Future Professional Communication in Astronomy
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FUTURE PROFESSIONAL COMMUNICATION IN ASTRONOMY: QUESTIONS AND CHALLENGES

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Abstract. This introductory talk aims at setting pieces of context for the FPCA meeting and at reminding bits of history, for both electronic publishing and astronomy communication in a broader sense. While emphasizing the necessary complementarity of media, it reflects on possible sociological limitations (among others at the level of evaluation committees) responsible for the fact that we still mainly produce electronic versions of documents printable or otherwise available on paper instead of practising full electronic publishing for our verified knowledge. After introducing new publishing models and sketching possibly interfering new technologies, criticisms and questions from the community are echoed in a *Complaint of the Publishing Astronomer*. A few comments are also made on evaluation criteria.

1. Communication

This introductory talk is reminding bits of history, setting up pieces of context, echoing comments and questions from the community, as well as perhaps putting the finger here and there where it could hurt.

Astronomers communicate all the time, with colleagues of course, but also with managers and administrators, with decision makers and takers, with social representatives, with the news media, and with the society at large. Education is naturally part of the process.

Astronomers communicate nowadays via a large variety of means: voice and print, phone and fax, as well as via the now omnipresent electronic tools, both active (e-mail) and passive (web), in addition to the various

graphical arts including the production of movies, videos, DVDs, and so on.

The astronomy-related communication process can be structured as in Fig. 1 giving an idea of the motivations, means and media used. We shall come back briefly hereafter to a very important motivation – recognition – which itself implies another concept: evaluation.

For most of us, communicating mainly means publishing, but the communication process is much broader. It is itself part of the more general concept of *information handling*[1] illustrated in Fig. 2. The information flow strongly evolved in the course of the last decades (Heck 2003). It is complex and iterative, and includes several evaluation steps.

Is communication in astronomy different from what it is in other communities? Basically not, with perhaps two significant differences though: the astronomy community is rather compact and well organized world-wide; astronomy has penetrated the general public remarkably well with an extensive network of associations and organizations of aficionados all over the world.

Also, as a result of the huge amount of data accumulated, and by necessity for their extensive international collaborations, astronomers have pioneered the development of distributed resources, electronic communications and networks coupled to advanced methodologies and technologies, often much before they become of common world-wide usage.

Astronomy communication has been dealt with in a dedicated volume (Heck & Madsen 2003) and has been a recurrent theme in the series *Organizations and Strategies in Astronomy (OSA)* (Heck 2000-2006). Please refer to the detailed tables of contents[2] as it would too long to mention all contributions here.

Communicating with the public is now frequently seen as a natural activity to attract funding and to raise interest in science students. A full session will be devoted to those aspects at this meeting. Therefore I shall mention here only

– the recently established IAU Commission 55 *Communicating Astronomy with the Public* and its various activities, including several "CAP" conferences (Tenerife 2002, Washington 2004, Garching 2005, Athens 2007), the planning of a peer-reviewed journal, and the preparation of 2009 as the International Year of Astronomy (IYA)[3];

– an impressive *Hands-on Guide for Science Communicators* put together

[1] See *e.g.* the duo *Information Handling in Astronomy* and *Information Handling in Astronomy – Historical Vistas* (Heck 2000 + 2003).

[2] See e.g. `http://vizier.u-strasbg.fr/~heck/osabooks.htm` .

[3] See the paper by Lindberg Christensen & Russo in this volume for more details on those issues.

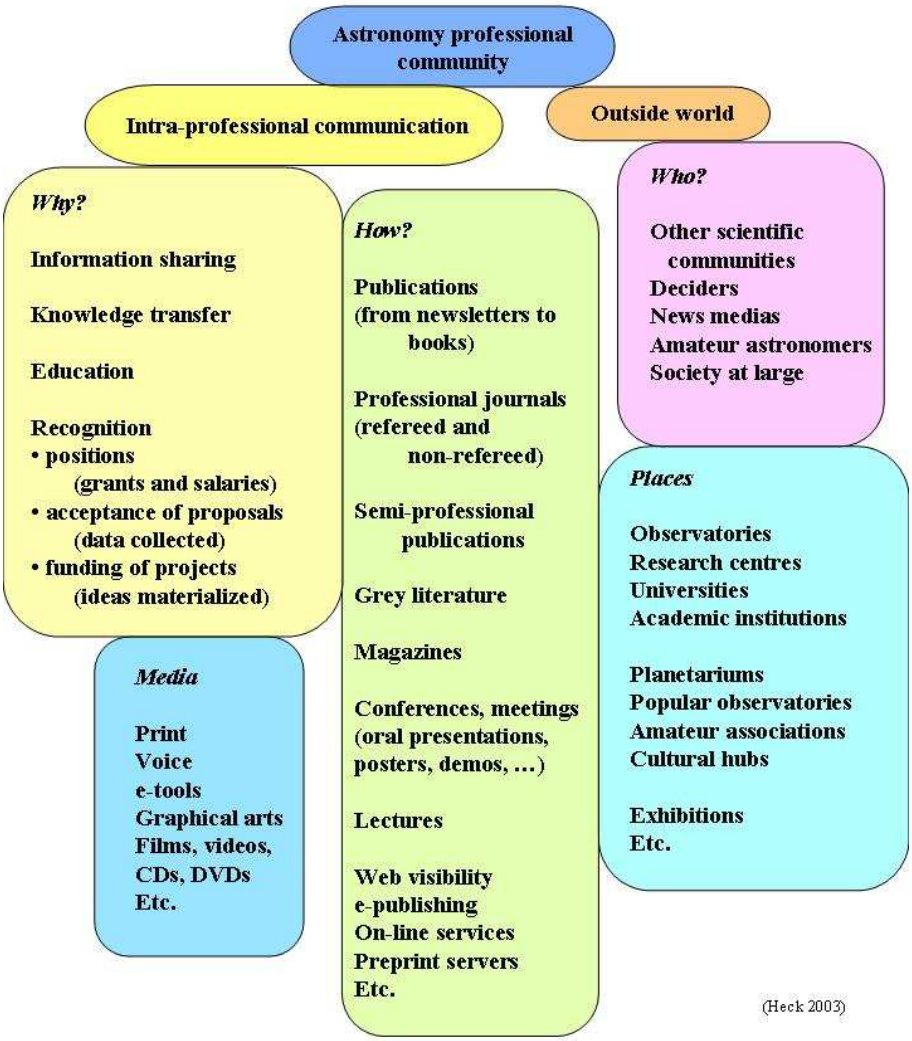

Figure 1. The astronomy-related communication process (adapted from Heck 2003b).

by Lindberg Christensen (2006) and offering, together with examples from physics and astronomy, an abundance of practical details in a good-humored style;
– the maturation of the astronomy communication as a field through novel

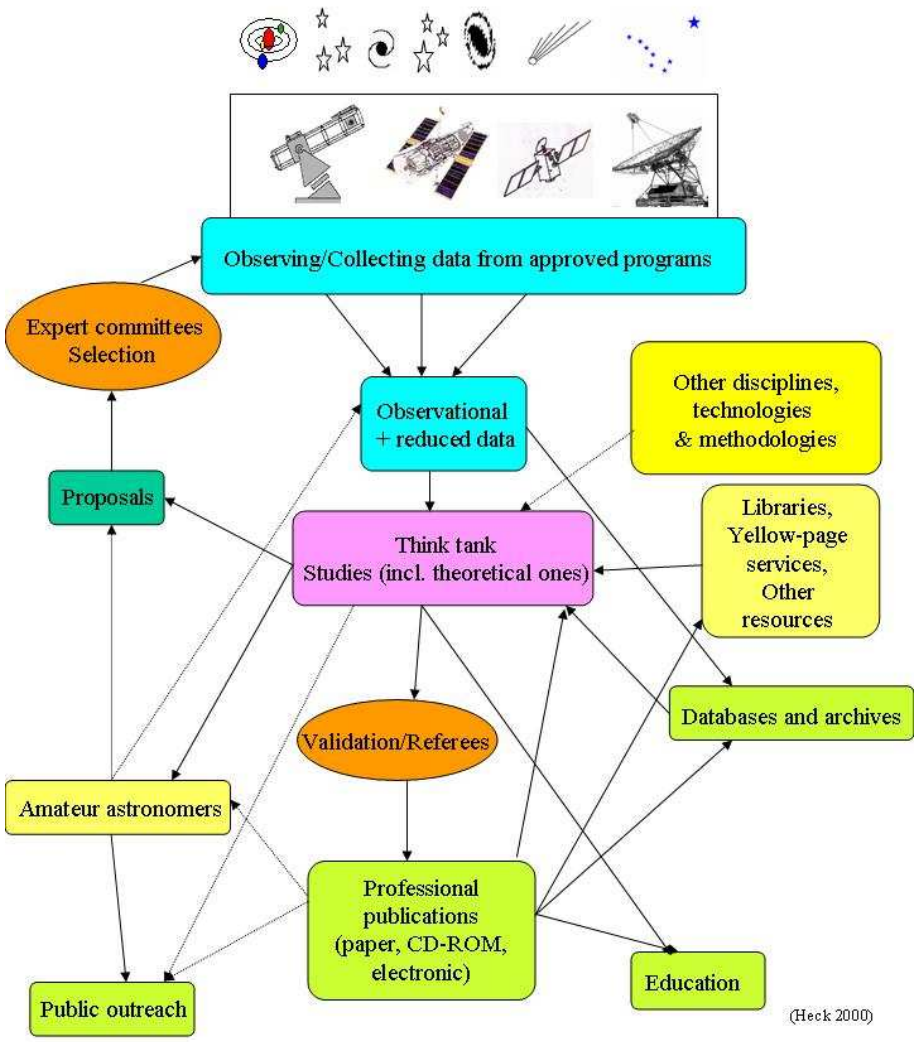

Figure 2. A schematic view of the astronomy information flow (from Heck 2000b).

approaches such as a study of hype and credibility issues (Nielsen *et al.* 2006, Fig. 3); such investigations are very much welcome as excesses in hype and contempt of credibility can badly hurt the whole community – my own view being that it is not enough to be honest and credible: we are

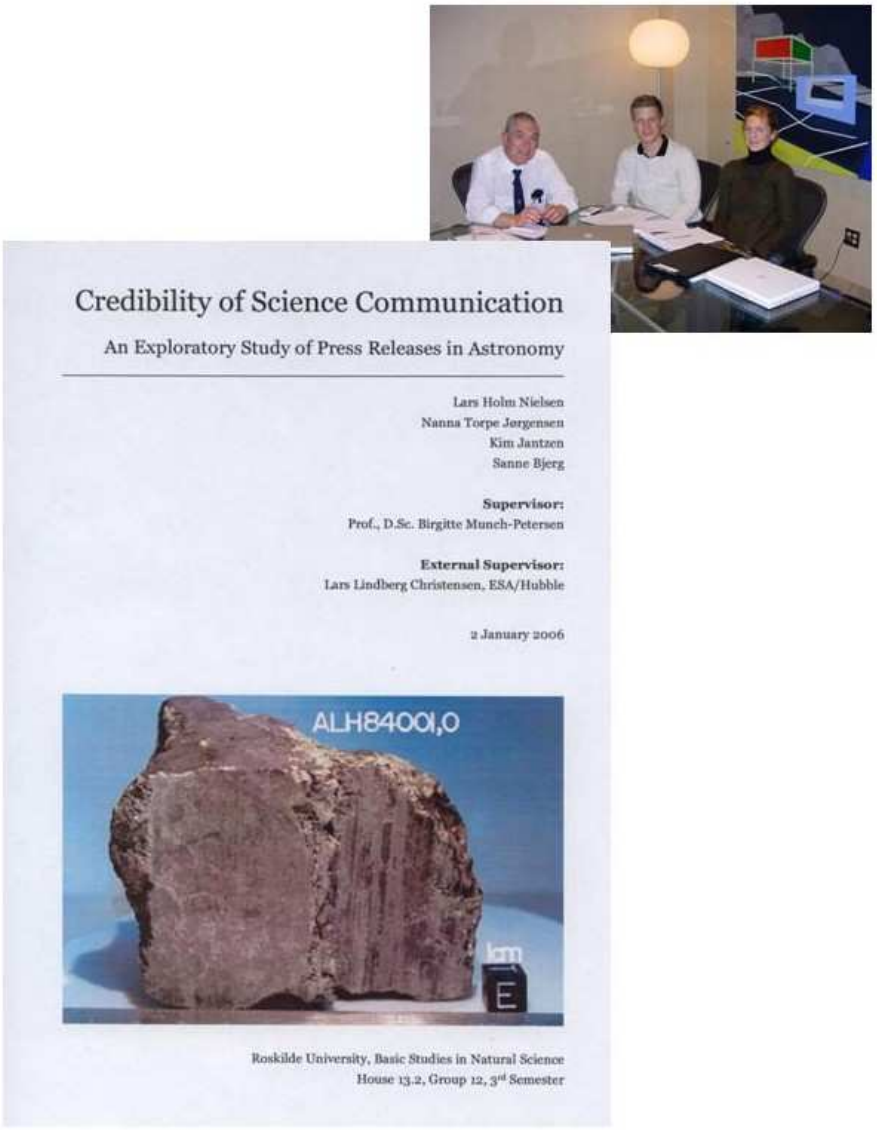

Figure 3. A noteworthy example of novel approaches in astronomy communication: a study (supported by ESA/Hubble) of hype and credibility issues (Nielsen *et al* 2006). The upper photograph illustrates the undersigned's interview by the two first authors (Boston, November 2005).

also responsible for making sure that the messages are correctly received.

Figure 4. An illustration of the dramatic increase of astronomical literature over a century: Helmut A. Abt, then Editor-in-Chief of *The Astrophysical Journal (ApJ)*, is standing next to stacks of that leading professional publication. (courtesy NOAO)

2. E-Publishing

Many of the talks at this FPCA colloquium will be devoted to professional publishing and most of the discussions will certainly deal with the future of electronic publishing.

The very first international colloquium on electronic publishing[4] in astronomy has been organized in October 1991 at Strasbourg Observatory (Heck 1992). In those early 1990s, the curve of growth of printed professional journals (Fig. 4), the popularization of desktop publishing and the fast spreading of the networks over the planet made it urgent to gather the key players together. The colloquium was a real catalyzer and many of the materializations and collaborations that we know today in e-publishing have their roots back at that meeting.

Strasbourg was also the seat of a web-organizing colloquium in April 1995[5] and of a European Science Foundation (ESF) Workshop on *Strategies and Techniques of Information for Astronomy* (Heck & Murtagh 1996). The e-pub pioneering work of the astronomy community was advertized by

[4]The buzzword shifted from *desktop publishing* to *electronic publishing* between the initial planning of the meeting and the publication of the proceedings.

[5] *Weaving the Astronomy Web (WAW):* `http://cdsweb.u-strasbg.fr/waw.html` .

Boyce & Dalterio (1996) in a synthetic paper and progress reports were regularly published: in a dedicated volume (Heck 1997), in various chapters of the OSA series, including, very recently for the main astronomy journals. See the OSA 7 papers by Meynet (2006) for A&A, by Milkey (2006) for the AAS journals, and by Murdin (2006) for the MNRAS.

Thus, all seems to be well for the major professional journals (Fig. 5); the production of proceedings and edited volumes was following suit; and we could think that we would be soon touring old libraries like zoos ...

3. Yes, but ...

It would howerver be a mistake to forget, one one hand, the complementarity of the media and, on the other hand, that not everybody shares a 100% optimism for e-publishing. See for instance Mahoney (2007) arguing that:

> "... electronic-only publishing is an unmitigated menace that must be resisted if we are to ensure that past and present research and scholarship be carried undiminished into the future, and that this is best accomplished through a judicious combination of print and electronic storage."

Some nuances have indeed to be brought to an idealistic picture.

First of all, fifteen years after the first international meeting on electronic publishing (see above), electronic mailings and web postings have profoundly changed the way our community works and communicates, but when the time comes to publish refereed documents, we are still mainly producing electronic versions of documents printable or otherwise available on paper instead of practising full electronic publishing. And we all know those innumerable articles downloaded, sometimes printed, never read.

Are there technical barriers at the level of archiving or database facilities that would hinder a switch to full e-publishing?

No problem has been identified for CDS resources as they deal mainly with pointers to celestial objects and bibliographical references. As to ADS, I understand from private talks (Eichhorn 2006) that it would experience difficulties with documents non fully pdf-able/printable and that non-negligible work would be needed to develop facilities accommodating them.

A few comments seem to be in order about `arXiv` (ex astro-ph).

From my own experience, if that system deserves all the respect, merit, and glory normally assigned to pioneers, it is in fact antiquated and obviously reflects initial tastes and options: it rejects pdf files generated from LaTeX, requesting original files, including figures, to be uploaded – which might take hours for heavily illustrated papers. The alternate solution requires compression, something out of age in this 21^{st} century! The practice

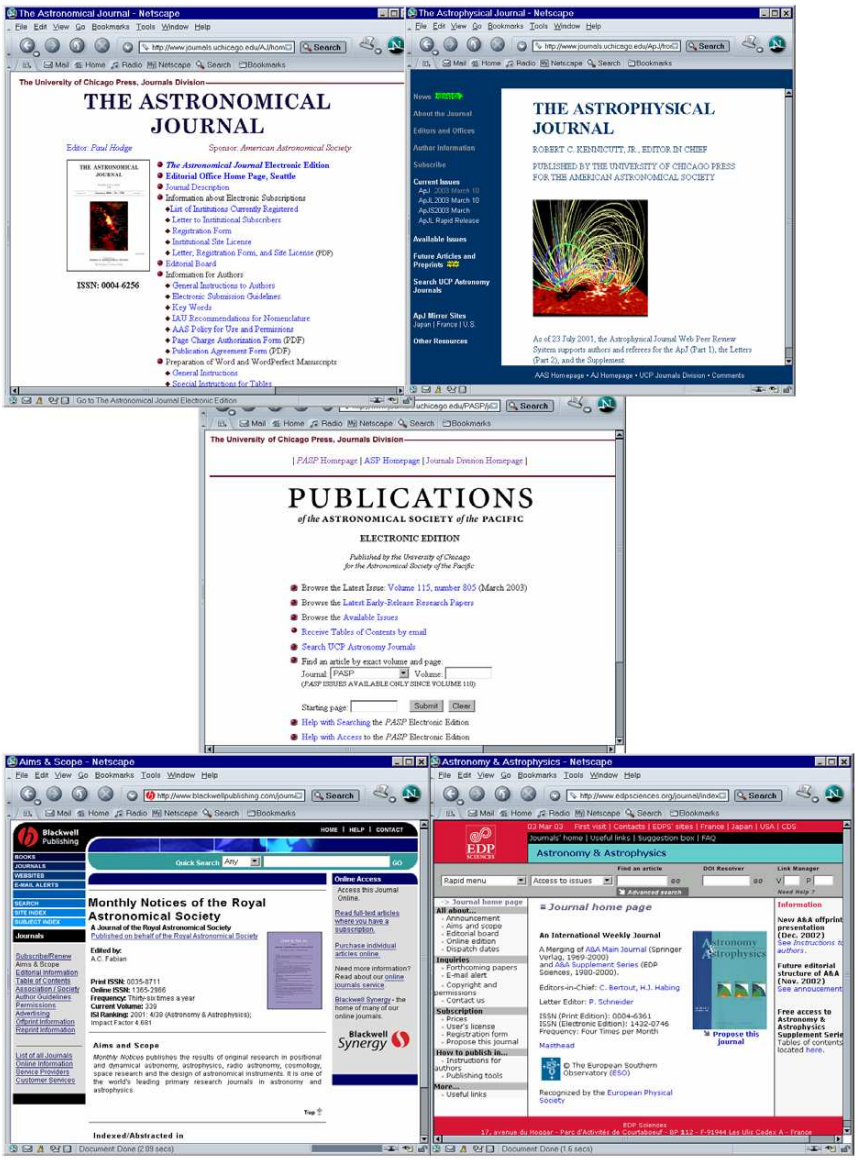

Figure 5. The web pages of five major professional astronomy journals.

of quoting `arXiv` references, if understandable for fresh preprints, is bad practice since it is pointing to unverified knowledge and has definitely to be condemned for references to published papers.

Verified knowledge is indeed a real fundamental issue.

Are there in turn sociological limitations to the full usage of e-publishing? For instance at the level of evaluation committees?

My own experience has been that there are sometimes differences between official claims about the policies followed and what takes place in practice: down to the real rating in conscience, what really counts are the "refereed" papers available through the traditional channels. Should not the evaluation processes reflect the complementarity of the media? Should not have authors the choice of the media best suited for expressing their results?

4. The Outside World

Talking of the future has always been a perilous exercise: the evolution of technologies and practices has been often different from what pundits had seen in their crystal ball. And specialists tend to be oblivious of constraints existing in the world outside their own little universes.

Here are a few limitations that must be taken into account by planners of the immediate future.

Acceptable connectivity is still far from existing everywhere and we are still far away from plugging our brain straight into electronic facilities ("jacking in") like the characters in Gibson's *Neuromancer* (1986). In other words, many areas of the planet are still underdeveloped technologically and, for this and other reasons, the complementarity of media is still a much needed requirement[6].

Multimedia are still a synonym of a chamber of torture for many people, even among those familiar with the usage of computers and the handling of software packages. The multiplicity of formats is a critical issue. Adequate training is definitely required to work, for instance, on movies.

Are we protected enough against buzzwords and fashionable trends? We shall speak extensively of Open Access (OA) at this meeting, so I shall not spend much on it here. But the following quotation from an electronic public reference summarizes pretty well all I could hear and read on OA:

> "Although there is substantial (though not universal) agreement on the concept of OA itself, there is still considerable debate and discussion about the economics of funding open access publishing, and the reliability and economic effects of self-archiving ..."[7]

[6]Recently Air France went fully electronic for their timetables and, just before this FPCA meeting, I had to remind AF's representatives of the handiness of the paper booklet and that, even downtown Paris, it was still not possible to get free WiFi links in most places – not to speak of benches in public parks. We all know that one day we'll most likely get, anywhere in the world, virtual images projected on eyeglasses or "seen" somehow in our brains, but we are not yet there!

[7]`http://en.wikipedia.org/wiki/Open_access`

The technology adoption life cycle has been schematized by Moore (1991) as a bell-shaped curve split into several segments: early innovators, early adopters, early majority, then, after the maximum, late majority, and laggards. According to Moore, the time needed to go from the 'early adopters' group to the 'early majority' is significantly longer than to cross the separations between other adjacent groups. This *chasm* (in Moore's terminology) could be where fully electronic publishing stands currently.

Our way of communicating might be significantly different in a not too remote future, especially if investigations in neuroscience continue their significant advances in understanding our brain (and thus our intelligence). See the specialized web sites (e.g. Stanford[8]) and the associated literature.

Progress does not always go in the right direction for us. Militaries and arm manufacturers have in stock some weaponry that could erase in a flash our digital memories. We definitely want to avoid another catastrophic loss of knowledge such as the disaster that destroyed Alexandria's library. Can we multiply enough the mirrors to be protected against amnesia if we go fully electronic?

Or – with similar consequences – what shall we do if, one day, ADS (for instance) is not funded anymore?

This brings us to the issue of money as the outside world of this 21^{st} century is changing quickly, including in its relationship towards money. Not everybody realizes it yet, but the ruling caste is now made of shareholders. Financial analysts (even them) agree that the current problems of Airbus come from the fact that the owners of the company are now banks and similar entities, and no more aircraft manufacturers. The question is then: how has that change of perspective, plus the monopoly games in the publishing world over the past years/decade, impacted our publishing activities? How will these be influenced in the future?

5. The Song from the Community

Before going further, let me share with you some statistics of a publishing machine. To this date (June 2007), I have produced under my own name and a pen name some 1447 "publications"[9] as author/editor in eight languages and going from half-page notes to volumes of ∼1500 pages. Out of these, there are 1042 publications under my own+pen names only (72%) and 405 in collaboration (1089 repetitive co-authors/editors). In terms of pages, this sums up to more than 147,000 pages (91% under my own+pen names) meaning an average over 100 pages per publication and reflecting a weighting influence of the bigger books.

[8] `http://neuroscience.stanford.edu/`

[9] Including 128 so-called "refereed papers".

Such figures are not detailed to brag about myself (well, ok, a bit), but rather to emphasize the numerous contacts of all kinds I have had so far in the publishing world and how privileged an outside observer I might have been over the recent decades.

An impression I had consistently is that the community of publishing astronomers at large feels sometimes disconnected from the group of people deciding on the way it should publish and communicate. This is certainly not proper to the astronomy community, but in recent times, the number, loudness and bitterness of complaints heard have significantly increased. The major ones are summarized in Table 1.

TABLE 1. The Complaint of the Publishing Astronomer (medley/old ditties).

Publishers are putting on us
more and more technical requirements ...
We are delivering a finalized product
for which we are not paid ...
We have the means to do everything
ourselves at lower cost ...
Publishing delays are too long and
the outcome is not always satisfactory ...
The prices (books/journals)
are much too high ...
Why should we pay so much to get back
information that we initially provided ...
We are loosing access to archives
if we stop subscribing digital editions ...
Some illustrations are not available online ...
Etc. etc.

In parallel, I hear from the publishers that:
– the circulations of journals and magazines are decreasing, thus some journals are increasing their geographical coverage in an attempt to compensate that effect; [but is a "journal" still the right answer to our needs?]
– too few individuals buy books or subscribe to journals;
[there is a concensus that the prices are too high!]
– professional astronomy is a small market commercially speaking, and
– many (specialized/professional) astronomy books are loosing money;
[should/could this be seen as an application of the "sport car syndrome"[10]?]
etc.

[10]Car makers (and other manufacturers) know how important it is to have a luxury item

The multiplication of issues and complaints makes really necessary the organization of meetings such as this FPCA one. There would be other issues to be discussed too, such as the policies regarding royalties on e-material, or thoses developed in some countries offering percentages on photocopies and downloads[11] which become real headaches internationally: in the case of Australian downloads from a Belgian author working in France and having published in the US, who pays who?

6. On the Bright Side

Astronomers have expertise as:
– knowledge/information producers,
– editors,
– referees,
– database/archive holders, and
– designers/maintainers of resources that are universally visible, searchable and successful.
In other words, astronomers have everything they need to handle themselves their own e-publishing future if they wish so. Should that be done via wiki-based servers (cf. Albrecht & Heck 2007)? For which kind of publications? Via professional societies? Successful ventures such as CDS (Heck 2005 & 2006) definitely came out of simple ideas.

In any case, everyone will certainly agree on the fact that the information we provide must remain:
– of quality (well processed, etc.),
– reliable (verified, ...),
– perennial (via non-volatile facilities),
– easily accessible.

7. A Few Comments on Evaluation

An in-depth discussion on the future of professional communication cannot be dissociated from the evaluation processes. Beyond the dissemination of knowledge, and as illustrated in Fig. 1, communicating – and publishing in particular – is a key factor in the recognition needed for securing positions, the acceptance of proposals and the funding of projects.

It is not really easy to get members of evaluation panels (of programmes, proposals, individuals, institutions, ...) to go beyond general principles or

in their line of products. Few people will buy it, but most purchasers of the standard items will get something out of it, be it only through the image associated to the brand name – somehow like dreaming (or getting friends and colleagues dream) of an unaffordable expensive lover ... (cf. Heck 2000c)

[11] See e.g. the *Verwertungsgesellschaft Wort* (`http://www.vgwort.de/`) in Germany.

issued recommendations and to speak in details of the processes (including the personal mental ones) leading to favoring an application rather than another one. The OSA volumes presented a number of chapters on such matters[12]. To make things more complicated, evaluation criteria are very volatile in some countries and systems, depending of the people in power and/or of the enforced policies of the time.

To render the exercise more scientific, if not more objective, evaluation bodies have attempted to quantify criteria. An easy way to do it has been through counting publications and citations, sometimes weighting them in a way or another. Thus *scientometrics* is often de facto reduced to *bibliometrics* (see e.g. Schubert 2001).

It is out of the scope of this talk to discuss the various metrics currently in use, but, after having produced quite a number of related papers via the OSA series[13], our own perception is close to the following quotation from Pijpers (2006):

> "Even in fields where publication is the primary output, there is considerable variation in publication and hence in citation rates. Data from ADS is used to illustrate this problem and argue against a 'one-size-fits-all' approach to performance metrics. [...]
> To the author's knowledge, there is no metric that reliably measures performance over periods as short as five years, and none that is an indicator of future performance. Specifically it seems inappropriate to use numbers of citations, even after the 'normalization' in the sense of the ADS, as a reliable direct metric of impact."

Fundamental, generally unanswered, questions are:
– what are those metrics measuring exactly?
– what is a "scientific impact"?
– what is behind the "impact factors", often considered as magical by politicians of science relying on feedback from policy makers, themselves frequently outsiders to the scientific areas on which they are running statistics?

As far as the future of scientific communication is concerned, how could those evaluation criteria
– be improved to become reliable measurement tools?

[12]See Bohlin (2000) and Volonte (2000) for space experiment proposals; Breysacher & Waelkens (2001), Grewing (2006), Hogg (2006), Linsky (2006), Schwartz *et al.* (2006), Uitenbroek (2006) and Veillet (2006) for observing time applications; Friel (2002) and Mamon (2003) for evaluation of projects, as well as on applications for grants and positions.

[13]See Abt (2000, 2003, 2006), Benn (2002), Christian (2004), Christian & Davidson (2006), Esterle & Zitt (2000), Madrid *et al.* (2006), Pearce & Forbes (2006), and Sandqvist (2004)

– be adapted to non-textual material?
– be tailored to purely electronic publications?

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This paper – and the FPCA colloquium – is the opportunity to express a deep gratefulness towards all people who made possible its genesis as well as the various earlier steps and productions.

In the first place, Léo Houziaux, FPCA co-organizer and host, was my first astronomy professor back in the mid-1960s at Liège University. His lectures woke up a solid and lasting interest towards the rôle of astronomy in the society, as well as in the position and function of man in the universe.

By supporting book proposals, the managers of the *Astrophysics and Space Science Library* at Kluwer, later Springer, allowed me to establish the necessary contacts enabling the materialization of projects and the maturation of ideas involving key players in the broad astronomy communication process.

Hence is duly acknowledged here the cooperation from the *OSA Family* – the authors of the some 150 chapters making up the prize-winning OSA series[14] – as well as that from contributors to other productions such as the *Information Handling in Astronomy* duo (Heck 2000 + 2003) and the *Astronomy Communication* volume (Heck & Madsen 2003).

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Main Acronyms

A&A	Astronomy & Astrophysics
AAS	American Astronomical Society (USA)
ADS	Astrophysics Data System (NASA)
AJ	Astronomical Journal
ApJ	Astrophysical Journal
CAP	Communicating Astronomy with the Public
CDS	Centre de Données Stellaires (France), later: Centre de Données astronomiques de Strasbourg (France)
CfA	Center for Astrophysics (Cambridge MA, USA)
DTP	DeskTop Publishing
ESA	European Space Agency
ESF	European Science Foundation
ESO	European Southern Observatory
FPCA	Future Professional Communication in Astronomy (conference)
IAU	International Astronomical Union
IRAM	Institut de Radioastronomie Millimétrique
IYA	International Year of Astronomy (2009)
MNRAS	Monthly Notices of the Royal Astronomical Society
NASA	National Aeronautics and Space Administration (USA)
NRAO	National Radio Astronomy Observatory (USA)
NSF	National Science Foundation (USA)
OA	Open Access
OSA	Organizations and Strategies in Astronomy (volumes)
ST-ECF	Space Telescope – European Coordinating Facility (ESA/ESO)
STScI	Space Telescope Science Institute (USA)
WAW	Weaving the Astronomy Web (conference)