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Bibliographic Citation in Information Service

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Abstract—This paper gives the history of the origin of citations in scientific literature and reveals the causes of the origin of different referencing styles. Modern methods for working with references in scientific technical literature are described. The role of network technologies in preparing scientific publications is pointed out.

Keywords: reference, bibliographic manager, search for scientific literature, electronic document, DOI identifier, bibliographic database

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INTRODUCTION

The most characteristic formal sign that distinguishes scientific technical literature from all other types is the detailed reference list that is used when creating any scientific document. The volume, composition, and character of a bibliographic list can be used to indirectly determine the quality and, in some sense, the content of a work itself. Usually, a very small reference list or its absence causes a negative attitude towards a publication. This being the case, abstract is undoubtedly a major instrument; it is a compulsory component of any scientific publication. However, it does not always satisfy a reader, in particular, since many authors have a too formal attitude to the requirement to present an abstract. In addition, the ability to make a short publication review of several lines is rather a complex work; this is the reason why this procedure is dealt with at reviewing centers by specialists after training. Therefore, one more publication assessment parameter is often a reference list. Indeed, references largely permit one to determine a scientific school to which an author belongs and whether he is familiar with the latest and most important works in a field under study.

The information society has involved in its research work not only a limited circle of persons who are professionally engaged in science and are willing to tolerate traditional canons that are not always comfortable but also specialists in almost all activities, as well as teachers. Mass involvement in science has caused a sharp need to create modern technologies, which on the one hand support the centuries-old traditional methods of scientific work (search, publications, scientific discussions, etc.) and on the other hand do not cause additional labor costs and increase the efficiency of studies. Undoubtedly, this affects the routine constituent of scientific work; modern developments in the information support of a researcher's work concern just this problem. It was necessary to combine electronic technologies with traditional presentation of reference lists. If the transition to digital classification is complete, a person will not be fully able to make a rapid expert assessment of a publication. The modern computer technologies have to a significant extent extinguished the negative attitude to the routine process of making citations in scientific works, ensured access to the sources of ready bibliographic information, and given the instruments to organize its storage in the form of individual and collective databases. The labor-intensive formation of a reference list has become automated for an author who regularly uses all these products.

Certainly, there are ample opportunities to improve this process. For example, in working with the paper version of a document, an author can by no means always easily find a corresponding bibliographic description in a ready DOI electronic form (a Digital Object Identifier), which is by no means applied in all scientific journals; however, developing information technologies will also gradually solve these problems.

Consequently, changes in the information support of scientific research have become a response to a new challenge that is related to the expansion of the public that is directly or indirectly occupied with scientific activity and wants to perform it under comfortable conditions using a computer to achieve this goal. However, this is only one of new stages in the development of the information support of science and, in particular, improving the citation mechanism of interconnection between scientific works, prioritization of authorship, and determining the novelty of a study. Therefore, it is natural to raise the question about the current compliance of the existing system of citations in scientific publications and technologies for working

with them to the major trends in the development and organization of science.

Citation instruments as a Basis of Navigation in the Scientific Technical Literature

Citations to related scientific works (studies) have been accompanying science throughout its entire history and the formation of citation instruments has gradually been modified and became more complicated according to the amount of scientific knowledge and progress in the technology of scientific publications. Meanwhile, the list of requisites that characterize a document expanded and the form of information presentation has been modified. The development of bibliographic citation instruments was affected by many circumstances, for example, changes in librarian storage or the origin of new types of documents.

Let us try to describe the major stages in the history of the development of bibliographic citations in scientific publications.

Citation to documents has a long history of development. As early as the first elements of writing appeared the priority was set for the problem as to how indicate the address of a document to a reader in order that they to pay attention to this document and recommend it. This was the first and by no means the simplest task, since early documents usually did not have a marked out completed title, there was no year of creation, and the author was not always indicated. However, the situation was somewhat simplified by the fact that it was impossible to obtain many almost analogous copies before the appearance of typography[1] and any document was unique (manual re-writing did not guarantee the accuracy of a copy). Therefore, addressing a single object that was possessed by a specific owner was sufficient when forming a citation. Using a brief informative description (a title, author, and, in the case of their absence, a conditional widely accepted name or initial phrase) and supplementing it by storage data and the owner's name made the identification unambiguous. Since at an earlier time there were almost no large document (manuscript) collections, this was absolutely enough to search for them. There were no formal rights for making citations (identification of documents) and it was impossible to create them, the more so since they were not claimed.

In today's world, manuscript documents have a museum or archival address storage, which in many respects repeats the above-indicated scheme. The address of the original or current storage and the name of one of the former owners are still present as a search sign in a document's description. A storage number that is assigned to each document as it is being placed in a depository is a major search sign inside a document collection.

As typographies appeared, a document acquired the major signs that are used in the modern bibliographic description: an author, work title, publication date, and name of a typography, which can be interpreted as a publisher of that time. Numerous copies scattered over different collections and searching by location ceased to identify a document unambiguously. The problem arose of how to universally formalize the source description. This became especially acute in librarian storage. By the middle of the 16th century, a developed library network had formed, viz., university libraries, royal libraries, and large personal collections. Therefore, these structures came to be a guide when searching for documents.

It is quite natural that libraries that have large literature collections required an efficient instrument to search for documents in their funds. This problem arose as the first antique libraries appeared, i.e., it is more than 5 centuries old and was always solved by creating a library catalog. However, there were no generally accepted rules of addressing in funds.

The scientific public was to become the second potentially interested participant in solving the problem of document identification. To ensure the continued development of science, it became necessary to cite the scientific articles that were used when publishing scientific results. Until the late 19th century, citation to related works was performed only through an author's surname without indicating a specific publication. This can be shown by the example of one of the best-known works by Newton, *Optics*.[2] Thus, pointing to the work on light refraction by the now forgotten scientist Grimaldi, Newton forms a citation as "Grimaldi supposes..." Presenting the results on the production of lenses with a large focal length, he indicates only the surname of Huygens without any reference to a corresponding document. For a very limited number of researchers, who knew each other and were in active correspondence with each other, similar author citations most probably had a fairly accurate address and simultaneously formed respect for authorship of other scientists.

An actually efficient and universal mechanism of document identification, which is used today not only for library storage, appeared only in the middle of the 19th century. In 1841 Anthony Panizzi suggested that the catalog of the British Library be given a revolution-

[1] Strictly speaking, each paper copy is unique even in the case of replication. Technical typographic errors are possible: weak printing or incorrect stitching. This is particularly noticeable in the samples of the early printing period. In a number of cases, copies are numbered to ensure uniqueness.

[2] The translation of this book into Russian is considered: Newton, I., Optics: Translation from the Third English edition of 1721 with comments by S.I. Vavilov, Moscow: Gos. Izd., 1927.

ary standard, which is known as the "91 rule of cataloging." These rules served as a foundation for all the subsequent schemes of cataloging in the 19th and 20th centuries and stand at the origins of the ISBD[3] which is a system for citation in scientific publications and modern metadata formats.

This is the manner in which instruments for accurate and universally accepted document identification were developed. Since libraries were a main information source until the late 20th century, these citation instruments largely ensured the development of science and permitted readers to search for literature in funds and to form a memo in order to turn to the documents repeatedly.

In the late 19th century, targeted links to related documents began to appear in scientific publications in the form that was close to bibliographic description in librarian catalogs. First, authors used them in journal articles and then they arose in book scientific literature.

The technology for using citations in scientific publication did not initially acquire the forms that have become traditional for modern publications. They arose gradually during several decades.

Let us trace the process of changes in the methods of referencing using the example of publications in the oldest scientific journal *The Philosophical Transactions of the Royal Society*,[4] which is published by the London Royal Society.

Initially, citations to thematically related scientific works arose in the late 19th century. Citations were built directly in a text, which can be exemplified by a fragment of a work from 1888:

"M. DESLANDRES states (*Comptes Rendus, vol. 100, p. 854*) that the first band of the water spectrum...".[5]

In some articles, citations were made as footnotes. Meanwhile, the main text briefly stated some scientific result and gave the surname of its author, while a citation pointed to a fragment of a corresponding publication by the cited author. At that time the citation format did not acquire the completeness that is typical for the modern bibliography, but citation already ensured the interconnection of publications.

The next important step was the appearance of reference lists in scientific articles. Authors of scientific publications understood that a similar address citation did not always reflect the origins of their study. A publication is often based on some fundamental works only ideologically and it is very difficult to refer to a specific result or fragment in these publications. This became particularly evident under the conditions of the rapid and extensive development of science, i.e., the continuous growth in the quantity of scientific journals, the number of researchers, and scientific documents. Therefore, in the late 1920s the publications of this journal began to appear with reference lists, which fixed a list of sources that were the basis of the scientific results that are expounded in the published article. Meanwhile, the format of bibliographic records in these lists, at least, the structure and methods of the formation of constituent elements, corresponded to the already established rules for making library catalogs. However, the sequence of requisites, system of separating characters, and punctuation were interpreted by scientific publishers in different ways. Therefore, a large number of styles of referencing formed historically. Having chosen some style initially, scientific publishers require that authors follow it in all received manuscripts.

These emerging reference lists had very versatile names: references, bibliography, literature, literature cited, or a list of literature. Entries were not numbered in that period; thus, a list had a familiarization character. The methods for citation in a publication text to a work that was included in an article reference list appeared only in the second half of the 20th century.

The regulation of the rules for the abbreviation of terms and names became the last significant change in the formation of references in scientific literature. Certainly, there are no absolutely strict conventional prescriptions that regulate each abbreviation. However, there are a number of materials that recommend the abbreviation rules; for example, directories of short journal names are most frequently used in foreign periodicals.[6] In Russia, this is GOST 7.88-2003 Rules for Abbreviations of Headings and Words in Publication Titles. Guided by these recommendations, publishers create detailed rules for their authors. However, the pursuit of brevity is not always useful for an ordinary reader. Thus, the abbreviations of two absolutely different journals *Journal of Mathematical Physics* (abbr. J. math. Phys.) and *Journal of Mathematics and Physics* (abbr. J. Math. Phys.) contain a distinction in the capital letter M in the second title that is easy to overlook and the initial title is poorly determined.

This is what for the most part marked the end of the formation of modern requirements to the formation of bibliography in a printed scientific work. It is necessary to note that the established rules proved to be

[3] The International Standard Bibliographic Description

[4] This is the oldest scientific journal of the English-language world and the second in history after the French *Journal des scavans*. It has been published since March 6 1665 without interruption, which makes it the oldest permanently issued scientific journal in the world. All full texts of journal numbers are accessible on the Internet (up to 50 years in free access, then on a commercial basis).

[5] Liveing, G.D. and Dewar, J., On the Spectrum of the Oxy-Hydrogen Flam, Phil. Trans. R. Soc. Lond. Ser. A, 1888, no. 179, p. 27, DOI: 10.1098/rsta.1888.002.

[6] Alkire, L.G., Periodical Title Abbreviations: 2nd ed., Detroit: Gale Research Co, 1977; World List of Scientific Periodicals publishers in 1990–1960 (4th edition, 3 vols, Butterworths, reprinted 1972.

fairly difficult for mass use and the origin of computers, which abruptly changed the work of researchers, gave birth to the task of simplifying working with citation instruments.

ELECTRONIC DOCUMENTS AND COMPUTER TECHNOLOGIES

The second half of the 20th century brought new documents that principally differed from traditional paper ones. Electronic documents, which were first found on magnetic carriers and then in the form of files placed on the Internet, gradually became a main instrument for the documentation support of science. Meanwhile, it was found that the identification of electronic documents required that the structure of bibliographic requisites be revised while being supplemented with new characteristics and correcting the existing concepts. Recommendations appeared for making references to documents placed on diverse autonomic electronic carriers (magnetic tapes, diskettes, CD ROM, etc.), which were accessible in the telecommunication environment (files obtained from network databases, files from FTP-servers, site pages of the WWW environment, etc.). We would like to emphasize once more that these changes only advanced the already existing bibliographic methods. Lastly, the revolutionary Dublin Core project was created:[7] this was the standard of metadata, a simple and efficient set for describing a variety of resources, including the semantic web. Unfortunately, the potential of this development is not used enough in practical applications.

The requirements for changes in the document identification system were put forward not only by final information users (readers, researchers, and students), but also by the structures for the support of its expansion. Let us consider the two most noticeable novelties, which optionally supplemented traditional bibliographic citation.

In the second half of the 20th century, the impetuous development of science and technology, the development of the education system, and the growth in the cultural level of the population yielded a significant growth in the amount of all types of literature. An industry was formed whose workers did not want to know and, due to their qualification, could not know all the details of bibliographic records, which were the only organizing instrument for taking account of the movement of typographic products in that period. Therefore, when computer technologies came to be introduced in the early 1960s in all spheres of industry, it became possible to implement the idea of avoiding this costly identification by replacing it by some abstract unique number. The ISBN (International Standard Book Number), which is the first standard that regulates this proposal for book literature, was developed in Great Britain in 1966 and issued in 1972 for direct application in publishing by the countries that joined the implementation of this project. At present, the works on the assignment of these numbers are performed by authorized national centers in the countries that support the project. The uniqueness of given numbers is ensured by international structures. The assignment of the ISBN and ISSN is coordinated by the London International ISBN Agency (www.isbn-international.org) and the Paris International ISSN Center, respectively. Russia takes part in both projects, with the function of the national center being performed by the Russian Book Chamber (www.bookchamber.ru).

Digital publication identifiers have radically simplified all production procedures in the printing industry and in the work of the bookselling network, but almost have not affected the format of a traditional bibliographic description. They can very seldom be found in a reference and, moreover, are by no means the most efficient sign of a document. However, they have nevertheless affected the traditional description indirectly. Thus, thanks to the introduction of the ISSN, the uniqueness of names of periodicals has been achieved, which is very important due to the impetuous growth in their number.

A more noticeable change in the structure of bibliographic citation was made by the origin of the DOI identifier, which is primarily due to the fact that almost all the publishers of scientific journals starting to place full texts of their articles on the Internet and it was necessary to perform a rather difficult search procedure in order to find them by a traditional reference. Web search engines are not oriented to working with bibliographic records. In addition, commercial databases of articles from journals of major publishers are not always accessible to crawlers. A user has to find a journal on the web, then a year and number, and only afterwards will it be possible to turn to an article itself. The DOI system arose due to the joint initiative of three trade associations in the publishing industry (the International Publisher Association, International Association of Scientific Technical and Medical Literature, and the Association of American Publishers) and was presented at the Frankfurt Book Fair in 1997. The basic idea was borrowed from the PURL project (the Persistent Uniform Resource Locator) supported by the research subdivision of the OCLC first-rate

[7] The project was implemented by the initiative group (Dublin Core Metadata Initiative, DCMI), which was created in 1995 in response to the need for the origin of efficient web-search mechanisms. In Russia, these recommendations were implemented as the GOST 7.0.10-2010 (ISO 15836:2003) standard: The National Standard of the Russian Federation. The system of standards on information, librarian work, and publishing. The set of Dublin Core metadata elements.

librarian structure.[8] The high and unpredictable mobility of web resources creates a situation where links do not lead to corresponding information if resources are replaced and domains are re-registered. One of the ways to retain correct addressing is to create a constant PURL address. A PURL is identical to a URL in its structure,[9] but it does not point to a specific resource site, but to an address of an intermediate entry in the PURL database that in its turn indicates an already specified URL-address of the resource. When the PURL is turned to, a server finds a necessary entry in this database and re-directs a query to the already specified resource site. An independent address database is supported on a gratuitous basis by the PURL project; the task of supporting an actual resource address in the database is performed by a resource owner and depends on him. The DOI project repeats this technology, but already at a higher organizational and commercial level.

The DOI project is managed and developed by the International DOI® Foundation (IDF). First, the identifier was developed as a universal instrument for the unique designation of electronic objects of all types (books, articles, films, etc.), but has become the most widespread for journal scientific articles. Today, almost all major scientific journals supplement bibliographic references with this element.

The practical work that deals with assigning the DOI numbers and supporting the servers that perform direct addressing to corresponding resources is carried out on a commercial basis by several companies, to which the IDF fund delegates the corresponding authority. The CrossRef registration agency is the best known among such companies (http://www.crossref.org). The registering structures perform two functions: a publisher is given a unique prefix during the first registration[10] and the support is given to the DOI-resolver servers that route a user to a corresponding source by a DOI number.

BIBLIOGRAPHIC MANAGERS

Today, the computer-product market offers hundreds of programs that automate the work with bibliographic references. Meanwhile, with allowance for a basic functional orientation, these programs can have the most diverse names: bibliographic managers, knowledge managers, personal information managers, organizers of scientific work, etc. Among them, a user can choose free products or direct his attention to commercial programs; meanwhile, almost all commercial programs have abbreviated free versions. Sometimes these tools for processing bibliographic information are developed within a first-rate database of scientific information, for example, the EndNote bibliographic manager of the Thomson Reuters Company, which is connected with the bibliographic Web of Science database of the project.

Developers of text editors do not abstain either, in particular, the Microsoft Corporation, which is constantly improving the technology for working with references. However, the products they create still cannot compete with specialized programs.

The most widespread group of programs for automation of work with references is formed by bibliographic managers. These are software products for personal computers, which are commonly offered as a solution for the Windows operation system and do not require any additional technical and software tools. They permit an ordinary user to create and support a private (collective) library of references to scientific literature with the opportunity to download original sources themselves and enable the automated preparation of reference lists for created publications.

A bibliographic manager includes the following compulsory constituents.

A database that stores the information on sources (elements of bibliographic descriptions, notes, marks, in some cases primary sources themselves, etc.). It is possible to browse through it, to edit references or manually add new ones using different input templates, and to perform filtration and searches over all fields. A database can be formed both on a user's computer (the offline version) and using the cloud technology, when a user places data on a developer's server. The functional distinction of managers is insignificant in this respect, since almost all of it is based on the already ready standard-function database management system (DBMS) of a third-party producer and it is rather difficult to suggest some original approach to the standard technology of working with downloaded data.

An data input (import) module that permits the information on sources (data for forming a link) to be automatically downloaded into a user's library. Each introduced link is given a separate entry in the database of a bibliographic manager. During inputting (import), a link is divided into constituent requisites, each of which is placed into a certain entry field, and data storage is organized in this form.

[8] The OCLC (Online Computer Library Center) is a first-rate librarian structure that gives many services for access to literature and maintains the World Publication Catalog. The network address of the PURL project is http://purl.oclc.org/

[9] an example of a PURL address is http://purl.oclc.org/keith/home

[10] DOI indices are symbol sequences, which consist of two parts separated with a forward slash (/). The first part is a publisher's prefix defined by a register and the second part is a suffix formed by the publisher accounting to its own established rules. An example of DOI is 10.1134/S105466X14040033, the publisher's prefix is 10.1134, which was given to the *Laser Physics* journal by the Russian Academy of Sciences, and S105466X14040033 is defined by the editorial staff

An input (import) module is the most important part of a bibliographic manager; each software product can have its own original approaches to its solution. The simplest requisites implemented in each product are the manual input of bibliographic document requisites and downloading of bibliographic information from files prepared in the formats that are known to the system.

Special mechanisms for uploading bibliographic data are created by owners of information resources (electronic libraries, scientific information databases, scientific portals, etc.) for the most widespread bibliographic managers. A user who works with such information sources has the opportunity to automatically introduce bibliographic information on a primary source of his interest into a database of his bibliographic manager.

Let us analyze this mechanism for uploading bibliographic data based on the example of its implementation in the Russian version of the Google Academy search engine. Let us suppose that a user is interested in searching for the second volume of the Russian translation of the book by Leonardo Olschki *History of Literature in New Languages*. When making a search, the engine finds this book among other sources on the site http://www.nehudlit.ru (this is an initiative librarian site, which defines itself as a catalog of references to web files). During accessing by the "*citation*" hyperlink, the following instruction is displayed:

"Copy the formatted bibliographic link via the clipboard or go to one of the links for import into the Bibliography Manager.

GOST Olschki L. History of Scientific Literature in New Languages. Vol. 2, 1933.

MLA[11] Olschki L. *History of Scientific Literature in New Languages*. Vol. 2 (1933).

APA[12] Olschki L. (1933) *History of Scientific Literature in New Languages*. Vol. 2. *BibTex*, *EndNote*, *RefMan*, *RefWorks*.

The BibTex, EndNote, RefMan, RefWorks hyperlinks permit a bibliographic link in a considered book to be automatically downloaded into the database of a corresponding bibliographic manager installed or downloaded at this moment on a user's computer. For other bibliographic managers, if a format of uploaded data (GOST, MLA, or APA) is supported, a search can be made in the half-automated mode via the clipboard.

When bibliographic data are obtained from automatic servers, a user must be critical of the proposed options of a bibliographic link. Despite the high potential and convenience, this very useful instrument is at the stage of development; thus, errors are possible, which a user must notice and independently correct in the manual mode. It is necessary to remember that if an author sends a text to editors, an editor must correct only the sequence of requisites and marks in a bibliographic link. He does not see and will not look for a publication to which the link leads. Therefore, if any requisite of the link is not correct (a year, name of a publisher, etc.) or absent, an error in the reference list will appear in the publication, or a competent editor will notice it in advance and address the author.

To illustrate the need for critical analysis of bibliographic information received from automatic servers, let us consider omissions in the above search results of the Google Academy search engine. Disregarding possible critical assessments of the search results in the MLA and APA formats, we will analyze the errors in a link formed according to the Russian GOST format. They mainly concern the absent output data of the publication: the link does not indicate a publisher and city in which it is located, as well as the fact that it is a translation from German. In addition, the book has a very informative subtitle *Education and Science in the Epoch of Renaissance in Italy*, which is also desirable to include in the link.

Undoubtedly, the most efficient and desirable variant is the direction where metadata are taken directly from the structure of an electronic document. If the search works on analyzing the structure of a document based on artificial intelligence are not used, it is really possible to implement this process only if the document contains RDF-data.[13] However, the sites that support this data format are very rare in the Russian web segment.

A tool for interaction with text editors permits links to database primary sources to be inserted in an edited text and enables the automated formation of a reference list. Meanwhile, two schemes of interaction are possible: building a manager into a text editor or export of a prepared link in the simplest software implementations, for example, via the clipboard. The major advantages of using bibliographic managers for forming the style of scientific works were implemented in exactly this constituent. In addition to the processing capability to transmit a ready link from a database of a bibliographic manager into a text of a scientific work, there is an opportunity to manage the referencing style (GOST or formats adopted by foreign editorial staffs). The referencing style is selected from a library of referencing rules, which is a component of a bibliographic manager.

[11] The MLA is a format of bibliographic references of the Modern Language Association of America.

[12] The APA is a format of bibliographic references of the American Psychological Association.

[13] The RDF (Resource Description Framework) presents assertions about resources in the automatically processible form and is a part of the semantic web concept.

This multivariate tool is becoming very important for a Russian scientist if he is going to publish his works in leading world publications.

It is quite natural that bibliographic managers are constantly developing, as any information product does. Thus, recently, with allowance for the role of the Internet in scientific communications, network interaction, support of collective work (a common bibliography database, collective making of a reference list, etc.), exchange and synchronization of bibliographic information in individual databases of different users, automated checking of links according to scientific article databases, etc. have become a basic field of their development.

A number of bibliographic managers provide the search for metadata according to the ISBN and DOI codes, as well as the opportunity to extract data from barcodes, if a user has appropriate equipment. These are software implementations that make it possible to form book catalogs, arrange materials on some project, and plan the research activities of a user.

To ensure the convenience of a user, bibliographic managers are integrated using specially developed plug-ins into Mozilla Firefox and Google Chrome browsers and much more rarely into Adobe Reader and Adobe Acrobat.

THE PROPERTIES OF EXPANSION OF BIBLIOGRAPHIC MANAGERS IN RUSSIA

In Russia, interest in bibliographic managers was comparatively limited until recently. They came to the notice of IT specialists and were actively used by scientific workers who had close contacts with foreign academic institutions. An ordinary researcher had a very superficial idea of this technological product.

This is most probably due to the low and, most importantly, irregular publication activities of the greater part of the Russian scientific public, particularly in foreign periodicals. It is exactly constant work on the preparation of scientific articles and monographs and interaction with numerous publishers that demand of a researcher not only the creation of his or her own thematic database, but also its translation into electronic carriers and familiarization with the modern instruments for working with this database. Publications are the main criterion of the scientific level for researchers from almost all of the developed countries; therefore, the preparation of articles is their regular and rather routine work, where several publications can be prepared simultaneously.

In Russia, the basic assessment of a scientific specialist was traditionally formed according to his or her contribution to the collective work of an organization where the scientist served. Meanwhile, publications were very desirable, but their role was not decisive in the certification of a scientific position. This led to the situation where a person who is occupied with scientific activities obtains a scientific result and has his own view on the surrounding processes and cannot set this out in the form of a publication. For a significant number of Russian researchers, writing an article is a scientific feat, while the majority justifies it by a lack of literary talent.

Another and perhaps more grounded reason for inattention to bibliographic mangers in Russia is that the overwhelming majority of Russian scientists publish their works in domestic and consequently Russian-language journals. References in them are formed according only to the rules (requirements) that are defined by the national GOST standard;[14] therefore, authors do not have the problem of transition from one publication style to another. This situation means that one of the most important properties of any bibliographic manager is not used, viz., that when its database stores a set of fields (requisites), from which a reference of any style can be made, instead of a reference itself.

Finally, some category of scientific workers, particularly the older generation, is wary of new tools for handwritten works.

However, in recent years, the situation with publication activity in Russia has strongly changed; this became noticeable after taking stringent administrative measures. Large scientific organizations have introduced requirements on the number of publications for the appointment to scientific positions, as well as allowances to the basic salary of research officers for publications in the most-cited international journals, which are huge by the standards of basic salaries. Undoubtedly, the growth in interest in bibliographic managers in Russia cannot be explained only by these actions. This instrument, integrated with most of the largest scientific literature collections, is becoming necessary for each Russian researcher.

Since the goal of this paper is not to analyze the advantages and disadvantages of even a limited number of the most widespread bibliographic managers in detail, it is impossible to make recommendations and conclusions and compare these products. However, relying upon the numerous reviews of this rapidly growing sector of computer programs, which are regularly placed on the web (unfortunately, we failed to find

[14] The standardization of bibliographic description in Russia has an almost half-century history. The standards of the first generation were adopted in the Soviet Union in 1969. These are regularly updated, supplemented, and improved. The last version of the standard GOST P 7.0.5-2008 A System of Standards on Information, Librarian Work, and Publishing. A Bibliographic Link. General Requirements and Rules of Formation, which has been regulating bibliographic citation since 2008, can be found via the reference http://protect.gost.ru/document.aspx?control+7&id=173511.

a more fundamental study on these themes), we can indicate the most popular ones. Zotero is a leader among free versions of such programs, at least in the Russian scientific community, while EndNote, from the Thomson Reuters Company, is the most used and full-featured commercial product. To understand the processes of familiarization with bibliographic managers in Russia in more detail, we can recommend the Center of Working with Bibliographies site of the Scientific Research University Higher School of Economics (http://academics.hse.ru/bibliography).

Despite all the usefulness and convenience, the euphoria about the high potential of bibliographic managers is somewhat exaggerated. These are only tools for automating the referencing process, which may fail under certain circumstances. An author must always control the results of their work. It is hardly justified to answer a reader's questions on a reference list with: "It was formed like this by a file manager."

In addition to controlling whether already prepared bibliographic links were formed correctly, the authors of scientific publications will still have to form links to scientific literature in the manual mode for a long time. Even in the future not all of scientific, and particularly technical, publications will be transformed into the electronic form (for example, technical manuals for long disused devices). If we suppose that an electronic analogue appears for all paper variants of documents, a bibliographic description will be correct and full in by no means all of them.

THE POTENTIAL FOR IMPORTING BIBLIOGRAPHIC DESCRIPTIONS FROM THE WEB

Let us consider the situation with obtaining a correct reference in the electronic form on the web in more detail. According to a preliminary assessment, we can suppose that the most favorable situation must emerge for book literature. The instrument of a "compulsory copy" and transfer of book catalogs of the world's largest libraries to electronic access seem to form the basis for such confidence. However, this is still true only for the most topical literature of the last several decades. The situation with obtaining references to old books in the scientific literature, particularly in languages other than English still does not meet modern requirements. Above, we have considered the procedure of importing a bibliographic description into a database of a bibliographic manager based on the example of the book by Leonardo Olschki *History of Scientific Literature in New Languages* (vol. 2, 1993) and we noted that the reference obtained from the Google Academy server contained errors. Therefore, it is quite natural to pose the question: is it possible to find a correctly formed reference to this document on the web? However, there was no success in searching in catalogs of the leading Russian libraries (Russian State Library, State Public Scientific Technical Library), the world's largest WorldCat bibliographic database, as well as in the service Obtaining bibliographic information from state library funds,[15] which is formed as a state service according to the legislation of the Russian Federation.

However, this is a temporary inconvenience. One can be sure that the entire book literature published in the world on any carrier will with time have not only a correct bibliographic description available electronically to any researcher, but also an electronic analogue of the publication itself. This belief is supported by the fact that any similar publication has at least one storage copy in some traditional library and a major task of these highly respected organizations is to transform *all* their resources into the electronic form and to organize convenient access to them.

The situation with the journal literature and collections of scientific works is more definite. At present, bibliographic information on scientific articles can be obtained in the electronic form (possibly, in the incompletely ready form) from a vast set of sources: on publisher sites, in bibliographic databases of scientific information (Scopus, Web of Science, Russian eLIBRARY), during work with scientific search engines, on the sites of scientific actions and research organizations, as well as in the rapidly developing archives of scientific electronic publications. However, these sources contain by no means all published articles. Thus, many publishers do not digitize their old products and access to publications of extinct publishers is complicated. Commercial bibliographic databases introduce information on only the most significant publications and do not always deal with retrospective information, since this costly project does not always pay off. Scientific search engines enter information in their search index only if their search works have fixed corresponding information in the web.

Digitizing and bibliographic description of the complete article array of the world's scientific periodicals seem to be impossible. A structure that will perform this work and place a corresponding database in the web will hardly be found. Traditional libraries are unlikely to keep the article inventory of all stored publications. In Russia, the situation is complicated by the fact that the Soviet Union had many scientific journals, from which information is almost unused now and their publishers have ceased to work. A reference to this literature is only possible when an author refers to some article of a similar journal, indicates it in a reference list in his work, and the list is available to the scientific community as soon as the article of this author appears on the Internet.

In addition to sources that give prepared references, authors often use the references that are avail-

[15] Obtaining bibliographic information from state library funds http:epgu.gosuslugi.ru/pgu/service/10000562924_48.html#!_description) (the reference on the site of the Russian State Library).

able in the texts of used works. Meanwhile, the cases are common where a reference is transmitted into a new article without turning to a primary source. An electronic document permits this to be done with minimum costs. However, an experienced author will never do this, since this method leads to errors.

We can argue with great certainty that authors will have to retain the skills to make bibliographic descriptions in the traditional manual form in order to make references to a significant volume of all journal publications, particularly in languages other than English.

CONCLUSIONS

The instruments for citation to scientific technical literature have a changing structure, which is rapidly changing according to the demands of time and changes in the information service of science. It is quite natural to pose the question: "What problems are desirable to solve in the nearest future?" Perhaps there are the tasks that require the next revision of a reference form and supplementation of traditional references with new parameters.

Let us mention the most important (in my opinion) tasks:

1. The introduction of DOI has not completely solved the task of rapid access to a scientific publication, since this commercial initiative is not available for documents that are oriented to free dissemination on the Internet, as well as to the publications of small editorial staffs. In addition, there are difficulties in the practical use of this identifier. Its bulky many-symbol structure does not have a mechanism for protection from input errors (there is no check digit), and publications with the same DOI can appear, since the second part of the identifier is generated by a user according to his own rules.

This task is subdivided into four subtasks: (1) Creating a unique publication code; (2) The creating in the web environment of a mechanism that permits a correct bibliographic description of a corresponding scientific work to be obtained according to the code; (3) The formation of a stable habit to indicate this code by all researchers during their citation of scientific work; and last, (4) Organizing direct access to a publication via its code.

The first subtask is fairly simple. For example, an comparatively short identifying code can be formed programmatically according to a strictly defined algorithm, which guarantees uniqueness and protection from errors during manual inputting based on compression of a traditional bibliographic description. The program must be free and a publishing structure must generate a code and indicate it in the imprint of a scientific work.

The second subtask can be solved by creating a server (or a system of interconnected servers) on the web that stores all given codes. Writing access to this system is possible only for publishing structures, which must introduce a bibliographic description of the next article when they obtain its code.

The third subtask is more difficult, but if authors are given an opportunity to indicate only the code of a reference instead of the reference itself when a manuscript is sent to an editorial staff, the situation can be solved. During publication, the editorial staff replaces the code with the corresponding reference.

The fourth task can only be simply solved if a publishing structure indicates the electronic address of a publication when they obtain a code. Access to the publication can be paid or unpaid.

The offered solutions can be implemented both as an initiative project, such as Wikipedia, and as an innovative project with a possible commercial profit. If a database about publications reaches a significant volume, it will be possible to develop scientometric studies on this basis, which will already have an independent commercial value.

2. Scientific activities in the modern society are largely assessed based on scientometric indicators. This gives birth to the problems of attribution of articles to a specific author, a certain scientific organization, etc. The case in point is that the requisites contained in a traditional reference are not sufficient to perform this operation. Owners of scientometric databases have to gather additional requisites directly from primary sources.

The major difficulties in searching for publications made at some scientific organization are that forms of names (a complete or short form) in a primary source are various and that names are frequently changed, which is due to organizational measures. Since the number of scientific structures is comparatively small, this task is solved in the existing commercial databases by services for support by the labor-intensive maintenance of the appropriate directories.

There are many more difficulties in searching for a complete list of publications by a specific author. Even when one supplements a traditional bibliographic description in scientometric databases with an author's workplace or his e-mail, it is very difficult to gather all the scientific works of an author, since these requisites change with time and there are no actually efficient instruments for fixing the changes.

The problem seems to be surmountable only by assigning all authors some unique constant identifier, but this proposal cannot be implemented in practice.

In any case, the situation where a reference in the closely networked information society does not make it possible to address an author himself if a reader does

not have access to a primary source is a serious reason to consider improving the citation instruments.

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