Upgrading Academic Scholarship – Challenges and Chances of the Digital Age

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Abstract

Purpose:
The paper is a discussion of what the beginning of the Internet Age means for the functions and structures of scholarly information and communication by looking at and evaluating today's usability and usage of the digital information infrastructure for and by academic scholarship.

Design/methodology/approach:
The paper gives an overview of the current state of development of digital information in the scholarly cultures and stresses the importance of data as the crucial – and considerably extended – basis of scholarly work.
The central role of the publishing world for the academic rewards system is analyzed to consider continuities and discontinuities in scholarly publication.

Findings:
The paper advances the thesis first coined by Christine Borgman that today we have an information infrastructure *of*, but not one *for* scholarly information. Some ideas and proposals of what should be done to move towards an information infrastructure for scholarly work conclude the paper.

Originality/value:
The paper tries to bridge the gap between information professionals as producers and scholars as users of information and communication technologies and shows that a joint debate on these issues is necessary.

Keywords:
Digital Age; academic scholarship; scholarly information; scholarly work; information infrastructure; digital libraries

Paper type:
Conceptual paper

1. Introduction

The national and international debates on new information and communication technologies and their impact on scholarship and academic work and generally on the information infrastructure of the scholarly world have a basic bias which at first sight

is fairly surprising: It is led – in Germany nearly completely, internationally predominantly – by information professionals, i.e. librarians and information systems specialists, in academia supported by information and some computer scientists. The people concerned – researchers, academic teachers, and students from the multitude of scholarly disciplines – are largely absent from the debate in spite of the fact that their current and particularly their future working conditions are at its core. There are many reasons which may offer partial explanations of this significant trend which cannot be discussed here in detail (see Henry, 2003; Sompel *et. al.,* 2004; Schmiede, 2005 for some more discussion). But it seems clear that the actors on both sides are fairly convinced that this has good reasons: the information professionals see themselves as the specialists who deliver the tools and methods, as long as users tell them clearly what they need. The users, or people concerned, on the other hand hold that information and communication technologies are not their concern, but should be provided for them as tools so that they can be used like the typewriters or calculation machines of the past. Both views are equally one-sided and narrow-minded, for information and communication technologies (ICTs) massively re-shape scholarly work and its conditions, and yet are significantly structured by social interests – be they conscious or not. This is a basic characteristic of most projects in the ICT area (see Schmiede, 2006, pp. 345 sqq.). Since this is the situation, the following discussion and ideas cannot be based on an ongoing rich international and interdisciplinary debate but their basic motive is to build bridges between the two different, if not opposing, cultures. For this reason this paper, although it draws on literature from various areas of research and debate, has an essayistic character rather than the shape of a solidly empirically and theoretically based analysis.

2. The digital age and scholarship

The internet with its World Wide Web interface has become part and parcel of normal academic life. We have moved from selective „logging on" to the rule of being „always on", and, as in other areas of work and life, an enormous intensification of information and communication has accompanied this development. Because of the quantitative explosion of information everybody is struggling to deal with the unavoidable deluge of information; a German information scientist (Wersig, 1987) many years ago called this an „explosion of nonsense", and, of course, this characterization describes one side of informatization (on the general theory of informatization see Schmiede, 2006). So it can be confirmed that academic scholarship has definitively entered the internet age.

But it is not only the quantitative increase of information and communication which is characteristic of the internet age. There are qualitative changes in information and communication, too. The „always on" type of internet use goes along with a mixture of usage for scholarly demands and everyday tasks: put more generally, an erosion of traditional boundaries between work and life; the problems of work-life-balance, which are usually discussed with regard to the limits of the working day and creeping of work subjects into the area of free time, can also be found in the course of work itself. New forms of communication which have only become possible on the basis of extended Web usage have gained importance and again create new structures of information: listservs, weblogs („blogs"), wikis, wikipedia, perhaps wikisearch, twitter etc. More generally, the Web 2.0 technologies and usage forms not only allow for more informal, even spurious forms of communication, but also make possible new pathways into the abundant quantities of information in general and scholarly information, in particular.

Have we arrived at the age of digital content at this stage? Not yet, we are still really climbing the staircase to get to it. Though new contents are, as a rule, produced in digital form, the older ones are, if at all, only selectively available or accessible in digital form. And the access to the new ones is mostly restricted by copyright and/or commercial restrictions. This is true for research as well as teaching and learning. The scholar and the student today are moving and acting within networks of data, information and people; but the interoperability between these networks and the technologies to access their respective contents is more likely to be lacking, than to be working smoothly, or can be realized only by finding and using additional tools and bridges. There are no acknowledged standards for typical contents of scholarly work: To send this paper, written in Open Office format, to the publisher I have to convert it to the market dominating MS format, and the bibliographic information is collected and structured using yet another software package; if I had included quantitative information, tables, figures or even empirical research results in this article, the mess of programs and standards would be multifold. The everyday work of people in the area of scholarly information is characterized by a continuous struggle with different formats and tools; we are far away from any kind of integrated desktop for different kinds of scholarly work.

Yet, some considerable extensions of the information infrastructure and the ensuing possibilities for scholarly work have developed. Information and communication technologies today are sufficiently mature to enable rich and productive forms and dimensions of information-intensive, distributed, and collaborative scholarship. The

problems mentioned above are social, economic, and political rather than technological ones. We do have considerably better access to data and information, more data are available and accessible, ICT-supported collaboration has markedly increased; this goes along with a substantially enhanced international awareness, with extended networks, and it has become much easier to transcend the traditional disciplinary boundaries (see Borgman, 2003).

These advantages and improvements, have at the same time, however, new challenges and tasks for scholarly work. Scholars have to and do read and handle an increased amount of scholarly literature and sources, as Carol Tenopir and Donald W. King showed recently (Tenopir and King, 2008). Work has intensified, the velocity of work and communication grown considerably. At the same time, this has become the technological basis for increased competition within and between disciplines which itself has rather economic, social, and political reasons. Scholars have to care for and to secure data production, their verification, representation, and – last but not least – preservation. This demand for improved representation is true for documents in general, as the comparison between a student paper today and 20 or 30 years ago will easily make clear. The scholarly publications' sphere is in rapid change, but this change has no clear direction, and yet there are tremendous differences between the scholarly disciplines, and often it is difficult for scholars to find the optimal way to publish. With the increased presence of scholarship on the Web, there are growing demands for publicity and responsibility of the scholarly disciplines and persons; scholarship is meeting better informed users and clients, something which is probably most pronounced in the area of medical information and therapy.

The relevance of data as the basis of scholarly work has considerably increased in the course of producing and making them available digitally. This is the case in spite of substantial differences between the disciplinary cultures: They range from measured and often machine-recorded process data to subjective records in language form which demand extensive interpretation. These new possibilities of creation and usage of data exacerbate the problem of how to deal with the old non-digital data and records existing in print or in other forms: over centuries the quantitative and qualitative analysis of text, documents and other sources of the past by historians, archaeologists, theologians, or philologists, but also by biologists, climate or medical researchers, was at the core of scholarly work. Today, all these disciplines and activities oscillate between the retrospective digitization of content, which is limited to certain special areas, and the necessity of practicing traditional pre-digital work forms which are obsolescent in principle, but cannot be avoided. However, the emergence of

new methods and disciplines which use the new data technologies in many areas (e.g. computer philology) is only just beginning. Moreover, there are extreme differences concerning the accessibility of data between disciplines and even within them: Whereas large parts of research data in chemistry or bio-technology are protected by patents or other forms of private property rights for commercial reasons, data from spoken language or in the field of earth science are widely available and mostly openly accessible.

New worlds of data which came into existence only on the basis of IT-based measurement and calculation have been created in the course of informatization: in the quantitative dimension facts, relationships and structures, which previously could not be examined due to their sheer size, can be modelled because of informatization. The terabytes of information which are delivered day per day in the big international geological and geospatial projects; the modelling and calculation of properties of substances in molecular chemistry; the calculation of properties of free geometric forms by systems of finite equations in mechanics; the modelling and visualization of energetic processes in thermodynamics or in civil engineering physics; the recognition of patterns and the numerical comparison of gene sequences in biogenetics; the electronic communication and analysis of X-Rays, MRTs etc. in medicine; but also the voluminous statistical calculation of cluster structures in the sociological analysis of social structures or in the economic investigation of input-output-matrices which allow for new insights and dimensions of analysis, are but some examples for the enormous potential of informatized procedures in science in general. Methods and technologies of simulation today are playing a central role in what Daniel Bell more than thirty-five years ago called "intellectual technologies" (Bell, 1973). In the humanities, new methods of analysis of texts, symbols, figures and pictures, i.e. in the more qualitative dimension, are, as already mentioned, imminent. Informatization in scientific work goes along with new objects, new standards and norms: Virtual construction processes in mechanical engineering are based upon massive efforts of formal or de-facto-standardization of technical objects; and the normed definition of diseases by ICD 10 (the International Classification of Diseases) has enormous scientific and practical consequences in medicine, e.g. in the form of acceptance or rejection of diseases and their diagnoses by health insurance institutions. So, the examples listed show substantial changes in the contents of sciences and humanities, but we do not yet really have a systematic overview of their dimensions and extent.

3. The situation: infrastructure *of*, not *for* scholarly information and communication

This overview of the present situation of scholarly work on the basis of a digitized scholarly information infrastructure confirms Christine Borgman's diagnosis (Borgman, 2007) that this infrastructure is one of, but not yet for scholarly information and communication. This is to say, the infrastructure is technology-based and/or institutionally-based, but not shaped by and aligned to the varieties of the many scholarly cultures. It is, as Herbert van de Sompel put it slightly differently but very much to the point in his keynote talk at the 2009 Bielefeld conference (Sompel, 2009), based on institutional repositories, not on the work processes and work flows of scholars or students. The (ideally) integrated disciplinary infrastructure is often fragmented into extremely diverse parts which are affiliated with or belong to different institutions. In addition, there are large differences between the more canonical and the rather "soft" disciplines which are interpretative or even comprise contradictory schools. Furthermore, there are substantial disciplinary differences concerning national vs. international orientation (e.g. philosophy vs. high energy physics).

A mixture of continuities and discontinuities has developed which is important to understand in order to be able to conceive of further fields of action. Print publication is still central for the academic awards system: It is well-known that 90 percent of the papers handed in to one of the most important open access repositories, ArXiv, as pre-prints are eventually published in traditional printed journals. The reason is, of course, the role of publishing for the social system of scholarship: Publishing is not just the technical multiplication and dissemination of a text or other content, bringing it more or less successfully into the marketplace; to solve this task organizationally and technically, is the easier part of the problem. The more difficult one is dealing with publication as part of the working mode of the scholarly social system. Publication plays a crucial role in demonstrating and allocating acknowledgement, status, functions, jobs and remuneration in the world of institutionalized scholarship. Journals, serials, and academic publishing companies in general are sources of honour and reward, of power and influence, and – last but not least – of income for learned societies. My impression is that electronic publishing so far has not provided a functional substitute for this system. A two-tier system seems to work in several areas of scholarship: Digital pre-print publishing appears as an excellent solution for the quick and cheap dissemination of scientific innovation which is provided by various open access repositories and services; but this first-tier publication practice does not seriously impede the working of the second crucial social process of publishing in print

as a social and economic allocation mechanism in the scholarly system. However, the systems of quality certification and legitimisation differ substantially between disciplinary cultures, as do the regulations of "intellectual property" internationally as well as in practice.

The stakeholder roles in the publishing sector are in transition, but there are no clear positions and fronts, although a general tendency towards more open access, open repositories, open archives and free publication is visible. We are still in a period where different functional and business models are experimentally tested. As the University of California Los Angeles librarian Schottlaender put it about ten years ago: "Faculty, librarians, and publishers are now one big dysfunctional family" (reported in Borgman, 2007, p. 77). But, nevertheless, in sum we witness a clearly enhanced role of open publication and access, albeit as part of ongoing struggles. Some landmarks in this development are the US PubMed Central, the Berlin Declaration, the CERN SCOAP3, the arrangement between Google and the authors' guild in the USA (with new critical dimensions emerging) in Fall 2008 and, at the beginning of 2009, the agreement between the Dutch Library Federation FOBID and the copyright holders' representatives' organization VOIcE in the Netherlands.

Informatization of scholarship in the digital age has opened up and is still creating a number of new features of academic work which are only slowly being realized. One is the publication of documents which report research results together with the data upon which the research is based; this is possible only through digital publication and is relevant for the broad areas of empirical research. Some frauds in empirical research, as for instance fraudulent cancer research in Germany about ten years ago, or, more recently, dishonest research in nuclear fusion physics in South Korea, have been discovered this way. However, this mode of publication is still the exception; it should become the rule to make the relationship between data and interpretation transparent. To put it more generally: documents are developing from static to dynamic entities. They become documentation of a process rather than of a final state of things, and because of that property they will change over time. But – apart from version management – no tool has yet been invented to allow for a smooth and efficient handling of this kind of dynamic document. Another consequence of informatization is that research possibilities are enhanced to a considerable extent: all formal operations can be more or less automated (but have to be re-contextualized by scholarly knowledge and competencies). This is true not only for mathematically-based subjects and operations but also for what have until now been human-based processes, like language analysis or complex social analyses, as mentioned above.

Last but not least, access to global scholarly information – although in most disciplines it is still far from being realized in a satisfactory way – is extending, and in many disciplines it is a new potential which will increase innovation, but also the pressure of competition.

4. Challenges and shaping of the future of scholarship in the digital age

Alan Kay, then developer of "Smalltalk" at Xerox Parc Palo Alto Research Center, which was the main inspiration for the Apple Macintosh and subsequent Windows developments, said in a 1971 meeting at the Parc: "Don't worry about what anybody else is going to do… The best way to predict the future is to invent it." (Kay, 1971). This saying is especially true in the world of ICT systems which are either shaped by all stakeholders involved right from the beginning of their conception, or are fully developed with only minor corrections of the ways of dealing with them left as possible inputs (see for further discussion Schmiede, 2006, pp. 345 sqq.). Scholarly work and publishing on the one side, and the technological infrastructure for scholarly information on the other are in the midst of restructuring. The choice of options in both spheres creates "path dependencies", i.e. more or less irreversible route maps of further development. The earlier the intervention, the better are the chances of influencing the future shape of information systems and especially their modelling of future work flows and organizational structures. As a rule, work interests and organization forms are not unambiguous but to a larger or lesser extent moulded and bridged by spontaneous and often customary everyday activities of the organization's members. This rules out any simple linear model of building IT systems which presupposes a clear formulation of aims and demand produced at a single point in time on which development of the system is then based. The more complex the organization and the IT systems, the more difficult it is to change anything after their implementation. In an analysis of ERP systems (enterprise resource planning systems, in this case SAP R/3) this has been compared to fluid concrete which can be used to model any forms; once it has dried up, however, the forms cannot be re-moulded except by destroying them (Hohlmann, 2007). The social shaping of ICTs and the informational shaping of the social environment have to go hand in hand, or they will be seriously limited in their functionality and acceptability.

Since on the one hand there is this inner relationship between the ways in which scholarly work is conducted and the way its results are published and, on the other hand, the shape and usage of information and communication technologies in the

sphere of scholarship, it is central to observe and to understand the different scholarly cultures. Who are the users? How do they communicate and collaborate? How do they conduct their research? What kind of data do they produce and use? What are their modes and habits of publishing? What is the content and form of teaching the respective disciplines? What are the preferred and dominant forms of learning? Unfortunately, hardly any substantial research on these questions can be found. Being aware of the embeddedness of scholarly work and its handling of dependence on the scholarly information infrastructure, it becomes obvious that special knowledge (or tacit or personal knowledge, as Michael Polanyi called it; see Polanyi, 1958) is necessary to be able to handle and to interpret the data used in the special discipline or branch of research. To accept these basic principles embodies some implications for the participating stakeholders which again have consequences for practical challenges and opportunities. Because they try to spell out these consequences the following deliberations have to a certain extent a normative character.

In the scholarly world, award systems in academic institutions have been characterized as the central allocation mechanism of acknowledgement, status and income. Because of this crucial social function, they have to be extended to comprise not only printed publications, but also the provision of data and their inclusion in new dynamic documents, i.e. the whole world of digital publication in its existing and newly developing forms. New enhanced forms of publication will gain an increasing importance. This is so, because research will increasingly depend on approaches utilizing multi-technological and multi-dimensional access to data and information and ways to develop a scholarly understanding of them. Furthermore, the emerging new forms of scholarly research will have to be more interdisciplinary than in the past, for reality as the object of scholarly research is not disciplinary, and the new ICTs in digital scholarship make the crossing of disciplinary boundaries easier. In the last decade, already, inter-disciplinarity has gained substantially in reputation and in practice in scholarly work. As a consequence, new disciplinary and trans-disciplinary scholarly information and communication cultures will have to be developed, including specific ICTs and modes of publication.

Academic institutions will be forced to adapt to these developments. Scholars are and will be more dependant than in the past on information infrastructure services (libraries, documentation centres, discipline-specific information centres etc.), because their information worlds are increasing in complexity. These services will have to be shaped according to their needs and workflows in continuous collaboration between scholars and institutions. The visionary hope at the beginning of the digital

revolution that scholars would organize their information sphere themselves (and would also manage their publication activities themselves informally) has proven to be an unviable utopia because it does not take into account the real work conditions and basic competencies of scholars. Scholars are not educated as information professionals, and few of them will succeed in acquiring sufficient disciplinary knowledge and information specialist knowledge at the same time. The "normal" scholar will find it difficult or impossible to get and keep up a rich overview of their increasingly complex disciplinary information culture. As a consequence, institutions will have to seriously re-think their role as service organizations for scholarly work.

This is especially true for libraries. Libraries are not at all expected to die away in the digital age. Empirically, the use of libraries, measured as articles obtained by readers, is continuously increasing. But they will have to adjust to the changes in scholarship in the digital age. On the one hand, they will have to handle highly centralized tasks and manage central administrative functions like negotiating bundle agreements, cooperating with other libraries, administering access rights, managing regional and national licences etc. This is an argument for locating these library functions close to the central management of academic institutions. On the other hand, there is the increasing need to support scholars in their respective information fields, mentioned above. As a consequence, scholarly personnel in libraries, i.e. information professionals with an education in the respective scholarly disciplines (subject specialists, in Germany called "wissenschaftlicher Bibliotheksdienst"), should be located in the faculties and departments close to the scholars and students as advisory and assistive staff who are familiar with the basics and the raw structures of the disciplinary culture, who are able to traverse the gap between this sphere and the world-wide disciplinary information world, and who see it as their central task to mediate between both spheres. The scholarly service function of libraries, which has often been reduced because of centralization and rationalization imperatives, should be re-vitalized.

In a more specialized dimension, special discipline-specific service institutions are necessary for research and development. General academic libraries can only provide the support necessary in the manifold disciplines of scholarship to a certain extent. Special documentation and information centres are needed which should be rooted as deeply as possible in the various disciplinary cultures. A multitude of forms and activities of curation and preservation of data and documents (including dynamic ones) will have to be developed, for this is the basic pre-condition for the viability of dynamic documents which presumably cannot be managed by the single scholar.

Preservation embodies special right-of-property problems which have to be tackled and solved. Furthermore, in this area in particular, the problems of a lack of standards for scholarly information and communication mentioned earlier have to be addressed.

Most of scholarly education is seriously lagging behind the development of information and communication systems in scholarly cultures. Students don't usually learn to distinguish in a profound way between web sources, digital documents, and conventional publications and sources. My guess is that this is because the majority of scholars would not be able to handle and to teach this structural and practical field in a systematic way. Most scholars have developed their own, experience-led and subject-specific way of discerning between what they consider to be important and unimportant, reliable and dubious sources and literature, and they rely heavily on their scholarly social networks, but they would not be able to have and give an overview of the whole discipline they have to teach. This has serious consequences which are gaining in importance: the human ability to mediate between information and reality, to contextualize information, is increasingly important in a rapidly extending information world and has to be developed and supported, especially in academic education. The danger of a subtle re-evaluation of knowledge (from true or wrong to accessible or not accessible, i.e. in/not in Google) has been pointed at (see Schmiede, 2008). Knowledge about Non-Knowledge is at the basis of human autonomy, the ability to distinguish both is essential for it. One of the central tasks of the special discipline-oriented service institutions mentioned in the last paragraph would be to transfer their competencies in bridging the gap between disciplinary content knowledge and the world-wide information structures of scholarly fields to curricula aimed at the further education of scholars and the basic education of students.

These competencies to mediate between information and reality, to contextualize information and to link it to other forms of experience and knowledge are crucial for the ability and power of judgement (Kant: "Urteilskraft") which again forms the basis of human autonomy and individuality. Under today's conditions this power of judgement is to a large extent dependent upon the ability to deal with and evaluate information from manifold external sources, and to use them deliberately and consciously. The lack of training in acquiring these competencies has been documented in various German and international studies. It is felt by teachers and by students as a lack of orientation in the field of teaching and research. This lagging behind real development in most scholarly disciplines will without doubt become the subject of a growing critique from the younger generation of scholars and students. To

educate not only academic specialists, but autonomous, mature and responsible persons, we will have to find ways of a reasonable transition to modernized curricula.

So, where do we stand, where do we go, and how do we do it? One central obstacle to progress has to be tackled. In current practice, in-between forms of organizing scholarly work and publication have emerged, and in the course of the last years some barriers between the stakeholders have eroded. But, unfortunately, the general situation, especially in Germany, is still characterized largely by the non-existence of a debate on general aims in shaping and developing academic scholarship in the digital age. NGO (Non Governmental Organisation) debating bodies focussing on strategies for the scholarship of tomorrow and on future information and communication worlds in scholarship should be brought into existence; they should involve the respective ministries and the EU and, of course, have an international world-wide dimension. The discussion and cooperation of the important stakeholders in the field (learned societies, academic institutions, libraries, publishers, documentation and information centres, students' representatives) should be actively and positively encouraged. We need an initiative to upgrade the role of scholarship in the society-wide debate about future forms of scholarly information and the outline of new opportunities for scholarship.

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