Chronological Terms and Period Subdivisions in LCSH, RAMEAU, and RSWK

Development of an Integrative Model for Time Retrieval across Various Online Catalogs

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After a fundamental examination of the phenomenon of time, this paper presents the history, authority, and structure of period subdivisions and chronological terms in the three subject heading languages LCSH, RAMEAU, and RSWK. Their usefulness in online searching is demonstrated using the online catalogs of the Library of Congress, the Bibliothèque nationale de France, and the Deutsche Bibliothek and is compared to the search options in selected digital encyclopedias (Encyclopaedia Britannica, Encarta, Brockhaus-Enzyklopädie). *The author develops a model for common time retrieval across all three online catalogs, outlines the conditions for that model (time period code, chronological code, and chronology authority file), and proposes a search interface.*

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In the era of globalization and internationalization, researchers are often required to access library materials from all over the world and beyond their native cultural understanding. Technically, this is possible through the Internet, which facilitates simultaneous searching in any number of online catalogs. However, varying languages and different cataloging rules make it hard for the user to conduct effective searches.

This paper focuses on subject searching. The term "subject" includes all topical aspects as well as all material about an author or about a specific work or publication. Chronological terms—that is, epoch headings, historiographic terms, terms with chronological restrictions (such as names of persons with dates of birth and death), and time codifications (years, dates)—are analyzed from both the cataloging and the retrieval standpoints. Furthermore, looking beyond the library field, chronological access to digital encyclopedias is explored. Finally, a new time retrieval model for linked multinational online public access catalogs (OPACs) is proposed.

The Problem

Librarians and documentalists have always considered the time aspect in subject cataloging an important element of subject analysis. Langridge attributes different values to the concept of "time" depending on the discipline.[1] While this category plays a comparatively minor role in science, technology, and social studies, it is more important and in fact constitutes the central category in history.

The ability to limit subject access chronologically, whether by subject headings or by classification, is a reasonable premise. Cochrane states, "In the online catalog, how can we limit a subject search on the basis of date or chronological period?"[2] The search using chronological terms in online catalogs is a challenge, one that has been documented in studies. Two of the studies are described here.

A study by Frost has examined a sample of records extracted from the University of Michigan Library's shelflist to determine the degree of similarity between subject heading terms and title terms.[3] All of the 2,268 sample records included the Library of Congress classification number, enabling a comparison of the similarities between various disciplines. Frost found that an exact match (between entire subject heading and title terms) occurred in only 4 percent of the history materials, compared to 23 percent in the sciences and technology.[4]

Another study, by Bates, Wilde, and Siegfried, analyzed the search terminology used by humanities scholars in DIALOG database retrieval.[5] In a two-year period (1989 to 1990), 165 natural language retrievals were conducted using 1,068 search terms from various categories. The occurrence of chronological terms totaled 16 percent in all natural language search statements that contained more than one type of term. Chronological terms are of three types: "date" or "date range," "period," and "time modifier."[6] These results supported findings in the authors' more detailed research project with the National Science Foundation in 1988 that showed that chronological terms appeared in 5 percent of search statements in the social sciences and not at all in the natural sciences.[7] Considering these numbers, the authors concluded "that searching in the humanities may be inherently more complex than in the sciences."[8]

The Phenomenon of Time

The *New Encyclopaedia Britannica* defines time as "a measured or measurable period, a continuum that lacks spatial dimensions. . . . It cannot be given any simple, illuminating definition. . . . Time is held to be non-ending, non-beginning, linear, and continuous."[9]

According to Brandt, time calculations and calendars originate not only from the observation of astronomical events that can be seen in the movement of celestial bodies. They also are based on regularly recurring changes in light, climate, and other environmental conditions on the earth that are linked to those astronomical events.[10] The author further states "that from the beginning, a calendar could not and is not only to be understood as a purely mathematically astronomical problem, but that each calendar system is an extremely complex entity composed of astronomical, environmental, ritual and practical elements and needs, and therefore: the *expression of a culture.*"[11]

This relationship of time's perception and measurement to environmental and cultural conditions is obvious in subject cataloging, too. On the one hand, calendars vary among different religions and cultures. In the predominantly Christian Western Europe and the United States, for example, the counting of years begins with the birth of Jesus Christ, whereas in many Middle Eastern countries, the beginning date is the Mohammed's flight from Mecca to Medina. However, these different time schemes can be converted from one into the other. Compared to this, chronological terms are even more closely attached to their culture of origin because of their linguistic manifestation. This becomes evident in the term "contemporary history." Among German-speakers, "Zeitgeschichte" is generally defined as the historical period directly preceding the present.[12] In France, "histoire contemporaine" begins with the French Revolution in 1789, and in Great Britain, "contemporary history" begins with the parliamentary reform of 1932.[13]

Similar complications are raised by epoch or period terminology. Epochs are time periods set up to divide the overall course of history into sensible, self-contained units. Case offers the following explanation: "Periods, then, are not merely convenient collections of years. They are thematic categories of time that require substantiation by the historian."[14] Furthermore, periodization occurs not only in political history, but also in other disciplines as well. "Periodization is pedagogically useful in managing unwieldy masses of factual data. It is interesting to note that periodization also is used by other disciplines. Often, periodization serves to demarcate recognizable contours of given phenomena. Art history and musicology utilize periodization to examine stylistic changes in time and space. . . . Specific fields in history (i.e., economic history . . .) and technology utilize periodization to grasp specific 'revolutions' in fields of human activity. Periodization can be extremely instructive when applied to highly demarcated fields (i.e., histories of education, biology, or chemistry)."[15]

Cataloging

The principle of chronological order is important in every systematic catalog. For Roloff, it goes beyond its formal

function as it simultaneously creates a topical connection; for example, it can combine works of literature into a literary style.[16] Roloff distinguishes two classification principles relating to time:

1. the chronologically topical order of entries according to the time period of the document contents (in subject cataloging),
2. the chronologically bibliographic order of entries according to their year of publication (in descriptive cataloging).[17]

Both principles will be described in detail in the following section.

Descriptive Cataloging of the Time Aspect

The most important element in descriptive cataloging is the publication year. Furthermore, the year of a publication's first edition, reprint, or copyright or, for an exhibition catalog, the date of the exhibition also form part of descriptive cataloging. The publication year does not always indicate the original date of the content. This is especially true in the case of a reprint, licensed edition, impression, or translation, which requires reference to the original year of publication.

The publication date also has to appear in subject cataloging, as it reflects the final content editing date. Richter gives the following example: "The publication date provides a chronological subheading. Thus you would have the index entries 'Droit civil, 1920,' 'Droit civil, 1984.' . . . For works that present a topic in a historical perspective, it is always possible to indicate two dates that limit the subject's development, even if these dates are not made explicit by the author."[18] The date is a vital and relevant element in collections with exclusively scientific documents whose content is not framed within any historical context, even if dates are rarely expressed in the subject data.

The publication year is important for works of literature and art that are representative of a certain literary or artistic style, regardless of the date in which the story is set, which may be completely different. "Novels, for example, are an important source for social history in particular . . . "[19]

Subject Cataloging of the Time Aspect

In the catalogs of large libraries, the possibility of limiting a topic using time elements must be taken into consideration. According to Hahn, "The time aspect is always necessary for historical objects—in the broadest sense—as well as for historical descriptions. In the subject catalog, the cataloging of time relevant details includes time periods (years) of events or processes, of political or legislative measures, time spans under review or reporting dates, investigation periods or simply the information status of facts."[20]

In order to take a deeper look into the various cataloging rules in use, three subject heading languages (SHLs) are considered. In this paper, they and the abbreviations used for them hereafter refer to the subject cataloging system in its entirety of code, authority file(s), and other resources. They are:

1. Library of Congress Subject Headings (LCSH)
2. Répertoire d'Autorité Matière Encyclopédique et Alphabétique Unifié (RAMEAU)
3. Regeln für den Schlagwortkatalog (RSWK) and all examples of RSWK[21]

These SHLs were selected because of the degree of their distribution; all three subject languages above are in use beyond their countries of origin (United States, France, Germany). A survey conducted in the mid-nineties under the auspices of the International Federation of Library Associations and Institutions (IFLA) shows the international importance of these SHLs. LCSH is used in twenty-four national libraries. RAMEAU is increasingly in use in the francophone countries of Northern Africa and the Middle East, such as Tunisia, Algeria, and Lebanon. RSWK spread out from Germany to Austria, Switzerland, and the German-speaking regions of Italy.[22]

Another criteria is the difference in languages used. This allows cultural divergences and traditions to be tracked in the indexing of time aspect across various language areas—the anglophone, francophone, and the German-speaking regions.

The oldest of the three SHLs is LCSH. When the Library of Congress (LC) began to set up a dictionary catalog in 1898, it went back to Cutter's set of rules and regulations (first published in 1876 as *Rules for a Printed Dictionary Catalogue*).[23] However, LC did not declare the rules obligatory and catalogers distanced themselves more and more from Cutter's code. Responding to the spreading inconsistency in subject cataloging, a list of subject headings was created at LC primarily for internal use. This list was first published in 1914 and its use spread quickly; it received its current name (LCSH) in 1975.[24] LC resisted repeated demands for creating a formal subject cataloging code. Instead, it offered various tools for assigning and creating subject headings. The LC *Subject Cataloging Manual: Subject Headings* (SCM), published in 1984, has been an important resource, although even today it does not constitute a formal code composed down to the last detail like Anglo-American Cataloguing Rules.[25] It is solely a collection of LC subject cataloging practices.

The French list of subject headings RAMEAU is based on LCSH. At the end of the 1970s, the Bibliothèque

nationale de France decided to establish its own subject authority file. The Bibliothèque national de France based it on the original LCSH and the *Répertoire de vedettes-matière* (RVM) from Université Laval in Québec, Canada, a French version of the LCSH that had already proved its practicability in the Bibliothèque publique d'information in Paris.[26] The Bibliothèque nationale de France neither translated the LCSH literally, nor did it just adapt the RVM. It instead put together a controlled vocabulary that fit its own conditions. In 1982, it published the *Liste de vedettes-matières de la Bibliothèque nationale*.[27] At the insistence of the ministry in charge of academic libraries in France, a national subject authority file for academic libraries, called RAMEAU, was created. It combines three authority files: RVM, the subject heading lists of the Bibliothèque nationale de France, and the Bibliothèque publique d'information. Today, RAMEAU is also used in French public libraries. The accompanying *Guide d'indexation* with its rules for creating and implementing subject headings is based on a translation of the SCM.[28]

The history of the French subject authority file shows that the basic principles in RAMEAU and LCSH, such as the very strong pre-coordination, are identical. Many subject headings are composed of one or more terms and a main heading with one or more subdivisions as fixed connections listed in the authority file. Additionally, free-floating subdivisions ("subdivisions affranchies") for all topics and special subdivisions ("subdivisions spécifiques") for specific topics exist both in the SCM and in the *Guide d'indexation*. However, the cataloging practices for subdivisions have diverged. The thirty-five lists of free-floating subdivisions in the SCM were reduced in the 1999 edition of *Guide d'indexation*; today even practices concerning period subdivisions ("subdivisions chronologiques") vary.

Strictly speaking, free-floating subdivisions for the time aspect that could be assigned to main headings of all topics do not exist in LCSH. The most applicable rule H 620.3.d provides the following period subdivisions:

> History—16th century
> History—17th century
> History—18th century
> History—19th century
> History—20th century.[29]

In contrast to LSCH, RAMEAU offers only one list, *Subdivisions d'emploi général (chronologiques)*, providing approximately forty subdivisions. Apart from this, both SHLs contain specific period subdivisions that may be assigned only within a specific topic and consist of standardized time spans, subdivided according to relevant logic. Moreover, in both systems time periods can be expressed verbally in the term itself, for example, as an adjective qualifier.

In 1972, Lois Mai Chan specified six forms of period subdivisions in the LCSH that are used with main subject headings. These are:

1. inverted "noun, adjective" headings;
2. main subject headings with a subdivision in the form of a noun or phrase (without any dates), clearly denoting a chronological period or historical event;
3. main headings with a subdivision containing the name of a historical period or event followed by dates;
4. main headings with the name of the century as a subdivision;
5. main headings with a period subdivision created with the preposition "to" followed by a date; and
6. main headings (often with aspect subdivision) with dates only as period subdivision.[30]

The RSWK is a cooperative project of several German-speaking public and academic libraries. After a project to create a universal classification system for all libraries had failed at the end of the 1970s, plans arose for a joint subject indexing system. In contrast to efforts in the United States, emphasis was put on the development of a code, which resulted in the 1986 publication of the *Regeln für den Schlagwortkatalog*.[31] A slightly revised second edition followed in 1991, and a third edition containing major changes was released in 1998.[32] Collaterally, from the very beginning of the practical implementation, the Schlagwortnormdater (SWD) was created as an authority file. The editorial headquarters is situated in the Deutsche Bibliothek. Unlike LCSH and RAMEAU, which contain only subject headings, RSWK also includes personal name headings.

RSWK is a syntactic indexing system. Strings of controlled terms are set up according to the rules. However, hardly any pre-coordinations exist. The time aspect in RSWK is reflected mainly in so-called "Zeitschlagwörter" (chronological headings). These not only include the terms "Geschichte" and "Prognose," but also some compounds with "-geschichte," such as "Geistesgeschichte." All chronological and also some form headings can be extended by adding year numbers. Some headings for time periods (such as historical movements and eras) are not considered "Zeitschlagwörter," but topical headings. Some epoch headings have to be converted into the string form of "Geschichte + time span (in years)."

The time aspect is always expressed separately as an independent facet. It is freely assigned by the cataloger without regard to other headings in the string, so that it (sometimes together with another chronological heading) gives the correct time period of the document in year numbers. No fixed period subdivisions exist for specific subject areas as they do in LCSH and RAMEAU.

In all three SHLs examined, the time aspect occurs on three levels:

1. as the controlled term (subject and personal name heading): the term itself is a chronological heading or part of another heading expressing the chronological aspect (for example, birth and death dates within a personal name heading or epochs/styles as adjective elements)
2. in a string of controlled terms (in RSWK) or in the subject heading that exists as a separate element (period subdivision or time span in years or a chronological term or both)
3. in the authority file as a term implying a chronological concept, which is expressed in an equivalent string, in a broader/narrower term, or in a time period code

All three subject authority files are structured as a thesaurus that includes relationships and explanations, cross-references, designation, class numbers, and scope notes. The term "history" is used differently in all three SHLs:

- "History" in LCSH is used for the introduction of year numbers in some cases, but not at all in connection with historiographic terms.
- "Histoire" in RAMEAU is never used for the introduction of year numbers.
- "Geschichte" in RSWK is used for a complete history of a topic (historical point of view) and as introduction of time spans in years.

Retrieval
Searching in OPACs

Because of their use of the examined SHLs, the following online catalogs were investigated for their retrieval functions: the Library of Congress catalog for LCSH, the Bibliothèque nationale de France catalog for RAMEAU, and the Deutsche Bibliothek catalog for RSWK.

One of the basic prerequisites for conducting a successful search is that the time periods and dates associated with a document have been taken into consideration in subject cataloging. However, there is no standardized rule in these three subject heading systems guiding when or even if such elements are indexed at all. Existing guidelines often originate from the card catalog era. This is true for LCSH, too: "But in the online environment, any kind of direct search on dates in subject headings will be thwarted if period subdivisions are added only to subdivide large files. All those other cases where the period is applicable but has not been so indexed will be lost to the searcher."[33] The historian Bates also criticized this practice:

Even the 'Library of Congress Subject Headings,' which predates the development of modern thesaurus principles and which makes detailed provision for geographical, period, and form subdivisions, uses some period subdivisions only to subdivide extra-large files. . . . With such unpredictable application—that is, unpredictable for the searcher—it is impossible to make reliable use of these non-other-common subdivisions in online searching. Yet, clearly, for the humanities scholar, meaningful online searches can generally be carried out only through use of both non-other-common and other common terms, with the emphasis on the former.[34]

Here, Bates uses "common terms" for the following types of subjects: works or publications as subject, individuals, geographical name, date or period, discipline; "other common terms" include all other types of subject that are not common.

Today, digital technology and high storage capacity have made these kinds of restrictions obsolete. More time details could be taken into consideration during subject cataloging while, at the same time, the number of matches can be controlled by appropriate retrieval software techniques.

Distinguishing between *stated* time aspects expressed in words (subject headings and controlled terms) and *encoded,* indexed time details is very important for retrieval in provided subject data. All three SHLs deal differently with this issue, for example, with personal dates (see figure 1).

While LCSH and RAMEAU prefer stated time period descriptions, RSWK uses exact dates, years, and periods.

Epoch terms, such as "Middle Ages," are particularly difficult and also handled differently (see figure 2).

Currently, retrieval using years is based on character comparison. A match occurs only when the time span entered corresponds exactly to the string in the index (single date or year range). Furthermore, this kind of retrieval always provides more matches than needed because the number may occur in the subject entry but with a completely different meaning.

This subject access using the encoded time form has various advantages and disadvantages for the strongly pre-coordinated systems (LCSH and RAMEAU) as well as the post-coordinated systems (RSWK). Just the time period that the user enters as a search term will be found (for example, "1884–1920"). Smaller intervals within that period, on the other hand, like "1890–1910," or overlapping intervals, like "1900–1940," will not turn up. In LCSH and RAMEAU, the time span in standardized period subdivisions includes all smaller periods. The user has to know, though, that there is no automatic cross-reference to the correct period subdivision used for a time span that deviates from or is smaller than that of the document contents. This issue is demonstrated in two examples (see figure 3).

LCSH:
JFK, reckless youth
>Kennedy, John F. (John Fitzgerald), 1917–1963—Childhood and youth
>Presidents—United States—Biography
(example provided by Chan[35])

RAMEAU:
Vie de Picasso. - Vol. 1: 1881–1906 [The life of Picasso . . . 1881–1906]
>Picasso, Pablo (1881–1973) ** Enfance et jeunesse
(example from the Bibliothèque nationale de France Internet-accessible catalog)

RSWK:
Peter Handke : Jugend eines Schriftstellers / Peter Haslinger. - 1992 [Peter Handke: Youth of an Author]
>Handke, Peter ; Biographie 1942–1967
[Peter Handke is an Austrian author, born in 1942]
(example from the Deutsche Bibliothek Internet-accessible catalog)

Figure 1. Comparison of SHL treatment of personal dates

LCSH:
The Prayers of Saint Francis / compiled by W. Bader
>Catholic Church—Prayer-books and devotions—English prayers, medieval
(example from LC's Internet-accessible catalog)

Companion to Medieval and Renaissance Music / ed. by Tess Knighton and David Fallows
>Music—500–1400—History and criticism
>Music—15th century—History and criticism
>Music—16th century—History and criticism
(example provided by Chan[36])

RAMEAU:
La peinture du Moyen âge en Europe, 800–1200 [The painting in the Middle Ages]
>Peinture médiévale
(example taken from *Guide d'indexation* RAMEAU[37])

Fictions of Advice: The Literature and Politics of Counsel in Late Medieval England
>Secretum secretorum
>Littérature didactique anglaise ** Moyen âge ** Histoire et critique
>Écrivains anglais ** Moyen âge ** Pensée politique et sociale
>Éduction des princes
>Rois et souverains ** Dans la littérature
>Politique et littérature ** Grande-Bretagne ** Moyen âge
(example from the Bibliothèque nationale de France Internet-accessible catalog)

RSWK:
Theologie im Mittelalter [Theology in the Middle Ages]
>Deutschland ; Theologie ; Geschichte 750–1500
>Deutschland ; Frömmigkeit ; Geschichte 750–1500
(example from the Deutsche Bibliothek Internet-accessible catalog)

Lateinische Lyrik des Mittelalters / komm. von Paul Klopsch [Latin poetry in the middle ages]
>Latein ; Lyrik ; Geschichte 300–1300 ; Anthologie
>Spätantike ; Lyrik ; Latein ; Anthologie
>Mittelalter ; Lyrik ; Latein ; Anthologie
(example from the Deutsche Bibliothek Internet-accessible catalog)

Figure 2. Comparison of SHL treatment of epoch terms

In the RSWK, the title cannot be found with the descriptor "Weltkrieg <1939–1945>." LCSH is not able to recognize a search for the Sartre *War Diaries* book that contains only the time span "1939–1940."

When searching with verbal descriptions of time, the existence of different forms of subject headings (simple or phrase headings) must be considered. Chronological terms, for example, may appear in adjective form (in LCSH and RAMEAU) or as a single controlled term (in RSWK) like "Middle Ages/medieval." Moreover, narrower terms (such as battles within a war) are not automatically included in the query results. Their relationship to the main term may be shown in the authority files, but the scope and usage notes are intended more for the cataloger than for the catalog user. In any case, the search must be repeated with the new terms found in the subject authority file.

In addition to year number or chronological term entries, all three OPACs at LC, Bibliothèque national de France, and the Deutsche Bibliothek offer indirect access through the subject heading index. Knowledge of permutation rules is necessary. Many terms in a string are not allowed to be permutated or are pre-coordinated connections and encoded time details mostly appear at the end of the string (before the form subdivision). The time codifications are in chronologically ascending order when the preceding character string is the same. A chronological term existing as a separate term in a string or as an adjective part of a heading is not included in this chronological order (with some exceptions) and remains in alphabetical order.

To date, enabling searches for time details in stated or encoded form has not yet been accomplished to satisfaction, and this

LSCH:
War Diaries: November 1939–March 1940
>Sartre, Jean Paul, 1905– —Diaries
>Authors, French—20th century—Diaries
>World War, 1939–1945—Personal narratives, French
>World War, 1939–1945—France
(example from LC's *Subject Cataloging Manual*[38])

RSWK:
Als Freiwilliger zur Luftwaffe : ein junger Westfale überlebt den Zweiten
        Weltkrieg [Volunteering in the airforce : a young Westphalian
        survives the Second World War]
>Deutschland ; Soldat ; Geschichte 1941–1945 ; Erlebnisbericht
(example from the Deutsche Bibliothek Internet-accessible catalog)

Figure 3. Comparison of SHL treatment of smaller time periods

issue has not been paid adequate attention by librarians in the move from card catalogs to OPACs.

Searching in Digital Encyclopedias

The modern catalog user is accustomed to numerous possibilities for time searches offered in various databases. This will be demonstrated with the help of digital encyclopedias.

In addition to other reference resources, encyclopedias have to be consulted when creating subject headings in all three SHLs.[39] *Encyclopaedia Britannica, Encarta,* and *Brockhaus—Die Enzyklopädie* have been chosen for the analysis because of the high quality of their content and their distribution area.[40]

The graphic search interface in digital encyclopedias is immediately appealing, in comparison to the menu-based access in OPACs. Under various names—"timelines" (*Encyclopaedia Britannica*), "historama" (*Encarta*), or "Zeitleiste" (*Brockhaus*), they offer separate screen displays for accessing the database chronologically. The principle of a chronological overview of events in encyclopedias was first introduced in 1990 in *Compton's Multimedia Encyclopedia* on CD-ROM, which offered a "U.S. history timeline" from 1942 onwards in a graphically designed schedule.[41]

Apart from the graphical display of pictures and text elements in a time arrow or timeline, the encyclopedias in some cases offer a chronologically arranged article overview ("text view" in *Encyclopaedia Britannica*). The intervals vary among the chronological sequence, depending on the period or era covered. The user can jump directly to a certain year or move continuously back and forth within the timeline. Furthermore, the timeline function provides the user with the possibility of searching for only personal names, using time periods that include personal dates (*Encarta* and *Brockhaus*) through which a (rough) limitation by topic can

be set. The connection of a person to an art or literary genre is available only through hyperlinks in the text of the documents. The magnifying zoom function in *Encarta*, which allows the user to reduce or enlarge the time intervals, is particularly user friendly and supports a clear screen display.

All of these views of chronological data are limited to specific article selections within the encyclopedia. Dates set in the future are listed only in *Brockhaus*.

Allen summarizes the advantages of a timeline for information systems:

> *Inform:* The timeline can, of course, provide basic information about the relative order and dates of events.
>
> *Show Context:* Events can be compared across timelines.
>
> *Encapsulate:* Events may be included as part of larger events.
>
> *Link:* Links can show that events share attributes or a hypothesized causal relationship.[42]

The Retrieval Model

In contrast to card and book catalogs, online catalogs enable direct access to time period and date information in the subject field. The European card catalogs' classical division into alphabetical and systematic catalogs no longer exists for OPACs, as all details are combined on one screen. The linear search employed in the card catalog has been eliminated by changes in user behavior with the online catalog (for exmple, through the use of Boolean operations). Nevertheless, the issue of searching for the time aspect is not completely resolved.

The attractive retrieval of time information found in digital encyclopedias also should be implemented in OPACs. However, two sources in bibliographic databases must be distinguished:

1. the subject (and personal name) heading authority file that includes the time span expressed in controlled terms, and
2. the bibliographic record that contains the subject field with the document's contents.

Schulz created a new and, so far, exclusively theoretical approach in retrieval of time information for RSWK by adding the date or date range to each chronological term in the subject field of the bibliographic record.[43] Criticism followed immediately: "This contradicts decades of documentary indexing experience, though. Imagine taking every work by and about Bach, Handel, Mendelssohn, Schütz,

etc. and adding the dates of living and possibly 'Baroque / Music . . . 1600–1790' and the geographic details Weimar, Leipzig, Saxony, Germany. . . . If these details are stored once in an authority file, every repeated insertion in the individual works is redundant. However, indexing should contain information about the document and not produce redundancy."[44]

Another proposal of RSWK has not been put into practice, although it avoids redundancy. A chronological term in the string would be replaced with the encoded form only during retrieval if no precise time span (according to the document's content) were given in the bibliographic data. The code would automatically be caught in the authority file.

Both retrieval models would result in an enormous number of hits if all smaller intervals were automatically included. Their concepts are based only on RSWK cataloging practice and do not take different rules for assigning encoded or verbal forms in other SHLs into consideration. Because RSWK prefers year numbers, the search with the encoded form and the search with the stated form are not coequal to each other.

Presuppositions

The first step for developing a new time retrieval model in an international environment like the Internet is to ensure that both the stated and the encoded form of time expressions are treated equally. For the encoded form, the year numbers or dates always must be indexed in accordance with the Gregorian calendar to establish an international standard. Furthermore, because heterogenous regulations for chronological terms and period subdivisions in the SHLs must be included in the model, the ability to cross search in different bibliographic databases is vital.

The new time retrieval model requires three elements: a "time period code," a "chronological code," and a "chronology authority file (ChAF)." The third element, ChAF—especially for information systems in history—is the heart of the model.

Time Period Code

In order to store time codifications in the subject field of a bibliographic record as numbers and not as characters, they should be stored in a separate numeric field that this author calls the "time period code." Consequently, searches for a time span with larger, smaller, and equal operators would be possible whereas currently only a character comparison is possible. For example, *The Cubist Print* by Burr Wallen and Donna Stein (published in 1981 and dealing only with the period 1907–1914 of Cubism) would be given a time period code of 1907–1914.

RSWK has already envisioned such a field, called "Zeitcode," but it has not yet been put into practice in the

Deutsche Bibliothek online catalog: "The time period code is used for all subject areas, not only for political history and for timely extensive statements. . . . If the document contains several time spans, a time period code will be assigned for each of the time periods."[45]

When re-indexing the existing records, section 418.2 of RSWK 3 recommends deriving the time period code (whenever possible) automatically from the subject field that exactly notes the time period of the document content in compliance with RSWK rules. For RAMEAU and LCSH, a time period code cannot be realized so precisely due to period subdivisions. However, an attempt can be made to extract the precise time span from titles and subtitles. Otherwise, year numbers of the period subdivisions can be transcribed into the time period code field. To enable a precise retrieval of time information in the future, a cutoff date for the beginning in standardization in cataloging should be set.

Chronological Code

The chronological code provides a time span valid for the chronological term in the authority record and must have the same structure as the time period code. Both codes should give an accurate account of an event's date to the day (such as a birthday or historic event) even when very few documents would be assigned a time period code with such an exact date (like diaries). Imprecise terms like "Middle Ages/medieval" have to be standardized, but may include various time periods depending on the cultural area, distinguished by a qualifier. Thus, a comparability of encoded and stated time forms would be guaranteed and a conversion of chronological terms would be possible. For example (from LCSH; BT = broader term, RT = related term, NT = narrower term):

Cubism   (*May Subd Geog*)
    BT   Aesthetics
          ...
    RT   Post-impressionism (Art)
    NT   Decoration and ornament—Cubism
          ...
Chronological code: 1907–1920

The chronological code can be changed at any time, for example, when new insights require a change in the period's time range or an adaptation of birth and death dates. If the same chronological term in older literature is used for a different time span, it will be indicated with a qualifier in parantheses.

RSWK already has proposed a chronological code, unfortunately also called "Zeitcode" in the SWD without distinction to the time period code. So far, it has only been applied rudimentarily. It will be used for the following chronological terms:

- personal name headings
- historical geographic and ethnographic terms that no longer exist
- topical subject headings covering a limited time span
- historical events
- epoch headings
- corporate name headings, insofar as they no longer exist
- older languages
- works (uniform titles)[46]

Chronology Authority File

The name "chronology authority file" (ChAF) is composed of the words "authority file" and "chronology." Authority file was selected to be analogous with "name authority file." The word chronology means "any method used to order time and to place events in the sequence in which they occurred."[47]

The authority data record of a ChAF consists of three parts: chronological terms (including personal names), the appropriate chronological code, and an indicator for the authority file where the term is stored, such as the personal name heading from the LC name authority file in LCSH. The sequence of the authority data records corresponds to that of a timeline in the digital encyclopedias discussed above. It starts with the largest time span and advances to narrower intervals down to an event on a certain day. The type of heading also should be stated (p=personal name heading, u=uniform title, t=topical subject heading, g=geographic subject heading, and so on). Figure 4 offers a brief example demonstrating the internal structure of the ChAF.

All chronological terms are entered along with their chronological code—including phrase subject headings with "ancient" or "medieval," creating an interdisciplinary synopsis of the temporal relationship of these terms. Because this format would result in a huge number of authority records, it would create a challenge not so much for storage space, but for user display design. Therefore a subject area indicator for each chronological term should be employed for more efficient retrieval. This could be the (shortened) class number of an international universal classification. Unfortunately, not all subject authority files work with the same classification. Future development probably will move toward the Dewey Decimal Classification scheme, already in use in RAMEAU and soon to be applied by the Deutsche Bibliothek.

Existing subject authority files lack comprehensiveness with regard to time retrieval because the incorporate only hierarchical, equivalent, and associative relationships, as well as occasionally references to more recent and former terms. This also applies to the MACS (multilingual access to subjects) project.[48] MACS tries to establish a connection between all three subject authority files: LCSH, RAMEAU and SWD. It does not intend to create a complete multilingual thesaurus, however. Each authority file remains independent within the authority file structure and remains the responsibility of the respective national library. It enables the user to browse in a meta-thesaurus and to continue a query with foreign-language equivalents. Furthermore, the user may go straight to the bibliographic search function in all affiliated OPACs, taking the cultural dependency expressed in the relationship of the terms into consideration.

In contrast to MACS, the ChAF shows temporal relationships between all chronological terms from all disciplines—artistic styles, historical movements, musical style, and so on. Artists (and other individuals) whose works do not belong to an art style also could be shown in the ChAF if they lived or live in the specified time period. If later research shows that an artists's work was part of a different art style, the appropriate class number and the hierarchic relationship would be changed. The temporal relationship, however, would stay the same. By including foreign-language terms in the ChAF, the user could recognize chronological terms outside his or her own cultural or language area more easily if in chronological sequence and also become aware of a possible additional equivalent time span in another language.

Search with the New Retrieval Model

This section describes a specially designed search screen for cross-searching different bibliographic databases. It is based on the current menu-driven interface and existing subject data of the OPACs studied.

Search Field "Time Period"

For searching directly in bibliographic records, a separate search field called "time period" would be useful. In addition, it also could be used to open the ChAF index at any term or date position using a ChAF button similar to the Headings List button in the LC online catalog.

For the ChAF display, zoom functions and limits should be included. Limitations can be set by subject area or by personal name with the help of class number or indicator for the heading type. Various writers have made requests to display personal name headings in chronological order by birth date. For example, Hagler has noted, "Arranging personal names alphabetically by surname is convenient for locating material by or about individuals. However, if the relationship of persons to historical events is of greater interest to users of the listing, it may be better to arrange them in the equally simple numeric sequence of each person's birth date, whether in forward or reverse

1789-01-01/1799-12-31	(LCSH, g)	France—History—Revolution, 1789–1799
	(RAMEAU, g)	France ** Histoire ** 1789–1799 (révolution)
	(SWD, t)	Französische Revolution
1789-01-01/1789-12-31	(LCSH, u)	Goethe, Johann Wolfgang von, 1749–1831. Torquato Tasso
	(SWD, u)	Goethe, Johann Wolfgang von / Torquato Tasso
1789-06-27/1860-08-2	(LCSH, p)	Silcher, Friedrich, 1789–1860
	(SWD, p)	Silcher, Friedrich
1789-07-14	(LCSH, g)	France—History—Storming of the Bastille, 1789
	(RAMEAU, g)	France ** Histoire ** 14 juillet 1789
1789-08-21/1857-05-23	(LCSH, p)	Cauchy, Augustin Louis, Baron, 1789–1857
	(RAMEAU, p)	Cauchy, Augustin-Louis 1789–1857
	(SWD, p)	Cauchy, Augustin Louis
1789-08-26	(LCSH, u)	France. Déclaration des droits de l'homme et du citoyen
	(RAMEAU, u)	Déclaration des droits de l'homme et du citoyen (1789)
	(SWD, u)	Déclaration des droits de l'homme et du citoyen

Figure 4. Internal structure of the ChAF

chronological order."[49] The view of personal names without chronological terms is important when using the biographical method in science, such as for time life research in sociology. The field "time period" should offer several options in the pull-down menu to search for a special time span with or without limitation using further search fields (see table 1).

Predetermined menu options will facilitate searching by users from various backgrounds. Poo and Khoo explain that "users of online catalogs are very heterogeneous, varying widely in background, age, subject interests, computer and library literacy, and many other aspects. So the online catalog has to be designed to cater a wide range of users."[50]

It may be a surprise to find the subfield "publication year(s)" listed here, but for most catalog users the difference between the descriptive and the subject indexed time is not clear. Two other subfields—"history in year numbers, date" and "future, forecast in year numbers"—are used to set limits with the help of the encoded time, while all other subfields work with the stated form.

The "year number or date" search provides direct access to the time period code in bibliographic databases. When there are zero, too few, or too many hits, shorter, longer, or overlapping time spans will be shown on an intermediate screen or even automatically included (in fixed intervals). This corresponds to the zoom function in the *Encarta* encyclopedia and can be accomplished by numeric comparison of time period codes. In addition, options to include chronological terms from the ChAF that lie within the searched interval should always be offered, as it is not apparent to a user unfamiliar with the SHLs whether the coded or the verbal form of time was used.

The subfield "future, forecast in year numbers" is intended for queries on fictitious time periods (prognoses or prophecies). It is filtered out through an indicator in the time period code. The indicator is necessary to separate real history from fiction. In some cases, documents (including fiction and poetry) involve fictitious time details set in the future. However, as time goes by, these "future" details move into the past, thus creating the impression of a real historical event.

Orwell's *1984* is a good example. The year of creation and publication of the work corresponds with the chronological code and is represented in the ChAF. Moreover, the time period code contains the year "1984" followed by the indicator for its fictitiousness. In the subject heading index screen, the fictitious year 1984 would be accompanied by text such as "fictitious date" generated automatically by the indicator.

The subfield "complete history" is envisioned as a query possibility on its own, although this aspect is not taken into consideration in the cataloging practice in current SHLs. "Complete history" actually means the historical point of view of a topic. Thus, the catalog user is able to look for the complete course of history of a topic without having to know the chronological code for this term. However, the degree of currency (not always identical with the year of publication) has to be indicated correctly in the short title list.

In bibliographic databases, a search term entered in the subfield "epoch, style, event" can be directly searched in the subject field. Nevertheless, the time span should always be pointed out to the user in encoded form using the chronological code because—depending on the SHLs—the time aspect may be expressed only in the encoded form. In addition, the ChAF offers the possibility to look for temporal relationships with other chronological terms, even foreign-language ones, and to use any of those terms to continue and refine the search. Apart from this, further relationships could be shown when the MACS project is completed.

The subfield "person" is used both for verbal identification of a time period (lifetime) as well as for the combination of the personal name heading with another subfield of "time period." Limiting a biographical section is difficult as the encoded and the verbal form may occur in subject headings. A reciprocal, general reference such as "Continue search with year numbers" and vice versa "Search with 'Childhood and youth' and 'Enfance et

jeunesse'" may be helpful. A person's social environment, currently indexed verbally with "Friends and associates," would be accommodated more comprehensively in the ChAF.

Figure 5 shows a sequence of search steps for time retrieval applying the model introduced that uses the ChAF. Figure 6 illustrates this model.

The query looks at the time period codes. If there is no exact match, the zoom option (which varies the time span) or the look-up option (ChAF for chronological terms) is offered to the user. Among other terms, "Medicine, medieval" and "History of medicine, medieval" would be found in the ChAF to continue the search. Alternatively, a search also can start with a chronological term. In this case, a link to the ChAF (to find other chronological terms in the same period) or a limiting option (year numbers) would be offered.

Display of Search Results

The design of search results displays is not only important for time retrieval. Since 1997, an International Federation of Library Associations and Institutions Task Force has been dealing with this at a high level, drawing up the *Guidelines for OPAC Displays,* based on work by Yee and Layne.[51]

Addressing and testing the following questions is important.

What should be displayed? Parts of the subject authority file or the ChAF, the list of subject headings, the short title list, or the entire list of bibliographic records could be shown. The kind of user-friendly intermediate displays that are shown depends on the query. It is possible to load a particular display automatically, based on the number of hits a record has received, as is done in the expert system *E-Referencer,* for example.[52] The *E-Referencer* system helps users retrieve relevant records in OPACs using LCSH. Here, the number of hits is evaluated to determine the next display: zero record retrieved, twenty or fewer records retrieved, more than twenty records retrieved.[53] However, the selection possibilities the user sees should not be overly restricted, and interactive dialogs in the form of a time retrieval diagram should be supported (see figure 5).

In which form should the data be displayed? This question refers to the display of the authority files, the index, and the results lists. The essential zoom function and the limitation of results by subject area or by personal names have already been addressed in connection with the ChAF. Furthermore, the subject index display should be redesigned and adapted to the length of the subject data. For the LCSH, Massicotte suggests substituting the subdivisions with a general text message.[54] McGarry and Svenonius recommend adding a "blanket compression" that would "delete from the initial display of entries for a subject

Table 1. Main search field "time period" with subfields

time period

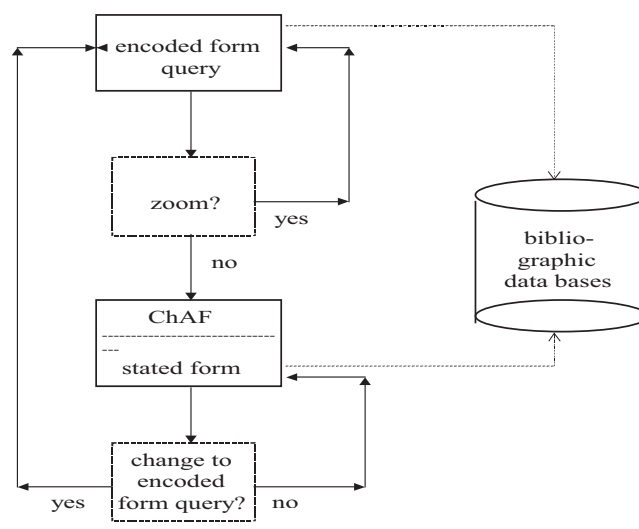| publication year(s) |
| --- |
| complete history |
| history in year numbers, date |
| epoch, style, event |
| person |
| future, forecast in year numbers |

Figure 5. Search steps for time retrieval with a ChAF

LCSH:
Medicine from the Black Death to the French disease
>Medicine, medieval—Europe—History
>Medicine—Europe—History—15th century
>Diseases and history—Europe
>Black Death—History
>Syphilis—Europe—History
>Syphilis—Epidemiology—Europe
>History of medicine, medieval
>History of medicine, early modern—Europe

RSWK:
Bader, Medicus und Weise Frau : Wege und Erfolge der mittelalterlichen Heilkunst [Barber, surgeon and wise woman : ways and successes of medieval medicine]
>Medizin ; Geschichte 500–1500

Note: The query seeks to locate literature about the history of medicine between 1450 and 1500, using the topical search term *"Medicine,"* the field "time period," and the subfield "history in year numbers, date," of 1450–1500.

Figure 6. Example of a ChAF

heading not only those with geographic (first) subdivisions but also those with repeating elements in subdivisions, phrases, inversions, or parenthetical qualifiers immediately following the heading."[55]

In which order should the data be displayed? The default display of subject headings, short title lists, and complete bibliographic records is usually alphabetical order, without giving the searcher any choice. It is particularly important for simple subject headings that cover a certain time period to first give the complete history of a topic and then show the encoded and stated time forms chronologically. The problem of heading and topical subdivision combined with a period subdivision and the position of the fictitious year numbers must be considered as well. For the subject heading index display, thought should be given to whether the time aspect should be displayed in the first place when it was called up in the query.

Conclusion

The development and networking of OPACs on the Internet bring into question subject cataloging rules developed during the card catalog era. Such rules fail to take advantage of technological possibilities and to meet user demands for independent and easy searching. This paper has considered chronological terms (epoch headings, historiographic terms, names, and so on) and time codifications (years, dates). Chronological searching is especially important and difficult for users from the arts and humanities, as studies have demonstrated.[56]

This paper has examined the OPACs of the LC, Bibliothèque nationale de France, and Die Deutsche Bibliothek along with various subject heading languages (SHLs) and their rules concerning dates and time periods. Sample searches have shown that retrieval options for time details are not yet adequate. The various options for including time aspects in catalog records are not clear to the user. However, as the number of entries in online catalogs continues to grow in the future, users will be even more challenged to find a complete set of resources for a certain time period. That is why—in order to reveal to users the treasures now hidden in catalogs—an improved method for date retrieval is necessary. Modern date retrieval, using the latest technological developments, should facilitate searching across various systems and language areas as well.

The time retrieval model introduced here was shown to require three components: a time period code, a chronological code, and a chronology authority file (ChAF).

1. The time period code is a numerical field in the bibliographic record that gives the exact time period covered by the content of a book. Encoded time elements in the sub-

ject heading are identified as numerals, not characters. Consequently, searches for a time span with larger, smaller, and equal operators would become possible, whereas currently only a character comparison can take place.

2. The chronological code is also a numerical field that must have the same structure as the time period code. It is attached to each chronological term (including personal names) in the authority files. Indistinct terms like "Middle Ages" should be standardized to guarantee a comparability of the encoded and the verbal forms.

3. The ChAF contains all temporally limited terms along with their chronological code and their chronological relationships. Its design should be modeled on the timeline/historama/Zeitleiste of the digital encyclopedias.

A search screen modeled on menu-based OPAC interfaces has been outlined. Finally, a time retrieval using a ChAF, the use of the search field "time period" and its subfields, as well as the search sequence, have been illustrated and explained.

The theoretical nature of the model presented here must to be emphasized. Various issues have not yet been solved. Above all, the implementation of a chronology authority file may only be appropriate in disciplines like history, literature, art, and music.

However, in this author's opinion, the development of a new time retrieval approach should be undertaken despite personal and financial obstacles. The implementation of a chronology authority file would help avoid redundancies in subject cataloging. Cross-references in subject heading languages would disappear (an example from LCSH: "France—History—Revolution, 1792–1793—USE France—History—Revolution, 1789–1799"). Moreover, duplicates (such as "Medicine, medieval" and "History of medicine, medieval") would not be necessary. Last but not least, well prepared catalogs result in increased and more intensive use of the collection and can stimulate international and interdisciplinary research, as well as foster new scientific studies.

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