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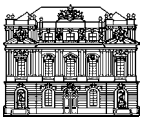
cyberscience

Research in the Age of the Internet

Chapter 8

CYBERSCIENCE, QUALITY CONTROL AND CREDITING ACADEMIC OUTPUT



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"There is no special problem of scientific quality control that is peculiar to the electronic medium."
(Harnad 1993, 1)

8 CYBERSCIENCE, QUALITY CONTROL AND CREDITING ACADEMIC OUTPUT

While the now established procedures of quality control in the scholarly publication system are a centrepiece of today's research system, E-publishing may well affect these traditions. On the one hand, the new technology gives way to new forms of refereeing, which challenge the present system (in particular open peer commentary and rating systems). On the other hand, self-publishing has led to a massive amount of papers available over the net without much, or even any, quality control. Based on an account of the traditional system (8.1), I shall present the developments in the age of cyberscience (8.2) and assess the future of quality control as a cornerstone of academia (8.3). Inter alia, I shall look into the widespread argument that more quantity and higher speed of publishing, as enabled through cyberscience, would necessarily lead to less quality (8.3.1). Finally, I shall look at the related issues of the publication record (8.4): can E-publications be credited just like P-publications, and what about the new forms of publication? There are signs that some professional associations are already discussing this issue, and the state of the debate and the direction of chosen strategies are to be explored. Quite obviously, the discussion of cyberscience's impact on quality control and publication records touches the very heart of the research system.

8.1 The traditional quality control system

One of the main reasons why many researchers at present voice reservations vis-à-vis E-publishing is that the current system of quality control works reasonably well. For sure, there are some shortcomings. At times, low-quality research makes its way to even the top journals. Even worse, plagiarism and fraud are not unknown. Furthermore, the prestige hierarchy of journals and publishers is not only a virtue, but may also lead to suboptimal results with respect to communication in science and research because it does not prevent poor contributions from being published eventually. However, by and large, the present system is accepted and there is a widespread conviction that no profound change is needed. As E-publishing is, in general, associated with a change of the system of quality control, it is often dismissed on these grounds (cf. 7.3.2.3 and 7.3.4). In this chapter, I shall put forward a number of arguments putting this into perspective. As a point of reference for the remainder, I shall first have a look at the current quality criteria (8.1.1) and the traditional quality control systems (8.1.2).

8.1.1 Quality criteria and prestige

Defining "quality of research" is certainly no easy task and it is not my intention here to attempt it. There are many possible definitions, applicable according to varying circumstances and to fields of research (Kircz 2001, 6, for instance, points at the huge differences in perception of the quality control issue within and among the various disciplines). For the purpose of an overall comparison between the different systems of quality control, some very general remarks should suffice. Following and expanding on Armstrong (1998, 44, with further hints to the literature), we may distinguish two groups of academic quality criteria for manuscripts, namely those related to content and those regarding form:

- *Content-related* criteria include: authority (intellectual rigour, convincing style); currency and timeliness (is the research up-to-date; does it include all pertinent previous research; is it new; does it contribute to a current research topic); consistency (is the argument presented without internal and external contradictions; convincing research design); coverage and scope (does it extend to all relevant issues, is the documentation complete); and methodological proficiency (are the methods applied adequate to the subject; are they applied correctly).
- *Form-related* criteria include: presentation (application of style guide; correct application of citation styles; systematic use of headings; adequate separation of quotes and own text etc.); language issues (idiomatic, grammatical and punctuation correctness; use of current language; political correctness etc.); and visual acceptability (layout, in particular of data presentation, font size etc.)

In addition, it seems useful to add a third category of implicit criteria. It cannot be denied that research is not only judged based on the above "objective" quality criteria, but also on social cues. These *implicit (social) criteria* include whether the author has quoted the "right" persons or research groups, and the author's rank and his/her membership in an invisible college. Slightly exaggerated, the scholarly journal could be compared with "a club where non-members will not be told the house rules, but are expected to know them, and will not be admitted if they transgress" (Peters 1996, 3).

These quality criteria not only play a role in the framework of manuscript-specific quality control procedures (cf. 8.1.2), but also with regard to assessment procedures of institutions and individual researchers (cf. 8.4) as well as with regard to the individual researcher's decision whether or not to read a publication. In this respect, the social criteria seem to play an important role, in particular the reputation and authority of authors, of authors' affiliations, of editing persons/institutions, of quoted researchers in asterisk footnotes, of the journal label and of the journal's or book's publisher.

The latter two are of particular importance. *Prestige* of a journal or a publishing house has turned into a criterion that is, to some degree at least, independent from content (and form). There is a hierarchy among journals in a field and among the publishing houses, both on a national and an international level. The individual prestige depends on various factors, including the record of outstanding publications that have contributed considerably to the advancement of a field; the number of citations all articles in a journal get (which is meticulously recorded and counted in scientometrics, cf. also 8.2.2.3); the cumulative prestige of the editorial board and authors; and last but not least, the rigour of the quality control system. There are disciplines in which the magnitude of the rejection rates is a key variable. While there is a hierarchy in all fields, it is, however, mainly in the social sciences that the rejection rate is the prime indicator (Harnad 1993, 6).

8.1.2 Traditional quality control systems

Academic quality control systems serve three functions. First, for science as an institution aiming at gathering "correct" knowledge[744] about the world, quality control tries to make sure that only certified knowledge is stored in its annals. It is a gatekeeper. Second, from the reader's point of view, it serves the purpose of reducing information overload. Given the huge output of the entire academic system and even of each and every tiny speciality, readers are thankful for the pre-selection and ranking of the new information. Finally, the author is interested in quality control as it establishes the above-mentioned hierarchy of publication outlets, which can be exploited for establishing a reputation. There are at least four systems of quality control with various sub-forms:[745]

- *No formal review*: This is not too common in formal (paper) publishing because there is normally at least one responsible editor. It nevertheless happens that manuscripts get published without any quality control. This concerns mainly books ("mimeo" self-publishing), conference proceedings (in particular pre-conference volumes where the paper is judged on the basis of the abstract only, but often not of the paper proper) and working paper series (in particular of small research units). In special cases, we may speak of "asterisk footnote reviews". Here people to whom the author(s) pay tribute for having commented "earlier versions" of the same paper, either on a personal basis or in the framework of a conference/workshop are mentioned in the first (asterisk) footnote in order to lend some legitimacy to the manuscript.
- *Editorial review*: The editor(s) of a journal, working paper or book series is (are) picking and vetting all submitted manuscripts. The editor is normally a most senior member of the research community whose authority and superior judgement is widely accepted. Therefore, editor review is not peer review (see below). Often, the editor also has an influence on style and can put his/her stamp on a journal. In extreme cases, the editor may even act as a (tacit) co-author. Editor review is practised by many working paper and book series, as well as by a few journals.
- *Editorial board refereeing*: In this variant of editorial review, the (main) editor is not alone, but has a supporting editorial board. All papers are not only judged by one single editor, but by the main editor (editor-in-chief) and one or more board members. This is already "refereeing" in the sense that more than one person reviews and makes a judgement on the quality and suitability of a manuscript for publication. In general, this board refereeing is not "blind". The board members judging the merits of a paper know the identity of the author (and the latter knows their identity, at least in all likeliness, from the masthead of the journal or series).
- *Peer review*: The previous system is further enhanced by external opinions of experts (referees, reviewers). There are a number of sub-variants of this system. The distinctions concern the number of external referees (between one and six according to discipline and quality standard of the publication); whether the identities of the authors and/or referees are disclosed (single blind – referees know identity of authors, double-

[744] It is not necessary for my argument here to enter the difficult debate whether this aim can be reached and what "correct" knowledge is and if it can exist at all. It suffices to say that this is perceived as one function of the quality control system.

[745] For a general overview on institutionalised patterns of evaluation in science, see Zuckerman/Merton (1971; also Ziman 1984).

blind – neither authors' nor reviewers' identities are revealed);[746] whether there is only one or more "rounds" of refereeing (after revisions); and the rank of the editors and referees (student journals or general academic).

Peer review is the most widely practised system. One editor-in-chief and several area or assistant editors typically manage it. The editors often belong to the editorial board, but the latter does not always play a direct role in the running of the journal. The main editor scans the submissions and assigns each to an assistant editor who reviews the submitted manuscript, decides whether it is appropriate for review (and occasionally rejects it outright), and distributes it to one or more reviewers. The reviewers are typically selected on the basis of, most importantly, familiarity with the topic, diversity among the referees and experience in former review processes, such as having been thorough and timely. The editor(s) usually have a large margin of discretion as to the appointment of referees. Reviewers typically will be asked to use a rating system for quality based on general criteria (8.1.1) and on suitability of the piece for the particular journal or series, and to return the manuscript to the editor with recommendations and comments to the author. Editors use this feedback to respond to the author, at times also including their own feedback. A typical set of possible answers to the author(s) would range from "Accept as is", "Accept with the following modifications" and "Resubmit with major revisions" to "Reject for the reasons listed", eventually with a proposition for "Submit manuscript to alternative journal". In case of a re-submit decision, editors may send the revised manuscript to some of the referees who reviewed the first submission and/or to some new reviewers.[747]

ACADEMIC QUALITY CONTROL SYSTEMS

Functions:	Types:
• For science: gate-keeping	• No formal review
• For readers: filtering	• Editorial review
• For authors: prestige	• Editorial board refereeing
	• Peer review (single-blind, double-blind, non-anonymous)

Overview 8-1: Functions and types of academic quality control system

The present peer review system is by far not undisputed. Among the shortcomings are, most importantly, selection biases on the part of the editors (Harnad 1998a; 1993, 7) and that the feedback by reviewers only comes at the latest possible time in the work process on an article (Fuller 1998, 142). Furthermore, the present system does not guar-

[746] Double anonymity seems to be practised most widely as there are good arguments in favour of it: It gives the reviewer the security that s/he can actually criticise openly without the danger that the author would know the originator and be resentful. At the same time, the editor knows his/her identity and can act as a filter, so criticism will not be unfounded and excessive. In an open setting, it is doubtful whether the peers will openly criticise others' papers (Harnad 1998a). Junior reviewers might be reluctant to criticise the work of senior researchers for fear of reprisals, in particular researchers depending on grants (Smith 1999).

[747] A work flow analysis of the traditional refereeing process is given by Zhang (1997, §9, referring to Peters).

antee that only good papers get published, as there is a hierarchy of journals (see above). An effect of such a hierarchy is that virtually everything that is written gets published somewhere. A manuscript may be submitted to a succession of lower and lower standard journals until it finds its niche, or there may be a hurrying obedience effect which leads authors to head more directly for lower-rank outlets already the first time round. Also, it has been widely argued that peer review tends to filter out dissenting, radically new contributions. In addition, numerous examples have proven that both fraud (that is the deliberate faking or bending of results) and plagiarism (that is taking over results produced by others without paying due tribute) cannot be totally avoided.[748] Finally, the traditional peer review system may lead to considerable time delays, as referees cannot be forced to react quickly. From the point of view of the reviewers, the present system is time consuming and hardly rewarding.

Suggestions for improvements cover, inter alia, increasing the number of referees, participation of authors in the selection of one of the reviewers, a right of appeal of authors, open reviewing, paying referees and the development and distribution of guidelines for manuscript review (e.g. Cole 1998, 186ff.).

8.2 Cyberscience developments and opportunities

As I shall discuss in 8.3, many E-journals and online working paper series already apply one of the many variants of academic quality control just presented (8.1.2). There are, however, a number of new opportunities, which are only possible in the age of cyberscience and which may eventually lead to a new system of quality control. First, we shall see that ICT enables changes in traditional ex ante control, that is, before a manuscript gets published (8.2.1). Second, there are a number of new, ex post, forms of quality control, which are only conceivable in the digital arena (8.2.2). Third, a digital, networked environment allows for useful quality labels and for selective databases (8.2.3). Fourth, ICT and in particular E-publishing trigger a few further interesting changes affecting quality and quality control (8.2.4).

8.2.1 New forms of ex ante quality control

The communicative potential of the Internet, in particular WWW publishing combined with E-mail and web mailing enables open peer commentary, either in a pure variant (8.2.1.1) or mixed with traditional review systems (8.2.1.2). Furthermore, it allows for differentiated refereeing standards (8.2.1.3) and improvements with regard to the selection of referees (8.2.1.4).

8.2.1.1 Open peer review/commentary

In the traditional quality control procedures, the submitted manuscript is only viewed and assessed by a handful of researchers. In fact, the manuscript's content, as well as its

[748] For general discussions, see Mayntz (1999; also Woolf 1993), for recent examples how to detect fraud in quantitative research, see Diekmann (2002).

existence (that is the fact that is has been submitted), is kept secret. In the double-blind system, even the names of those involved are not revealed. In general, the research community at large only finds out about the submission once it is printed and sent to the subscribers. If it is rejected, (almost) nobody will ever know. The traditional system is closed, not open.

By contrast, open forms of reviewing in E-journals announce that a paper has been submitted (on the journal's homepage). The submission is uploaded to the journal's server and everyone can have a look at it. In case of revisions (along the path from the original submission to the final published text) the interim steps are also visible for everyone. In addition, the editor does not select referees, but opens a general, open debate about the manuscript. Self-appointed referees (Sumner/Shum 1997) comment on the merits of the paper online. In general, both the author's and the public referees' identities are not disguised. While there are good arguments in favour of anonymity[749], the primary argument against anonymity is that it seems wrong for somebody to make an important judgement on the work of others in secret (Smith 1999). Although, in principle, the technology allows for anonymity, it is not implemented because it would not suit well the otherwise open character of the procedure.

The philosophy behind open peer review is basically that it is expected that the more people participate in the review process, the better the result. An open, non-anonymous procedure would be more "democratic", less determined by a single editor or a small board. In addition, the author is not only at the receiving end of a decision already taken, but in a position to participate in the review process by directly answering to comments in an interactive process. While reviewing in the traditional model is a solitary activity, the open communicative process may lead to a discourse in which the ideas are refined and shaped.

However, open peer commentary is not without problems. Similar to the ex post variant discussed below in 8.2.2.1, there are the following four dangers. (1) Many articles will just not get any comments at all, in particular those that are flawed. (2) There might be strong competition to attract any form of positive comment, "an outcome likely to diminish scholarly discourse's integrity and originality" (Tomlins 1998, 138). Both (1) and (2) "might accentuate already current tendencies towards scholarly cliquishness and self-justifying solipsism, and, over all, generate more sludge" than the traditional review systems do (ibid., similar Harnad 1998a). (3) Furthermore, it may be problematic to assure that the self-appointed referees or commentators are qualified specialists (Harnad 1998a). Will the top specialists engage in this extra work at all? In other words: will it be peers, i.e. experts of at least the same level as the authors, who will comment? Perhaps only those at the periphery, which have no other possibility to be taken notice of, will participate. (4) Finally, the general arguments in favour of anonymous refereeing are pertinent here as well.[749]

Given these problems, open peer commentary is rather present in mixed systems as a powerful and important supplement to peer review, but not as a substitute for it (Harnad 1998a). As a form of "scholarly skywriting" (cf. 7.2.4.4), open peer commentary may be used in the prepublication stage of scientific inquiry in which feedback is still critically shaping the final outcome (Harnad 1991, 48). See the next sub-section (8.2.1.2) for examples of mixed systems combining traditional and open peer review.

[749] See 8.1.2 and in particular fn. 746.

8.2.1.2 Mixed systems

With a view to combining the strengths of both worlds, of traditional and of open peer review, a number of mixed models are being tried out by editors of innovative journals.

One alternative borrows the idea of openness and transparency and applies it to the refereeing process. For instance, referees' comments could be made available for open exploration and interaction so that "the value of the journal would be enhanced: it would be a working model of the concept of quality in a discipline" (Davenport/Cronin 1990, 187). Referee reports could be revised, published and linked to the published article as commentaries if the referee wishes, alongside with author rebuttals as well as other commentaries (Harnad 1998a).

Another alternative combines anonymous reviewing with open peer review at a later stage. Hence there are different participants in the different stages of the whole process. This is practised, for instance, in the journals BBS[750] and Psycoloquy[751], partly in more than one round and on different levels: reviewing becomes an iterative endeavour. The Journal of Interactive Media in Education (JIME)[752] is not only innovative in its use of multimedia (cf. 7.2.4.1), but also uses a sophisticated refereeing system (Sumner/Shum 1997, 6), as summarised in the following Overview 8-2. The two reviewing phases (5 and 8) go on only for a specific time-span, pre-set by the editor (in general, a couple of weeks). The JIME system has been developed and implemented hand in hand with the software package "D^{3}E"[753] which allows handling the administrative procedures involved and producing the "review site" on the WWW with multiple windows for text and comments and the cross-links in-between (cf. 2.4.4.2).

PHASES OF JIME REVIEW PROCESS

1. Author(s) submit article
2. Editor verifies relevance to journal
3. Editor appoints 2-3 (non-anonymous) reviewers
4. Publisher generates review site (with restricted access)
5. Reviewers and author(s) debate merits of article in the review site
6. Editor decides upon acceptance in principle (on the basis of the recorded debates on the review site)
7. Editor checks (hitherto restricted) review debate and modifies as necessary to create a coherent 'seed' for public review
8. Article is published as a 'pre-print'; review is open to the public for reader comments
9. Editor prioritises review comments for author(s) and may invite additional commentaries from reviewers or readers
10. Author(s) revise article
11. Editor verifies revisions and edits commentaries
12. Publisher prepares final web version
13. Article is published in final (and quotable) form; discussion continues

Overview 8-2: Phases of a mixed review process as practised by JIME

[750] Behavioral & Brain Sciences (<Cyberlink=253>).
[751] <Cyberlink=238>; both BBS and Psycoloquy are edited by S. Harnad.
[752] <Cyberlink=236>.
[753] <Cyberlink=57>.

Other mixed systems could also include two (or more) review phases, one open, the next restricted, but the other way round as compared to JIME: In this case, the open review process would precede the appointed referee or the editorial board review phase (e.g. Odlyzko 1994, 30ff.). The public comments would inform the referees and the editor. A proposal with even multiple open peer commentary phases was also recorded by the OECD report (1998, 213f., quoting Delamothe 1996): Researchers would begin a study by posting their protocol to a website for review by their peers (open peer commentary), possibly followed by a call for collaborators and for assistance in recruiting research subjects. After the research is completed, early drafts of papers would be posted for comments and criticisms (open peer commentary of E-pre-print), which could then be taken into account in further drafts. At some point the paper would be transferred to a journal's website (if the editors thought it had a chance of eventual publication). It might be made available on the basis of limited access (to specialist referees – closed peer review) or openly (for anyone to make comments, open peer commentary). At some point the raw data from the study would also be posted on the Internet. After further revisions the electronic version of the paper would be given the journal's go-ahead for printing and made available simultaneously in hard copy and electronic form (publication).

The British Medical Journal (BMJ)[754], too, planned open peer commentary (on a limited scale, though). The comments received should have served as a basis of the editorial decision just as traditional peer review reports would have done (Harnad 1998a). This idea has, however, never been implemented. What the editors of BMJ now call "open peer review" is not open in the sense described above (that is without pre-selected referees), but instead non-anonymous refereeing. However, one of the editors was envisaging the BMJ to go further:

> "Soon we will probably start to list reviewers at the end of articles. Then we may move to a system where authors and readers can watch the peer review system on the world wide web as it happens and contribute their comments. Peer review will become increasingly a scientific discourse rather than a summary judgement. Through such openness we will hope to show that peer review by journals does add value to the scientific process and that we will thus have a place in an electronic world where authors can potentially go straight to readers." (Smith 1999)

The overall idea of these various systems is to increase transparency and openness of the review process and to broaden its basis while, at the same time, guaranteeing a fair and targeted review process. Technologically, such models are now feasible.

8.2.1.3 Differentiated refereeing standards

The digital publishing environment allows for various levels of quality standards to be included in the same archive. Two proposals have been put forward with a view to having explicitly, differentiated refereeing standards:

(1) In the context of a scenario in which academic communications will be hypertexts, "refereeing standards can be improved as they can be defined as a function of the module" (Kircz/Roosendaal 1996, 10). While at present, articles are peer-reviewed without any discrimination between the various kinds of information in them, in a "world of well-defined modules, the refereeing standard for a module Method will be distinctly different from the module Data-acquisition. Thus, quality control will go up." (Kircz 2001). Differ-

[754] <Cyberlink=309>.

ent experts may also referee different parts (modules). This fragmentation[755] should, however, have its limit. In order to guarantee, nevertheless, an appropriate integrative appraisal of the whole work, taking due account of the interconnection of all parts, an additional supra-referee would have to be appointed who overlooks and integrates the partial assessments.

(2) Electronic archives provide the opportunity to publish scientific content that would not be accepted in a traditional journal, not because it does not meet the required quality standards, but because it does not fit the 'line' of a journal or simply because it is too long. For example, E-Biomed[756] should also include "the description of experimental work, from both laboratory and clinical investigators, that lacks definitive or 'positive' results" (Varmus/et al. 1999). While such material is unlikely to be accepted for publication in most current journals, it would often be useful to others contemplating similar experimental approaches. Even though many may continue to look only at the refereed content of the archive,

> "the option of seeing all available information in a field (...) is a powerful incentive for those who are willing to look more broadly. At present this is a nearly impossible task, because results are presented in so many journals that are difficult to examine, because they are offered only at individual websites that are not surveyed by convenient search engines, or because they are not publicly available at all." (ibid.)

In both cases, quality would be controlled, but not at equal levels to allow for access to innovative or otherwise useful material.[757]

8.2.1.4 Selection of reviewers

Two interesting proposals have been made as regards the future selection of referees: (1) the burden sharing among referees, and (2) the electronic peer hierarchy for skywriting[758].

(1) The new means of communication facilitate improvements to the traditional refereeing procedure (Harnad 1998a). The distribution of the load among referees can be made more equitable and perhaps more impartial if the editor formally invites a large population of selected, qualified experts. While this is rather impractical in an offline mode, the network offers the possibility of "electronic surveys of the literature, citation analysis, even posting Calls for Reviewers to pertinent professional experts' bulletin boards" (1993, 7). A possibly field-wide database of experts could be generated supporting the editorial boards of journals and book series.[759]

(2) Given that the archiving of scientific findings is on a continuum already, with varying degrees of formality, reliability and even of peer validation, one could transpose all of this into the electronic dimension as well by organising a "vertical peer hierarchy" for skywriting. This would be a

> "pyramidal hierarchy of email groups, the height of each depending on degree of expertise, whether in a subspecialty, an entire discipline, or even an interdisciplinary field. An accredited group of peers at level i would have read/write access at level i; those at level i-1 would have read-write access at level i-1 and read-only access at level i but with the right to post to a read-write peer at level i who could in turn post their contribution for them, if it was judged good enough. An indi-

[755] My colleague H. Torgersen suggested the term "refereeing Taylorism".
[756] Now BioMedCentral (<Cyberlink=226>).
[757] At the same time, this model is increasing transparency (cf. 6.4.1.4 and 10.4.4).
[758] That is the extensive writing for academic discussion lists; cf. 7.2.4.4.
[759] To make this work, such a system would have to be backed by a new incentive structure (cf. 8.4.2).

> vidual with an established record of valuable mediated postings could eventually be voted up a level. (...) This vertical hierarchy would be based on the contributors' degree of expertise, specialization, and their record of contributions in a given field. In principle, the hierarchy could trickle down all the way to general access groups for nonspecialists and students at the lowest read/write levels." (Harnad 1990 3f.)

This proposed peer hierarchy in E-lists would be paralleled with a corresponding hierarchy of archival media, i.e. E-publications, in which the products of skywriting in these discussion groups are being refereed the usual way and then published. This will have to vary from field to field: in mathematics, for instance, there seems to be no need for this type of filter (Odlyzko 1994, 29).

8.2.2 New forms of ex post quality control

In the traditional paper-based academic publishing environment, only ex ante quality control is feasible. If something turns out to be erroneous or to need qualification, it nevertheless stays part of the published "body of knowledge". There is no way to delete ex post a text printed and distributed around the world. Nor would it possible to tag the contribution saying that the content "should be handled with care". Cyberscience, instead, provides for a variety of ex post mechanisms that could do exactly this.

As a first alternative, I should mention that already today (and even more so in the future), most researchers access publications not directly through browsing the shelves of a library, but by scanning the results of an online query in a bibliographic database. One simple, but dangerous way of deflecting from false results – no matter how this might have been established – would be to remove the item from the "first layer" of the database. The effect of this would be that the item would not be found any more (except if the default settings are changed explicitly; see 8.2.3 for a discussion of the issues involved in quality filters). Other alternatives possible in the digital environment leave the publication and the bibliographic entry untouched, but let readers (as well as the author) attach comments of various sorts. Subsequent readers may use this added information for their own assessment of the content. In the following, I shall discuss three such novel mechanisms: annotation (8.2.2.1), rating (8.2.2.2) and use tracking (8.2.2.3).

8.2.2.1 Online (ex post) commenting/annotation

Quality control might also be provided after publication by reader comments (or annotations) that the new technology could 'attach' to any given article. This may be organised for self-published manuscripts (pre-prints) as well as for articles formally published in E-journals (with or without[760] traditional refereeing and even after an open peer review phase[761]). The necessary technology is already developed and various experiments are under way, for instance with D^{3}E as used by JIME[762]. On a global level, the WWW Consortium in the Semantic Web initiative has taken up this idea (cf. 2.2.2.1). In particular, the Annotea project aims at enabling annotations to web documents worldwide, either in

[760] In German studies, Nathenson (2001) proposes a combined E-journal/E-forum which would publish virtually everything submitted, but at the same time ex-post scrutiny by the community of peers by opening up debate and discussion about the manuscripts.

[761] This is in fact the model of JIME as discussed in 8.2.1.2, cf. point 13 in Overview 8-2.

[762] <Cyberlink=57>.

public or for private or restricted use.[763] Attaching comments may be global, that is to whole documents, for instance in a related, threaded E-list linked to the document[764], or very targeted, that is with a link to individual paragraphs or even words in the full text.

The idea is that positive comments would probably make an article more significant, while negative comments (or no comments) would probably encourage its marginalisation. LaPorte et al. (1995) exemplify this in their well-known article "The death of biomedical journals" with the plan of a "global health information server" where papers would get a public comment card: "If papers are poor, then the scientific community will most certainly indicate that they are poor; this is the nature of science, and this is the nature of the internet." In fields like law (which has mainly editorial, not peer review), the 'peers' would be "individuals sufficiently interested and informed about the article's subject matter to have read the article voluntarily" (Hibbitts 1996a, 4.7). Each review would rate an article without (as in the current system) forcing its (perhaps premature) suppression due to a negative verdict of the reviewers (see also Tomlins 1998, discussing Hibbitts proposal). In such a system, each reader can have the critical warrant that has been the prerogative of the traditional referee: "canonical status may now be assigned on the basis of consumer assessment, not papal fiat" (Davenport/Cronin 1990, 186).

The comments are stored together with (or at least directly linked to) the paper which becomes a "living document" (Odlyzko 1994, 28). This could be combined with a system allowing the author to submit, from time to time, a new version of the paper including or taking due account of the comments. The project for collaborative text production OpenTheory[765] does something similar: the main author provides for a consolidated version of the common text from time to time which will again be commented, paragraph after paragraph, until a consensus is reached. This liveliness – or fluidity as I called it in section 6.4.1.3 – of future E-publications is remarkable.

The subversive potential of ex post commenting challenges how the questions of "what is scholarship and who is a scholar" (Nathenson 2001, 3) are decided today. Whether the quality of the collective assessment – which certainly includes evaluations of people with insufficient knowledge – meets the quality of appointed referees is an open question. It reminds us of the debate about democracy and whether, for example, a plebiscite can be a valid alternative to expert decisions. This is not only an ideological question. What we can learn from this parallel discussion regarding the political sphere is, inter alia, that minimum thresholds may play a role. Similar to political votes which may not be valid because too few people participated in the voting, one could think of designing ex-post quality control systems that do show comments, and ratings (see below), only as soon as a minimum number of people have registered their comments. This is, however, a very tricky issue and needs in-depth pondering and testing. A related issue to consider is that commenting, and again ratings (see below), may lead to what may be called "mainstreaming". While at the same time enabling dissenting opinions to get published at all, "fishing" for positive comments and ratings may tend to favour less controversial contributions. Again, the effect is possible, but difficult to be evaluated in advance without practical experience.

[763] According to Marshall (1998a), "annotation" is rather used for personal notes to be stored with the document in a digital environment, but not to be published. However, the Annotea project (<Cyberlink=741>) of the W3C deploys the notion for both individual and public notes attached to web documents.

[764] D³E (<Cyberlink=57>) has in fact a so-called "ubiquitous" version which allows setting up a discussion list very easily for whatever web document you want. The threaded discussion is displayed in one half of the screen window whereas the related text shows in the other half.

[765] <Cyberlink=50>.

8.2.2.2 Rating/scoring

Commenting as discussed in the previous sub-section is but one form of reacting to published manuscripts. It has two "disadvantages": first, commentators have to write new text which takes time and needs more in-depth reflection; second, subsequent readers, too, need time for orientation as they have to browse through all comments with a view to making sense of all of them before being in a position to decide whether they should go on reading the main article. Either in combination with commenting or independently, "rating" (scoring) has been proposed to solve these two problems. Rating is giving marks by readers (Alton-Scheidl et al. 1997). The marks are collected and means are computed. The current results are offered to the reader. Some argue quite radically that sophisticated, democratically legitimised rating or scoring systems could deprive the "traditional evaluation elites" of their power.[766]

This idea has already seen some proliferation in the non-academic world, for instance in online bookstores such as AMAZON[767]. An academic example was the interactive common bibliography database GOLA[768] of the German Society for Online Research, which allowed users to rate entries in the database. For journal articles, it is conceivable to combine a rough screening procedure to exclude "libellous, salacious, or otherwise unsuitable material" (Varmus/et al. 1999) with a commenting and rating procedure. Rating may also play a role in the context of E-mail lists with a view to making the use of E-lists more user-friendly, time-efficient and targeted. There are a number of technically assisted evaluation procedures (described by Rost 1998b; 1998c). Among them we find the newsreader "srln", which filters incoming messages according to user-defined criteria (for instance, who is the author, how long is the article); "GroupLens", which is based on user ratings; and Rost's own development of a more sophisticated scoring server (cf. 2.4.2).

The problem with rating is that it is difficult to control for participation. If everyone, including the author, may rate, even more than once, there is a big chance that we would end up with a strong bias and the result would be highly doubtful, if not unusable. In a closed system with all possibly participating researchers known and with strict access control (everyone having a user-id and password), it would be technically feasible to implement a semi-anonymous system. Such a system would allow checking that each member of the closed group (except the author) has exactly one voice without the individual ratings being de-anonymised. For instance, only the average rating may be shown.[769] However, it would probably be a major task to administer the groups' membership – something perhaps to be organised by the respective scholarly association. Another problem would be how to cope with controversial results. If a manuscript receives only positive or negative or medium ratings, a rating system computing averages would be helpful. But what about a paper that splits the community and gets very positive and very negative scores. The resulting medium score would hide more than it would reveal if the standard

[766] See already above in the previous section and e.g. Rost (1998b).

[767] <Cyberlink=795>; it could also be argued that the success of the Internet search-engine GOOGLE (<Cyberlink=760>) is based on some variant of (indirect) rating as the order of search results is determined by the popularity of a site, measured in terms of links pointing at it. Setting a link to a webpage is somehow equivalent to giving the target a good rating.

[768] <Cyberlink=38> (not active any more).

[769] Ratings could also be the basis for selective databases (cf. 8.2.3) which would only show, on a first level, articles with a higher ranking.

deviation (variance) would not be indicated, too. Another solution to this problem would be a more differentiated scoring system, for instance, a multi-dimensional rating scheme, that is not only one overall score.

Most advocates of scoring systems in academia, however, tend to see it as an add-on to other systems controlling for quality. The same is also true for the next innovation.

8.2.2.3 New perspectives for scientometrics: access and citation counts, use tracking

The quality of a publication can be and is already measured by its use, as well. In the paper world, use can solely be computed by counting sold copies of a journal or book. This is, however, very imprecise, as copies of journals or edited books contain several articles and as many journals go to libraries which have an indefinite number of users. Furthermore, it is indirect, as the sole fact that a copy is within reach is only a very rough indication that the article is actually read and used. In addition, one could manually count citations of a particular print article in other publications. While citations are already a better indication of the actual use of a publication – however still not a perfect one as the reason for citing an article can be quite diverse[770] – the practicability of this method is very limited.

Meanwhile, the advent of electronic bibliographic databases and automated text analysis allows for very precise citation statistics. This is the topic of a whole research field, scientometrics. A number of specialised organisations[771] administer huge databases that record and analyse precisely how often each article is quoted. One of the results of these computations is the so-called "impact factor", that is a measured value indicating the frequency with which the "average article" in a journal has been cited in a particular year or period. These figures may also be used to evaluate, indirectly, the quality of any particular article.

The advent of E-publishing has brought about new perspectives for scientometrics: one improvement to citation counts and three new variants on how to get to "hard figures" about the use of research results:

- *Online citation analysis*: If all publications included in the citation analysis are available online, and perhaps even cross-linked (cf. 2.3.4.3), it is much easier and more efficient to do the citation calculations (e.g. LaPorte et al. 1995). In this context, Cameron (1997) proposed a universal, Internet-based, bibliographic and citation database that would "link every scholarly work ever written – no matter how published – to every work that it cites and every work that cites it". As Cameron foresees, such a "citebase" could be a catalyst for reform in scholarly communication and a major improvement to scientometrics (Fröhlich 1999, 36).
- *Hypertext citation counts*: A hypertext environment with standardised meaningful (citation) links (cf. 6.2.3.2) would be in an even better position to make the bibliometric

[770] While automated procedures (see just below) are able to subtract self-citations, they are not able to differentiate between favourable and unfavourable citations. Hence, a paper getting many citations may, nevertheless, be of low quality as it is perhaps always only quoted as a "straw man", that is as an example of bad science as opposed to the quoting article. In addition, courtesy quotes as usual among the members of so-called citation cartels or among teachers and their students cannot be detected without in-depth knowledge of the specific academic community (for an overview on the critique of present scientometrics, see e.g. Fröhlich 1996b; 1999).

[771] E.g. ISI (<Cyberlink=488>) and PrestigeFactor (<Cyberlink=626>).

enterprise useful. Davenport/Cronin (1990, 187f.) argue that "achievements are less likely to be over or underestimated, as dissenting references can be distinguished from those which corroborate or confer assent." Hence, one of the major flaws of present crude citation counts could be avoided through differentiation.

- *Access counts*: Unlike in the paper world, there may be automatically generated figures available telling us how many people have already accessed and/or downloaded a particular digital document.[772] In this context, Denning (1996) speaks of "home page hits" as opposed to "publications in prestigious journals".
- *Use tracking* is more than just counting access, it is tracing and computing the degree to which different publications are used and in what ways. In other words, it helps us to know "the extent to which other scholars in the discipline (or scholars in other disciplines, students, and members of the general public) access the publication" (Atkinson 2000, 67). The data, which are automatically generated when someone connects to a server with a view to downloading an article, includes more information than only the sole fact of a "hit", that is the download. Inter alia, it also includes information about the address of the computer from which the download was requested.[773] This information could be used to establish crude profiles of the users of that document. These profiles could be much more precise in a closed system where each user would be identified when logging in. Indeed, Atkinson (1996, 256) proposes tracking the history of the use of information units in what he calls "the control zone" (cf. 8.2.3). In this online environment, the use of all objects could be tracked and such use could even be differentiated by user group. We would be in a position to answer questions like, which items have been read (or at least retrieved) by which groups of readers (for example, members of academic departments in the field), which have been read by scholars in other fields, by students, by the public at large etc.?[774] With a view to indicating something about the quality of a piece, one might envisage even differentiating between the rank or standing of a scholar: if an article is widely read by those at the top of the hierarchy, this might be taken as an indicator for quality.

All of these new tools for scientometrics are not without old (in the case of citation counts) or new (in the case of access counts and use-tracking) problems. To begin with, it still remains dubious whether counting citations or hits does indeed say something important about the quality or performance of a scholar (e.g. Remler 2000; Fröhlich 1999). This will remain a hotly debated issue without particular connection to the digital medium as such.[775] As regards access counts, in particular, there are still a number of technical problems to be solved before access figures would be of any use at all. It is relatively easy to stimulate hits on a web page or even generate them yourself, mechanically. How-

[772] Note, however, that real access counts can only work in a closed environment, that is with password-protected access, not in the open Internet because of "caching". Both users' browsers and specially devoted caching servers store once retrieved files with a view to minimise web traffic. If the user receives a copy from the cache, the original server is not in a position to count the actual access because it is never informed about it.

[773] That is the IP address (cf. 2.1.2). These addresses follow a certain scheme that allows, at least to some degree, to say to which domain the computer belongs, for instance to which university, in some cases even to which person.

[774] In order to make the use-tracking results as reliable as possible, the implementation of the "control zone" would need to be rigid as regards open access. Users, for instance students, would have to identify themselves when accessing the zone from multi-purpose terminals in library spaces, or via a WWW access from outside campus.

[775] Cf. already fn. 770.

ever, if the practice of measuring web hits becomes important there will be ways to study adequately patterns of hits that represent real interest, and to extract useful information from these observed patterns (Ullman 1996).

Furthermore, not all access is alike. A quick visit to an online article (perhaps just looking at the abstract and then deciding that it will not be used) would have to be differentiated from a long look at the full text or a download (Rohe 1998, 2). With certain limitations, this would be technically feasible.

While counting anonymous hits does not involve a danger for privacy, use tracking (as described by Atkinson 1996, 256) has such a potential. While the use tracking computers would have to be in a position to match use and identity to make use tracking possible, it would be necessary to prohibit these sensitive data from being disclosed. They should only be presented in anonymised and cumulative form. However, even if this were the case, it might still be possible to find out exactly who read what on an individual level since there may only be very few people of a certain category. While this problem is also present in today's anonymised peer reviewing where the reviewer can often guess who the author is, generalised use tracking may be used to make much better guesses, in particular if data mining techniques are applied (cf. 2.2.2.3).

In conclusion, the digital environment makes it possible, at least in principle, that scientometrics may replace expert judgement in evaluating a scholar's output as well as the quality of a paper. It has been argued that citation ranking and expert judgement of scholars are highly correlated (So 1998). If this scenario becomes reality, the slogan "publish or perish" would be changed to "get hit or get out". While counting papers is certainly no perfect indicator, "since almost anything can be published if one finds the right journal or conference, the web allows us to measure something that couldn't before be measured: readership" (Ullman 1996). In the long run, citation ranking and use tracking have the potential to fully replace ex ante quality control. In the medium run, they might be a useful add-on to current quality checking mechanisms.

8.2.3 Quality labelling, selective databases, levelled archives and the "control zone"

> "But there remains a pressing need for organization of intellectual value-added, which by definition cannot be automated even in principle, and that leaves significant opportunities for any agency willing to listen to what researchers want and need."
> (Ginsparg 1996, 8)

> "We expect to see a clearer separation of reputation, with all that a reputation is worth, as professionally managed electronic media distance their offerings from the Web sites of hobbyists, amateurs, and cranks."
> (Regier 1997, 8)

Readers of academic publications seek instruments to unburden them from filtering through everything published and pertaining to the field of enquiry. As we have seen, quality control is one of these instruments (cf. 8.1.2). In the paper world, it is the name of the journal or publisher that gives the initiated some indication as to the quality to be expected. If you know the journal, you know what refereeing system is applied. In a bib-

liographic database, there is no other way of finding out if you do not know the journal. Only if it is a highly selective database, like the S(S)CI[776], then finding a quote in the database is an indication that it belongs to a journal which has been found worth being in the database, at least at some point in time. Many think that this traditional system did not cope with the need for filters in an optimal way. Some argue that the filters were both too rigid (they filter out too much) and elitist and conservative (Rost speaks of "guild organisations" in academia). In this view, the present filtering technology is primitive and deficient; therefore, a new technology is needed in order to be able to intelligently select publications (Rost 1998d, 8). For the development of an intelligent selection mechanism, the complete digitisation is an important precondition (1996c, 174).

Indeed, in an online environment with large archives of full texts we can go well beyond the present state of affairs. There are many such proposals.[777] Adding labels to each item in a database or archive has two immediate advantages: first, the human reader is in a position to know what control gates each individual item has already passed; and second, this information can be used for semi-automatic retrieval by knowbots[778], but also by filters set when retrieving bibliographic entries from the database (Nentwich 1999b). The following elements of a labelling system have been proposed – I distinguish between strictly related to quality (1) and those related to content (2):

1. Related to the quality control system:
   - Simple distinction between *refereed (i.e. published) and not refereed*, that is, whether or not a paper has an "academic seal of approval" (Okerson 1997c) or "electronic watermark" indicating certified cyber-documents (Thatcher 1996, 203).
   - The *type of quality control system* applied (Sietmann 1999, 231); e.g. whether or not a paper has passed a refereeing processes of one of the accredited editorial boards or was simply "screened" by a board (Varmus/et al. 1999)[779]; also how rigorous the quality control was could be indicated as in the "bronze, silver, and gold areas" proposal by Lesk (1997, 13); furthermore, it could be indicated which editorial board, which journal has approved a paper[780].
   - *With or without evaluations* (Odlyzko 1994, 29): the evaluations of appointed referees would be added to the papers; one could filter out those without evaluations.
   - *Refused work:* Quality labelling may also include the possibility to make rejected material available "as a salon des refuses, a working model of what is not currently acceptable, but possibly a latent resource" (Davenport/Cronin 1990, 187).
   - *Access figures* (cf. 8.2.2.3): apart from pure figures, "the relative 'significance' of objects, as defined by the number and type of readers who have previously accessed them" (Atkinson 1996, 254f.) could be displayed and used for filtering, too.
   - *Reader ratings* (cf. 8.2.2.2); it could be possible to filter out all papers below a certain rating.

[776] <Cyberlink=488>; there are many other selective databases in the Internet, e.g. ERPA (<Cyberlink=215>), for a description, see Nentwich (1999b).

[777] In no particular order: Sietmann (1999); Okerson (1997c); Odlyzko (1994); Varmus (1999); Harnad (1998a); Ginsparg (1996); Thatcher (1996); Armstrong/Lonsdale (1998); Denning (1996); Pew Higher Education Roundtable (1998); Lesk (1997); Atkinson (1996; 1993, 206).

[778] Semi-automatic knowledge robots (cf. 2.2.2.2).

[779] In the final implementation (BiomedCentral: <Cyberlink=226>), the rough screening procedure has been dropped, manuscripts are put online immediately and solely the addition to the heading "provisional" indicates that it is still in the queue for refereeing.

[780] Harnad (n.y.) refers to a co-operative arrangement between the American Physical Society (APS) and the physics archive.

2. Content-related:
   - *Overall importance* as assessed by approved editors; in particular, whether something is an "essential read" could be indicated[781]; also in Atkinson's control zone proposal[782] writings would be singled out "that experts in the field (editors) endorse and recommend to other experts to read" (1993, 206). Note that information would not necessarily have to be attributed once and forever, but could be "dynamic" in the sense that descriptions could be added also at a later point in time.[783]
   - Type of paper in terms of *intended readership*: for instance, whether a paper is educational review material accessible to outsiders/students (Ginsparg 1996, 6); Atkinson calls this "work level", which should "differentiate information objects by their level of difficulty or specialization and should indicate to the reader in effect how much he or she needs to know about the topic in order to make use of that particular object" (1996, 257).

Summing up, a digital and networked publishing environment allows the creation of archives and databases that contain not only the bibliographic information and the full text of the published manuscripts, but as well indications about the level of quality control it has passed. As a first step, a differentiation between non-reviewed working papers and refereed publications could be made. But there is the potential to go further to indicate the exact amount of quality control applied (editorial screening, editorial review, double blind refereed, open peer reviewed, ex post commented and user rated etc.). The search-engines could make use of these additional meta-data with a view to providing filter mechanisms that allow the user to retrieve either all or only those items above a certain level (or items that belong to a certain category).

8.2.4 Miscellaneous new aspects

Apart from new developments as regards the procedures of quality control, cyberscience may also impact in other ways on the system of quality control as a whole: the quality control process is accelerated (8.2.4.1); the amount of non-reviewed publications has increased (8.2.4.2); the origin and status of publications is obfuscated (8.2.4.3); and plagiarism is both enabled and complicated (8.2.4.4). These potentials will be discussed in the following.

[781] Cf. Ginsparg (1996, 6); similarly Pew Higher Education Roundtable (1998, 8); in this Pew proposal, "multi-levelled web sites" would have at a third level a selection of particularly significant papers.

[782] Atkinson's "*control zone*" (cf. already above 8.2.2.3, as regards use-tracking) would be "a single, virtual, distributed, international digital library, a library that has (conceptual, virtual) boundaries, that defines its service operationally on the basis of the opposition between what is inside and outside those boundaries, and that bases that service on the traditional social ethic that has motivated all library operations in modern times. The academic community must consider, in other words, the creation of a control zone (...) understood as something that is technically and conceptually separate from the open zone." (1996, 254f.)

[783] In the words of Ginsparg: "There could also be retroactively added descriptive information, 'this paper was important since it drew upon a, b, c [hyperlinks to sources] and led to new developments x, y, z [more hyperlinks]' to provide a further guide to the literature. Or the interface could point to a specific paper as having been important, but warn the beginner to go first to a later paper by the same (or other authors) that subsumes, extends, or corrects the same results in a more understandable fashion; or this paper generated much attention but skip it since the fad played itself out and people returned to more serious pursuits. The literature need not be frozen in time as in the paper medium, but can remain as fluid as the research itself." (1996, 6)

8.2.4.1 Speeding-up

ICT has a potential to speed up the review processes. While the referees will still take their usual time (Odlyzko 1994, 46), the overall time for quality check will be reduced by electronically distributing manuscripts for reviewing (either by E-mail or via a website where the referee accesses the electronic submission in the pre-print archive directly) and electronically processing the opinions and related correspondence (Appel 1996). The OECD report (1998, 214) estimates the time "elapsing between submission and the journal's offer to publish and between ultimate acceptance and publication [to] dwindle from the current months to days (or even hours)"[784] (cf. already 7.2.1). A number of projects have developed software to help the editorial process to become fully electronically and faster (cf. 2.4.4.2). It seems almost impossible to go back to the previous slow paper-mail system since we are all already accustomed to the new speed.

Furthermore, E-publishing contributes to increased turn-over of publications which may make already published material look outdated sooner with the effect that it would not be quoted any more. Quality may become more related to timeliness: only the most recent publications *seem* to be up-to-date and worth quoting. By this token, in some disciplines, books have already lost their "value" since, obviously, they cannot include the most recent developments in the field due to time lags in the production. This is indeed different with online publications with rather short production cycles.

8.2.4.2 Increase of non-reviewed publications

Today, in the beginning area of cyberscience, an increasing amount of papers that have not yet undergone any process of quality control involving outsiders of the core research group is "published" (in the sense that it is made widely available). This is in contrast to the earlier habit of only "distributing" copies by hand among a few colleagues (which cannot be rated a publication, yet, cf. 9.2.1.2). The prime example is physics with the physics E-pre-print server (cf. 7.1.2). But there are numerous further examples of such archives as well as genuine self-publishing endeavours on individual homepages (cf. 7.2.4.2).

8.2.4.3 Obfuscation of origin?

Due to the increase of non-reviewed publications (above) and the overall increase of available material (cf. 7.1.1) in the Internet, quality in terms of status and origin can be said to be more difficult to detect. Layout and appearance may be misleading in the WWW, as it is easy to copy and to make something appear a professional site. Also the Internet address is not always telling, as it is relatively easy to "buy" domain names. Hence, origin and quality are not immediately perceptible. What is then a trusted source? As Atkinson notes:

> "All locations become relatively equivalent on the network: they lose their difference, and therefore their significance. (...) The network by virtue of its endemic neutrality encourages the reader to view all texts as current and all authors as contemporaries." (1993, 204)

While previously, you had to be in command of a relatively expensive apparatus (a publishing house) to produce scholarly publications, this is not the case in the digital age any more. Academia will have to cope with this by quality labelling and/or Atkinson's

[784] The latter ("hours") is certainly an extreme as it presupposes that the selected referees are immediately available – certainly not a standard situation.

"control zone"[782], or trusted source collections (cf. 5.3) which would allow the academic reader to do his/her research in a trusted environment. In any case, academics will have to acquire new skills to cope with the new environment (cf. 5.1).

8.2.4.4 Plagiarism and priority claims

The availability of publications in digital format allows for easy "cutting and pasting"[785] which is very convenient for extensive quoting, but also has the inherent increased danger of *plagiarism*. In particular, this seems to be a growing problem with theses and dissertations (Armstrong/Lonsdale 1998, 19) or with students writing their home assignment essays with the help of official homepages, scholarly online articles or even online collections of student essays (cf. 2.4.8, last para.). Among academics, some argue that this is probably no real problem: "theft of ideas may be 'an academic equivalent of a monster under a child's bed' – frightening, but with no real substance" (Peters 1996, 5). "Cyberspace pirates" (Peters) waiting to copy and pass off as their own an idea for an academic article may not exist. The plagiarism argument has even been turned upside down: the fact that it is much easier to cut and paste from each other works could trigger a new form of dynamic cooperation which could be accepted and appreciated as an advancement in communications (Kircz 2001, 9f.). For sure, this argument is based upon a different picture of science and research than hitherto, namely that of a collective endeavour, solely aiming at the advancement of knowledge, regardless of who is making a contribution – a picture not likely to become dominant in the near future.

It is important to note that, in principle, technical solutions to the plagiarism challenge are possible: "Whatever increased power the Net may provide for stealing texts, it more than matches with its power for tracking them down." (Harnad 1998b, 127) There is already software available that enables us to find out quickly whether large portions of a text are in fact just copied from other Internet sources.[786] This is particularly helpful for academic teachers marking students' essays. In combination with an institutionalised complaints procedure (perhaps with academic associations) it may also be a way to avoid undue quoting without making a reference. Technology alone would be not sufficient, as it has to be backed by an adequate organisational setting. Plagiarism is no inherently technical problem but, as all misconduct, it is a social problem because "people can always retype, steal and add fraudulent data" (Kircz 2001, 9f.).

The E-publishing environment also makes decisions upon *priority disputes* much easier (Davenport/Cronin 1990, 187) because the exact date and even time of publication can be recorded, at least in principle. As it is possible to fake the date in the digital environment, this would only work in a controlled network with trusted institutions (e.g. scholarly associations) to guarantee its reliability. Harnad's "vertical peer hierarchy" proposal (see 8.2.1.4), for instance, could be combined with a "soft archive for all skywriting [which] could be used to authenticate priority where necessary" (1990, 2). It has been observed that E-pre-print archives also lead to the strange situation that research groups who worked independently and concluded their research almost, but not quite at the same time, will be credited more differently than hitherto (Merz 1997, 260). The winner is clear

[785] In particular, E-publications in the standard format of the Web, HTML, and even more conveniently in MICROSOFT's Word or RTF formats allow this. Documents in ADOBE's PDF format can be locked for copying, but often this is not blocked.

[786] <Cyberlink=811>.

due to the "time stamp" of the E-archive, whereas the second might not be able to publish the results any more (although this is not plagiarism). This was different before the advent of the E-archives since the second group did not have to know from the earlier results of the first group. On this synchronisation hypothesis, see 4.3.5.4.

8.2.5 Outlook

The developments discussed in the above sub-sections are only in the making. First experiments have taken place, some of the new practices are already well established, however only in tiny islands, not least because of the still small spread of genuine E-publishing. A final assessment of the impact of cyberscience in this respect is hence not yet possible. What I can say at this point, however, is that the electronic media have the potential to challenge established traditions.

Some argue that we are heading towards dynamic, never finally reviewed and constantly commented publications based on open peer commentary. This would certainly lead us to re-think the informal and formal systems of scholarly communication. Perhaps wide diversification in all fields lies before us with "electronic conversations, squibbs, mega-journals, consensus journals[787], and models not yet dreamt of" (Okerson 1991b, 9). The more timely and communicative forms of publishing as opposed to document presentation in a final archival form, after lengthy and hidden deliberations would make "explicit other aspects of documents such as timeliness, history, and intellectual lineage" (Sumner/Shum 1997, 7). This may ultimately lead to a situation in which readers, due to an enriched "context readily available and integrated into the document form, (...) are in a better position to judge for themselves the work's relevance and quality".

In the next section, I shall assess this potential by looking at the possible path to a future quality control system.

8.3 The path to a cyberscience certification system

> "Because of the lower production and distribution costs of the electronic medium, more resources are available for quality control."
> (Rey 1996, 133, transl. MN)

It is obvious that today's quality criteria for academic work (cf. 8.1.1) will be of importance for what is in the making for the future E-based publication system as analysed in 7.3. As Raney puts it, the "message should be clear: No matter the medium, quality cannot be sacrificed for the sake of lesser factors" (1998). The developments described in the previous section (8.2) may be considered as a rich tool-kit by which the future system will be built. For sure, there will be huge differences between the various disciplines and

[787] In the context of the discussion about new forms of open peer review, Stodolsky proposed the so-called 'consensus journal' (1990). This is a special case of an 'invitational journal', i.e. a journal to which one does not submit ready-written articles but where the journal editor invites contributions. Authors to consensus journals are selected by a consensus calculation (carried out by the mediator, that is the editor) among those who send in reviews to previously published articles.

fields, depending on working practices and existent quality control traditions (cf. 3.3.6). The often cited model of physicists is certainly no general model for all fields (OECD 1998, 215). However, the differences in their assessment of quality are not so big that it would not make sense to analyse in general terms the path towards a sustainable certification system. I shall begin with a discussion of the argument that more quantity and speed would necessarily lead to less quality (8.3.1). In a second step, I shall stand up for re-establishing and reforming peer-review in the digital realm (8.3.2). Finally, a few implementation issues will be discussed (8.3.3).

8.3.1 Does E-publishing lead to less quality?

> "(E)lectronic publication does not in any way prevent the maintenance of present publishing standards."
> (Odlyzko 1994, 20)

The often heard argument included in the heading comes in various forms and goes as follows: The Internet would enable more people to publish because easy-to-be-attained skills would suffice to put something online (E-self-publishing, cf. 7.2.4.2) whereas previously researchers needed the help of costly professionals. Additionally, publication would be much faster (cf. 7.2.1) but therefore could lead to premature publication of unfinished work. Furthermore, the computer would facilitate "copying and pasting" activities (cf. 8.2.4.4) leading to more publications without necessarily more content. All this would necessarily bring about mass production with low quality (cf. 8.2.4.2).[788]

Although there might be some "pull effect" because of the fact that it is easier to publish electronically and to bypass the traditional quality checks, this argument is not convincing but can be refuted by a number of counter-arguments. (Note that I am not talking here of "quality" in a normative sense (cf. 8.1.1), but rather have in mind a concept of equal or different "levels of quality control".)

First, "not reviewed" does not equal "no quality" as the prospect of later publication may have *anticipation effects*. One can speak of a "self policing" (Harnad 1998a) effect, as the "invisible hand" (1995, 5) of peer review is also present in this allegedly non-refereed archive since all papers are destined to later appear in journals and hence are written in a quality which might satisfy the future editors and referees. For the physics archive, it is generally acknowledged that peer review operates in an informal way (e.g. Odlyzko 1994, 26). But there seem to be safeguards against bad research in other disciplines as well. Answering one of the concerns against the E-Biomed project (namely that it would encourage the deposition of vast quantities of valueless or erroneous information in a public repository) Varmus et al. (1999) argue that only "few scientists would knowingly put such information into the public domain, because it would soon diminish their reputations". A similar assessment comes from the humanities: Under an E-publication model

[788] Most researchers interviewed for this study, when asked whether E-publishing would lead to more output in terms of more publications, were not uniform in their answers. Except for the historians in the sample who agreed unanimously, all others were split. The majority, however, agreed to the hypothesis that publication numbers are positively correlated to E-publishing. Most interviewees could, however, not have much experience with E-publishing, as it was only just starting in their fields. Therefore, their answers have to be taken as opinions rather than expert judgements.

with ex-post quality control "where the measure of a text's value comes *after* publication and is left to the sole discretion of its readers" (emph. in orig.) it is doubtful whether anyone would risk such exposure "recklessly" (Nathenson 2001, 3). There are studies showing that when students are asked to grade each other the failure rate would be much higher than when marking is left to the professors. "Thus, while an e-journal would be more democratic in its evaluation procedure, there is likely to be no significant increase in texts 'published'." (ibid.)

The OECD report comes to the conclusion that the assessment of (the appropriateness of) non-reviewed E-pre-print should depend on the working practices in the specific discipline. Where research evolves around a limited number of expensive instruments and involves large collaborative research groups and long time horizons are involved (such as in high-energy physics), the research has been extensively reviewed already before submission to a journal. In this case, the reviewer is unlikely to find major conceptual errors and is also unlikely to add much in terms of editing. Furthermore, the risk of plagiarism is reduced as "the scientists involved are few, well-known as access to the equipment is extremely restricted, and the time to publication is very short" (OECD 1998, 213). By contrast, where research is fragmented, the assessment will be different. Hence, the problem of less stringent or no quality control when it comes to pre-print archives "may turn out to be more acute for psychology than for physics whose journals have lower rejection rates than psychology journals: a physics paper is probably going to end up published anyway" (Thagard 1997b).

Second, a high proportion of the *increase in scholarly publishing* is not due to E-publishing, as we have seen in 7.1.1, but *a general phenomenon* with many roots. The perception that the digital medium has something to do with it is largely due to the fact that it has improved access to these masses of publications, in particular to the many working papers. However, as we have seen in 7.2.2, improved access is at the same time a powerful tool against information overload. Furthermore, we should not forget that even in the pre-cyberscience era, the addressees of working and conference papers knew very well that these were drafts without institutional guarantee that they had undergone some sort of quality control system and had to be treated as such.

Third, multiplication of publications is not always a negative thing and cyber-publishing may be *used in innovative ways*. For instance, writing for different audiences seems perfectly legitimate (cf. also 6.2.3.3). More importantly, there is a strong case for at least a partially non-refereed "zone". Some do not see any danger in producing more, in supporting more discourse (i.e. in the form of skywriting), to the contrary: The so-called "publication flood" is less of a problem than ignoring the potential and importance of new ideas – the essence of academia (Rost 1998a, 3). Probably a large amount of information gets lost in the conventional peer review process, because the end result is only "a single one-time all-or-nothing binary decision" (Ginsparg 1996, 6). While this may somehow be adequate for the purpose of validating research for job and grant allocation, one may argue that it would provide only little benefit to the readers. The latter are "forced to perform the majority of the selection on their own by some set of additional criteria, and their primary need is simply access to the information as quickly as possible" (ibid.). Note, however, that these authors are not advocates of "no peer-review at all", but propose a layered system in which a complete raw archive forms the basis (see 8.2.3). While

such multi-tiered systems in the interest of an open research-based knowledge production seem quite likely to be consensual, more radical proposals are more disputed.[789]

Last and most importantly, quality is much *more a question of the quality control systems in place than one of medium*, quantity and speed. Therefore, it depends primarily on the publishing norms in each field (Odlyzko 1994, 20). As soon as an article passed the check, speed of publication or the fact that it adds up to an ever-increasing quantity does not alter anything with regard to the approved quality. There is no difficulty, in principle, to set up quality control systems in an electronic world. The question is: Will they be put in place? And the preliminary answer is simple: Why not? The evidence is abundant that serious E-only journals (not to speak of the P+E-journals, which have taken over their traditional system anyway) all perform serious quality checks. Many see a natural need for quality control in academia (this is not least exemplified by the fears of those who have put forward the initial argument that it might be in danger because of E-publishing). However, there is no reason to believe that academia could not establish quality control in cyberspace. Given the various new opportunities (cf. 8.2), it is likely that the traditional systems will adapt and develop further. As we shall see in 8.3.2, the digital environment will even help to address some of the shortcomings of the present system. In particular, coping with the overall increasing output of academia might be done more efficiently in cyberspace than with the bottleneck of the traditional peer-review system.

8.3.2 Re-establishing and reforming peer-review

> "Peer review, scholarship's classical mechanism of quality control, is medium-independent: it can be implemented in the air as readily as on land or sea."
> (Harnad 1998b, 127)

While there are some voices arguing that academia could do without quality control altogether, there seems to be a consensus that we should not abolish, but rather reform the present system. Most commentators see no reason why the refereeing system with editorial boards should not be sustained in a digital environment.[790]

Indeed, there are already many examples in all disciplines of online publications with a strict peer review policy. For instance, the newly established BiomedCentral set up a system whereby editorial boards, whether already established or newly created, review the submission to the archive (Varmus/et al. 1999). Note that this is not only something to be considered in the context of publications, but also for scientific databases. "In all disciplines, extensive electronic distribution of scientific data has made it more difficult to categorise data according to quality, including the degree of review and certification. Gaps in quality control (...) have been particularly acute in observational sciences." (OECD 1998, 205) Therefore, the simplest answer to the question how to guarantee quality in cyberscience is that we take over established practices from the traditional paper world and even expand it to new forms of academic publishing (cf. 7.2.4). However, many ask why we should reproduce the paper-based peer-review system in the electronic world. They

[789] Also for law, Hibbitts (1996b, 2.21ff.; 1996a, 4.7ff.) advocates self-publishing with post-hoc open peer review as he sees in the present system of quality control rather an impediment to the advancement of legal scholarship.

[790] E.g. Davenport (1990, 187); Odlyzko (1994, 29); Stichweh (1989, 54f.); Harnad (1993, 5; 1997, 7).

argue that peer review as practised today is not the right way to go further and should be enhanced and reformed. According to Owen (2000, 8), for instance, Mode-2 knowledge production (Gibbons et al. 1994) and the mixed-mode communication require a more composite and multidimensional approach to quality control than is offered by traditional peer review.

Hence, it is quite likely that traditional refereeing will be transformed and reformed along the path into the age of cyberscience. Some of the new models and opportunities presented and discussed in 8.2 are highly attractive, at least for some groups of actors. Some of the advantages of a networked publishing environment are so convincing that almost everyone will use them. In particular, it seems not probable that the tools to speed up the whole quality control process (cf. 2.4.4.2 and 8.2.4.1) would not be universally used. This would mean that, sooner or later, quality control would be a process entirely administered on the Net. From there it is only a small step to actually attach the referees' assessment to the manuscripts, at first perhaps in non-anonymised form. Furthermore, at least for some types of papers (depending on disciplinary field), a combination of a closed peer-review procedure with an ex ante open peer commentary and/or an ex post commenting phase seems attractive. This may turn publishing from a unidirectional activity (which starts from the author, passes through a number of steps involving editors and referees, and ends with the readers) into a multi-dimensional communicative process with authors, editors, referees (appointed or self-selected), and readers entering a "multilog", moderated by the editor.

Given the new opportunities of attaching both automatically generated data about the use of a paper (cf. 8.2.2.3), user-generated ratings (cf. 8.2.2.2) and quality labels (cf. 8.2.3), all of them both readable for the human user and for search-engines and robots, integrated publication databases will become feasible. These would be highly attractive as one-stop services with powerful filtering mechanisms enabling the reader to browse and search through different layers of quality. However, this is certainly a big step and not likely to be taken in the near future. There are too many pre-conditions to be met before such a system could be implemented. In particular, E-publishing would have to be generalised, at least in the respective discipline, and it is only conceivable where pre-publication has a tradition (cf. 3.4.4.4). What seems likely, by contrast, is a gradual shift towards semi-automated and more transparent quality control systems.

8.3.3 Implementation issues

Along the road, a number of implementation issues will play a role. Here is a short list:

Quality labelling: Possibly there would not be any need to make quality labelling in any way obligatory (e.g. via scholarly associations) since there may be other means with the same effect in practice. In particular, social pressure may play a role. Not having a label may be interpreted as a hint that no quality check took place. Publishers might be inclined to apply such a labelling system with a view to promoting their products.

Handling of revisions: The new publishing system is likely to allow for subsequent versions of a manuscript (cf. already 6.4.1.3). The consequences for quality check need to be addressed. How far-reaching do the changes have to be in order to make it necessary to re-submit it for review? To begin with, it seems reasonable to ask "that each edition must be defined by the author as finished before it can be admitted to the control zone" (Atkinson 1996, 259). According to this model[782], only unaltered originals belong to the

core body of the digital library. However, more dynamic models (e.g. "living" hypertext structures) may have a place, too. While I hold that previous versions should remain in the archives (cf. 6.4.1.3), it would be apt to editors to implement reasonable policies when re-reviewing should take place (cf. 7.2.4.1 for the model developed for the Living Reviews in Relativity[791]).

Reward system for reviewers: Three cyberscience-related developments have led to an increased demand for more and faster reviewers. First, the overall number of publications increased (which is, however, only partly due to the advent of E-publishing, cf. 7.1.1). Second, there is the increasing perception that the publication system should be fast and long delays should be avoided (because it is now feasible, cf. 7.2.1 and 8.2.4.1). Finally, there is the need to make sure that referees take their jobs seriously and that at least some of the self-appointed referees comment in-depth, in particular in an open peer review environment. Some already speak of the advent of a review crisis, even if only indirectly related to the advent of CMC (e.g. Owen 2000, 3).

It is doubtful whether it would be possible to induce referees to be faster and equally reliable (Odlyzko 1994, 46). A few proposals have been made in this respect. For instance, financial rewards could be envisaged.[792] There are, however, also less expensive proposals. Part of the reward system may be the publication of (revised) referee reports alongside the published article (as proposed by Harnad 1998a). By this token, something more "tangible" is available for the scholar's record (to be assessed by promotion committees etc.). In addition or alternatively, the list of referees could be regularly published on the homepage of journals and publishers. While the option of financial rewards is obviously independent from cyberscience, the latter two proposals are – although, in principle, feasible in a printed environment – much easier to be implemented in the age of E-publishing.

Policies of scholarly associations, libraries and universities: The role of scholarly associations as regards implementing novel and reforming traditional systems is important. For instance, a network of editorial boards and scholarly societies could be made responsible for procedures and criteria (Atkinson 1996, 260). There are some hints that associations have already taken up the issue: Denning (1996) discusses the respective ACM policy. Also, the AAAS is aware of the problem (see AAAS 1998), discussing "what constitutes an 'accepted publication' in science in an electronic environment and what standards should be applied to make that determination" and "what will be the role and form of peer review in electronic journals". The Pew Higher Education Roundtable believes "that the World Wide Web sites of these scholarly and disciplinary organizations ought to play a major role not just in the dissemination of important work within the field but in the certification of quality as well" (1998). They propose "multi-levelled web sites" for these associations (cf. 8.2.3). Others underline the role of the libraries or, more generally, of the academic information services "to ensure that national – or preferably international – peer review structures are in place" (Atkinson 1993, 210). Okerson believes that

[791] <Cyberlink=237>.

[792] Stevan Harnad (2000) quotes the mathematical physicists John Harnad's recommendations on the subject of referee answerability and compensation: "(a) all referees should be paid to referee papers; (b) payment for a rejected paper should be minimal (say, $ 200), but payment for an accepted paper should be commensurate with the effort of seeing it through the successive revisions (say, $ 2000) to successful publication; and, to avoid the potential abuse discussed above, (c) if a paper is accepted, the name of the accepting referee(s) should be co-published with it, to share the responsibility, praise or blame."

"a paper published in a prestigious university database might eventually pre-empt the paper version, provided some network review mechanism is added" (1991b, 17; similar Lesk 1997, 13). In other words, the involvement of scholarly associations and universities may contribute to acceptance of E-prints. I shall come back to these policy issues in chapter 11.

8.4 Academic credentials for online publications

> "Yet the general perception is that electronic publishing is risky and that in fact, to receive tenure an assistant professor must play the game according to the traditional rules in the discipline, department, and at the institution. As more and more peer-reviewed journals are moving to electronic publication, though, perceptions and actualities may converge."
> (Langston 1996, 4)

Publications are the two-headed "currency" of science and research: they are both essential for substantive communication and for individual professional purposes, i.e. career promotion. It is the latter function, which interests me here. The present system of credentialing publications is characterised by

- a philosophy often labelled "publish or perish" (e.g. Pew Higher Education Roundtable 1998) which has a widely acknowledged tendency to lead to more quantitative than qualitative output. In the eyes of many academics, a significant proportion of what is published is of mediocre quality and is probably produced primarily to satisfy criteria for grants and tenure (e.g. Okerson 1991a, 2);
- a distinct hierarchy among the various journals, book publishers and other series in a field; as regards journals, in many fields, the so-called "impact factor" of a journal (cf. 8.2.2.3) plays a dominant role. In some fields, certain journals play no role whatsoever when it comes to evaluating job applicants and grant proposals (e.g. Ginsparg 1996, 4, for physics); international reputation can be acquired via publishing in international journals rather than local ones[793];
- the importance of monographs vis-à-vis journal articles in most fields of the social sciences and humanities as well as in parts of the sciences; the status quo is not without problems (in particular due to the economics of book publishing, cf. 9.1.3.2) and highly debated (e.g. Bennett 1998, 6); and
- a relatively low status of conference contributions (except in a few fields, including chemistry).

For job applications, tenure review procedures and grant applications, the following additional credentials, indirectly related to publishing, are taken into account:

- letters of recommendation by trusted senior researchers;
- the overall sum of grants received, that is of successful research project applications;
- recent activity levels, as acknowledged by assessors and/or measured by latest publications;

[793] Nunberg (1996a, 106) argues that, in the age of instantaneous world-wide E-publishing, it has become much easier – and hence irrelevant – to demonstrate that one's work had "an international reputation".

- but no direct reward for other forms of active participation, e.g. as discussant or commentator in workshops, not least in E-lists; and
- practically no reward for peer reviewing (cf. already 8.3.3).

In the reminder of this section, I shall analyse how E-publishing in general (8.4.1) and the new forms of cyber-scholarliness (8.4.2) fit into this scheme.

8.4.1 Publication record and E-publications

> "It is because the learned author writes for Impact that he would much prefer that his bits reach every inquiring mind without any needless impediment."
> (Harnad 1997, 2)

E-publications have only recently entered the scene. Therefore, their status is still not finally settled when it comes to publication records. While many would argue that credit for scholarly publication (as well as quality control and peer review) is medium-independent (e.g. Harnad 1998b, 127),[794] many scholars are reluctant to publish electronically as they are not sure whether digital articles would be accepted when it comes to job applications and promotion. A 1994 study found that "the fraction of their respondents who said either 'an author receives somewhat less' or 'an author receives no' credit for online publications was almost double the fraction who said an author receives as much credit for online publication as for print" (Lesk 1998, 12). In 1996, nearly three-quarters of the universities responding to another survey had no laid-down policy regarding whether E-publications were acceptable for staff promotion reviews. However, only 14 % thought that E-articles were not likely to be accepted for promotion by the end of the century (Gomes/Meadows 1998, 180). While the former may be still the case today in many circumstances, E-journals have been accepted in the U.K. university research assessment exercise already since 1996.[795]

It is to be expected that this formal recognition will be universal soon, E-publications are likely to count in favour of promotion, tenure and habilitation (professorial thesis) procedures. However, formal recognition is not enough when it comes to assessing the publication record. As long as E-publications are not on an equal footing and are not given the chance to acquire high prestige, the situation is bound to change only slowly. Besides the prestige of paper (cf. 7.3.2.3), the prestige of the imprint (Day 1998, 2)[796] and the impact factor, in particular, may play a role here. Empirical studies with regard to quoting of E-journals (cf. 7.3.2.3) show that, so far, the latter are quoted much less than traditional journals (depending on disciplines however). It will certainly take some time still until E-publications are not discriminated in practice by indexing and abstracting serv-

[794] Cf. already above 8.3.1.

[795] "In the light of the recommendations of the Joint Funding Councils' Libraries Review Group Report (published in December 1993) refereed journal articles published through electronic means will be treated on the same basis as those appearing in printed journals." (HEFC 1994)

[796] "Without prestigious imprints to use as markers of the distinction of a scholar's work, committees are going to have to spend much more time judging the scholar's work. The already-onerous task of evaluating a scholar will be substantially increased – at every step in her career."

ices.[797] Perhaps the most important indexing service provider, ISI, seems not to have included any E-only journals yet, but claims to accept them in principle.[798]

In order to get truly accepted many E-journal projects are trying to be almost indistinguishable from P-journals. For instance, the Journal of Artificial Intelligence Research (JAIR)[799] is an E-journal, but whose yearly volumes are printed and sold to libraries. JAIR's editors do not encourage citations to include URLs and the journal articles are distributed in postscript format including headers, footers and page numbering to imitate standard P-journals. "JAIR leaves no traces of its e-journal status for academic administrators such as department chairs and deans to sneer at. If they see a JAIR article during an academic career review, it appears as a bona fide p-journal publication, and can be assessed on the basis of its content." (Kling/Covi 1995; see also Wellman/Minton 1998) It seems likely that only "modes of electronic communication that mirror established practices will be rewarded for the near future" (Langston 1996, 2). One short-term problem with "mirroring" is that some of the E-journals do not look professionally enough (Burg et al. 2000, 4).

Others envisage that E-publishing will take another route with a view to obtaining the necessary standing. One such route are the "electronically-recorded reactions and comments of their colleagues" (Hibbitts 1996b, 2.29), that is a "marketplace approach to status" (Atkinson 1996, 258), namely accurate retrospective tracking of actual use by different user communities.

While the conservative first route is likely to be successful in the short run – in particular given that the majority of E-journals are P+E-journals and let the E-version appear exactly the same as the P-version – it cannot be an answer with respect to new forms of cyber-scholarliness. They will be the topic of the following sub-section.

8.4.2 Credentials for new forms of cyber-scholarliness

As presented in 7.2.4, there are a number of new formats of academic publishing in the Internet. In addition, new forms of refereeing have been developed (cf. 8.2). Both constitute a challenge for academic credentialing.

Skywriting, the informal contributions to discussion lists and newsgroups as well as commenting to online documents (cf. 7.2.4.4) are definitely not publications in the traditional sense. So far, "online scholarly collaboration or collaborative writing has not yet

[797] The often heard argument that the extraordinary role of these indexing services is not desirable at all (because of their distorting effects and questionable methodological basis, cf. 8.2.3, also fn. 513) and, therefore, E-journals should not even try to get accepted, is, however, short-sighted. As long as these databases are so important, E-journals should not be discriminated against. The question of the disadvantages of the system as a whole is unrelated, as it is rather unlikely that the E-only journals would be powerful enough to establish a competitive service on their own which could erode the present system from outside.

[798] From the ISI website, under "additional information" (<Cyberlink=488>): "As stated earlier, ISI's basic mission is to provide access to the world's most important and influential journals. This commitment extends to the evaluation and inclusion of electronic journals. Although the electronic medium calls for some revisions in the evaluation process, ISI still looks for all the marks of quality found in traditional journals. Editorial content, the caliber of the editorial board and authors, grant funding, peer-review, and international diversity are as important as ever." At the time of writing, there seems to be a moratorium with regard to taking on board E-journals.

[799] <Cyberlink=457>; note that JAIR is indeed included in the SCI.

received any official status or recognition as a publication" (Harasim/Winkelmans 1990, 404). It seems likely that, for some time to come, the collectivity of individuals controlling the system would probably not redefine advancement criteria to take into account certain features of E-publishing, such as easily changeable text revised through public critique and collaboration (Langston 1996, 2). However, there are good reasons to treat skywriting as a genuine contribution to scholarly communication for which the originators should get credit, one being that otherwise, there is no incentive to contribute (Rost 1998b; 1998a, 3) The active participation in electronic discussions may be part of a future job description of academics. Further developing his metaphor of "sky"writing, Harnad argues that "(j)ust as citation statistics have become relevant to tenure/promotion committees, so will airtime – weighted, of course, by the altitude in the peer hierarchy where it takes place" (1990, 3). It is even conceivable that, as soon as these new forms of informal contributions are archived, they will become cited and "these 'soft' citations will be increasingly seen as the locus classicus, or at least the site of origin, of new contributions" (ibid.). The archiving of most E-lists is now standard[800] and quotes can be found here and there, but it is not yet standard practice, not to speak of a focal point of novelty in any field.

Hypertexts which are "multi-multi-authored", that is where authorship becomes increasingly blurred (cf. 6.4.2.2), pose the problem of attribution to single persons. At the end of the day, jobs are given to individuals. The mere listing of all authors would be one option, similar to the established practice in, for instance, high-energy physics with even hundreds of authors. In most fields, however, this seems not satisfactory, in particular if the number of authors exceeds a certain number (e.g. 15). One option would be to compute and indicate the individual percentages of each author's contribution to the whole of the hypertext. However, how can we account for the varying quality of contributions as compared to the mere quantity of "modules" added to the hypertext? How to account for the crucial contribution of the guiding argument of a hypertext? While the former questions could be put in a traditional environment as well, but are solved by the group of authors themselves (who is listed as author and in what order), there are also new issues arising with hypertext publishing: How would it be conceivable to get due credit for "minimum publications" (cf. 6.4.1.4)? Would we have to give credit to the author(s) of the two linked modules together with the author of the link? Fuller, for instance, has strong views on this. He argues that "the reinvention of medieval hypertextual practices in the electronic medium (...) would wreak havoc on the credit allocation schemes that currently operate in the academic world (...) as virtually all of these depend crucially on the key Gutenberg practice of assigning authorship to text" (1998, 127). These questions cannot be reasonably discussed in theory and have to remain open until we gain some experience with practical hypertexts.

Fluidity: A special problem in this context are the consequences of the dynamics of E-publications (cf. 6.4.1.3). How could dynamic updates and new versions of the same article be counted for the publication record? One option would be to list and count all updates. However, in a world of continuously updated E-documents, this may soon become overwhelming. Therefore it has already been suggested that scholars should get recognition for the currency of their documents rather than the number (Treloar 1996, 141). This would, however, not be easy to implement both for authors, for referees and for editors. Furthermore, such a credentialing policy may have unintended consequences: If keeping

[800] Note, however, that long-time and reliable archiving is a unresolved issue (cf. 7.4.1).

each publication up-to-date becomes a must, this may lead to steadily increasing levels of workload for each scholar. More advanced scholars (who already have a number of publications to keep up-to-date) would not have the time to follow new routes as they would be required to work on old ones, and only the newcomers would be allowed to do something new.

In conclusion, it seems that many questions are still open when it comes to setting appropriate standards for credentials of new forms of E-publications. Probably, we need to distinguish between material intended to be a "publication" in a narrower sense and other contributions. While in the first case, e.g. as regards new types of journal manuscripts or even academic FAQs (cf. 7.2.4.2), we may expect that the academic community will be prepared to give due credit, it seems less likely in those cases which are further away from publishing in a traditional sense. Where authorship is less definitive and where the output is rather fluent and close to interactive communication processes, different standards will have to be developed in the future.

8.5 Conclusions

In this chapter, we have seen the considerable potential to change the system of quality control, but we have also discovered a number of hurdles as adjustments of important traditions would be necessary.

First, academic quality is, in principle medium-independent. Whatever the medium, quality may be low or high, depending on the quality control system applied. Second, cyberscience brings about new forms of quality control, which have the potential to improve the traditional systems, if carefully implemented (in particular as add-ons and only partial replacements of traditional forms). In particular, the new forms of ex post control are not feasible in the paper-based world of publishing. In some respect, they may revolutionise scientometrics. Third, working paper archives and journals will probably offer both ex ante and ex post open peer commenting. This may turn scholarly publishing into a much more communicative process than hitherto.

Since interactive (as opposed to one-way) communication plays a significant role in most of the new formats of quality control, the single most important factor seems to be time, namely the time needed for such enhanced communication. It is difficult to predict – and largely independent from cyberscience developments – whether publishing will continue to be ruled by the requirement to publish as much as possible or whether quality becomes more important. In the first case, there will only be very limited or no additional time available for more communication. Hence, the traditional system of quality control would be likely to move to the Internet, but a qualitative metamorphosis would be less probable. Here, cyberscience's main impact would be that it speeds everything up. In the second case, by contrast, there would be more time available for communication, for instance in the form of skywriting and commenting. Here, the potentials could be exploited more fully and cyberscience may indeed contribute to and accelerate this change of scholarly work.

Which of the two scenarios will be realised, depends largely on the publishing traditions of the various fields and how they develop. The further evolution of quality control systems in the various disciplines would probably not be synchronous. It may well be

that in some fields, the more revolutionary concepts may take shape in the not-so-distant future. In particular, a unified publication archive into which everything to-be-published will already go as a unrefereed pre-print, seems attractive (most of physics has already implemented it, mathematics and the cognitive sciences are following). If combined with quality labelling and if other ratings, as well as comments, were linked to each article in the database, this could turn into a user-friendly publishing system of the future, which would allow for pre-selection of quality levels. In addition, academic literature would be more embedded in the scholarly communication process.