

# The structural transformation of the scientific public sphere: Constitution and consequences of the path towards open access

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## Abstract

We are currently witnessing a fundamental structural transformation of the scientific public sphere, characterized by processes of specialization, metrification, internationalization, platformization and visibilization. In contrast to explanations of this structural transformation that invoke a technological determinism, we demonstrate its historical contingency by drawing on analytic concepts from organization theory and the case of the Open Access transformation in Germany. The digitization of academic journals has not broadened access to scientific output but narrowed it down even further in the course of the ‘serials crisis’. For a long time, research institutions were not able to convince large academic publishers to adopt less restrictive forms of access to academic journals. It was only through the emergence of new and in part illegal actors (shadow libraries and preprint servers) that the existing path could be broken, and an Open Access path constituted. Following this analysis, we discuss consequences of the Open Access transformation for the public spheres of science and democracy. We conclude that Open Access publishing can only help to transform both communicative spaces towards the normative ideal of a public sphere when complemented by systematic support for non-profit publication infrastructures.

## Keywords

open access, path dependence, scientific public sphere, serials crisis

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## Introduction

Increasing specialization, metrification, internationalization, platformization and visibilization of scientific work is changing the nature of the communicative space in which scientists can exchange information about scientific issues. Thus, the scientific public sphere is currently undergoing a fundamental structural transformation. Previous attempts to interpret this structural transformation suggest that changes in the arena of scientific discourse are to be understood primarily as a consequence of digitization – that a normative assessment of the condition of the scientific public sphere can thus be derived more or less directly from the properties of digital technologies (Bartling and Friesike 2014). The aim of this article is to contrast such interpretations colored by techno-determinism with a grounded description based on organization theory, which focuses on the contingency of structural change as a process of negotiation between collective actors. This results in a more differentiated and indeed ambivalent assessment of the consequences of structural change for scientific work and the role of science for the democratic public sphere.

An organization theoretical perspective requires a narrowing of the empirical object to a concrete organizational field. In this article, we therefore focus on the current Open Access transformation in Germany – the change of business models in the market for scientific journals from a subscription model ('Closed Access') to a model in which articles are openly licensed ('Open Access'). In the first step, we reconstruct the Open Access transformation and show that the 'path breaking' (Dobusch and Schüßler 2013; Sydow et al. 2009) of the Closed Access model and the subsequent constitution of an Open Access path did not succeed purely due to technological change (digitization of journals), but that major publishers could only be persuaded to change their business model through the interaction of established actors (librarians, university associations) and new types of organizations (shadow libraries, preprint servers).

In the second step, we discuss consequences of the constitution of the Open Access path for the scientific public sphere. In previous accounts of the Open Access transformation, the predominant assessment is that freer access to specialized literature fundamentally shifts the communicative space of science in the direction of a normative ideal of the scientific public sphere. Without fundamentally questioning these consequences – which are positive from the perspective of science – we discuss the unintended and potentially negative consequences of the incipient Open Access path. Among these, we include the emergence of hybrid Open Access business models and predatory journals, as well as the amplification of Matthew effects and the exacerbation of the discoverability crisis. In the third step, we highlight consequences of the Open Access transformation for the larger, democratic public sphere. Here, we address the role of freely accessible scholarly texts for journalistic source work, the construction of digital knowledge commons (e.g., Wikipedia) and the appearances of scientists as public experts.

In order to avert negative consequences of the Open Access transformation for the scientific public sphere and to strengthen points of contact with the democratic public, it seems helpful – at least this is suggested by our analysis of the conflict over Open Access – to actively promote the development of publication infrastructures for the

common good. We therefore conclude our article with a brief description of this vision of the decommodification of scholarly publishing, referred to as the ‘Diamond Road’.

## Structural transformation of the scientific public sphere

We define the scientific public sphere as the normative ideal of a communicative space in which scientists can freely exchange views on scientific issues (based on [Habermas 1990](#)). The factual structure of the scientific public sphere differs from this ideal. Historically, different phases can be distinguished, in which this factual structure of the scientific public sphere, or rather the actors involved and the conditions of communicative exchange, underwent fundamental change. The individual phases of structural change can therefore be examined to determine whether and in what way the factual structure of the scientific public sphere has come closer to the ideal type.

Currently, the scientific public sphere is once again undergoing a phase of structural upheaval, the beginnings of which date back to the early 1990s. Our main interest in this article is the question of how, during this phase, a fundamental transformation of the business and distribution model for scholarly publications towards ‘Open Access’ was possible and what consequences for the scientific and democratic public sphere have resulted from this path breaking. The Open Access transformation is a significant process within a broader structural transformation of the scientific public sphere.<sup>1</sup> In order to understand the conditions of this process, it is necessary to first outline the currently ongoing structural transformation of science across its full breadth. Our proposal for this outline runs along five developmental lines of change: specialization, metrification, internationalization, platformization and visibilization.

For some time now, new disciplines and intradisciplinary research communities have been emerging at a rapid rate, for example, around previously unrecognized research subjects or methodological innovations. Through ever new journals and conferences, this specialization of science is leading to a strong growth of scientific literature. In the period between the two world wars, the annual growth rate of scientific research results (‘output’) was 2%–3%. In 2012, the growth rate was already 8–9%, which corresponds to a doubling of the output within 9 years (Bornmann and Mutz 2014). The specialization of science is in tension with the ideal type of the scientific public sphere. It is becoming increasingly difficult for individual scientists or working groups to filter the available literature according to relevance and thus to establish a critical-rational context of communication with colleagues beyond a narrow area of specialization. This field of tension and the related concern about the state of the scientific public sphere is becoming manifest in the widespread criticism of current publication strategies (e.g., ‘salami slicing’, that is, dividing findings among as many individual articles as possible), patterns of reception (e.g., limiting reading to a few ‘top tier journals’) and citation practices (e.g., overciting and citing according to the principle of recency rather than relevance). To navigate this tension, new text genres (e.g., meta-reviews) and technological methods for personalized search and visualization of scholarly sources are emerging, such as ‘discovery infrastructures’ and ‘knowledge maps’ ([Kraker et al. 2021](#)).

The everyday wisdom that ‘what can be measured will be measured’ applies increasingly to science as well. A *metrification* of science is particularly evident in two areas: the measurement of universities through rankings and the measurement of individual research performance through scientometric indicators. Lists such as the ‘Shanghai Ranking’ or the ‘Times Higher Education’ ranking created global reputation hierarchies between universities for the first time. These rankings not only reflect research activity, but also act as drivers for the transformation of universities and entire science systems (Brankovic et al. 2018; Krüger 2020; Krüger and Petersohn 2022). Through university rankings, private-sector providers often intervene indirectly in the scientific communicative space, since university administrations are induced to support primarily the kind of research that promotes their own institution’s performance according to the ranking criteria. University rankings also change the scientific public sphere by contributing to the ‘organizational becoming’ (Meier and Krücken 2006) of universities. It is no longer only individual scientists who appear in the scientific communicative space; universities also try to position themselves as advantageously as possible in the discursive arena and thereby acquire reputation, which could have an effect in turn on their positioning in a future ranking. The various attempts to make the activities of individual scientists measurable and thus comparable by means of scientometric indicators have a similar effect on the scientific public sphere (Krüger 2020; Krüger and Petersohn 2022). Indicators such as the H-index aim to measure the ‘pure’ research output of a researcher (articles, books). Altmetrics are metrics that aim to capture the activities of scientists more comprehensively by including alternative outputs, such as blogposts or tweets. Like university rankings, these scientometric metrics are changing the scientific public sphere. They create incentives meaning that contributions to scientific discourse are no longer based exclusively on scientific-argumentative criteria, but also on their measurability and potential popularity (‘virality’).

The structure of the scientific public sphere is also changing because of the *internationalization* of science. In terms of the German scientific landscape, this is expressed above all in a change in the language of publication from German to English. At German universities, publication in large parts of the natural, life and technical sciences is already exclusively in English, via international conferences and journals. In large parts of the German humanities and social sciences, such a shift in the frame of reference has only taken place partially, yet. As a result, the scientific public sphere in many subjects is fragmented into German and English sub-spheres, where an exchange on scholarly issues of the discipline takes place to a very limited extent.<sup>2</sup> While in some disciplines the linguistically separate communicative spaces can assert themselves quite equally at German research institutions (e.g., sociology), in other disciplines there is a progressive marginalization of German-language research activities (e.g., business administration).

Until the 1990s, the scientific public sphere was constituted primarily by personal interaction (e.g., via lectures at conferences and private correspondence) and via specialized publications (e.g., journals and books). With the Internet, new, more informal spaces of communication emerged, such as mailing lists and online forums, managed by scholars themselves, in which attempts were made to translate the organizing principles of scholarly discourse into the new media. For some years now, however, a *platformization*

of online scientific communication can be observed (Mirowski 2018). Increasingly, scientific discourse takes place on science-specific social media platforms such as ResearchGate, Academia.edu or Mendeley. Scientists use these platforms to share texts, coordinate projects, discuss questions and search for new interlocutors. In contrast to mailing lists, however, most of these platforms are not operated by scientists themselves, but by private companies. Thus, the way communication is structured on them (e.g., forms of algorithmic sorting and filtering) does not exclusively follow the principle of scientific discourse logic but is influenced by the platform operators' efforts to commercialize the communication activities.

The final line of development of structural change is the *visibilization* of scientific work processes, materials and intermediate and final results. Since the early 2000s, the so-called 'Open Science movement' has been growing within the scientific community (Friesike & Bartling 2014). Supporters of the movement advocate – partly with a pragmatic motivation in terms of research (e.g., to overcome the 'replication crisis') and partly from ideological conviction (e.g., to approximate to the Mertonian norm of scientific communism) – a radical change in the visibility regime of scientific work (Heimstädt and Friesike 2021). Practices of making visible, which the open science movement advocates, include making datasets (Open Data), software codes (Open Source), construction plans for scientific instruments (Open Hardware), expert opinions (Open Peer Review), project documentation (Open Lab Book), and scientific articles and books (Open Access) generally accessible. The increasing visibilization of working materials and research results is changing the scientific public sphere, sometimes drastically, since it is no longer merely technical articles and books that can be mobilized discursively, but a wide range of scientific artifacts. One striking example is the 'Reinhart-Rogoff controversy', in which a doctoral student was able to prove fundamental errors in a politically influential article by two renowned economists by re-analyzing an initially inaccessible, original dataset (which was, however, made available to him upon request and with reference to the ideal of open science) (Herndon et al. 2014).

The shift from proprietary licensing and valorization of scientific texts to Open Access is not the only process in the current structural transformation of the scientific public sphere, but it is a particularly significant one. The Open Access transformation has points of contact with several lines of development of structural change, first and foremost with internationalization (emergence of a basically global circle of recipients of scientific texts), metrification (easier retrieval and citation) and visibilization (free access to research results via digital infrastructures). To examine the conditions for the comprehensive Open Access transformation, we draw on the theory of organizational path dependence, as this is particularly well suited to explaining stability and change in markets for digital information goods. Following this path-theoretical analysis, we tie the results back to considerations of public sphere theory.

## Path breaking in the journal market: From Closed Access to Open Access

### *The 'serials crisis' as a consequence of the Closed Access path*

Scientific publishers play a central role in the production of the scientific public sphere. Since most scientific publishing is private, the 'rules' of the market for scientific literature influence the shape of the scientific public sphere. The market for scholarly journals – the dominant medium of the scholarly public sphere in most disciplines<sup>3</sup> – differs from other markets for information goods in several crucial ways. Briefly, scientific publishers process scientific manuscripts into scientific publications and offer them for sale to research institutions. Research institutions purchase access rights to scientific literature and make it available to their researchers and students. In contrast to other markets, the creators of the information goods, the scientists themselves, are not usually remunerated. For this reason, publishers incur little or no costs for the preparation of manuscripts or for scientific quality assurance in the form of peer review.

Another difference is the substitutability of scientific journals. A few decades ago, the market for scientific journals was similar to other markets for information goods, inasmuch as products were essentially substitutable, if only to a limited extent. Although the individual value of a novel or music album for buyers is closely tied to a particular author or music group, a different purchase decision is possible if the price of information good differs too drastically from other novels or albums. For scientists, access to a scientific journal is closely linked to the possibility of publication in this medium. Only if scholars can engage in detail with the discourse within a journal is it possible for them to contribute to that discourse through publication. Even before the 1990s, publication in journals was the most important prerequisite for a successful academic career in many disciplines. However, compared to later decades, there was greater freedom of choice regarding the publication organ during this period. While informal guidelines as to more or less prestigious journals prevailed in many disciplinary cultures, these were rarely quantified in the form of rankings. For research institutions, this meant that journals as products were substitutable to a limited extent. Scientific publishers were also aware of this characteristic of their products and therefore opted for more moderate pricing from today's perspective.

From the mid-1990s, however, an imbalance developed in the market for journals, which ultimately built up into the so-called 'serials crisis' (Hanekop and Wittke 2005; McGuigan 2004; Tenopir and King 2000). More and more disciplines began to quantify journal reputation in the form of rankings, mostly citation-based. Through these rankings, career opportunities for scholars became more closely linked to individual journals. In the evaluation of scientists' performance, the importance of citations and thus of the Journal Impact Factor (JIF) increased considerably.<sup>4</sup> At the same time, scientific publishers began to significantly raise the prices of particularly (career) relevant journals, especially in the life, technical and natural sciences (Kopp 2000). In addition, larger publishers began to offer journals not only individually, but in reduced-price bundles (more relevant journals together with less relevant journals). Stagnating budgets on the part of the research institutions forced them to cancel individual journal subscriptions. Journals from smaller

publishers, niche journals and monographs were particularly hard hit by this, as they were less (career) relevant on the one hand, and could not be bundled with highly relevant journals on the other. The resultant poorer access to marginal journals contributed to their further weakening in citation-based quality measurement in favor of journals from larger publishers – a self-reinforcing effect typical of path-dependent processes (Sydow et al. 2009).

The growing importance of centralized journals allowed the larger publishers to raise the prices of these same journals even further, resulting in a further deterioration of the position of small and niche publishers. Equally symptomatic, and driving this escalation of the serials crisis, was the increasing concentration in the market for professional journals. In 2003, about 66% of the world market for life, technical and scientific journals was controlled by eight major publishers. The major publisher Elsevier accounted for more than 28% of the global market share (House of Commons 2003, p. 12). The publisher reported a profit margin of 33% for its ‘Science & Medical Division’ (Reed Elsevier 2002, p. 3) in 2002. The disadvantageous position of smaller publishers in the serials crisis described above further reinforced this market concentration.

The Open Access movement emerged as a possible way out of the serials crisis in the early 2000s (Heimstädt and Friesike 2021). Members of this movement, including scientists, librarians and research funding institutions, called on publishers to change their business model. However, the demands were largely ignored or otherwise rebuffed by publishers. As a result of the change in market structure as well as scientific evaluation practices for individual research performance, a ‘path dependence’ (Dobusch & Schüssler 2013; Sydow et al. 2009) developed on the dominant market position of a few large publishers and the restrictively licensed – and thus much restricted access – subscription business model they were pushing. Already adopted before the serials crisis, the Closed Access path became even more entrenched during the serials crisis. The rigidity of this path was impressively demonstrated by the failed negotiation attempts by the Open Access movement. It was only through interaction with two new types of actors in the scholarly public sphere – shadow libraries and preprint servers – that Open Access advocates succeeded, from the mid-2010s onward, in breaking the existing Closed Access path and constituting a new Open Access path, at least in a rudimentary form.

### *Shadow libraries as useful illegality*

A first important background condition for the path breaking in the market for scientific journals was the emergence of shadow libraries as a new type of actor in the scientific public sphere. Shadow libraries are full-text databases that make digital copies of scientific publications available free of charge via the Internet. Shadow libraries differ in the scope and thematic focus of the works they make available. What they have in common, however, is that their operation and use are either situated in legally gray areas or are clearly illegal. Despite this illegality, shadow libraries are an almost indispensable resource for many scientists in their daily work in times of limited subscription supply. Although it is formally possible for scholars to gain access to most scholarly sources through interlibrary loan systems and acquisition requests, they often cannot muster the



effort and time required to obtain access to these resources. However, the effort and duration of these formal processes are in stark contrast to the timeliness of other demands placed on scientists, such as tight review deadlines in peer review processes. After a phase of hesitance in the early years of scientific shadow libraries, they are now used by a large number of scientists, as it has been shown that legal prosecution of illegal use is not possible in the vast majority of cases, or is not prioritized in law enforcement practice. From the perspective of science, shadow libraries are thus in an area of ‘useful illegality’ (Luhmann 1964, p. 304).

In the field of shadow libraries, there is, as to be expected, little transparency about the numbers and backgrounds of the various databases. What is known, however, is that most shadow libraries are run by individual scientists themselves and are supported in many ways by the broader scientific community, for example, through donations in the form of money or literature archives. Thus, shadow libraries represent a new kind of actor in the scholarly public sphere, participating in the negotiation of access to literature beyond the dichotomy of librarians and major publishers. In one of the few studies on the topic, Fischer (2020) distinguishes between thematically specialized shadow libraries (such as UbuWeb and AAARG) and comprehensive shadow libraries. The latter seem to be of particular importance for the path breaking in the market for academic journals, due to their scope and notoriety among scholars. The two most important comprehensive shadow libraries are LibGen and Sci-Hub. LibGen was created in Russia in 2008, by merging various digital corpora from both scientific and non-scientific literature. Over time, more corpora were added from existing collections, via automated downloads from publishers’ websites or through leaks from university networks (Bodó 2018). In 2014, the total corpus already included about 25 million documents (Cabanac 2016). The emergence of LibGen in Russia was fueled by a ‘lax attitude of the Russian state towards copyright infringement in the media sector’ (Fischer 2020, p. 234, own translation). One of LibGen’s preventive measures against attempts by copyright holders to suppress publication is the platform’s technical architecture. By disclosing the necessary code, LibGen allows users to download the database in its entirety and republish it elsewhere on the Internet (‘mirroring’).

In 2011, Kazakh Alexandra Elbakyan founded the shadow library Sci-Hub. Her motivation reads as a direct response to the negative externalities of the serials crisis. As a doctoral student in Kazakhstan, Elbakyan, according to her self-description, could not access the literature she needed for her research because her university did not have the financial resources for subscriptions. She developed the shadow library Sci-Hub as a technological solution to this economic-legal problem (Bohannon 2016a). Like LibGen, Sci-Hub relies on limited legal enforcement and several technical tricks (e.g., periodically changing the top-level domain) to protect it against attempts at prohibition. In 2019, about 74 million documents were available through Sci-Hub (Strecker 2019). The considerable size of the database can be explained on the one hand by the automated process through which the Sci-Hub corpus is constantly expanded. When a user submits a search query for an article, it is retrieved from the existing corpus if it is already archived. If the article is not yet included in the corpus, Sci-Hub uses an IP address pretending to the publisher’s website that the request is coming from an authorized account (Fischer 2020, p. 235). The



article is made available to the user and simultaneously added to the shadow library. Ultimately, however, the decisive factor for the size of Sci-Hub is the broad popularity that this shadow library enjoys among scientists. Information about the legitimacy of Sci-Hub is presented by usage figures of the shadow library, which have been provided by Elbakyan herself. An analysis of this dataset concludes that a total of 28 million articles were requested between September 2015 and February 2016. The requests came not only from countries in the Global South (where lower subscription budgets tend to be assumed), but also to a large extent from the Global North. Geographically, accesses took place where many research institutions are located (Bohannon 2016a).

Shadow libraries such as LibGen and Sci-Hub also enable those scientists whose research institutions have not arranged subscriptions to access almost the entire body of scientific literature. The global access figures demonstrate that shadow libraries are by no means merely an access route for a small, technically savvy section of the scientific community. At the same time, shadow libraries do not offer a direct substitute for scholarly publishers and their function of quality assurance. In the following, we describe how the growing popularity of preprint servers is challenging the quasi-monopoly of publishers as instruments of quality assurance for scientific manuscripts.

### *The preprint server as alternative quality control*

A second background condition for the path breaking in the market for scientific journals was the development of preprint servers into a significant group of players in the scientific public sphere. Preprints are those scientific manuscripts intended for publication in a journal but not yet submitted for peer review or accepted for publication. Sometimes preprints are sent by scientists directly to colleagues, published on private or institutional websites or shared on scientific social networks such as ResearchGate or [Academia.edu](https://www.academia.edu/). However, a rapidly growing way of making preprints accessible is publishing them on preprint servers. Most preprint servers target individual disciplines or scientific fields, such as the social or life sciences. Preprint servers thus connect to practices of a collegial but unsystematic exchange of ideas and interim results that have been central to scholarly work in the past.

The beginnings of the preprint servers date back to the early 1990s, when physicists started to deposit digital copies of their manuscripts on the arXiv platform founded by Paul Ginsparg (Butler 2001). Shortly after this, scientists from other scientific and technical fields also began to share their preprints via arXiv. Since the 1990s, arXiv has developed into an important scientific communicative space. The success of arXiv can also be attributed to the fact that preprints are not simply deposited, but that a certain scientific quality assurance takes place through a complex system of automatic filtering and the review and sorting of preprints by administrators (Reyes-Galindo 2016). In recent years, the number of preprint servers has increased significantly. Some speak of a ‘second wave’ of preprint servers (Johnson and Chiarelli 2019). A 2019 study counted 63 different preprint servers worldwide, 38 of which launched between 2016 and 2019 (Johnson and Chiarelli 2019). Many of these newer preprint servers are significantly less busy and have scarcer resources than arXiv. However, almost all involve a brief formal review of

submissions by volunteer scientists before the manuscript is published. Many preprint servers now assign a 'Digital Object Identifier' (DOI) to uploaded preprints, increasing the permanence and thus the citability of these documents. Initiatives such as 'PREREview' also seek to further increase the scientific authority (and thus the citability) of preprints by actively soliciting public comment and review of preprints among scientists in the comment columns of preprint servers. While shadow libraries thus provide access to manuscripts formally reviewed by journals, preprint servers create new evaluation practices that compete directly with one of the scholarly publishers' central value propositions, namely, the organization of quality assurance through peer review. Preprint servers, along with shadow libraries, are thus entering the negotiation of access to scientific literature and the constitution of the scientific public sphere as a new group of collective actors.

A historical example illustrates the competitive situation between scientific publishers and the exchange of preprints organized independently of publishers. As early as the 1960s, the US National Institute for Health (NIH) organized an extensive 'experiment' to circulate unpublished results from biological research (Cobb 2017). From the NIH's point of view, the project was a reaction to the growing discontent among many scientists regarding the long duration of review and publication processes in scientific journals. NIH invited scientists to join thematically focused Information Exchange Groups (IEGs). At short intervals, members of the IEGs received relevant preprints by mail from the NIH. Between 1961 and 1967, a total of more than 3600 scientists participated in the exchange system, and more than 2500 documents were shared during this period. However, the project had to be terminated abruptly after scientific publishers began to state (or even enforce on the scientific editorial boards of journals) that scientific journals would not accept manuscripts for publication that had previously circulated as preprints through the IEGs. This arrangement, which became known as the 'Ingelfinger rule', was justified ostensibly by the publishers on the grounds that there was a risk of distorting scientific competition through multiple publications. In fact, however, it seemed to have been primarily driven by fear of negative economic consequences for journals (Cobb 2017).

Today, some 50 years after the IEGs, the relationship between scholarly publishers and preprint servers is much less clear. As the popularity of arXiv and other preprint servers grew steadily despite the disincentives, publishers began to move away increasingly from the Ingelfinger rule (Borgman 2007). One current strategy to curb the organized informality practiced by scientists is for major publishers to set up their own preprint servers. For example, the major publisher Sage offers scientists submitting a manuscript to a Sage journal the additional possibility of the manuscript being published on the publisher's own (and thus not primarily organized from within the scientific community) preprint server 'Advance' in parallel with the peer review process. On the one hand, this offer can be understood as a promotion of the scientific public sphere through the publication of preprints. On the other hand, the historical example suggests that this strategy is aimed primarily at keeping alternative assessment practices contained on platforms that are outside the economic exploitation possibilities of major publishers. The success of preprint servers, which are run from within academia, thus performatively calls into question whether scholarly publishers are as indispensable to the evaluation of

scholarly work as they (themselves) assume. Furthermore, freely accessible preprints can also serve, to some degree, as a substitute for final accepted article versions, as they can also be cited, at least to a limited extent. Although less directly than through shadow libraries, preprint servers thus also exert pressure on the subscription business model of major publishers.

### *Path breaking and the open access transformation*

The combination of shadow libraries, which were legally questionable but considered legitimate in the scientific community, and the rapidly growing prevalence and importance of preprint servers changed the framework conditions under which the libraries of universities and research institutions could negotiate with (major) publishers about changes in the prevailing contractual and access structures. Before the establishment of shadow libraries and preprint servers, libraries were in a weak negotiating position. Unilateral termination or non-renewal of contracts with major academic publishers would have massively complicated everyday research for scientists working at the institutions. Alternative forms of access, such as interlibrary loan, are still very slow and cumbersome compared to digital journal subscriptions. Publishers have taken successful legal action against contemporary digital variants of interlibrary loan, such as “Subito”, which emerged from an initiative by the German Federal Ministry of Education and Research (Müller 2006). For this reason, and despite the worsening serials crisis and the development of alternative publication models such as Open Access in the 1990s, canceling subscriptions, which were overpriced from the point of view of the libraries, was not an option for universities and research institutions for a long time. However, with the knowledge of the establishment of shadow libraries and preprint servers, new negotiation opportunities came up for research institutions in the mid-2010s.

In 2014, the Alliance of Science Organizations in Germany commissioned the German Rectors’ Conference (HRK) to negotiate new contract models with three major scientific publishers, Elsevier, Springer Nature and Wiley, throughout Germany.<sup>5</sup> The aim of the negotiations, which were conducted under the name ‘Project DEAL’, was to agree on so-called ‘Publish&Read’ contracts. These not only provide access to current and past issues of a journal, but also ensure that all publications by scientists at the participating institutions are permanently and freely accessible to all (‘Open Access’). In return, participating research institutions pay a fixed fee for each article published by their own scientists. However, regardless of the number of articles published by a research institution, access to all new and (depending on the agreement, smaller or larger parts of) the publisher’s archived journal articles is guaranteed.

A position of perceived strength, however, caused the three major scientific publishers to reject this proposal initially. Market leader Elsevier in particular did not want to agree to any transitional arrangements. As a result, more than 60 scientific organizations decided in 2016 to let their contracts with Elsevier expire.<sup>6</sup> From a statement by the HRK on the temporary breakdown of negotiations with Elsevier:

“The publisher did present us with an initial offer for a nationwide license a few days before this deadline and after months of intensive negotiations. However, this rejects the principles of Open Access and all arguments for fair pricing: Despite the already existing 40 percent return on sales, the publisher is relying on gigantic price increases beyond the license sums paid to date. In addition, the publisher categorically refuses more transparent business models based on publication performance that would make publications more openly accessible.” ([German Rectors’ Conference 2016](#), p. 1, own translation)

The lack of protests from those researchers affected showed how much Elsevier’s bargaining power had diminished thanks to alternatives such as shadow libraries and preprint servers. In fact, numerous individual and reputable researchers showed ostentatious solidarity with their research institutions and resigned from editorial positions at Elsevier. In the months following this first wave of boycotts, the number of German scientific institutions that let their contracts with Elsevier expire grew. Between August 2017 and early 2018, the number of universities without a contract with Elsevier rose from 30 to 50, that of vocational universities from 16 to 34, and that of other research institutions from 26 to 38 ([Dobusch 2017](#)). Meanwhile, the two other major publishers, Wiley and Springer Nature, had already shown greater willingness to negotiate and were prepared to make transitional arrangements. In January 2019, the first Publish&Read agreement was finally concluded with Wiley. The concrete agreement provides for a Publish&Read fee of €2750,

“which covers, on the one hand, the publication of the [...] articles (publish) in Open Access and, on the other hand, reading access to the entire portfolio (read) of subscription journals. The total price for the nationwide DEAL contract with regard to publishing and reading in the subscription journals is calculated by multiplying the [Publish&Read] fee of €2,750 by the number of articles published by Submitting Corresponding Authors of the institutions that are eligible to participate in principle. There are no additional costs for reading access (reading fee). In addition, there is only a one-time payment for a retrospective gap closure for the archive (connection to the national licenses until 1997).” ([Forschungszentrum Jülich 2019](#), own translation)

This agreement is associated with improved access to scientific knowledge in two senses: the institutions covered by Project DEAL generally gain access to a much larger part of the Wiley digital archive, and the contributions of their scientists are immediately and freely available online worldwide. The agreement does not change the mechanisms of scientific quality control. A similar agreement was signed with Springer Nature a year later ([Springer Nature 2020](#)) and both agreements have been extended since. Meanwhile, the lack of contracts between Elsevier and almost 200 German universities, colleges and research institutions continued (until finally an agreement was signed in September 2023, as well).

## Consequences of open access for a theory of the public sphere

This path-theoretical analysis of the Open Access transformation has demonstrated how the transformation of the business model in the market for scientific journals became possible only through shadow libraries and preprint servers. Likewise, it has become clear that the transition to Open Access remains contested and potentially reversible if shadow libraries or preprint servers lose influence, through regulatory measures such as network locks, for example. An extensive and primarily scientometric literature has already gathered evidence in a variety of ways about the manners in which the Open Access transformation is changing the scholarly discursive arena toward the ideal type of scholarly public sphere. We refrain from reproducing these results in detail here and refer to recent review articles (e.g., [Tennant et al. 2016](#)). In what follows, we instead address some theoretical implications of the Open Access transformation for the public sphere that have been little discussed to date: the downsides of change for the scientific public sphere and the consequences of Open Access for a larger, democratic public sphere.

### *Unintended consequences for the scientific public sphere*

The solidification of the Closed Access path and the serials crisis had moved the structure of the scientific public sphere further away from its normative ideal. There is much to suggest that the Open Access transformation is part of a countervailing trend toward the ideal type of a scientific public sphere. However, the Open Access transformation by no means implies a return to an ‘original’ structure of the scientific public sphere. Rather, in addition to the normatively desirable consequences, some unintended consequences of the transformation become apparent from the perspective of Open Access advocates. We discuss four of these potentially problematic side effects in more detail below: Hybrid Open Access business models, predatory journals, Matthew effects and the exacerbation of the discoverability crisis.

One side effect of the Open Access transformation are **Hybrid Open Access business models**. This side effect results from struggles relating to the interpretive control over the definition of Open Access. While librarians have succeeded in persuading publishers to switch from subscriptions to Open Access, publishers have used the momentum of the transformation to define Open Access in ways that have exacerbated the economic imbalance of research institutions. Under the heading ‘Hybrid Open Access’, publishers have made it possible for research institutions to make individual articles by their scientists freely available on the Internet in return for the payment of a license. Thus, scientists and research institutions have been able to fulfill their voluntary commitments to exclusive Open Access publication. At the same time, however, publishers have stuck to the subscription model, with the result that individual issues of journals contain both proprietary and freely licensed articles. If research institutions want to make not only their own articles but also the other articles in the journal available to their scientists, they still have to subscribe. However, studies on this so-called ‘double dipping’ have shown that the subscription prices in this system often remain relatively stable, and research institutions thus pay for both the individual Open Access articles and the subscriptions

(Mittermaier 2015). Although the Hybrid Open Access model is criticized by research institutions, major publishers often succeed in deflecting this criticism by pointing out that they have now granted Open Access. In extreme cases, Hybrid Open Access models can therefore contribute to a further decrease in access to scientific literature through Open Access, rather than an increase.

Another side effect of the Open Access transformation is the emergence of *predatory journals*. In Open Access models, many publishers generate their revenues not through subscriptions, but through one-time payment of so-called ‘article processing charges’ (APCs). In the shadow of major publishers, new publishers have emerged, whose Open Access journals attempt to siphon off such APCs by offering articles of dubious quality. The business model of predatory publishers and their journals is claiming to conduct peer review, but either not conducting it at all or only conducting it very superficially (Dobusch and Heimstädt 2019). Through a vast number of spam emails and very short turnaround times for manuscripts, which result from the lack of or only very superficial peer review, predatory journals have made it to a significant number and size. It is estimated that the volume of predatory journals has grown from 1800 in 2010 to more than 8000 in 2014. In 2014, Shen and Björk (2015) estimated the size of the predatory journals market to be about US\$74 million (compared with US\$244 million for serious Open Access journals and US\$10.5 billion for the total global journal subscription market).

Predatory journals are a danger for individual scientists in several respects. At first glance, predatory journals seem to be an adequate response to growing publication pressure due to their short processing time, but many scientists only realize the journal’s lack of acceptance among colleagues and thus the essential loss of a manuscript for their own career development after publication in such a journal. Predatory journals can also be abused strategically to delegitimize (sub)disciplines through hoax articles. In 1996, the U.S. physicist Alan Sokal published a hoax article in the journal ‘Social Text’ (Sokal 1996b), which he made public as a performative act of criticism of what he saw as the lack of scientificity in postmodern cultural studies (‘Sokal affair’, Sokal 1996a). In a similar but more recent case, philosopher Peter Boghossian and mathematician James Lindsay staged an attack on the discipline of gender studies with their hoax article ‘The Conceptual Penis as a Social Construct’, published in the interdisciplinary and at least tendentially predatory journal ‘Cogent Social Sciences’ (Boghossian & Lindsay 2017). In their attempt to delegitimize the discipline, they drew attention to an overly superficial and unscientific peer review but failed to reflect on the journal’s at least questionable quality. Finally, predatory journals also offer opportunities for ‘science washing’, that is, the production of supposedly scientific knowledge to support questionable to pseudoscientific theses in public, non-scientific discourse.

Another negative side effect of certain forms of the Open Access transformation could be that the change in major publishers’ business model will entrench or even increase existing inequalities in the science system (Pooley 2020). Specifically, there is a concern that the ‘*Matthew effect*’ (Merton 1968), which has been widely demonstrated in academia, will now be reinforced via the Open Access business models of academic publishers by linking the opportunity to publish in reputation-enhancing journals to the economic resources of individual scientists (or the academic

institutions at which they are employed). This concern seems justified at this stage, when scientists from systems with Publish&Read contracts are compared with scientists from resource-poor systems without Publish&Read contracts. In this case, Publish&Read contracts are associated with an attention advantage over others for participating research institutions, because their contributions are more openly accessible and thus more frequently cited. Institutions from countries of the Global South generally do not have those contract structures at their disposal in a comparable way (Pooley 2020). Even more, studies such as those by Omobowale et al. (2014) rather suggest that the aforementioned predatory journals are predominantly used by marginalized scholars from the Global South, further deepening reputational differences. Altogether, the commodity-based forms of Open Access transformation – whether with author fees or Publish&Read contracts – are unable to overcome global inequality regimes, or in some respects may even entrench them. We reflect on possible alternatives to this at the end of this article.

The concern about Matthew effects seems to be less relevant when comparing scientists with publish-and-read contracts (Mittermaier et al. 2018). In these cases, on the contrary, there is a justified assumption that Open Access contributes to equalizing existing inequalities. In the libraries of less research-intensive institutions, the switch to publish-and-read contracts should free up budget capacities, which can be used in turn to purchase niche journals and monographs. At the same time, it seems possible that research-intensive institutions will expend more financial resources than on the subscription path. It is to be expected that this situation will give rise to internal university processes around the redistribution of budgets, the outcome of which may vary greatly between universities. Fundamentally, however, these considerations show that publish-and-read contracts tend to reduce inequality between more and less research-intensive institutions. Moreover, the criticism that Open Access increases inequality by tying publication opportunities to capital investment can also be debunked from another perspective. About 70 % of Open Access journals listed in the Directory of Open Access Journals do not charge APCs (Mittermaier et al. 2018, p. 9). Even if institutional budgets are exhausted and no further funds can be acquired, scientists have wide-ranging opportunities for publication. Libraries are also able to budget in such a way that sufficient funds are made available for (in the view of scientists) ‘indispensable top journals’ – even in the face of fluctuating publication performance (from year to year) (Mittermaier et al. 2018, pp. 7–10).

Another potentially negative side effect under discussion is whether the growing number of Open Access journals further exacerbates the *discoverability crisis and filtering problems* (see the section on ‘specialization’ above) in science. Critics base their arguments on the observation that in the run-up to Publish&Read agreements, many new Open Access journals emerged in parallel with proprietary licensed journals. Among those re-establishments there are serious competitors to existing Closed Access journals, predatory journals and Open Access journals founded by major publishers as ‘mirror journals’ (often with identical editors) of existing Closed Access journals as another variation of the double dipping described above. Even if Open Access increases formal accessibility, the number of re-establishments could further exacerbate the already



existent filtering problem of science and thus undermine the ideal of a scientific public sphere. However, it was clear from our analysis of path breaking that the absolute increase in journals is not a side effect of the Open Access transformation, but an upstream phenomenon in time. The creation of new Open Access journals was not a reaction to Publish&Read contracts but was the result of a situation in which major publishers resisted entering into Publish&Read contracts. As Publish&Read contracts become more widespread, it can be assumed that at least the quantity of Open Access sister journals and serious competing products will not continue to increase.

There is another reason why the causal link between Open Access and the filtering problem in science is implausible. In order to deal with the filtering problem, it is necessary to either limit the scope of scientific publishing (e.g., indirectly by asking applicants to submit only a narrowly defined number of publications) or to change the filtering procedures. Artificially limiting publication output is a direct contradiction to the professional autonomy of scientists and the ideal of academic freedom. Thus, hopes for addressing the filtering problem lie in the development of new filtering systems. Open Access publications are better suited than proprietary licensed scientific publications for the development of such systems. Systems for filtering scientific information draw on both the metadata and the full digital texts of scientific articles. The more freely metadata and full texts are available, the better they can be read, evaluated, processed and combined with data sets from other filter systems (Kraker et al. 2021).

### *Interactions with the democratic public sphere*

The scientific public sphere does not exist in isolation but is embedded in a ‘network of different overlapping spaces of communication’ (Fraser 2009, p. 151, own translation; Habermas 1990; Habermas 1992). Our interest in this article is in the overlaps between the scientific public sphere and the larger ‘political public sphere of the democratic polity’ (Nanz 2009, p. 358, own translation; Habermas 1990). Therefore, we examine the consequences of the Open Access transformation for the democratic public sphere by focusing on three points of contact: journalism, knowledge commons and expertise.

**Journalism** is a key avenue through which scientific research results can gain significance in a larger, democratic public sphere. For example, scientific studies can complement reporting on daily economic, political or cultural issues. But they can also be the focus of coverage in the context of science journalism itself. Especially in online journalism, Open Access offers journalists new opportunities to weave scientific studies into their reporting. While studies could only be cited in print journalism in the form of footnotes or similar references, online formats allow direct links to scientific studies. However, linking only offers added value for readers if the digital version of the study is also openly accessible. If journalists want to use the possibilities of direct linking (e.g., to signal professional values such as diligence and evidence orientation), it is logical to refer primarily to Open Access studies. In bibliometric research on the media reception of Open Access articles (Tennant et al. 2016, pp. 7–10), this effect is discussed as the ‘general media advantage’ (Tennant et al. 2016, p. 10) of Open Access over proprietary licensed articles.

Alongside journalism, digital *knowledge commons* have developed into important points of contact between the scientific and democratic public sphere over the past two decades. The most important of these knowledge commons is probably the collaborative online encyclopedia Wikipedia, which is supported by the non-profit, donation-funded sponsoring organization Wikimedia. Wikipedia is one of the most frequently visited websites in Germany and worldwide (Wikipedia, n.d.). It thus represents an important media infrastructure of the democratic public – both as a source of information for participants in the discourse arena and as a contested communicative space within itself. Reference to (scientific) sources is an important element of the writing practice within the community of volunteer Wikipedia authors. Analogous to online journalism, an online encyclopedia offers the possibility to link directly to scholarly sources. Bibliographic research on Wikipedia shows that editors primarily receive and link to studies that are accessible without institutional access via a research library (Teplitskiy et al. 2017). One difference between online journalism and online encyclopedias is the scope of potentially citable sources. Journalistic media still tend to work with limits on text length and number of sources, even in the online realm. Thus, the preferred use of Open Access studies does not influence the absolute number of studies cited, but only their selection. In digital knowledge commons such as Wikipedia, however, there are usually no such editorial restrictions. The more Open Access-studies are published on a topic, the more can be cited as sources in Wikipedia articles. Communities around digital knowledge commons thus act as ‘amplifiers’ (Teplitskiy et al. 2017, p. 2117) of Open Access scholarly articles, as articles from Open Access journals are cited significantly more frequently in sub-publics such as Wikipedia than articles from proprietary licensed journals with a comparable JIF. Via the creation processes of digital knowledge commons, the Open Access transformation of the scientific public sphere is thus leading in part to a ‘scientification’ (Weingart 1983, own translation) of the democratic public sphere.

A third point of contact between the two publics is the performance of *scientific expertise* aimed at a democratic public. This is happening both individually through appearances in the mass media, such as the regular podcast ‘Coronavirus Update’ with virologist Christian Drosten, and as co-authors of public expert opinions and recommendations for action, such as the ad hoc statements on the coronavirus pandemic by the Leopoldina. In most cases in which scientists appear in the democratic public sphere as experts, they are confronted with ‘trans-scientific questions’ (Weinberg 1972) that they *cannot* answer according to scientific standards but nevertheless *have* to answer. In the days of the Closed Access path, experts could deal with this tension by means of a fiction of consensus: A topic that was quite controversial within the scientific public sphere could be presented more clearly to the democratic public, since members of the larger public usually had little opportunity to compare the expertise with broader scientific discourse. Criticism of the clarity of presentation could therefore be voiced only by other experts, if at all.

The Open Access transformation opens up the possibility of criticizing scientific expertise to new groups of actors in the democratic public sphere. When scientific articles are freely accessible, scientists take a considerable risk when they give an unambiguous answer to trans-scientific questions despite scientific ambiguity (or even unanswerability).

The Open Access transformation is changing the presentation of scientific expertise by making previous forms of presentation more difficult and thus pushing scientists to explore new forms of presentation. We observe at least two strategies of expertise under Open Access conditions. Some scholars take the broad accessibility of scientific research as an opportunity to link their scientific expertise much more closely to their own research, avoiding more general statements and educated guesses. Other scientists adopt a strategy of ‘performing authenticity’ (Reckwitz 2017, p. 137, own translation) and present themselves to their audience as credible experts, not by making particularly unambiguous statements but by signaling their trust in the public’s ability to deal responsibly with the ambiguity of science (for an example regarding the communication of uncertainty around preprints, see Heimstädt 2020; see also Bauer et al. 2023).

## **Outlook: Decommodification of research findings**

Before the Open Access transformation, scientific knowledge had the character of a club good. There was no rivalry around access to digital journals, but there was the possibility of exclusion from access due to subscription costs. The Open Access transformation changed scholarly knowledge from a club good to a public good, for which there is neither rivalry nor the possibility of exclusion from access. Despite this momentous change, however, scholarly knowledge continues to be commodified by predominantly private-sector publishers. Research institutions now pay APCs to publishers for individual articles instead of subscription fees for entire journals. We have shown that the Open Access-transformation in Germany—and also in other countries such as Austria or the Netherlands – has been at least partially successful, but that the path taken is still fragile. This fragility is also rooted in the perpetuation of commodification. If publishers were to succeed in combating shadow libraries and displacing independent preprint servers with publishers’ own offerings, a return to the subscription path or an Open Access serials crisis would not seem out of the question, either.

From the perspective of scholars, librarians and university administrators, it seems desirable to stabilize the changed shape of the scientific (and democratic) public spheres brought about by Open Access. We suggest that one of the most promising strategies to contribute actively to a lock-in of the Open Access path may be the development of public-domain publishing infrastructures. This would not only make research results freely accessible, but also decommodify them. The decommodification of scientific knowledge through public benefit-oriented publication infrastructures could help to redirect parts of the profit margins currently flowing to major publishers to the Open Access-transformation of previously marginalized genres of literature, such as monographs (Adema and Stone 2017).

In Open Access discourse, this form of literature delivery is referred to as the ‘Diamond Road’. Instead of paying subscription fees or APCs, research institutions use their acquisition budgets to fund non-profit publication infrastructures. This type of funding means that there is no (additional) cost to researchers or their institutions for either reading or publishing through these infrastructures. One example of the Diamond Road is the ‘Open Library of Humanities’, which is funded by a consortium of foundations, libraries and research institutions and currently (as of August 2023) manages 28 APC-free Open

Access journals. Diamond Road models require funding models beyond market logics. They are based on solidarity-based funding, either among different scientific institutions or mediated through government institutions. Whether such further development of the Open Access idea is feasible, however, does not depend solely on the existing players in the journal field; it is also closely linked to the processes of specialization, metrification, internationalization, platformization and visibilization described above. Moreover, the question remains open whether such a structural change of the scientific public sphere is possible without a simultaneous, if not advance-complementary structural change of the democratic public sphere on a wide front.

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## Notes

1. We thus understand the scientific as well as democratic public spheres as macro-level objects of investigation and the Open Access transformation as a meso-level phenomenon. The Open Access transformation is primarily embedded in the scientific public sphere, but it has points of overlap with the democratic public sphere (see section ‘Consequences of Open Access for a theory of the public sphere’).
2. On the unfinished internationalization of German business administration, see [Macharzina \(2012\)](#).
3. Some disciplines, especially the humanities and law, follow different logics, which put greater emphasis on books. In the following, we focus on disciplines with journal-centered publication markets.
4. There are numerous studies on the problem of the journal impact factor as a quality measure for journals, for example, [Baum \(2011\)](#) and [Osterloh & Frey \(2020\)](#).
5. Even before the serials crisis, libraries in Germany did not negotiate with publishers on their own, but through ‘meta-organizations’ – often regional consortia but also through national organizations such as the DFG. The Alliance’s negotiations corresponded to this practice of negotiation ([Ahrne & Brunsson 2008](#)).
6. While decisions about the Elsevier boycott were made individually by science organizations, a field report from the Alliance negotiators indicates that the meta-organization helped to share information about the strategies and consequences of a boycott among the individual science organizations ([Mittermaier 2017](#)).

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