A journal is a club: A new economic model for scholarly publishing

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Abstract. A new economic model for analysis of scholarly publishing—journal publishing in particular—is proposed that draws on club theory. The standard approach builds on market failure in the private production (by research scholars) of a public good (new scholarly knowledge). In that model publishing is *communication*, as the dissemination of information. But a club model views publishing differently: namely as *group formation*, where members form groups in order to confer externalities on each other, subject to congestion. A journal is a self-constituted group, endeavoring to create new knowledge. In this sense 'a journal is a club'. The knowledge club model of a journal seeks to balance the positive externalities due to a shared resource (readers, citations, referees) against negative externalities due to crowding (decreased prospect of publishing in that journal). A new economic model of a journal as a 'knowledge club' is elaborated. We suggest some consequences for the management of journals and financial models that might be developed to support them.

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> *Americans of all ages, of all conditions, of all minds, constantly unite. Not only do they have commercial and industrial associations [firms] in which they all take part, but also they have a thousand other kinds: religious, moral [intellectual], serious ones, useless ones, very general and very particular ones, immense and very small ones; Americans associate to celebrate holidays, establish seminaries, build inns, erect churches, distribute books, send missionaries to the Antipodes; in this way they create hospitals, prisons, schools. If, finally, it is a matter of bringing a truth to light or of developing a sentiment with the support of a good example, they associate.*
>
> (Alexis de Tocqueville, *Democracy in America*, 1835, Vol 3, p. 896)

1 Economists against journals

The existence of commercial scholarly journal publishers follows from the economics of specialization and the division of labour. Lacy (1963; prior to gender-neutral scholarly language) put it like this:

> Between the artist and his audience stands the medium of communication through which he must reach them: … the broadcast networks, the publishing houses. … Throughout history an entrepreneur of some kind has assembled the artist's audience and given him the chance to be heard.

Substitute 'scholar' for artist and 'other scholars' for audience, and we have the standard modern commercial model of journal publishing. The economic logic of this model was predicated on the specialized capital and skills required to produce and distribute scholarly journals, and recognition that those capabilities were not efficiently possessed by scholars (or artists), as the producers and consumers of scholarly output. The result was the *papyrocentric* (Harnad 1995) business model of a

closed-access journal in which a private publishing company held the intellectual property rights and was supplied with free content and free labour (Bergstrom 2001).

This modern model, with its attendant commercial players and profits, is a departure from the original model of journals. While part of the original motivation of the first research publication in serial form—the *Philosophical Transactions of the Royal Society* in 1665—was to make money, the history of scholarly publishing is largely one of community subsidy to cover losses or breaking even. The first serials to which the name "journal" was applied in the early to mid-19th century often struggled to find audiences sufficiently large to justify the printing of content of interest to professional researchers.

It is only in the mid-20th century with the massive expansion of public research funding, and the consequent expansion and globalisation of research communities that our modern system developed. The small society presses struggling to cope with growing scale were supported by and then largely supplanted by the large commercial presses. These newly empowered players brought an industrial sensitivity to the publication and dissemination process, for the first time realising the benefits that those specialised capital and skills could provide by operating at a scale that was to that date, unprecedented. The successful publishers grew—and consolidated to grow further—alongside a pre-Cambrian explosion and specialisation of journals to create the landscape today where the majority of journals are owned, controlled or at least produced by a handful of companies.

But with the arrival of the PC, the internet—and soon the blockchain—and with the spread of hardware and software capabilities that have led to open access desktop publishing, the economics of this model have shifted (Kahin and Varian 2000, Gans 2000, Bergstrom and Bergstrom 2001, Fyffe and Shulenburger 2002, Willinsky 2005). This has forced two interrelated pressures on the extant scholarly publishing model that taken together suggest: (1) that it is profoundly broken (Bergstrom and Bergstrom 2006); and (2) that a general move to an open access regime is imminent (Bergstrom and Bergstrom 2004; Willinsky 2006, 2009; Armstrong 2014; McCabe and Snyder 2014). First, it is no longer clear that the closed

access proprietary model is at all necessary (Houghton 2001). As Conley and Wooders (2009: 71) explain:

> 'Open access journals have overwhelming cost advantage over commercial publishers. In addition, open-access is consistent with our mission as scholars to increase and spread knowledge and also feeds our personal and professional interests much more directly. But we are still living with the system of scholarly communication we inherited from the papyrocentric era.'

Second, this model preserves many dysfunctional aspects of the model of the scholarly journal itself, including as Frey (2003) points out, the tendency for scholars to have to 'prostitute' themselves before editors and referees, due to the veto power that referees wield and the necessity of journal publication to climb career ladders. Frey proposes a series of institutional reforms in the way property rights work in scholarly publishing to mitigate this. Furthermore, as Conley (2012) editorializes, the result is bad for the scholarly community because it entrenches a model with very high rejection rates that is inordinately wasteful of 'free' scholarly resources. Conley finds that this represents:

> 'a compelling reason to take advantage of new technologies to take control of certifying and distributing research away from commercial publishers and return it to scholarly community.'

The 20th century publishing model once made economic sense as outsourced specialization, but technological change has upended that logic by dramatically lowering the cost of in-house production. The old model holds on mostly through legacy effects and has transformed into a model of monopoly exploitation. This is costly in pecuniary terms, but also in the ability of scholarly communities to develop and change publishing institutions to suit their own needs. There is now a broad consensus that the economics of scholarly publishing is broken and that a new way forward turns on exploitation of new open access-business models (Binfield 2013). But open access models, including hybrid models (Björk 2012), are also proving difficult to implement, running into problems of cost, free-riding, and incompatibility with extant scholarly research institutions (Neylon 2015a).

The purpose of this paper is to elaborate what we propose as a new economics of scholarly publishing that is based around the production and consumption of scholarly output by the scholarly community. We argue that this can be represented not as an economics of firms, markets and specialization, but as an economics of team production and consumption in *clubs*, or as we style them 'knowledge clubs' (Hartley 2015).

2 Economics of scholarly publishing

The economics of publishing—and not only scholarly publishing but also quality news journalism—is usually formulated as an intermediating service in the production and consumption of a private good (information) with public good-like properties (due to appropriability and positive externalities). Significant fixed costs in publishing, mostly due to capital requirements (e.g. printing presses and distribution networks) and specialist skills (e.g. typesetting, editing) tended this model toward imperfect competition. The information economics of branded quality signalling—in authors, mastheads and presses—also tended to reinforce a winner-take-all oligopolistic market structure. Alternative institutional arrangements and experiments were created for communities and sub-cultures (from community broadcasting to zines) in reaction to these outcomes. For the most part, these group-based efforts remained marginal players within the news media and publishing domains (Rennie 2006). But when the technology of publishing changes, so does everything else (Eisenstein 1982, Ong 2012).

Through the nineteenth and twentieth centuries, entrepreneurial solutions were institutionally embedded within business models that furnished workable solutions to this problem. For instance, publicly funded university libraries maintained print subscriptions to large suites of scholarly journals; or newspapers, which often held monopoly positions, cross-subsidized news journalism with classified advertising. The crisis in scholarly publishing in which new digital technologies run headlong into old business models, has been diagnosed as a form of disruption awaiting

transformation, possibly through new models of public subsidy, new business models, or both.

One common way to look at this is through the lens of an evolutionary industrial transformation—i.e. what Joseph Schumpeter called 'creative destruction'—involving deep endogenous change in the organizational and market order. Individual academics who both produce and consume journals may worry about whether the unfolding sequence of development will eventually be characterized by a cataclysmic shakeout or a smoother sequence of adjustments in what broadly appears to be the standard view—through the lens of the Schumpeterian industrial transformation model—of the current crisis in scholarly publishing and quality journalism.

The consequence of this narrative of "disruption" whether promoted by advocates or feared (or disdained) by commercial incumbents is that it depends on new entrepreneurs to create new markets. The Schumpeterian arrival of these new players will defeat the once lean competitors of the mid-to-late 20th century that have become bloated monopolists through consolidation. The new technology opportunity and entrepreneurial competition will sort this out through an industrial transformation from one technological model (the printing press and physical distribution) and one financial model (universities' subscriptions) to a new technological model (free online distribution of "web native content") and consequently new financial models (currently controversial but surely to be determined by "the market"). This narrative has no place for the actual generators and consumers of value, the research author, review, editor, and reader.

The "disruption" narrative sits atop a broader one of the transformation from closed private goods (the profits of publishers) to public (and therefore open) goods. The dichotomy between private and public goods is central to the rhetoric of Open Access advocates whose arguments are largely rooted in economics and politics of public good provisioning. By the same token it is also central to the rhetoric of traditional publisher lobbyists and traditionalists within the research community, who argue that the 20th century industrial model is a successful public-private partnership in which commercial entities obtain a reasonable return on private investment and the

research community receives a useable public-like good in return for its contributions. But once again, these arguments, while often referencing "the community", usually without defining it, rarely engage with how "the community" is defined, what it is contributing and what it receives in return for any specific journal.

An alternative view would be to place the community at the centre of an economic model. This would provide an alternative both the 20th century broadcast-industrial model built on rational specialisation and the political argumentation based on the public-private dichotomy. Such a model would focus on the (self)-identity, contribution and benefits to a community. We believe that this form of model could provide new insight into methods by which the community can sustain itself, supporting the re-emergence of local commons, or clubs. Our argument therefore is that we need to consider what it means to view scholarly publishing through the lens of club theory and the concept of a club good.[1]

3 Knowledge clubs

Club theory introduces an intermediate option between the economics of a world made entirely of individuals coordinated by markets (private goods), and a world of a collective coordinated by the state (public goods), with a third class that is based around the formation of self-interested and coordinated groups (or clubs). A club can be simply a firm that both produces and consumes. A moment's reflection on the fact that scholars both produce and consume their own product does suggest that club theory is *prima facie* a good approximation of scholarly publishing (Neylon 2015a, 2015b). To expand this we will need to consider who may be identified as the "members" of this club, what their various contributions are, and what the benefits for members are.

Traditionally we would consider a journal as a node that organises market relations between authors, readers and specialist publishing capabilities. This naturally leads to the presumption of outsourcing of various of these roles in a

[1] In economic theory there are four types of goods: private [rivalrous, excludable], public [non-rivalrous, non-excludable], club [nonrivalrous, excludable] and common pool resource [rivalrous, non-

competitive market. In our new model we see a journal as club, in which access to those services is internalised as a membership benefit. While those services might still be outsourced in practice it can be seen that such a shift potentially has substantial political and economic consequences in how we see the relations between players (owners of capital and their customers are seen as service providers to communities.

We have a good economic understanding of the former, but less of the latter. So our argument here is to elucidate a club-theoretic understanding of scholarly publishing and use this to probe the current economic and political crises challenging our current systems. We focus entirely on scholarly publishing in journals, but the general points we advance *mutatis mutandis* extends to scholarly publishing in books (Montgomery 2015), and to quality journalism, which we return to in conclusion. The reason for this tight focus is that scholarly journals present the clearest exemplar of the 'knowledge club' model.

The concept of a *knowledge club* is based on the 'demic-diffusion' model of *cultural science* developed by Hartley and Potts (2014). This is a coherent analytical framework built out of a synthesis of cultural studies, evolutionary economics and evolutionary biology in which the core hypothesis is that the evolutionary function of culture is to form groups, and the evolutionary function of culture-formed groups is to produce knowledge, and the selection mechanism over those groups operates at the margin of other groups, i.e. knowledge is most intensively produced at group-boundaries. The purpose of cultural science is to naturalise the study of culture, based around the growth of knowledge, and therein to endogenise human group formation about knowledge production and consumption. This paper will not advance that model directly, but it is an application of cultural science in that it points the analysis of 'the publishing problem' to consider group-formation dynamics. The purpose of this paper, then, is to explore this cultural science hypothesis using the (well-known and established) tools of the economics of club theory.

To reform scholarly publishing, we need therefore to start by recognizing that a journal is a club. A scholarly journal is neither a private good nor a public good—it is a club good (Neylon 2015a). A journal is a publishing operation, both in production and in consumption, which is best understood—dynamically as well as statically—as

a club good, meaning that the basic economics of club goods should help in making sense of the turmoil that the scholarly publishing industry is currently experiencing.

4 What is a club good?

If a journal is a club, what then is a club? Economic theory has a very specific answer to this question. *Club goods* are distinguished from *private goods* (where consumption is both rivalrous and excludable) and *public goods* (where consumption is non-rivalrous and exclusion is not possible) by being non-rivalrous (up to a congestion point) and excludable. Completing the standard four-term matrix are *common pool resources*, which are rivalrous but non-excludable (Ostrom 1990). Club goods are also known as 'toll goods' (Ostrom and Ostrom 1999), because the congestion point requires a toll for efficiency; and also as 'local public goods' (Scotchmer 2002), because groups are often spatially organized.

The concept of a club good was introduced into economic theory by James Buchanan (1965) (Sandler 2013) to recognize that the Samuelsonian division between private goods provided by markets and public goods provided by the state (Samuelson 1954) was missing an important institutional construction in the ability of small organized groups (Olson 1965) to come together privately to produce and consume local public goods. Club theory is now a standard foundation of modern general equilibrium microeconomics (Berglas 1976; Sandler and Tschirhart 1980, 1997). Buchanan's point was that many things that were commonly portrayed as public goods—hospitals, schools, roads, swimming pools, etc.—were actually better understood as club goods. Scotchmer (2002: 1999) summarizes the implication: 'the thrust of club theory is that the competitive market will function efficiently to provide club goods, so there is no reason that such goods should be provided publically at all.'

So, to be clear, the political economy imperative of the introduction of club goods was not on the side of markets-versus-the-state, but rather of a more oblique point on the private-public continuum, in that it argued for the economic efficiency of organized free individuals (groups, associations) versus the state. Free individuals could form groups, and those groups could self-govern to produce public goods (and

that this outcome is economically superior to both market solutions and government solutions). Clubs are non-market solutions to public good problems that rely on the ability of self-constituted groups both to self-organise and successfully to self-govern. This usually happens locally, for what is increasingly recognized as evolutionary-theoretic reasons (Bowles and Gintis 2009), hence the local public good focus on such things as health clubs, sports clubs, education clubs (libraries), transport clubs (toll-roads), and so on. But note that the internet and its digital affordances make that group formation less a spatial phenomenon and more a cultural phenomenon. Clubs, then, refer to the formation of groups of people who share a common concern, who are willing to pool their common resources and specialization-skills, and act in concert in pursuit of 'shared externalities'. This is why the economics of clubs overlaps substantially with the economics of *knowledge commons* (Ostrom and Hess 2007, Frishmann et al. 2014).

In a market of individual actors, the key institutional mechanism of coordination is *bilateral exchange*. If both parties expect to gain, such that marginal private benefit is greater than marginal private cost, then the transaction will occur and not otherwise. This principle underpins both general equilibrium theory and welfare economics. In the state or government, the key institutional mechanism is *coercion* to overcome free-riding in providing a public good, such that the sum of marginal benefits for each agent is greater than the total marginal cost of public provision. This principle underpins the logic of the state and its powers. In a club, the key institutional mechanism is voluntary or culture-made *group formation*, such that the private benefit condition holds for a shared good. Clubs are 'voluntary' in the language of microeconomics, but in cultural science 'voluntary' should be understood as a *secondary* feature of culture-made groups. Culture makes groups that are unified and bounded by shared codes, relationships, identity and meaning. The production of 'free individuals', who are in possession of the 'economic rationality' needed 'voluntarily' to 'choose' to join or form a club, is a function of culture-made 'we'-groups or demes. It follows that not everyone can join a club (demic outsiders); and that free individual choice is itself a product or *outcome* of demes, not a causal

mechanism by itself. This, first and foremost, is a socio-cultural, not an economic or political principle. Scotchmer (2002: 1999) explains:

> 'Club models are models of group formation. … The basic notion of club economies is that agents form groups to confer externalities on each other. The main source of these externalities in the original Buchanan (1965) paper are public services. Buchanan assumes that agents band together to share the cost of (excludable) public goods. Optimal sharing groups are bounded in size because of a second externality, crowding.'

It is most intuitive to think of a club as relating to a shared resource, such as a local swimming-pool, but Scotchmer's language is precise: 'agents form groups to confer externalities on each other'. Clubs are in this sense necessarily economically rational (and politically viable) about the costs and benefits of group formation. Individuals join clubs because they expect to benefit. In the case of scholarly journals, the benefits consist of prestige, where citations accrue from participation either as a contributor or an editor (and less successfully as a reviewer) via a group of readers either within that club or aspiring to it. The club good is therefore not the reading public, which does not have to be 'bounded in size' but membership through peer-based knowledge sharing activities.

Sandler and Tschirhart (1997: 336–7) explain five key differences in the economic properties of clubs and club goods with respect to public goods as such:

(1) Clubs are voluntary, which means that members join clubs only where they expect a net benefit (hence for a club good, unlike a public good, the marginal rate of substitution is always positive).

(2) Clubs involve sharing, which results in crowding (or congestion). Crowding implies an upper limit of the optimal size of the club, and tolls to control crowding. There are two types of crowding: anonymous, and non-anonymous, where attributes of other members are important determinants of crowding.

(3) Clubs imply finite groups that balance at the margin externality benefits with costs associated with crowding, such that there are non-members who are excluded.

This also implies an exclusion mechanism that operates at less cost than the benefits from the club.

(4) Clubs can partition over a population, enabling competition between clubs. For any population, and for a given externality and congestion function, there will exist an optimal number of clubs.

(5) A club involves two simultaneous choices: membership size and provision level of the shared good.

A club, therefore, is a self-organising group that, in the language of microeconomics, expects to benefit from the net externalities they impose on each other, minus the costs of doing so, and organized such that an optimal club size exists (because of crowding). Clubs are 'voluntary' (in the microeconomic rather than cultural sense), and clubs involve pooling resources, and clubs involve exclusion mechanisms, which are endogenous aspects of the voluntary pooling mechanisms that define the economics of a club. The implication is that clubs have optimal sizes that are determined by technological and institutional factors. Many forms of economic organization are clubs, and in the past 40 years economists have explored most of the obvious instances of clubs, as well as many non-obvious forms (Scotchmer 2002). Journals too can be clubs.

5 The economics of knowledge production & consumption

To identify a scholarly journal as a club, we need to connect the basic elements of club theory, which is about a group and the public good it seeks to produce and consume, to the externalities it seeks to impose and the congestion effects it will experience. The first part is simple. The group is scholars interested in a particular question or intellectual domain. This is the extension of the fabled invisible college, an imagined community (Anderson 1991) of scholars who pursue ideas, and seek each other out. Scholars are perhaps the most club-like of all animals outside the military. The less obvious part is about the costs and benefits of a scholarly publishing club, or knowledge club.

First, a journal is a club where members 'confer externalities on each other'. They do so in both production and consumption. The externalities here are those of reading, understanding, citing, and refereeing the papers that each scholar writes. Scholarly papers are written to be read and then to be acted upon by other scholars: they are not simply consumption goods, but inputs into further scholarly production. They are both outputs and inputs.[2] This is how scholarly production and publishing differs from the publishing of novels or journalism, for example, in that the producers and the consumers are not distinct sets; rather they are an overlapping set: a club. The producers of scholarly knowledge seek to 'impose externalities' on each other. They want to not just produce papers, but to produce papers that will be read by a particular other group, possibly anonymous and unmet—as in the invisible college—but likely imagined.

The shared good in production is mutual attention to an idea, which is the good allegedly supplied by the publishing intermediary in the idealized form of generalized *attention* to the idea (Lanham 2006). Compared to a private good, where such attention must be purchased, scholarly publishing provides that for free (this is in effect the 'toll'). But what scholars are purchasing in their supply of content is clearly a club good: it is shared access to the benefits of other smart, like-minded scholars, who are implicitly part of an open team production exercise—itself imagined as part of a larger knowledge commons.[3]

From the communication perspective, congestion or crowding is a more difficult concept to grasp. It is perhaps an axiom that all content producers want maximum audience: every person in every country is the asymptotic ideal. The 'positive externality' they wish to 'impose' is *knowledge*, such that the fullest extent of the 'imagined community' is not confined to disciplinary specialists but may extend to all within a particular deme: for example, 'our' industry, city, nation, or even species. But in practice, scholarly production does not take 'humanity' or any

[2] What the neo-Ricardian economist Piero Sraffa (1960) called 'the production of commodities by means of commodities'.

[3] We mean this in the sense of both open innovation economics (i.e. models of open knowledge production, e.g. von Hippel (2005) Chesbrough (2003)), and also of team production (Alchian and Demsetz 1972). An 'open team' is a concept that is separately defined in microeconomics, but not in its conjunction (cf. an innovation commons).

other general population as its interlocutor. Most scholars actually have in mind a finite and possibly small set of readers—even when these are people they may not know, or who may exist only in the future. Scholarly production is for a community of peers. Not only the production realities of scholarship and science, but also the consumption realities, mean that there is only a finite set of people who are potential readers of that product. This is a minimum value subset of the ideal club, meaning that the publishing club experiences heterogeneous crowding (Scotchmer 2002). The key point is that the set of potential producers and the set of incumbent consumers is the same set, although actual producers may harbour ambitions to enlarge the club by attracting previously unengaged consumers. That same set of individual producers seeking information dispersion is also competing to publish in the same attention space, as defined by the finite qualities of a journal, which is therefore a club.

A journal is a club because there is both shared positive externalities, as the prime resource, which is new knowledge by self and others;[4] and there is congestion, caused by finite attention in the readers, and in one's own time, to read, understand, comment, critique, and ultimately the most important, to adopt. A scholarly journal is therefore a club in the specific senses of being: (1) 'voluntary'; (2) non-anonymously crowded; (3) exclusive; (4) globally partitioned; and (5) rationally constructed:

(1) Voluntary means that agents within a given demic group join clubs based on a rational calculus. If the benefits are greater than the costs, then you join a club. The benefits are basically that of being read by others; the costs are that of reading and citing others. Voluntary means that you make this choice based on your best assessment of career payoff.

(2) Non-anonymously crowded means that you care whom else is in the club. So it's not just cost-sharing, as it were contributing to a swimming pool, but also costly signalling, because the more prestigious or authoritative the other members, the more exclusive and therefore valuable is your membership. The implication from club theory economics is that we can expect differential tolls, as access price, which may

[4] Scholarly publishing has the same logic as a research department – in the sense of why science organizes itself into problem-domain themes – a point that has been made by Kling *et al.* (2002) in reference to the efficacy of the underlying 'guild model' of scientific production and publishing.

sometimes be negative.[5] Crowding means that each additional club member imposes a cost, and the most obvious cost in a scholarly club is access to the journal, not simply as a reader but as access to the means of production and dissemination. In a knowledge club with 30 members, you get published, on average, once a year. In a knowledge club with 300 or 3000 members that likelihood is lower. But of course there is more knowledge in the larger club, so on balance there will be a trade-off on both margins.

(3) Exclusion means that a club is a mechanism for limiting the benefits of non-members, which happens quite naturally in scholarly knowledge clubs, by simple cost of access in time and language. Scholarly communities use specific language, part of which is for precision, and part of which is for exclusion (Pagel 2012). But knowledge clubs in general arrive at exclusion technologies, not all of which are technological – indeed, many of them are social and cultural.

(4) Global partition recognizes that clubs will be finite and that there will be other clubs emerging at the margin, and possibly closely related (or identical, as in public good clubs over spatial domains). But in scholarly publishing, club theory predicts that there will be many entrepreneurial opportunities at the margin of each club. In essence, club theory implies that there will also be ongoing competition, and therefore that the rent each club creates is ultimately contestable (Baumol et al 1982).

(5) Rational construction means that club choice is a dual choice of membership (to join or not – as demand) and also of quantity (what level the club will supply). The level of interdependent externality (the local public good) a club chooses to offer also affects the demand for that club, which in turn affects the toll that club can charge at the margin. The point is that in general equilibrium this choice is determined simultaneously. In scholarly publishing, at least one of these variables is expectational. In consequence, knowledge clubs are speculative assets.

6 Cases in practice

[5] For example, invited articles with the impression of lower reviewing barriers, or free submission of reviews to APC funded journals.

What does such a model look like applied to real journals? In this section we discuss a range of different journals in terms of this club model and examine the implications.

The small society journal

The simplest case in which to apply the model is that of a small scholarly society focussed on a specific area of research that publishes one single journal that is made available to members. In this case the overall community of interest is clear as it is the set of members of the society that is the same as the set of readers of journal. Authors are assumed to come from the membership. This is a reasonable approximation to a range of society journals in the humanities and some parts of the sciences.

Members of the society, all make a contribution through membership fees that sustains access to the mean of producing the journal. (This might be managed in house or more likely contracted out.) Membership is voluntary, at least in the sociological sense referred to above. In practice working in the area may be dependent on membership.

Congestion occurs obviously in two places: in access to publication space within the (likely printed pages of the) journal itself; and in access to the attention and readership of subscribing members. Crowding is non-anonymous. Authors, and other members, care a great deal about who else is a member, who else is an author, and exactly how the attention of specific readers is apportioned. Invitations to provide reviews and commentary, effectively space in the journal and a line on the CV with lower than usual barriers to entry (i.e. less heavily reviewed) show the differential tolls in play. Having the right people author adds to the prestige other benefits for all members.

Exclusion occurs trivially due to a lack of access to non-members. Less trivially library subscriptions are almost always substantially more expensive than individual memberships. Language and shared narratives will also contribute to exclusion but the primary mode is through exclusion from the status of member of the society, conferred only on those who, tautologically, are paid-up members.

The club is finite, both in terms of authors and society members (at least at any given point in time) and will frequently be in competition with other similar clubs at the margins. The gradual disappearance, as distribution was first industrialised and then digitised, of many national or local societies that flourished in a world of physical distribution and face-to-face meetings is one example of this.

Finally the choice to join is clearly dependent on an expectation of what benefits will arise, both in terms of content of the journal and opportunities to publish. In principle a member's choice to join and the club's decision to publish are both rational and dependent on each other.

Understanding change

Applying the model is one thing, showing that it is useful, ideally predictive is quite another. A way to test this is to consider changes to our hypothetical journal from its native state as painted above. An obvious change, and one that more closely models reality for small society journals is the expansion of authorship. What happens when authors who are not society members seek to join the club by publishing in the journal? We expect "entrpreneurialism at the margins" so changes who in who is excluded are likely to be framed as experiments. We also expect differential tolls due to non-anonymous congestion. Authors who bring prestige, or unique content that adds to the prestige of journal, or attracts new membership, are therefore likely to be sought out, with formal membership "requirements" and payments being waived. The calculus for the author will depend on the externalities the club provides, prestige, a particularly readership.

7 Emerging technologies and knowledge clubs

The implications of seeing scholarly journals as club goods, as opposed to public or private goods, is that we can begin to formulate clear models, and—with emerging technologies—enact them. The club aspects of scholarly journals involve delivering prestige factors for those within the community of peer producers, as well as practical distribution mechanisms, required to ensure that mutual attention within the knowledge occurs. In the digital environment, academic journals have retained their

club-like qualities through blind-peer review and editorial boards in order to build prestige and quality assurance. However, as described above, in the case of commercial scholarly journals, those that do the work to generate these externalities for the group are outsourcing production to commercial companies, as well as the infrastructures that measure and reveal citations and impact factors.

Emerging technologies hold promise in that they may enable new forms of automated coordination that overcome the need to outsource publication, distribution, and search, thereby returning these functions to the knowledge club itself. Understanding journals as club goods is useful in that it allows us to interrogate which parts of the current system we might wish to protect or enhance, and which are superfluous or detrimental to knowledge itself.

Blockchain technology has been described as a giant decentralised ledger (Swan 2015) used for asset registry, inventory and exchange, originally built for bitcoin but increasingly applied to other systems including legal contracts and identity verification. The importance of blockchain technology is that can achieve trust on a trustless internet through encryption and automation. As Buterin (2015) writes, blockchain is not about enforcing one set of rules, but 'creating the freedom to create a new mechanism with a new ruleset extremely quickly and pushing it out'. Blockchain technology can thereby provide a technical layer upon which decentralised governance systems can run. In the case of scholarly publishing, blockchain could by used to resolve current weaknesses in the system including securing peer-review, and generating trusted and open citation metrics.

For instance, blockchain to technology can transform attributes such as citations into token-like objects, resulting in trustworthy open metrics as opposed to proprietary database systems. A token-like system could also shift what is currently volunteer-based labour into an incentive compatible system that rewards referees and editors, not just authors. For instance, refereeing journal articles might result in micropayments (either monetary or reputation-based) that accrue to those that perform such tasks, providing transparency of labour on the production side and encouraging those within the club to perform tasks that, under current conditions, are becoming increasing difficult to procure. Platforms such as *Backfeed*, whilst experimental at the

time of writing, work on similar systems whereby a complete infrastructure could be developed.

Such technologies could also be used to authenticate academic works that have been through the process of peer-review and editorial acceptance. If a scholarly work has been assigned the value of 'accepted' on the blockchain, then the need for physical or digital journal artefacts diminishes. It is foreseeable that an author could distribute a work through whatever means they feel is appropriate (for instance a university repository) and be assured that it possesses identifiers that prove the knowledge club (journal) has accepted the work. Those same identifiers could be used for searching, effectively bundling knowledge club outputs from across a distributed system. The journal itself may not be necessary, reducing or eliminating the production costs altogether.

8 Conclusion: knowledge clubs evolve

Scholarly publishing is a club good. This matters to economics because the standard diagnosis is that publishing is a private good with public good aspects, and is thus analysed through the lens of market failure. The consequence is a misdiagnosis: the crisis in scholarly publishing is not actually an industrial transformation with complex consequences. If it is actually a process of club evolution, then what needs to happen is that scholars themselves will need to develop new and better governance models (e.g. Frey 2003).

Knowledge clubs are communities with governance structures that evolve through differential variation and selection, largely through entry by new scholars, and exit as scholars leave, in the context of the institutional structure of clubs, through which scholars interact, in part through the mechanism of publishing. The arguments of Karl Popper (1963) and Thomas Kuhn (1970) on the nature and structure of scientific revolutions reinforce this club-like aspect of the dynamics of science. To model scholarly publishing as a club good starts by focusing on the way in which scholarly output is produced and consumed. Producers of knowledge seek to interact with other producers, of whom they will also be consumers of a fuzzy set of that same

knowledge. The gain from such club formation is 'the ability to confer externalities on each other' in the form of readership, critique and understanding, and is set against the congestion costs imposed. The crowding costs are access to those same journal slots, which increases the larger the club. The general equilibrium logic is that there will be an optimal number of scholarly clubs (journals) and an optimal allocation of scholars over clubs. There will be a finite number of clubs, and each club will contain a finite number of scholars, and each scholar may be a member of several clubs. Club theory is the natural language of the economic analysis of scholarly publishing.

However, knowledge is expansive and dynamic and not a zero-sum game. Thus, 'general equilibrium', 'finite number' are contextual terms in a larger frame of reference, applying only to incumbent players (already certified scholars). But communications technologies such as the internet—the very technologies that have undermined existing business models—are also generating new kinds of knowledge club beyond the purview and scope of scholarly communication as presently constituted. There remains an external 'creative destructive' competitive pressure on scholarly institutions overall, be they epistemological (disciplines), spatial (universities) or local (specialist knowledge clubs). An implication that we have not addressed in this introduction to 'knowledge club' theory is that scholars themselves need to attend to the dynamics of club-formation, which may already be much more advanced in informal DIY, start-up and entrepreneurial environments than it is in the papyrocentric universe of peer review journals. Creative destruction is at hand, but it is not publishers who need to worry; it's those who generate knowledge—production and consumption—without understanding the value of knowledge clubs and commons. If a journal is a club, we should be creating new types of journals.

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