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SEMANTIC AND INTEROPERABILITY PROBLEMS OF CONTEMPORARY ARCHIVAL DESCRIPTIONS

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Abstract
In archival theory and practice various on-line archival information systems are developed with different types of contemporary archival descriptions. Despite the fact that there are internationally accepted professional standards for archival description, in practice there are major discrepancies between realizations of descriptions and their standardized forms. The paper presents the results of analysis of more than 20 such systems. No significant differences are observed on technical-technological level, whereas on syntactic and semantic level many problems are identified. This causes some fundamental archival scientific problems. Among them is the question whether data structures of considered archival information systems are compatible with each other in the context of exchange of information on international level. Some indicators show that achieving this goal demands major interventions in individual archival information system and therefore has a direct negative impact on the cost of target record production.

Key words
semantics, on-line archival systems, archival descriptions

1. INTRODUCTION

Modern archival information systems are complex. They are designed to support different needs for managing archival material i.e. units of description, repositories, use of archival material etc. They also include information about different contexts that should be in form of authority records of repositories of archival holdings, persons, families, corporate bodies, places, functions and activities /**1**/. From the user's point of view, archival information systems are quite static and sometimes not very user friendly as well as they often lack the needed information. Furthermore, in many cases the problem is much deeper. It can be defined as the realization of long-term stability and usability of captured data structures about archival material. In archival theory and practice a new paradigm is formed. It is based on the fact that archival professional development along with technological support reflects in the complexity of users' requirements. This principle can already be seen in the traditional archival information aids when observing them on long-term period. In this context, the development of archival holdings guides in Slovenian archives during the last five decades could be a good example /**2**/. The differences between traditional and computer suported finding aids can be seen not only in the narrow field of data structure maintaining, but also in the field of implementing modern solutions of data-, information-, content- and context-management, data access, personal and other sensitive data protection etc. Almost infinite possibilities of adding or changing data in computer supported archival finding aids provide seemingly ideal access to archival materials /**3**/. However, some analysis present quite different picture. In reality, existing archival databases have several weaknesses. Some discrepancies between comparable data structures are evident, especially in the portals of

aggregators of modern archival information systems /**4**/. There are also some other indicators which show that some content in the systems are insufficiently informative outside the institution where records were created /**5**/. Quite common are also weaknesses on the level of capturing data. We shall highlight defective realization of some type or parts of data structures i.e. title or content /**6**/. Acquired content from this kind of archival information systems cannot fulfil the basic users' criticism, nor different complex users' needs. The term like "quality of archival database" and related methods for measuring the integrity or some parts of such databases as well as the way of presenting the results of their measurment, become a new challenge for the entire contemporary archival community /**7**/.

2. DEFINITION OF RESEARCH PROBLEM AND ITS LIMITATIONS

In the frame of SIRAnet /**8**/ appear different archival professional initiatives related to advanced use of collected data. Particularly special is demand for interactive cooperation between archivists with the same or comparable research interests within or between archives /**9**/. At the same time, there appears a necessity for development of reduction communication noise between users and databases as well as the absence or inconsistency in the use of authority content /**10**/. In order to determine the basic elements of long-term stable archival databases we have conducted different limited interconnected researches /**11**/. They were limited to the implementation of archival professional standards in more than 20 online small and large archival information systems in Europe and North America /**12**/. The research opened different archival professional questions. Some of them are related to:

- understanding relations between implemented data structures of archival information systems and demands in archival professional standards;
- understanding implemented information technology in development of complex archival information systems and related demands for different types of users;
- requirements related to the standardization of basic terminology solutions;
- abandoning description methods for needs of historical research and implementing description methods for universal archival material researches.

Basic goal of that research is limited to verification of methods for defining information potential in archival databases, assessment of the descriptions' integrity in relation to the professional standards, their consistency, completeness and understandability of basic elements of description, including normative records etc. /**13**/ Our starting point in this context is that the existing archival data bases will grow in future and we can expect enormous records in these databases. They must ensure information and data stability throughout long period. The lack of content control of archival databases presents a risk for different deviations, particularly problems related to understanding the content and the context (semantic problems). Altogether, this could cause enormous problems with searching and using data about archival material not only in different local archival information systems, but also on the level of national and international archival data aggregators.

3. SELECTED METHODS AND TOOLS FOR SOLVING SEMANTIC PROBLEMS IN ARCHIVAL DATABASES

Modern technological tools allow verification of information quality and credibility in different ways. Archivists shoud have their focus on implementation of quantitative and qualitative analysis. For this activity we could use the term "archivometrics" as it is the same professional activity, from a methodological point of view, as the bibliometrics, webometrics etc. /**14**/

In quantitative analysis our starting point is that for creation of every data structure, which could represent possible information, is required an adequate number of characters and blanks. On this basis, we can carry out average length of words, average number of word in the element of data structure etc. For achieving adequate level of communicative content of archival data structure, the quantitative analysis of the whole data structure of the description must be performed. It is known that archival professional standards for archival description ISADg2 have obligatory 6

elements for description and the implementation of the rest of elements is not obligatory /**15**/.

In this context, we could highlight:

- the degree of implementation of individual, standard defined elements in data structure,
- appropriate syntactic form (sorting option for specific criteria),
- the possibility of control of linear or hierarchical sequences and use of punctuation,
- syntax and mode of record date values,
- the definition of numerical values which the system treats as numerical value, and
- the definition of alphanumeric values which the system treats as numeric value.

The qualitative analysis also considers the correctness of written content, especially determining spelling errors in the record, number of words and systematics of individual terms occurrence. Analytical data, obtained from the quantitative analysis, are used to determine the index of potential database practicability. These relatively simple data analyses require the addition of analysis of individual terms occurrence and their interrelationships within the descriptions of archival entities. We can use these data to determine the potential of archival databases in the context of implementation of random or intuitive researches in archival databases. The provided content from the archival information system must be consistent with the intended standardized data structure within each record. Records and their data structures must be consistent with the levels of description which are set out in international standards (structural coherence) and in accordance with sequences derived from descripted entities (linear coherence) /**16**/.

The implementation of qualitative analyses is much more complex due to different aspects and methods of research. Therefore, the content analysis plays an important role /**17**/. If data are correctly written in database and information derived from them is reviewed, credible and evaluated, we can say that they are "filtered" /**18**/. Archival professional problems related to understanding databases of archival information systems does not begin at the level of information, but at the level of data. From this perspective, it is necessary to develop methods for determining the consistency and comprehensiveness of content transmitted through the archival information systems in at least three basic levels:

- The first level represents the control of data structures, consistency and adequacy of the record within databases as well as the interoperable–oriented system/**19**/.
- The second level identifies the methodological solution on the semantic level of data.
- The third level represents methodological solutions on the level of information, deriving from the data contained in archival information systems.

4. RESULTS OF CASE STUDIES

According to standard ISADg2, referece number[2], title and level of description are obligatory elements for describing archival material[3]. These elements appear in archival information systems as independent entities. They are linearly sematically connected on the level of understanding the whole record /**20**/. As opposed to that relation in record of description unit, appear other non-linear semantical relations. They can be hierarchical (i.e. technical unit or box-bandage) or of "interpretive-descriptive nature" (i.e. between title and content or summary). These relations are often set up as »ad hoc« relations, especially where logically or sematically known patterns cannot be defined. "Ad hoc" sematical relations appear between elements "level of description" and "type of archival material". Analysis of reference codes implementation in 27 archival information systems and their databases[4]

[2] The reference number or other identifying marks are discussed in the doctrine of archives as freely-formed entities that serve to the construction of archival information systems. In the past they were implemented as pointers with informative content that are pointing out the direction of the content of archival information in to the excact physical manifestation of archival material. It has often been implemented also their reverse role. In modern archival information systems the reference note recieve additional role. It is defining the position of units of description in the structure of the record and thus provides a unique identification of the content of the description.

[3] The other three elements are quantity, author and date.

[4] Structure and characteristics of archival information systems show that 63% of them are based on the programming tools scopeArchiv and applications for

shows that the majority of them have implemented the reference code[5]. However, almost 25% use reference numbers which are not in accordance with ISADg2 standard or do not meet the requirements for computer supported data proccesing[6]. Therefore, we can conclude that archival professional workers in spite of good technological support build extensive information systems.

Only about 33% of treated archival information systems have defined country code in reference number. The rest of the archival information systems have no such data or are provided on specific level of description or group of records[7]. This fact shows that many databases are not suitable for direct data exchange on international level. Adjustment of the reference number element, especially part connected to the domain, opens new questions related to searching through such database, generating references in database on the base of reference code, citation of the archival sources etc.

Results of the reference numbers research show us also different solutions from expected or standardized versions. Deviation can be seen on the terminological level as well as on the level of the realization of reference code[8]. Second enormous problem of non-standardized reference number use is the possibility of steming, especially reference number prefixes in different information systems for representation of description units. Results of inquiry could be relevant only in the systems which support full text searching. Non-standardized reference codes for unit description can give the archivists fictive freedom to create data structures for descriptions of specific unit. At the same time archivists must define the system for creating reference numbers in the description unit. This is important especially when the method of creating reference code is not evident from the reference number itself. In 22 archival information systems the research related to the implementation on the level of description was performed /**21**/. Basic analysis of implemented level of description shows us the following results:

- Creators of databases were familiar with the standard ISADg2, however, in the majority of systems prevail local specifics.
- In the majority of cases, the highest level of description was "archival institution". There are also archival information systems with the highest level "fond", "group of archives", "root" etc. From the point of view of the data migration, this means that the target system i.e. Archival Portal Europe /**22**/ must develop its own system of hierarchical tree structure from the imported description of description unit above the "level of the fond". The complex archival professional problems appear in some archival information systems that have defined additional levels of description, which are not defined in the ISADg2 standard.

From the archival-methodological point of view, the requirements of the standard

the web query scopeQuery. 27% of archival systems represent other solutions that are defined as the huge systems. These may be mutual systems of large numbers of small archives or one large archives (e.g.: Canada, Scotland, England and Croatia network archives), or systems of large national archives (e.g. England, Ireland, USA, Germany, Poland etc.).

[5] 94% of all systems have implemented reference number. However, only 77% of systems implemented a unique reference number. 23% of systems are not fully implemented, but in the individual segments (e.g. at the level of the fond and collections), or its unique was not clearly defined.

[6] 70% of systems have an interface that allows you to sort by some criteria, among them the also by the reference number. But it has only 11% made such a reference number that actually makes possible this kind of sorting. The same percentage of systems does not allow sorting by reference number. 78% of systems allow you to sort or only part of the information or the information about sorting could not be obtained. A similar relationship is also in the field of the implementation of complex treatment of reference number. 30% of systems have implemented reference number using leading zeros. In the rest of the 70% of it could not be determined. They either do not have a consistent system of building a character string derived that define it as reference number, or that a string could not be found at all levels of description.

[7] 30% of databases have in the reference number specified domain name of institutions, where records were created. 55% of databases do not present such requirements, in other 15% databases this information could not be defined.

[8] 63% of databases have also implemented a structure in the reference number, 27% of databases have formed reference number in such way that the structure is not possible to determine. In 44% of databases, it is possible to determine that the reference number was built by a single methodology for all types of content archives, 56% were built according to different methods of reference number or the reference number was not implemented.

ISADg2 are handled and implemented in different ways. Often are equated the levels of description with technical equipment of archival material. This is not in accordance with the requirements of the standard ISADg2, particularly in paragraphs 3.1.4 and 3.1.5 and to a certain extent in paragraph 3.4.4. The analysis of the implementation of microclassfication "level of description" in the archival information systems shows us that this rule is multilevel and single-faceted /**23**/. The implementation of the principle of a double division (structural aspect of archival materials and the aspect of organizational structure) was implemented in 66% of archival information systems. In 33% of archival information systems only one principle of sharing (aspect of archival material) has been implemented. The syntax of the titles of each category in classfication depends on grammatical rules of the language of record of description unit[9].

Deviations of that classification can be defined as:

- relationships between the same categories which appear either as synonyms or as subordinate or parent values,
- use of suffixes in parenthesis, where data about the types of archival material appear as attributes,
- use of suffixes in parenthesis, where notes about the use of each category appear as attributes,
- use of suffixes in parenthesis, where technical equipment appears as attribute.

In the context of multilevel and single-faceted classification appear solutions as:

- extensions, which could act as multifaceted
- sorting descriptions of categories in alphabetical order and not by defined structure,
- adding the minimum inventory level "item"; identifying additional levels of archival materials that are not defined by standard, and have no normative content,
- adding contextual unresolved or undocumented extensions to indicate the subordinate levels.

Analysis of microclassfication "types of archival material" shows that the majority of implementations is single-faceted with added file extensions /**24**/. Syntax of descriptions for each category in that classification depends on general grammatical rules of language used in archival information systems. However, in the presented cases we can find the individual deviations like duplification of syntax description, inconsistent use of singular or plural, or use of uppercase and lowercase letters. From the archival professional point of view, semantic aspect of the classifications is particularly problematic. This is especially evident in single-faceted classification scheme that classifies the content based on various criteria. Definitions of some categories can be close to synonymous values or are too broad and do not reflect the proper content. Deviations can be detected also in the basic realization of classification scheme. Certain categories should be sorted on the basis of different sharing principles. However, if we compare the microclassification "level of description" with microclassification "type of archival materials", we can observe that two-thirds of systems have clearly defined sharing principles in one or another classification; in one third of systems these principles are not clearly defined, which means that the same or similar content appears in both microclassifications. In the case of data transfers from archival information systems to transnational systems along the lines of metadata libraries /**25**/ there will be extensive semantic problems. At the same time their inquiry feature and thus their normative value will be reduced. The focus of the functionality of both discussed classifications will be limited only to their informative function. Comparisons of the implementation of titles of description units within individual archival information systems have been carried out as examples of existing archival practices /**26**/ for description of archival materials. They show a great diversity of solutions, which are not synchronized across the levels /**27**/. At the same time methods for creating title for description unit cause archivists a lot of problems. The same occurs when archivists have to create

[9] 57% of treated archival informational systems have defined "archives" as the highest level of decriptions, 14% of systems have defined "fond" and 29% of systems have "other" e.g.: group archives, root, institution etc.

content or abstract from the content of archival units /**28**/. This leads to a poor, often inappropriately understandable message, which is transmitted through time and space with the help of archival information system, in relatively inconsinstent forms /**29**/. Presented examples show the complexity of the problems of understanding transmitted information by archival information systems. Professional questions concerning means and methods for verification of understanding and for providing comprehensive databases in the frame of their interoperability are arising. On this basis, it is possible for archivists to implement the necessary tools for realization of such activities.

5. CONCLUSIONS

Archival material is by its nature and incidence generally unique. This uniquenes has its own logic, which is supported by certain professional archival principles /**30**/, laws, standards, requirements, agreements etc. In this context the paradigm of archival material has not changed, therefore it is possible in this segment to clearly specify the proactive role of contemporary archival services. However, quite an enormous problem represents the implementation of proactivity in the segment of construction of archival information systems. Standardization in this field does not have a long tradition; unique archival material represents an extensive problem in this field as the handling and design of archival material descriptions requires a high degree of abstraction /**31**/. It is often expected that the new technological solutions will enable an adequate solution for the problems of compatibility, interoperability and in particular, will eliminate the problems in the field of specified semantic functions of decription in relation to preserved archival material and historical contexts. If the published archival information aids in physical form were defined by the standards, which are applicable to an average published publication, then the end user in electronic environment expects much more sophisticated information solutions than currently available on-line accessible archival information systems. A theoretical question arising from this is which features must include archival information systems for their long-term stablility, interoperablity, and above all, from the standpoint of the user or other systems, semantic correctness. From this follows a multitude of other issues that relate to data structures of individual descriptions of archival material, their syntax, and especially, their semantics.

Notes

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/3/ Novak, M. (2007). Preslikave vsebin v arhivskih strokovnih postopkih. Maribor : Pokrajinski arhiv.

/4/ Tipically, the use of abbreaviations in archival descriptions is related to a specific historical period and place i.e. »SZDL«, »KPJ« etc. (Source: Archives Portal Europe on http://www.archivesportaleurope.net/).

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SEMANTIČKI INTEROPERABILNI PROBLEMI SUVREMENIH ARHIVSKIH OPISA

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Sažetak

Na području arhivske teorije i prakse razvijeni su razni *on-line* arhivski informacijski sustavi s različitim vrstama suvremenih arhivskih opisa. Unatoč činjenici da postoje međunarodno prihvaćeni profesionalni standardi za opis arhivskoga gradiva, u praksi postoje velike razlike između realizacije opisa i njihovih standardiziranih obrazaca. U radu su prikazani rezultati analize više od 20 takvih sustava. Nema značajne razlike na tehničko-tehnološkom nivou, dok su na sintaktičkoj i semantičkoj razini identificirani brojni problemi. To uzrokuje osnovni znanstveni problem u arhivistici. Među njima je i pitanje jesu li informacijske strukture koji se smatraju se arhivskim informacijskim sustavima kompatibilne jedne s drugima u kontekstu razmjene informacija na međunarodnoj razini. Neki pokazatelji govore da postizanje tog cilja zahtijeva velike zahvate u pojedine arhivske informacijske sustave, što ima izravan negativan utjecaj na troškove proizvodnje meta zapisa.

Ključne riječi

semantika, on-line arhivski sustavi, opisi arhivski