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HOW WE GOT HERE: TURNING POINTS IN SCIENCE PUBLISHING

Public Access to Federally Supported R&D - Publications National Academy of Sciences, May 14-5, 2013 "Publication in a peer-reviewed journal remains the standard means of disseminating scientific results. [Other publication venues] risk weakening conventions that have served science well." (NAS, *On Being a Scientist*, 1989, 1995)

"The four functions of Oldenburg's journal: registration, dissemination, peer review and archival record are so fundamental to the way scientists behave and how science is carried out that all subsequent journals, even those published electronically in the 21st century, have conformed to Oldenburg's model. All modern journals carry out the same functions as Oldenburg's and all journal publishers are Oldenburg's heirs."

(Memorandum from the Publishers Association, in *Scientific Publications* (London: Stationery Office, 2004)

The two quotes you just saw are emblematic of the status and functions that the journal article has come to assume in the sciences and, to a lesser extent, in the social sciences and the humanities.

I want to show you, in a very synthetic fashion, that the science publication system has not evolved as smoothly as these quotes suggest, and that in fact there is very little continuity between the *PhilosophicalTransaction* of Henry Oldenburg and modern scientific journals. The journal article as we know it today, is about 100 years old.

This reminds us that the modalities of science publication have changed quite drastically in its short history, and that a move to Open Access would be just one change in that twisty trajectory. The world will not come to an end (or at least not because of OA).

Let me take you quickly through what I take to be the three main phases of the history of science publishing.

PART ONE: BEFORE ACADEMIES & JOURNALS (up to about 1650)

NO DIRECT CONNECTION BETWEEN PUBLICATIONS AND JOBS:

Careers

- university teaching, tutorships, court positions, private wealth, astrology (for mathematicians), or membership in religious institutions

Reputation mattered a lot, but was not exclusively tied to publications - Be known to people through lectures, conversations, letters, "mathematical duels," etc.

No publication requirements for university jobs until the 18th century - "Stars" like Galileo or Newton had few or no printed publications for several years, sometime decades, into their university appointments - Higher productivity among court mathematicians, like Kepler - Worth thinking about why that was the case...

INTELLECTUAL PROPERTY:

Little or no expectation of revenue from sale of publications

- patrons often funded science books
- Small commercial market for science, and its texts sometimes difficult/costly to print
- Data (astronomical table) or "flashy" books the exception
- But law granted only local protection to publications anyway
- Unauthorized reprints of scientific books typically tolerated or even encouraged by authors eager to maximize publicity
- Concerns over "propriety" rather than "property"
- Fear over loss of priority or authorship, not sales
 - Famous priority & plagiarism cases

No hostility toward patenting

- Galileo, Royal Society, Huygens they all patented
- BUT no conflicts because publishing and patenting because publications did not count as prior art under the patent law of the the time.

PRIORITY:

No clear registration protocols or definition of "publication"

- Letting people know, better if with witnesses
- Letters to key people (but not necessarily peers)
- Ciphers (especially among mathematicians)
- Printed publications (books, but also pamphlets) Best if sponsored and distributed by a well-connected patron
- Room for (foul) play
 - Book publication dates unreliable, ante-datings of prefaces, ciphers with more that one meaning, etc.
- -For sure, publication not synonymous with print

(See Biagioli, "From From From Ciphers to Confidentiality: Secrecy, Openness, and Priority in Science," *British Journal of the History of Science* 45 (2012): 1-21)

COMMUNICATION & DISSEMINATION VENUES:

- Printed books
- "Private" letters

-Correspondence networks and "intelligencers" (Mersenne, Oldenburg, Peiresc, etc.)

- (A bit of a return to these practices today with blogs, etc)

- Diplomatic networks
- Lectures (at universities, in public settings, etc.)
- Personal visits, travel, etc.
 - More than we thought/expected
- "Epistolary volumes" (planned, but not developed, by some renaissance academies)
- Few novelty-based publications (pamphlets about discoveries, travel literature, anatomy, etc)
- Not just print, letters, lectures, and conversations:
 - Alchemy (manuscripts)
 - Natural history (often manuscripts)

- Traveling crates with texts and objects, serial authorship by the recipients and contributors of the manuscript (Elizabeth Yale, "With Slips and Scraps," 2009)

- Worth reflecting on disciplinary differences today (ArXiv, SSRN...)

SUMMARY PART ONE:

- Research yes, but "publication" meant a lot more than printing.
- Weak correlation between publications and professional success
- -Publication often "performative" rather than textual or print-based - Visits, talks, lectures, etc
- Slow emergence of reward for new claims, discoveries, etc.
- Not clear what genre or venue those claims should be printed in
 - Typically, books were not where you'd publish novelties, but the genre of the article had not emerged yet

PART TWO: EMERGENCE OF ACADEMIES & "PERIODICALS"

TWO DIFFERENT MODELS OF ACADEMIES & JOURNALS:

- Royal Society of London (*Philosophical Transactions*)

-Academie des Sciences, Paris (Memoires de l'Academie...)

- NOTA BENE: -Different reasons to publish, but also NOT to publish ROYAL SOCIETY: "Constructing the center through the periphery"

A great looking brand – "Royal Society" - (1662, 1663), but little else from King

- Operating budget from paying (not paid) academicians

- Meetings, experiments, discussions but few publications

Oldenburg (RS Secretary) and his vast correspondence network

- Learning from the *Journal des Scavans'* model (news, reviews, etc) From letters to the *Philosophical Transactions* (1665)

- "Let one letter answer another..."

- Publishing non-members's work was crucial to the RS
 - But risk control strategies, like pretending that PT was unconnected to RS, while reaping the benefits of that association
 - (Similar to the musical chairs arrangement you may see today in cases of scientific fraud)

PT produced very limited income for Oldenburg, despite a decent print run

ACADEMIE DES SCIENCES: "Publish to spread authority"

- Chartered by King in 1699 but active since 1660s
- Starts publishing its *Memoires* in 1702
 - Salaries, equipment, etc. provided by king
 - Much smaller than the Royal Society (and thus less research output)
- Very few publications (books), mostly collective before 1699
- High concern with the dignity of the Academy and of the King
 - Almost victim of a "fear of publishing"
 - Did not publish outsiders because personally unknown or "unvetted"
 - After 1702, research papers, individually authored, published once a year
 - The journal was more an anthology than a journal
 - Papers of varying length, first presented at AS meetings
 - Papers could be very long
 - They were all reviewed collectively

CONVERGENCE (AND SPREAD) OF THE TWO MODELS (1750-1800)

- The Royal Society migrates toward the Academie des Sciences' model around 1750
 - *PhilTrans* go from short articles, news, reviews, reprints, abstracts, and bibliographies toward the genre of the *Memoires*.
 - Slower publication schedule, large format, high cost, longer articles, etc
- AS moves toward the RS model too:
 - Starts to publish non-members, but in a dedicated journal
 - Memoires des savants etrangers (1750-)
- Scientific academies appear all over Europe, including Russia, and all tend to gravitate toward publishing *Memoires*-style journals.

INTELLECTUAL PROPERTY

- Privileges ("copyright") incorporated protection and censorship

- Particularly difficult problems with privileges for periodicals/journals
 - Difficult to license because of publication pace, and dealing with news
 - Because of political relevance, news were deemed to need prepublication censorship
- CRUCIAL: Academies granted to act as both publishers and licensers - A first
- Key to academies was not IP protection but relative freedom to license & publish
 - IP was crucial, but not at all for the reasons we think today

"PEER" REVIEW

"The Academy will examine all works that academicians propose to have published; it will give its approval only after a complete reading in the meetings, or at least only after an examination is made by those the Academy has designated to prepare a report; and no academicians shall use the title academician in his writings unless that work has been approved by the Academy." (Article 30, Academie des Sciences, Statute, 1699)

"No book be printed by order of the council, which hath not been perused and considered by two of the council, who shall report, that such book contains nothing but what *is suitable to the design and work* of the society." (Royal Society Council, 1663)

Peer review certainly not blind (Could not have worked at all if blind)
Fully centralized, not relying on experts outside the academy
"Defensive" nature of peer review. Not to guarantee quality to the public but to shield the credibility of the Academy and its royal patron

PRIORITY:

Neither *PT* nor *Memoires* could effectively register priority due to slow pace of publication, and non-inclusive editorial practices

- Practice of double publication in the Academie des Sciences
- Publish in the slow-moving journal, but also outside, in the more popular press

Reliance on academies-managed registers and "sealed notes," not just on print

Limited trust, initially, in editors and journals

- Huygens's and the *Philosophical Transactions*, 1675
 - communicating discoveries to the journal in ciphers
 - Not unlike today's fears of plagiarism by referees

EMERGENCE OF REQUIREMENTS FOR ACADEMIC MEMBERSHIP:

- Based on research but not necessarily on printed publications, and not in
- academic journals (since 1699 in France).
- Prussian universities required printed publications since 1749, but NOT specialized, research publications
- -RS listed requirements for membership, with authorship being only one of 5 categories (1840)
- Slow emergence of the resume...

SUMMARY PART 2 :

- -Peer review to protect the publishing academy, and its patrons. No "public" in sight yet, ergo no concern with safeguarding it from bad publications
- Publishing by Academies was an emergent policy, with many fits, starts, and deadends
- Peer review modalities was still close to licensing/censorship protocols
- "Intellectual property" crucial as permission to print and license, not to own.
 Perhaps because most journals, published by state academies, were seen as "government publications"?
- Slow emergence of the resume, but still NOT privileging printed publications
- Notice the link of periodical publications to academies, their different political authority and relation to kings, and eagerness, or caution, with publication to begin with
- The ambiguous role of the "outsiders": Academies need their copy to keep their journals going, but can they trust them if they are not fellow academicians?

PART 3: DEVELOPMENT & HEGEMONY OF THE JOURNAL ARTICLE (1800-1900)

(based on Alex Csiszar, "Broken Pieces of Fact," PhD Dissertation, Harvard 2010)

- Development of the journal article as we know it today
- An uneasy and unwanted hybrid between 18th-century academic periodicals and 19th-century commercial magazines
- Coming of age of the journal article and concomitant decline of the authority of learned societies and academies as sites of knowledge production and authorization
- Knowledge becomes "literature" -- no longer something one presents (orally, at first) to authoritative peers, in an authoritative setting

Early 19th-century views of academic periodicals:

"The permanent records of Science are chiefly preserved in the Transactions of learned Societies; and are principally confined to the labours of their Members only" (JSA, 1816)

"They come out at intervals too distant for the constant diffusion of knowledge that is necessary; they are too costly for general circulation; and are devoted to subjects too important to take in that subordinate but still valuable mass of information that is fitted only for the pages of a periodical." (N.A. Vigors, 1822). Early 19th-century "unperiodical periodicals":

-Large format, a few long articles, up to 100 pages each

- Typically by members of the academy, based on papers presented and commented on ("peer reviewed") at the academies' meetings
- Or by external members' whose work was presented/read by academicians
- Widespread reliance on offprints/preprints because journals' pace too slow/unpredictable
 - -Printed texts but distributed through private correspondence, like early modern letter
 - -Nightmare for searches because possibly different titles, format, and without full cross-references

But toward end of 18th century, commercial magazines & newspapers started to report on academic meetings, both in Britain and France (after the Revolution). That was followed by publication of short articles.

"The monthly publications, edited by individuals, furnish an account of what may be regarded as the News of Philosophy" (*Journal of Science and the Arts*, 1816)

Philosophical Magazine, Journal of Natural Philosophy, Chemistry and the Arts, Annales des Chimie, Journal de physique...

From 1809 on, AS begins to admit that its *Memoires* are only a "recueil classique" of something already published in shorter & incomplete form elsewhere.

No peer review, no authorization, no guarantee of good reporting for quickly published notices or reported presentations

The distinction was between "steady" knowledge (published slowly and at length) and "fresh" knowledge (published quickly, almost newspaper-style), but not necessarily between good and bad knowledge

The learned societies' response:

Comptes rendus hebdomadaires des séances de l'Academie des Sciences, 1835

- Meetings on Monday, mss of presentation submitted at the end of day, and the issue out by Sunday at the latest

- Effectively no peer review

"quantity control," not "quantity control." An annual cap on how many pieces one could place in the *Comptes rendus Comptes rendus* managed by a science news editors of the Parisian daily, *Le temps*

Great success: AS members almost stopped publishing elsewhere, and started feeding "salami slices" to the *Comptes rendus*.

On this occasion, commercial publishers were the "good guys", opening up what had previously been a closed science

Learned societies modeled their new journals on the commercial ones:

- Several issues per year, regular schedule, wide range of info...
- Commercial model made credible by the migration of traditional academies into it

From the book of nature to the magazine of nature (paraphrasing James Clerk Maxwell, 1856)

"If you constrain [a chemist] to present [their results] as so many aphorisms, each detached one from the other, their value can be but imperfectly understood, and only the authority of the author's name can provide confidence in the result – always an extremely dangerous situation in science. But give him enough space to indicate the chemical trials he has undertaken, the elements of organization that they have enabled him to discover, and the consequences that will lead to applications: then will this publication possess all the useful characteristics wanted, both for the present and the future." (Biot, 1842)

Fragmentation/salami science

- Not necessarily an unethical "gaming the game," but a strategy encouraged by the new publication genre/format
- Which was, in turn, resulting from the "opening up" of science

"The same author not infrequently publishes the same facts several times over in several of these periodicals, or publishes fragments of what is practically one series of researches in different journals. No greater state of chaos can be imagined." (*Nature*, 1893).

"Men of science naturally grumble at the constant increase in the number of journals, Proceedings, Transactions, &c., which they must painfully look over. But this increase is inevitable. What we should aim at is not its curtailment so much as its methodical arrangement." (*Nature*, editorial 1883)

REVOLUTION IN DEFINITION OF PRIORITY:

-Priority becomes connected to printing in an academic journal

Peer review & priority certification folded together
 Evaluation of quality, not just timing of claim

Le Verrier - Adams dispute over discovery of Neptune
 (1846) emblematizes the shift in the definition of priority

Still not crucial in the 19th century, when journals seemed OK with the reprinting of articles, after a very brief embargo period:

"Gentlemen who are indulged with separate Copies of their Communications [offprints], are requested to use their endeavour to prevent them from being reprinted, *till one month after* the publication of that part of the *Philosophical Transactions* in which they are inserted." (1803)

SUMMARY PART III:

-The journal article becomes a standard that folds several norms within itself:

- A unit of knowledge (no longer book or long article)
 - Nature becomes a "magazine"
 - Beginning of trend toward LPU and "salami science"
- Priority is folded into printing the claim in an academic journals
- Not just a change in literary genre but a new definition of "knowledge"
 - Knowledge as "literature"
- More publications because almost everything is published now
 - As opposed to the 18th century, when presentations may not reach print
- Scientist's authorship credit becomes tied to articles
 - No more presentations, etc

-Not necessarily the best genre for science, but a convention that encapsulates a series of key conventions of the social system of science

- Simultaneous eclipse of the traditional role of academies:

- From authoritative judges who printed the best, to institutions who need their

- journals in order to be perceived as authoritative
- Membership becomes tied to subscription (because it costs a lot more to
- publish a weekly comprehensive journal, and subscriptions help funding that)

A coda:

- Explosion of publications and of a variety of bibliographic tools from the mid 19th-century onward to search and find knowledge, often involving complex international cooperations, all of which failed.

- But in answers to questionnaires scientists indicated that they did not use these tools to find knowledge, or that they consistently relied on journals as a way to find what they needed to read. (Royal Society Scientific Information Conference, 1948)

- It then appears that these tools have become useful not to scientists but to those who study scientists to map what scientists produce and, more recently, what they cite, in what journals they publish, etc.

- Today's Web of Science is probably less about finding useful knowledge and more about evaluating scientists and scholars.

So is the modern journal article about faculty performance metrics?
 Arxiv and SSRN would suggest so...

CONCLUSIONS:

I hope to have shown you how far from linear and progressive the history of the journal article is -- that it is a convention, not a god-given norm.

CHANGES IN GEOGRAPHY:

- The journal article became a genre disconnected from academies, and journals are no longer necessarily journals of some society

-The credibility conferred by peer review came untied from authoritative institutions (like academies), and became increasingly connected to its protocols, though arguably with mixed success

-The "public" became a constituency, which it had not been before. Certain features of the publication system (like peer review) are enlisted to protect it

CHANGES IN THE MARKET:

-There was no significant pedagogical market till the end of the 19th century, but there is a very large one now, in universities

- Emergence of the university (not the academy or the learned society) as the center of knowledge production AND use of the literature

- In previous periods the producers were probably not the users because they may have already known (or at least heard) what they eventually published

THE NONLINEAR IMPACT OF PUBLICATION TECHNOLOGIES

- We see a long-term trend toward textualization away from orality/performance. But that's NOT because of technology. Printing predated the *Philosophical Transactions* by 200 years. That trend from performance to textualization was social: how science organized itself as a practice in relation first to the state and then to the "market"

- New digital technology is not just about "copying" but about enabling dissemination, searches, and interactions. It's not turning the clock backward by returning science to some "oral" phase, but rather enables exchanges that were constrained or even erased in the age of the printed journal article – exchanges that were present in the early modern period. So there is a bit of a return to that, as well as to the "correspondence" model of science (blogs, social media, etc)

- Technology has the potential to change the conventions:
 - Open access repositories and the revision of priority, by disconnecting it from peer review.
 - It also has the ability to render the publication of knowledge and its retrieval/search as a process that is no longer necessarily tied to the journal.