

- [Hilbert] STEPHEN HILBERT, JOHN MACELI, ERIC ROBINSON, DIANE DRISCOLL SCHWARTZ, and STAN SELTZER, *Calculus, An Active Approach with Projects*, John Wiley & Sons, New York, 1994.
- [Harvard S] DEBORAH HUGHES-HALLETT, WILLIAM MCCALLUM, ANDREW M. GLEASON, ANDREW PASQUALE, DANIEL E. FLATH, DOUGLAS QUINNEY, PATTI FRAZER LOCK, WAYNE RASKIND, SHELDON P. GORDON, KAREN RHEA, DAVID LOMEN, JEFF TECOSKY-FLEDMAN, DAVID LOVELOCK, JOE B. TRASH, BRAD G. OSGOOD, and THOMAS W. TUCKER, *Single Variable Calculus*, 3rd ed., John Wiley & Sons, Inc., New York, 2002.
- [Harvard M] WILLIAM MCCALLUM, DEBORAH HUGHES-HALLETT, DANIEL FLATH, BRAG G. OSGOOD, ANDREW M. GLEASON, DOUGLAS QUINNEY, SHELDON P. GORDON, WAYNE RASKIND, PATTI FRAZER LOCK, JEFF TECOSKY-FLEDMAN, DAVID MUMFORD, and JOE B. TRASH, *Multivariable Calculus*, 3rd ed., John Wiley & Sons, Inc., New York, 2002.
- [NAA] J. W. NADLER, D. E. ANGELAKI and G. C. DEANGELIS, A neural representation of depth from motion parallax in macaque visual cortex, *Nature* **452** (2008), 642–645.
- [NNA] J. W. NADLER, M. NAWROT, D. E. ANGELAKI, and G. C. DEANGELIS, MT neurons combine visual motion with a smooth eye movement signal to code depth sign from motion parallax, *Neuron* **63** (2009), 523–532.
- [NS] M. NAWROT and K. STROYAN, The motion/pursuit law for visual depth perception from motion parallax, *Vision Res.* **49** (2009), 1969–1978.
- [Pengeley] EDWARD D. GAUGHAN, DAVID J. PENGELEY, ARTHUR KNOEBEL, and DOUGLAS KURTZ, *Student Research Projects in Calculus* (Spectrum Series), MAA, 1992.
- [Smith-Moore] DAVID A. SMITH and LAWRENCE C. MOORE, *Calculus: Modeling and Application*, 2nd ed., 2010, <http://calculuscourse.maa.org/>.
- [S-Focus] KEITH D. STROYAN, The changing face of calculus: Engineering math at the University of Iowa, *MAA FOCUS*, February, 2006.
- [S-Projects] _____, *Projects for Calculus: The Language of Change*, <http://www.math.uiowa.edu/~stroyan/CTLC3rdEd/ProjectsCTLC/ctlcProjects.htm> (originally published by Academic Press, 1998).
- [SN] KEITH STROYAN and MARK NAWROT, *Visual Depth from Motion Parallax and Eye Pursuit*, submitted, 2010.
- [SD] <http://demonstrations.wolfram.com/HerdImmunityForSmallpox/>.
- [C:TLC] KEITH STROYAN, *Calculus: The Language of Change*, <http://www.math.uiowa.edu/~stroyan/CTLC3rdEd/3rdCTLCText/ctlcctoc.htm> (originally published by Academic Press, 1993 and 1998).



Journals in Flux

Peter J. Olver

Whither the academic journal? Publishers are scrambling to adapt to the new and rapidly evolving digital world. Libraries must balance declining resources with soaring prices and new bundled models of journal subscriptions. Meanwhile, management and investors are ever more nervous as tried-and-true economic models become obsolete. The mathematics community has reached a crossroads, requiring a full and frank discussion of the future role of journals in our profession.

The traditional published journal offered four primary benefits to the scientific community (see below for definitions): *enhancement*, *dissemination*, *archiving*, and *validation*. These formed the lure that, in the past, enabled publishers to sign

on researchers to work pro bono (or even pay page charges) as authors, referees, and editors, while readers and libraries paid for material that the community freely supplied and evaluated.

By *enhancement* I mean the process of turning handwritten or, subsequently, typed manuscripts into polished, professionally typeset articles. With the ascendancy of $\text{T}_{\text{E}}\text{X}$, the onus of enhancement has shifted to the author. Most journals now expect a $\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$ source file, adapted to their own peculiarities, with little or no editorial involvement. Some journals continue to copyedit papers, but they are now the exception. Thus, remarkably, publishers have managed to extend the free labor model to include most of their traditional enhancement functions.

Similarly, in the days of handwritten and typed manuscripts, *dissemination* of research to the

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wider community was an essential function of journals. Nowadays, preprints first appear on the arXiv, on university preprint servers, or on authors' personal websites, freely available to anyone with a sufficiently rapid and suitably uncensored Internet connection. In many fields, papers appear in journals, either electronic or print, as an afterthought, and those at the forefront of the subject have long since absorbed their contents. Fortunately, many publishers do allow authors to post at least the preprint versions of their works online, and authors and editorial board members should favor such journals. (And make sure to read the fine print: one publishing agreement I recently saw contains an unacceptable clause that appears to prevent authors from altering their personal or arXiv online version once the paper is submitted.)

Archiving of older material presents a different challenge, as many commercial publishers seek to profit from their past, limiting access to their archives to subscribers and thereby disadvantaging those without means or institutional support from being full members of the worldwide research community. Publishers may offer some level of near-term archival stability, but organizations and businesses can disappear, and previously accessible material, either paid or free, can be lost unless properly backed up by third parties. The rapid evolution and eventual obsolescence of hardware, software, and file formats compound the problem, and archivists face as yet unresolved difficulties with long-term electronic preservation of large volumes of material and prevention of data loss.

So, while enhancement, dissemination, and archiving all underlie the traditional journal system, to a large extent only validation persists as the reason for its continuation. By *validation*, I mean the confirmation of the correctness, originality, and status of a paper by its appearance in a refereed journal, which in turn helps validate its author's status insofar as hiring, promotion, grant funding, and salary rely (at least in part) on an individual's accumulated research output. But cracks in the system are starting to appear. In certain areas of applied mathematics, including computer vision, cryptography, and computer algebra, journals have been mostly superseded by prestigious conference proceedings, which are rigorously refereed and accept only a small percentage of contributions.

One increasingly contentious issue is journal ranking. While certainly not foolproof, the prestige of a journal is commonly regarded as confirmation of a paper's relative worth, especially by nonexperts. Publishers and administrators are consequently pushing citation-driven metrics such as the Impact Factor and its variants. Indeed, China now pays cash rewards for published papers, using a sliding scale based on the journal's Impact Factor [1]. But such metrics are known to be unreliable and, even worse, subject to abuse, motivating

unscrupulous journal editors and publishers to artificially manipulate the Impact Factor and hence the supposed ranking of their journals [2]. While established researchers tend to have reasonably consistent estimates of journals' ratings (although this seems more true in pure than applied mathematics), those "not in the know" may easily be led astray, not to mention the administrators and bureaucrats who know nothing of the field.

Of course, while they are presumably correlated, a journal's ranking cannot unambiguously rank its individual contents, although reputation, selectivity, prestige of the editorial board, and stringency of the refereeing process do confer an implied status on the papers therein. On the other hand, too many high-profile researchers have been willing to lend their name to editorial boards without paying close attention to the journal's contents or operation; see [3] for a particularly egregious example. In 2010 the General Assembly of the International Mathematics Union (IMU) approved a document, *Best Current Practices for Journals* [4], prepared by its Committee for Electronic Information and Communication (CEIC). The document describes how well-run journals are managed through adherence to the fundamental principles of transparency, integrity, and professionalism, as well as detailing the rights and responsibilities of authors, referees, editors, and publishers.

Can the status of a paper be assessed, even without its appearance in a refereed journal? Quality evaluations in other contexts, say restaurants, might provide an answer. For a number of years, I've toyed with the idea of starting a "Michelin Guide" for math papers. Done right, with a rigorous refereeing process, this could completely supplant the validation provided by journals. Thus in one's vita one could point to having posted online, say in the arXiv, five one-star papers, three two-star papers, and one very rare three-star "Mathelin"-rated paper. Indeed, one can envision a variety of general-purpose guides with competing ratings, as well as specialized guides that would convey status within a particular field. The worth of each rating would depend on the reliability of the particular guide. Furthermore, unlike journals, these guides—like those for restaurants—could allow fluctuating ratings over time, as might happen when a once obscure, unrated paper suddenly provides the key to solving an important problem. Or, vice versa, a previously undetected error is found or the subject area falls out of favor. Less clear is how such a system could be practically instituted. (Michelin's original motivation was to sell more tires by encouraging car owners to drive to faraway restaurants, but eventually their guide and others became economically viable on their own merits.) *Math Reviews* was initially designed to play such a role, but most of its reviews nowadays are mere restatements of abstracts, and serious

reviewing (except for the occasional book) has all but disappeared. The challenge is to devise a sound economic model for such scholarly guides, which ideally would include mechanisms for suitably compensating reviewers.

Finally, I feel compelled to say a brief word about the “dark side” of scientific publishing. I already noted journals artificially manipulating metrics such as the Impact Factor. More odious are predatory journals and conferences, which seek to profit from naïve and unscrupulous researchers through registration fees, pay-to-publish models, and the like [5]. Furthermore, the bane of plagiarism is more widespread than many of us acknowledge; see [6] for some recent cases in SIAM and my own website [7] for a personal experience that culminated in legal action and an official acknowledgment (as well as some remuneration) from the publisher. The community has been far too willing to overlook such abuses, which has only served to embolden the perpetrators. For instance, see [8] for an astonishing case of serial academic fraud in economics. Only full publicity, including naming names and, when appropriate, taking legal steps, will counter these insidious practices. Thus, while the electronic era has exacerbated older problems and created new ones such as citation-based metrics, it also provides a range of potentially powerful tools that can be employed to combat such nefarious influences on the profession.

The time is ripe for a radical rethinking of the traditional academic model for scholarly communication within mathematics. While many established researchers seem uninterested in or unwilling to fully come to terms with the rapidly shifting electronic publishing landscape, the community as a whole cannot afford to lull itself into a false sense of security. If we are not properly engaged, the future will be decided for us and, almost certainly, will not be to our liking.

Acknowledgments

The author is currently serving as chair of the CEIC and would like to thank its members and other colleagues, particularly Doug Arnold and David Mumford, for valuable input on earlier drafts. This column represents his personal views and not (except as noted) official CEIC or IMU policy.

References

- [1] SHAO JUFANG and HUIYUN SHEN, The outflow of academic papers from China: Why is it happening and can it be stemmed?, *Learned Publishing* **24** (2011), 95–97. See also Phil Davis, Paying for impact: Does the Chinese model make sense? *The Scholarly Kitchen*, <http://scholarlykitchen.sspnet.org>, April 2011.
- [2] DOUGLAS N. ARNOLD and KRISTINE K. FOWLER, Nefarious numbers, *Notices Amer. Math. Soc.* **58** (2011), 434–437.

- [3] Retraction notice, *Applied Mathematics Letters* **24** (2011), 406.
- [4] Best current practices for journals, *Notices Amer. Math. Soc.* **58** (2011), 62–65. See also <http://www.mathunion.org/fileadmin/CEIC/bestpractice/bpfinal.pdf>.
- [5] JEFFREY BEALL, “Predatory” open-access scholarly publishers, *The Charleston Advisor* **11**(4) (2010), 10–17.
- [6] DOUGLAS N. ARNOLD, Integrity under attack: The state of scholarly publishing, *SIAM News* **42**(10) (2009), 2–3.
- [7] PETER J. OLVER, *A case of serial plagiarism*, <http://www.math.umn.edu/~olver/plag.html>, February 2010.
- [8] BEN R. MARTIN, Research misconduct—does self-policing work?, in *Confluence. Interdisciplinary Communications 2007/2008*, Willy Østreng, ed., Centre for Advanced Study, Oslo, 2009, pp. 59–69. See also http://www.cas.uio.no/Publications/Seminar/Confluence_Martin.pdf. [Smith-Moore] DAVID A. SMITH and LAWRENCE C. MOORE, *Calculus: Modeling and Application*, 2nd ed., 2010, <http://calculus-course.maa.org/>.
- [S-Focus] KEITH D. STROYAN, The changing face of calculus: Engineering math at the University of Iowa, *MAA FOCUS*, February, 2006.
- [S-Projects] ———, *Projects for Calculus: The Language of Change*, <http://www.math.uiowa.edu/~stroyan/CTLC3rdEd/ProjectsCTLC/ctlcProjects.htm> (originally published by Academic Press, 1998).
- [SN] KEITH STROYAN and MARK NAWROT, *Visual Depth from Motion Parallax and Eye Pursuit*, submitted, 2010.
- [SD] <http://demonstrations.wolfram.com/HerdImmunityForSmallpox/>.
- [C:TLC] KEITH STROYAN, *Calculus: The Language of Change*, <http://www.math.uiowa.edu/~stroyan/CTLC3rdEd/3rdCTLCtext/ctlctoc.htm> (originally published by Academic Press, 1993 and 1998).