [accessed 20 July 2012].

2. Clayton M. Christensen has written more than a half-dozen books beginning with *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail* (Cambridge: Harvard Business Press, 1997). His two most recent books, *Disrupting Class: How Disruptive Innovation Will Change the Way the World Learns* with Michael B. Horn and Curtis W. Johnson (New York: McGraw-Hill, 2008) and *The Innovator's Prescription: A Disruptive Solution for Health Care* with Jerome H. Grossman and Jason Hwang (New York: McGraw-Hill, 2009), provide good summaries of his theories, as do a number of lectures that can be found on the Web (for example, Clayton M. Christensen, *SC10 Keynote with Clayton Christensen*, Dec. 4, 2010, video [running time: 1:00:28], available online at <http://insidehpc.com/2010/12/04/video-sc10-keynote-with-clayton-christensen/> [accessed 20 July 2012] and Clayton M. Christensen, *The Innovator's Prescription: A Disruptive Solution to the Healthcare Crisis*, May 13, 2008, video [running time: 1:27:38], available online at <http://video.mit.edu/watch/the-innovators-prescription-a-disruptive-solution-to-the-healthcare-crisis-9380/> [accessed 20 July 2012]). I have applied Christensen's work to academic libraries. See: David W. Lewis, "The Innovator's Dilemma: Disruptive Change and Academic Libraries," *Library Administration & Management* 18 (Spring 2004): 68–74, available online at <https://scholarworks.iupui.edu/handle/1805/173> [accessed 20 July 2012].

3. I will use the term "Gold OA" to refer to what is sometimes more precisely called "Direct Gold Open Access."

4. In theory, the idea that open access should lead to greater use and more citations seems unassailable, and most of the research on the topic concludes that this is the case. See, for example: Chawki Hajjem, Steven Harnad, and Yves Gingras, "Ten-Year Cross-Disciplinary Comparison of the Growth of Open Access and How It Increases Research Citation Impact," *IEEE Data Engineering Bulletin* 28 (2005): 39–47, available online at <http://eprints.ecs.soton.ac.uk/11688/> [accessed 20 July 2012]; or Gunther Eysenbach, "Citation Advantage of Open Access Articles," *PLoS Biology* 4 (2006): e157, doi:10.1371/journal.pbio.0040157, available online at <http://www.plosbiology.org/article/info%3Adoi%2F10.1371%2Fjournal.pbio.0040157> [accessed 20 July 2012]. A recent review of the literature on the topic finds that 27 of 31 studies found some open access advantage; see: Alma Swan, "The Open Access Citation Advantage: Studies and Results to Date," Technical Report, School of Electronics & Computer Science, University of Southampton, 2010, available online at <http://eprints.ecs.soton.ac.uk/18516/> [accessed 20 July 2012]. Others have argued that the apparent open access advantage can be accounted for because of several confounding variables; see: Iain D. Craig, Andrew M. Plume, Marie E. McVeigh, James Pringle, and Mayur Amin, "Do Open Access Articles Have Greater Citation Impact? A Critical Review of the Literature," *Journal of Infometrics* 1 (July 2007): 239–48; and Philip M. David and William H. Walters, "The Impact of Free Access to the Scientific Literature: A Review of Recent Research," *Journal of the Medical Library Association* 99 (July 2011): 208–17.

5. Rajiv Nariani and Leila Fernandez, "Open Access Publishing: What Authors Want," *College & Research Libraries* 73 (March 2012): 182–195 available online at <http://crl.acrl.org/content/73/2/182.full.pdf+html> [accessed 20 July 2012].

6. George Monbiot, "Academic Publishers Make Murdoch Look like a Socialist," *Guardian* (Aug. 29, 2011), available online at <http://www.guardian.co.uk/commentisfree/2011/aug/29/academic-publishers-murdoch-socialist> [accessed 20 July 2012].

7. Mikael Laakso, Patrik Welling, Helena Bukvova, Linus Nyman, Bo-Christer Bjork, and Turid Hedlund, "The Development of Open Access Journal Publishing from 1993 to 2009," *PLoS ONE* 6 (2011): e20961, doi:10.1371/journal.pone.0020961, available online at www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0020961 [accessed 20 July 2012].

8. See Laakso et al. 2011 "Table 2: Results Datasheet" and "Table 4: Estimates for 2009 Shares of Direct Gold OA in Major Indexes." The 7.7% estimate is based on *Ulrich's*, the broadest list of journals considered.

9. The 3% increase in the number of scholarly articles was documented by Mark Ware and Michael Mabe, *The STM Report: An Overview of Scientific and Scholarly Journal Publishing* (Oxford: International Association of Scientific, Technical and Medical Publishers, 2009), 18, available online at http://www.stm-assoc.org/2009_10_13_MWC_STM_Report.pdf [accessed 20 July 2012].

10. I will not explicitly cite references to Christensen's general theories as they are reiterated in a number of his books, articles, and lectures.

11. A very good explication of this process using the steel industry example can be found in Christensen, *SC10 Keynote with Clayton Christensen* (see minutes 18:10 to 29:00).

12. Poynder, "Suber: Leader of a Leaderless Revolution."

13. See Association of Research Libraries, "ARL Statistics Tables 2008–09", Expenditures (exp1), available online at www.arl.org/stats/annualsurveys/arlstats/arlstats09.shtml [accessed 20 July 2012].

14. Ware and Mabe, *The STM Report*, 16.

15. See Directory of Open Access Journals, "DOAJ by Country," available online at www.doaj.org/doaj?func=byCountry&uiLanguage=en [accessed 20 July 2012].

16. William H. Walters and Anne C. Linvill, "Characteristics of Open Access Journals in Six Subject Areas," *College & Research Libraries* 72 (July 2011): 280, available online at <http://crl.acrl.org/content/72/4/372.full.pdf+html> [accessed 20 July 2012].

17. See, for example, Jennifer I. Papin-Ramcharan and Richard A. Dawe, "Open Access Publishing: A Developing Country View," *First Monday* 6 (June 2006), available online at <http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1332/1252> [accessed 20 July 2012]; Alasia Datonye Dennis, "The Impact of the Open Access Movement on Medical Based Scholarly Publishing in Nigeria," *First Monday* 12 (Oct. 2007), available online at <http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1957/1834> [accessed 20 July 2012]; Albert Borrero, Mila Ramos, Anna Arsenal, Katherine Lopez, and Gene Hettel, "Scholarly Publishing Initiatives at the International Rice Research Institute: Linking Users to Public Goods via Open Access," *First Monday* 10 (Oct. 2007), available online at <http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1955/1832> [accessed 20 July 2012]; Aneesa Guttikonda and Sridhar Gutam, "Prospects of Open Access to Indian Agricultural Research: A Case Study of ICAR," *First Monday* 14 (July 2009), available online at <http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2488/2238> [accessed 20 July 2012].

18. See the press release, available online at www.hhmi.org/news/20110627.html [accessed 20 July 2012].

19. See "Open Biology—Open for Business," BOAI Forum (July 5, 2011), available online at <http://threader.ecs.soton.ac.uk/lists/boaiforum/2360.html> [accessed 20 July 2012].

20. Ware and Mabe, *The STM Report*, 52–54.

21. Charles A. Schwartz, "Reassessing Prospects for the Open Access Movement," *College & Research Libraries* 66 (Nov. 2005): 492, available online at <http://crl.acrl.org/content/66/6/488.full.pdf+html> [accessed 20 July 2012].

22. *Open Access Primer (Public Version)*, Market Intelligence Service: Market Report, vol. 3 (Burlingame, Calif.: Outsell, Inc., Dec. 14, 2009), 42 (no longer publicly available).

23. Alicia Wise, e-mail message to Peter Suber posted to the BOAI Forum, June 24, 2011, available online at <http://threader.ecs.soton.ac.uk/lists/boaiforum/2353.html> [accessed 20 July 2012].

24. Clayton M. Christensen, Michael B. Horn, and Curtis W. Johnson, *Disrupting Class: How Disruptive Innovation Will Change the Way the World Learns* (New York: McGraw-Hill, 2008), 96–98.

25. To create these estimates, I converted the figures provided by Laakso et al. for the periods in question to logs and took the average annual increase to project the straight line in log scale. I then converted the logs back to normal scale to establish the projection of the portion of OA and subscription titles into the future.

26. *Open Access Primer (Public Version)*, 41.

27. *Ibid.*, 42.

28. A review of the case and the issues it raises can be found at: "What's at Stake in the Georgia State Copyright Case," *Chronicle of Higher Education*, May 30, 2011, available online at <http://chronicle.com/article/Whats-at-Stake-in-the-Georgia/127718/> [accessed 20 July 2012].

29. Joseph Branin, "Editorial: *College & Research Libraries* Goes Fully Open Access," *College & Research Libraries* 72 (Mar. 2011): 108, available online at <http://crl.acrl.org/content/72/2.108.full.pdf+html> [accessed 20 July 2012].

30. Christensen, *The Innovator's Prescription* [video]. Reference at 1:21:40.