

The Hybrid Model for Open Access Publication of Scholarly Articles – a Failed Experiment?

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Abstract

Mainstream scholarly publishers have since 2004 started to offer authors in subscription journals the possibility to free their individual articles from access barriers against a payment (hybrid OA). This has been marketed as a possible gradual transition path between subscription and open access to the scholarly journal literature, and the publishers have pledged to decrease their subscription prices in proportion to the uptake of the hybrid option. The number of hybrid journals has doubled in the past couple of years and is now over 4,300, and the number of such articles was around 12,000 in 2011. On average only 1-2 % of eligible authors utilize the OA option, due mainly to the generally high price level of typically 3,000 USD. There are, however, a few publishers and individual journals with a much higher uptake. This article takes a closer look at the development of hybrid OA and discusses, from an author-centric viewpoint, the possible reasons for the lack of success of this business model.

The hybrid model for open access publication of scholarly articles – a failed experiment?

Introduction

Over the last 15 years almost all publishing of scholarly peer reviewed journals has migrated to electronic web publishing as the main dissemination channel. Nevertheless the fundamental revenue model of scholarly publishing, that of charging readers and their intermediaries for access, has for the bigger and established publishers largely remained the same. At the same time new stakeholders, both individual scientists and innovative publishing companies, have launched Open Access (OA) journals, which offer the full content of the journals to anybody with Internet access to read (Björk, 2011). Many society journals have also made the electronic versions of their journals free, either directly or after a delay of typically one year. The use of article processing charges (APCs) as the central mechanism for funding Open Access publishing was pioneered by the start-up publishing company BioMedCentral in 2002.

As an alternative to the OA availability of articles at the original source (“gold OA”), authors have also started to make manuscript copies of articles published in subscription journals available for free on the web (“green OA”). A majority of publishers have had to accept green OA in their copyright agreements with the authors, due to pressure from academics and in particular important research funders like the NIH and the Wellcome trust. A recent study estimated the global uptake of Open Access in 2009 to be 20.4 %, split into 8.5 % directly in journals and 11.9 % as manuscript copies in different types of repositories (Björk et al., 2010).

In an attempt to build a gradual transition path between the traditional subscription journal and Open Access several major publishers have started offering so-called “hybrid” journals. These are traditional closed access subscription journals, which offer individual authors the possibility to open up their articles for free access from day one, against a payment.

Short history of Hybrid OA

The idea of allowing individual authors the opportunity to pay to make their articles in subscription journals openly available in electronic format on the web was first mentioned by Thomas Walker in 1996, building on the established culture of authors ordering paper off-prints of their articles to send to colleagues (Walker, 1996). When the Entomological Society of America started offering authors this possibility for its four journals in 2000, the initial price was in fact set to be equivalent to 75% of the price of 100 paper reprints, roughly 100 USD. Currently the charge is 287 USD for a 9-12 page article, in addition to page charges for all articles. The possibility was eagerly taken up by authors, with the uptake increasing rapidly from 25% in 2000 to a level between 62- 67 % in 2003-2008 (Walker, 2012).

The journal *Limnology and Oceanography* also started offering such a possibility in 2001 with a price equal to 100 reprints (126 USD), resulting by 2003 in an uptake of

66 %. The high uptake worried the publisher about the effects on subscription income and the price was increased to 350 USD for 2004 (Walker, 2004).

In 2003-2004 three other publishers (American Physiological Society, Company of Biologists and Hindawi publishing Corporation) followed suit, but with much higher fees in the range 800-1,500 USD. Walker found initial uptake percentages of between 7 % and 13 % for these (Walker, 2004). The OA fee of *Physiological Genomics*, published by the American Physiological Society, was initially 1,500 USD. In 2006 when the journal started imposing page charges on all authors and offered a lowered additional charge of 750 USD for the Open Access, this resulted in an increased uptake of 18 %. When the publisher in 2007 started to offer a hybrid option for all its 10 journals this price level was deemed unsustainable and the price was set at 2,000 USD for research articles in all the journals (APS, 2007). In a press release about the increase in the 2009 subscription prices the publisher indirectly hinted that the uptake in 2007 would have been around 2-3% (APS, 2008).

The year 2004 saw the massive launch of the Springer “Open Choice” program covering almost all of the publisher’s journals. The price level was set at 3,000 USD per article, in line with the publisher’s calculation for the average price of publishing an article, which would need to be recovered if the journals would gradually transition into full author pay mode. This was rapidly followed by the launch of similar schemes by other major publishers, however usually for a smaller share of their journals. The price level of Springer seems to have set a precedent for the APCs of the other major publishers, since prices have clustered very narrowly around 3,000 USD. Strong informal signals from some research funders that this price level would be the maximum that they would allow to be paid from their grants, in particular Wellcome Trust, may also have influenced this pricing strategy (communication from Jan Velterop).

After a period of growth when authors became familiar with the concept, and when some publishers offered price reductions for society members and subscribers, the uptake percentage seems for most publishers to have stabilized in 2007-2008. In the last couple of years growth has for most publishers come through the extension of the hybrid possibility to a larger share of their journals, rather than higher uptake levels. At the same time many publishers seem to have turned their attention to starting new full Open Access journals, following the success of start-up OA publishers such as BioMedCentral and Public Library of Science.

Aims of This Study

Hybrid OA has from the start been marketed by many publishers as an “experiment”. David Prosser outlined the strategy for this experiment in an article in 2003 (Prosser, 2003). Publishers frequently argue in their press releases and on their web pages that due to the rising demand for OA from the academic community and major research funders they are willing to give the authors a choice, so that these can continue publishing in well established traditional subscription journals and benefit from the high quality peer review services and prestige connected with such journals, while at the same time profiting from the increased dissemination due to the open accessibility. If authors would start using the option on a large scale, this would then provide a gradual transition path for subscription journals to full OA. If the uptake on the other hand would prove to be low, this could be interpreted as an indication that

despite all the pro-OA advocacy there would in fact not be that much of a demand for Open Access from the scholarly community.

If the uptake levels would rise rapidly, subscribers would notice this and there would be a risk of cancellations of subscriptions. Hence there would be a need to decrease subscription prices in line with the growing share of OA content (for which subscribers should not pay). As the uptake percentage would grow, there would come a point of no return where the whole journal would flip to full Open access funded by the article processing charges. For this reason the APCs should from the start be set at the level of the average current subscription revenue per article, so that the publisher's income would remain constant if the whole journal would convert to full OA, and also during the gradual transition if subscription prices were reduced linearly as uptake would grow. The strategy would thus be risk-free from the publisher's viewpoint. It is worth noting that this strategy was markedly different from the way the early pioneers described above set prices, seeing open access to the digital version of the article as an alternative to traditional off-prints, and equating the prices to the marginal cost of these.

Eight years have now elapsed since the introduction on a larger scale of hybrid journals and the time is now ripe to take stock of how popular this route to OA has in fact become, and to discuss the possible reasons for the current state of affairs.

The specific aims of this study were thus to:

- Study the development in the number of hybrid journals and articles, as well as uptake levels on the global level
- Study cases of publishers and journals with significantly higher uptake levels and to find out possible explanations for this relative success
- To draw conclusions about the success or failure of the hybrid “experiment”

Method and data sources

Getting empirical data about the current situation of hybrid OA publishing is a bit like detective work. Publishers tag hybrid articles on their journal pages in different ways and few have published systematic data on the number of articles and uptake percentages. Patch-wise information from secondary sources can be combined with studies of the websites of individual publishers and journals, but it is impossible to produce comprehensive information using the same systematic method applicable to all publishers.

The most important data source is the listing of publishers offering hybrid journals in the Sherpa/Romeo database (Sherpa/Romeo, 2012). There are currently altogether 78 publishers in that list (subtracting some multiple entries from essentially the same publishers). Most of these publishers have only one or few hybrid journals. In an earlier study conducted in 2009 data for the twelve most important of these publishers was collected from the web or obtained directly from the publishers (Dallmeier-Thiessen et al., 2010). This study will in the text be referred to as the SOAP-study, due to the project acronym. In October 2009 these twelve publishers offered 1,991 hybrid journals, representing around a quarter of their total journal portfolios. The number of hybrid articles in 2009 in these journals was estimated to be around 2 % of the eligible articles. In addition to the above study some figures concerning the

number of hybrid journals, articles and uptake percentages for particular publishers have been reported on publisher web pages, in press releases, blog posts and in scholarly journal articles.

The twelve publishers for which data was reported in the SOAP study were studied anew in January 2012. Three other publishers (BMJ Group, IOP Science and the International Union of Crystallography) were also included, in order to get a more comprehensive estimate of the current number of hybrid journals and articles. Of these IOP Science has just recently started its hybrid program with 27 journals and BMJ Group has included almost all its journals in its hybrid portfolio of 28 titles. International Union of Crystallography is an interesting case, since it has offered all its eight journals in the hybrid mode since 2004, and since it was possible to get very detailed data on the uptake. The inclusion of further publishers from the remaining 63 publishers in the Sherpa/Romeo list, most of which just offering one hybrid journal, was deemed to add little extra value.

Finding the number of current hybrid journals was for most publishers easy and straightforward if the websites contained lists of such journals. But for some of the biggest publishers this was not the case, and searching the author guidelines for hundreds of individual journals was out of the question. In such cases direct queries to the publisher or info in press releases was used to gather the data.

The simplest solution to get data about the number of hybrid articles was of course to ask the publishers directly and in a few cases this was possible. Counting the numbers directly from the websites would be very painstaking, since each journal volume may contain only a couple of such articles. In some cases the hybrid articles are not even marked very clearly. This method could be used for a few journals with higher uptake levels, but was in practice out of the question for publishers with large hybrid portfolios. This would have been the only way to study all publishers in systematic way.

In some cases the publishers website contained search mechanisms to find all the hybrid or OA articles from the publisher (i.e. Royal Society, American Physical Society). If hybrid articles are clearly marked in the full text versions with labels like “Freely available online through the PNAS open access option“ or “EXiS Open Choice” then Google Scholar can be used to check the total number of such articles in different years. This method could be used for some publishers and journals. Another useful method was to use special filtered searches in PubMedCentral for Open Access material from particular publishers. The drawback with that method is that it covers only articles in biomedical journals, and only some of the publishers included in this study. Lastly some figures could be found from press releases, articles etc., but not always for the year 2011.

Another interesting type of data concerns the price level, including eventual discounts for society members or for authors whose institutions have subscription, all of which are factors that influence the average net price. Most of the major publishers with a single uniform price level in the 3,000 USD range do not offer discounts, but a closer look at some of the publishers with higher uptake levels revealed interesting background factors. It was also very difficult to find info of the possible development of the prices over time, if that had been case. Such data, where appropriate, is reported in the sections on individual publishers.

Results

Overall results

Table 1 contains data about the number of hybrid journals in October 2009 and in January 2012. Most of the numbers for 2009 are from the SOAP study. The publishers are listed in order of the current size of the journal portfolios. No attempt has been made to calculate a global uptake figure, since it would be very difficult to calculate the overall number of eligible articles in over 4,000 journals. However, given the increase in the number of journals and the number of articles, the uptake level cannot differ much from the 2 % estimate in the SOAP report. Uptake levels are discussed more in the section concerning individual publishers.

Table 1. The number of hybrid journals and the estimated number of articles published in them for the fifteen studied publishers

| Publisher | Publication charge USD | Hybrid Journals | | Hybrid Articles | |
|-------------------------------|---------------------------|------------------|-----------------|-----------------|------|
| | | February 2012 | October 2009 | 2011 | 2009 |
| Springer | 3000 | 1360 | 1100 | 7243 | 4500 |
| Elsevier | 3000 | 1160 | 68 | 1014 | 516 |
| Wiley & Blackwell | 3000 | 726 | 300 | 596 | 410 |
| Taylor & Francis | 3250 | 577 | 300 | 153 | 74 |
| Sage | 3000 | 177 | 54 | 37 | 10 |
| Cambridge University Press | 1350-2700 | 120 | 15 | 30 | 15 |
| Oxford University Press | 3000 | 109 | 90 | 818 | 882 |
| American Chemical Society | 1000-3000 | 38 | 35 | 323 | 182 |
| Nature Publishing Group | 2500-3900 | 37 | 14 | 334 | 160 |
| BMJ Group | 3145 | 28 | 19 | 237 | 155 |
| IOP Science | 2700 | 27 | 0 | 0 | 0 |
| American Physical Society | 1700-2700 | 7 | 7 | 79 | 24 |
| Int. Union of Crystallography | 1000 | 7 | 7 | 127 | 79 |
| Royal Society | 2380 | 7 | 7 | 212 | 172 |
| National Academy of Sciences | 975-1300 | 1 | 1 | 886 | 916 |
| All | | 4381 | 2017 | 12089 | 8095 |

Notes concerning table 1.

- For some of the publishers the article numbers for 2009 (as reported in the SOAP study) have been adjusted to correspond to a full year.
- IOP Science started its hybrid offering in 2011, hence most of the columns are empty.
- The figures for Springer, Sage, Oxford University Press and BMJ group are based on correspondence with the publisher's representative

- The 2011 article count for Wiley-Blackwell is from 2010 (White & Morgan, 2011).
- The number of articles for Taylor & Francis (years 2011 and 2009), Cambridge University press (2011), American Chemical Society (2011 and 2009) and Nature Publishing Group (2011) are based on a filtered search in PubMedCentral.

Table 2 contains figures obtained for some of the publishers using targeted searches in PubMedCentral. The share of the publisher's hybrid journals included in PMC varies a lot. Note that for some publishers the counts for 2011 may not be complete due to delays in uploading to PMC. A couple of publishers that are depositing articles (BMJ Group and Oxford University Press) were not included because their figures include both full OA and hybrid journals. The figures give some indication of the growth of hybrid publishing over a longer time period, although the numbers are only about half of the total numbers reported in table 2.

Table 2. The number of articles in biomedicine deposited in PubMedCentral by the hybrid programs of eight of the studied publishers

| Publisher | Hybrid journals | Journals depositing in PMC | Share of journals in PMC % | Articles deposited in PubMedCentral | | | | | |
|----------------------------|-----------------|----------------------------|----------------------------|-------------------------------------|------|------|------|------|------|
| | | | | 2011 | 2010 | 2009 | 2008 | 2007 | 2006 |
| Springer | 1360 | 533 | 39 | 3575 | 4723 | 3291 | 1718 | 1455 | 463 |
| Elsevier | 1160 | 463 | 40 | 849 | 691 | 486 | 352 | 270 | 30 |
| Wiley-Blackwell | 726 | 276 | 38 | 507 | 562 | 460 | 536 | 368 | 111 |
| Taylor&Francis | 577 | 162 | 28 | 153 | 84 | 74 | 62 | 27 | 6 |
| Sage | 177 | 21 | 12 | 23 | 37 | 2 | 6 | 1 | |
| Cambridge U.P. | 120 | 17 | 14 | 30 | 25 | 8 | 12 | 4 | 2 |
| American Chem. Soc. | 38 | 38 | 100 | 323 | 247 | 182 | 102 | | |
| Nature P.G. | 37 | 26 | 70 | 334 | 186 | 67 | | | |
| hybrid publishers in PMC | 4195 | 1536 | 37 | 5794 | 6555 | 4570 | 2788 | 2125 | 612 |
| all hybrid publishers | 4381 | | | 12089 | | 8095 | | | |
| share of articles in PMC % | | | | 48 | | 56 | | | |

In the following these fifteen publishers are discussed more in detail. The order is the same as in table 1, according to the number of hybrid journals. For some publishers the discussion is very short, for others offering interesting cases longer.

Springer

Springer has earlier reported a steady growth for the uptake of its "Open Choice" option, from 0 % in 2004 to around 1 % in 2009 (Dallmeier-Thiessen et al., 2010). The total number of hybrid articles reported in the SOAP study for 2009 was 1,520. This includes however only such Open Choice articles where the authors had individually paid the fee. According to the publisher there were in addition twice as

many articles, which resulted from framework agreements with different universities and organizations, so that the total numbers for 2009 were 4,500 and for 2010 5,935 (correspondence with Bettina Goerner). The trend seems to have continued in 2011 with 7,243 articles.

Springer has had such framework agreements since 2007 with for instance University of California Libraries, The Dutch University Libraries Consortium, the University of Göttingen, the Max Planck Society and a consortium of Polish academic libraries (Albantes, 2009). In these agreements the universities' e-licenses to Springer's journals (SpringerLink) have been bundled with free Open Choice for all authors from the institutions in question. It is very difficult to find out what marginal price these organizations would be paying for the OA. The essential consequence of this is that the decision to open up the article no longer resides with the authors. The future of some of these framework agreements is currently unclear (UCSD, 2011).

Elsevier

Elsevier also charges a uniform charge of 3000 USD for its so-called "sponsored articles". Elsevier seems to have expanded its selection of hybrid journals very rapidly in the last couple of years, from the 68 reported in the SOAP study to over 1,000 currently. The uptake level is low. On its web pages about sponsored articles the publisher admits that "less than 1% of the articles in our subscription titles were sponsored open access articles" and "Sponsorship revenues from these articles amounted to less than 0.1% of Elsevier's total revenues." (Elsevier, 2012).

Wiley-Blackwell

Wiley-Blackwell reports a total number of hybrid articles of 596 in 2010 (White & Morgan, 2011). Only ten journals accounted for 27% of these, and 94 % of articles were in life or health science journals. Two journals had uptakes of around 10%, but it seems that around half of the journals had no hybrid articles at all (Morgan, 2009).

Taylor & Francis

Taylor & Francis has the highest price level of all the publishers, with 3250 USD. It also has rather restrictive policies for author posting of manuscript copies, with embargo periods of 12-18 months, which in principle should increase the interest in the hybrid option. For Taylor & Francis the figures from the special filter search in PubMedCentral were used. This captures articles in Biomedicine, which probably constitute the majority of articles.

Sage

The numbers for Sage are directly from the publisher. Sage has a very low uptake with only around 0.2 articles per journal both in 2009 and 2011. One possible explanation could be that their portfolio of journals, compared to other major publishers, has a higher share of social science and humanities journals. Authors in these fields typically have less funding available to pay high APCs.

Cambridge University Press

Cambridge University Press has increased the number of journals offering its "Cambridge Open" option rapidly in the last couple of years (from 15 to 120). The uptake has so far been rather low. The base fee is 2,700 USD, but interestingly the

publisher has recently announced that it is permanently lowering the fee for the 69 journals in the Social Sciences and Humanities to 1,350 USD and is further offering an introductory offer for these of 675 USD until the end of July 2012.

Oxford University Press

Of the publishers actively experimenting with hybrid journals, Oxford University Press has been the most open in informing about the uptake. Bird (2010) reports on clear differences in uptake depending on the broad disciplines of the 80 journals offering “Oxford Open”. Life Sciences lead with around 10 %, mathematics and medicine were in the midrange of 4-6 % and humanities and social science trailed with around 2 %. A couple of journals in life sciences had uptakes far above the average (*Human Molecular Genetics* 18 % and *Bioinformatics* 30 %). Bird speculates that the comparatively high overall uptake for OUP journals could partly depend on the fact that authors based at institutions with subscriptions to the journal in question initially got a 50 % discount from the standard OA rates (for instance of the authors in *Bioinformatics* using the option in 2006, 87% were eligible for the 50 % price reduction). She further mentions that OUP made considerable efforts to promote the Oxford Open option to authors.

Since the start of the program OUP has slightly increased the full prices at the same time as it has gradually phased out the discounts (Kaemper, 2010). In 2005 the full price was 2,800 USD and the reduced price 1,500 USD. Currently the full price is 3,000 USD and the discount to authors with institutional subscriptions has been dropped altogether. Instead OUP currently offers discounts to authors from developing countries by using a three tier-pricing scheme, based on the country of origin of the author. This is in line with similar schemes and waivers used by many full open access journals (Björk and Solomon, in press).

Bioinformatics, which has had the highest uptake of OUP’s journals is in more than one respect a special case. The journal publishes two types of articles, longer “original papers” with the standard OUP hybrid fee and shorter “application notes” with a 50 % lower fee. In the first four issues in 2011 there were 80 original papers with an uptake of 16 % and 56 application notes with an uptake of 36 %. It thus seems that the rather low price for the shorter papers has contributed much to the high uptake. The other factor which may have increased the attraction of the hybrid option is that the main competitors and alternative outlets for authors in this particular discipline are full OA journals charging author fees in the range 1,825-2,250 USD. *Bioinformatics* is the number two ranked journal in the category “Mathematical & Computational Biology” in Journal Citation Reports. The other top journals are *PLoS Computational Biology* (No 1), *BMC Systems Biology* (No 3) and *BMC Bioinformatics* (No 4).

Experimental Botany, which is published on behalf of a scientific society by Oxford University Press, is probably the hybrid journal with the highest OA share. The journal offers the standard OUP hybrid OA for a charge of 3,000 USD. But in addition articles, where the corresponding author comes from an institution that has an institutional subscription to the journal, are made OA immediately. All journal articles are in any case made openly available after a delay of one year. The journal has had an Open Access article share of 78-91 % among research articles in the last six issues (July 2011-Jan 2012). It is impossible to check from the website what share of these are paid hybrid OA and which due to institutional subscriptions of the

author's institutions, but it is highly likely that the vast majority are due to institutional subscriptions.

American Chemical Society

In contrast to the major commercial publishers, which tend to have a single fee of around 3,000 USD, many of the society and university press publishers offer significant discounts to author fees. The base fee for ACS is also 3,000 USD, but depending on whether authors are members of ACS and furthermore on whether their institutions have subscriptions to the journal in question the fee goes as low as 1,000 USD. With a membership base of some 158,000 it is likely that a significant proportion of authors pay the lower rates. Assuming that the total article volume of all ACS journals is around the same as in 2009 (34,611) the overall uptake is slightly under 1 %.

Nature Publishing Group

Bird (2010) reports an overall uptake in 2009 of around 5 % for the STM hybrid journals published by the Nature Publishing Group, based on correspondence with the publisher. In 2009 the number of hybrid journals from NPG group was still rather low (14 in the SOAP study) with some journals with a higher uptake like the *EMBO* journal with 11 %. Since then the hybrid portfolio has increased to 37 journals.

BMJ Group

The BMJ Group paid OA option is called “unlocked” and its actually easy to make a search for such articles on their website. 237 articles were open in 2011 making the overall uptake 7.1 % for the included journals. The average was raised by *Annals of the Rheumatic Diseases* with a 22 % uptake, a society journal which is the number one journal in Journal Citation Report's category Rheumatology with an impact factor of 9.1. Looking deeper into unlocked articles in ARD, it turns out that of the 20 most recent ones, 14 had resulted from research funded by pharmaceutical companies, which partly could explain the high uptake level.

IOP Science

This is a major society publisher in Physics. It recently started a hybrid program currently including 27 journals, and also publishes 7 full OA journals. The whole publishing field in physics is also in turmoil, due to the CERN led SCOAP3 initiative to force the publishers of the leading physics journals to convert these to full OA.

American Physical Society

The APS publishes 10 journals in all, of which two are full OA and the others offer a hybrid choice. The pricing has varied according to the journals, for instance 975 USD for the *Physical Review journals* (A-E) and 1300 USD for *Physical Review Letters*. In February 2011 the prices where almost doubled (to 1,700 USD and 2,700 USD respectively). APS claims on their web pages that unlike the earlier “Free to read” program, the article-processing charges have now been set to cover all costs, thus providing a sustainable model.

The contents of the APS journals can be easily searched via their web site Concentrating the search on the six hybrid journals mentioned above (*Physical Review A-E* and *Physical Review Letters*) shows a total article count of 19,370 in

2011 out of which only 79 Open Access ones (an uptake of only 0.4 %). The uptakes for the years 2007 to 2010 were on average 0.3 %. This low uptake might paradoxically be explained by the very strong open access culture in physics, where most authors in any case upload copies of submitted article manuscripts to the arXiv preprint server. Hence they might perceive less need of open access to the final article.

Royal Society

In the SOAP report the Royal Society was singled out as one of the hybrid publishers with the highest overall uptake (Dallmeier-Thiessen et al., 2010). The report contained a graph showing a steady growth of the uptake for its seven hybrid journals leveling out at around 8 % in 2008-2009. Our own calculations using Google Scholar searches for 2010 and 2011 yielded 8.6 and 7.6 respectively. The current price level of the hybrid option is 2380 USD. Royal Society initially offered authors prices discounted by 25 % in order to create interest and get the experiment going (Suber, 2006).

An interesting point about the Royal Society hybrid program is the very clear visibility of their “Exis Open Choice” articles among the other journal articles on their table of contents website which acts as a visible marketing mechanism to other authors to use the option. This can be contrasted with the very low profile policies of some of the bigger publishers.

International Union of Crystallography

The International Union of Crystallography has been offering a hybrid option to its eight journals since 2004. It differs from several of the publishers discussed above by the relatively low charge, 1000 USD. Due to initial funding from the UK organization JISC, which partly inspired IUC to start the hybrid program, the overall uptake percentages were highest in 2004-2006. After the deal expired IUC converted the high-volume *Acta Crystallographica Section E* to a full Open Access journal from the start of 2008, at the same time lowering its APC drastically to 150 USD and streamlining the processes to keep down costs. Section E is in fact one of the most successful OA journals, publishing around 4,000 articles per year. Table 3 shows exact counts of the number of hybrid articles published in IUC’s journals since 2004.

Table 3. Uptake (%) of the hybrid option in the journals of the International Union of Crystallography. Section E converted to a full OA journal in 2008.

Uptake (%) of the hybrid option in the journals of the International Union of Crystallography

| | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|------------------------|------|------|------|------|------|------|------|------|
| Acta Crystallography - | | | | | | | | |
| Section A | 7 | 12 | 5 | 8 | 0 | 0 | 2 | 9 |
| Section B | 9 | 23 | 24 | 4 | 1 | 2 | 4 | 9 |
| Section C | 10 | 17 | 16 | 4 | 1 | 0 | 0 | 0 |
| Section D | 13 | 16 | 30 | 15 | 22 | 27 | 22 | 21 |
| Section E | 6 | 7 | 5 | 1 | | | | |
| Section F | | 9 | 10 | 5 | 3 | 3 | 11 | 11 |

| | | | | | | | | |
|-----------------------------|----|----|----|----|----|---|----|----|
| Applied | | | | | | | | |
| Crystallography | 18 | 10 | 13 | 5 | 6 | 6 | 5 | 3 |
| Synchrotron radiation | 6 | 18 | 5 | 12 | 29 | 8 | 22 | 29 |
| Average for all except E | 12 | 15 | 16 | 6 | 7 | 6 | 9 | 11 |

Acta Crystallographica Section D: Biological Crystallography and *Journal of Synchrotron Radiation* have the highest uptake partly because they publish articles in biomedicine, partly because they regularly have some conference special issues where the organizers have paid for the open accessibility.

Proceedings of the National Academy of Sciences (PNAS)

The *Proceedings of the National Academy of Sciences of the United States of America PNAS* is a multi-disciplinary serial, which has been published since 1915 (current ISI impact factor 9.7). Roughly two-thirds of corresponding authors for the approximately 4000 yearly articles come from the US. Although it is a subscription journal, *PNAS* offers free electronic access to all its articles just 6 months after publication. *PNAS* also deposits the final, published version of all its content, regardless of funding, in PubMed Central (PMC). The uptake of the paid hybrid option for immediate OA has regardless of the above rather liberal policy been high, in the interval 17-23% since 2006.

The regular fee for immediate open access for the electronic articles is 1,300 USD, but corresponding authors from institutions with site licenses receive a discounted open access fee of 975 USD. It is important to note that the journal charges all authors page charges in any case, with a basic fee of 70 USD per page. Since the average length of articles is around 5.5 pages this would result in a typical fee of around 385 USD. An important aspect of the *PNAS* experience with hybrid OA is thus that authors need to go through the process of paying and financing page charged in any case, which means that paying the additional hybrid charge is administratively extremely simple.

Discussion

In just over two years the number of journals from major publishers offering hybrid Open Access has more than doubled, from approximately 2,000 to over 4,400. Since the overall numbers of journals from these publishers has remained on the same level, the hybrid share has risen from 25 % to around 50% of all eligible journals. In the same period the number of articles has increased from around 8,000 to 12,000. Roughly half of these articles have been deposited in PubMedCentral by the publishers and the share of articles in biomedicine is even higher.

According to the data available the uptake among the biggest commercial publishers that offer a uniform hybrid alternative for large numbers of journals across disciplines and quality levels is generally very low, below 2 %. Examples of such publishers include Elsevier, Sage, Taylor & Francis, Wiley-Blackwell. In the case of Springer, which has the biggest portfolio of hybrid journals, the uptake seems slightly higher, but the difference is explained by Springer's framework deals with a number of universities, where hybrid publishing has been bundled with e-licenses.

Among the lessons learnt is that at the 3,000 USD price level the overwhelming majority of authors do not pay the charges. It is difficult to know to what extent this is due to lack of awareness of the option and of the benefits of OA, unwillingness to pay at the prevailing price level or difficulties in funding the hybrid charge. The only way to study that would be a massive web survey with authors who had published in eligible journals and not used the hybrid opportunity.

The figures reported in this study can be compared to the numbers of full open access journals and articles. According to a recent study 4,767 OA journals published 191,000 articles in 2009 (Laakso et al., 2011) and in march 2012 the number of OA journals registered in the Directory of Open Access Journals was 7566. A yet unpublished study has estimated the number of articles published in OA journals that use article processing charges to have been around 100,000 in 2010 (Solomon and Björk, in press).

In comparing the low uptake of hybrid OA with the rapid growth of full Open Access publishing the key factor is the 3,000 USD price level of the major publishers for hybrid OA, which can be contrasted with the average article processing charge in APC funded gold OA journals which is estimated to be around 900 USD (Solomon and Björk, in press). The few full OA journals that charge between 2000-3000 USD, such as *PLoS Biology* and *Nucleic Acids Research*, are usually very high quality journals ranking near the top of their disciplines in Journal Citation Reports.

Also one cannot compare full OA journals directly with hybrid ones, since the type of service differs somewhat. Most OA journals review and publish quite rapidly compared to traditional journals, and the success of *PLoS ONE*, publishing around 15,000 articles in 2011 for an APC of 1,350 USD, testifies that authors value the services such journals can offer. Full OA journals charge an APC as a compulsory prerequisite for publishing, in hybrid journals the Open Access is an extra luxury, since the article is published in any case. In the case of most hybrid journals the author can also achieve almost the same OA effect for free by uploading a legal manuscript copy to an institutional or subject-based repository. The importance of the price level as a determinant of the uptake is also illustrated in two studies where authors have been asked about the effects of the article processing charge on their willingness to submit to full OA or hybrid journals. Solomon & Björk (2012) found that the maximum article processing charge that authors who had previously published in full OA journals were willing to pay was on average around 650 USD. Authors to the PNAS journal were in a survey carried out in 2003 asked what the maximum amount would be that they would be willing to pay for hybrid open access to their work in that journal (Cozzarelli, Fulton, & Sullenberger, 2004). The key results are shown in table 4 below.

Table 4. Share of authors willing to pay different levels of hybrid charges for the Proceedings of the National Academy of Sciences.

| Maximum amount Of hybrid charge in USD | share of authors Willing to pay |
|--|------------------------------------|
| 500 | 79.4 % |
| 1000 | 14.7 % |
| 1500 | 3.9 % |
| 2000 | 2 % |

It is interesting to reflect on the uptake results reported in this study and compare with the table 4 above. In all the relative few reported cases of journals with uptakes around or higher than 10 %, there are usually a number of special factors that contribute to the popularity. Most important among these is that prices are much lower or heavily discounted, for instance since the authors are members of the publishing association or their employer has a subscription to the journal in question. The Springer case with institutional agreements contribution two thirds of the publisher's hybrid articles also illustrates this point.

Below is a proposed list of factors influencing authors in the possible choice of the hybrid option:

- Cost to the author, taking into account possible discounts
- Possible OA mandates of the funder of the research or the author's employer
- The journals OA policy (possible delayed OA, restrictions concerning manuscript posting in repositories)
- Availability of funding for the OA charge
- Extra "effort" of securing the finance and making the payment
- Marketing to authors, in particular targeted marketing to the potential authors of a particular journal
- Visibility of hybrid articles on the journal table of content pages
- Discipline of the journal, in terms of the importance of early availability of publications (speed of publication and citation accumulation)
- OA awareness in the academic sub-community of the author
- Commonness of full OA journals among the primary alternatives for the submission

There has been some skepticism about the transparency of the publishers' pledge to decrease subscription prices according to the uptake (Weber, 2009). With the very low average uptakes for the bigger publishers and the dominance of the big deal e-licenses, where license fees are the subject of university or consortia specific negotiations, it is difficult to see much evidence of such reductions. Some funders of charges in full OA journals also refuse to fund hybrid charges (Shieber, 2009).

In any case the hybrid offering seems to have reached a state where the prospects for growth are low in the near future. The big publishers have already included around half their titles, probably most of the ones deemed to have better chances of uptake, and many university presses and society publishers already have a clear majority of their titles in their hybrid offering. Thus there is relative little scope for growth via the addition of new titles. The best chances of rapidly increasing the uptake would be to drastically reduce the price level. But that could in turn put the subscription income at risk. Since the marginal cost of keeping the hybrid offering running is almost zero publishers are likely to continue with this route in its current form in the near future.

But in parallel the trend seems now to be for many established publishers to start wholly new full Open Access journals, and in particular journals with very broad disciplinary coverage and reasonable article processing charges.

The overall conclusion of this study must be that the hybrid experiment, at least in the case of the major publishers and with the current price level, has failed as a way of significantly adding to the volumes of OA articles, and that hybrid OA will remain a very marginal phenomenon in the scholarly publishing landscape.

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