UDC 004.03:025.3-056.262
Survey Paper

Documents for Visually Impaired Users in the Light of Library and Information Science: A Document Paradigm Revival

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Abstract

The article aims to show that the classical document paradigm in information science has the greatest potential to grasp the issues related to providing information to persons with visual disabilities. Additionally, it aims to ascertain whether the FRBR (Functional Requirements for Bibliographic Records) study is usable in this area. The article is divided into two parts. In the first part, the paradigmatic turns in information science are briefly presented with an examination of their impact on the issues connected with users with visual disabilities. The second part briefly describes the structure of the bibliographic universe and with an examination of how it is possible to create a model of documents for users with visual impairment and of associated processes. The model of the bibliographic universe is applied to the situation of the documents for visually impaired users which currently exist. Methodologically, the article is based on the information system analysis. There is described and used an entity-relationship approach to a model of the bibliographic universe on which the FRBR study is based.

Keywords: users with visual disabilities, documents, information, paradigms of information science, bibliographic universe, functional requirements for bibliographic records

1. Introduction

Although computer science in collaboration with other disciplines has achieved many successes in the development of tools enabling the creation, storage and retrieval of documents intended to compensate for the information deficit of visually impaired users,[1] there is a relatively small reflection of the issues related to such documents themselves and to the processes connected with them (for example cataloging) from the viewpoint of library and information science (LIS) (compare with [10]).

No.	Subject headings	Number of records
1.	"Document delivery"	1.530
2.	"Information storage & retrieval systems"	8.884
3.	"cataloging"	5.007
4.	"People with visual disabilities" and "Libraries & the blind"	363
5.	"Blind -- Books & reading" or "People with visual disabilities -- Books & reading"	62
6.	People with visual disabilities" and "Documentation" or "Cataloging"	4

Table 1. The results from the database of Library, Information Science & Technology Abstracts

As we can see in Table 1, which provides the results obtained from the database "Library, Information Science & Technology Abstracts", we find a relatively large amount of literature dealing with the document delivery (even though literature on this topic numerically cannot compete with the resources which deal with information storage and retrieval). A relatively large amount of literature deals with the cataloging of documents and not small number is

[1] The international conference on "Computers Helping People with Special Needs" deals with a relationship between computer technology and users with special needs.

dedicated to the issues concerning library users with visual disabilities. Significantly the fewer amount of the resources discusses the documents accessible to visually impaired users and a negligible amount of them deals with the cataloging of such documents.

This situation has two basic explanations:

1 the term "document" has been replaced with the term "information" in LIS [8]
2 LIS has turned from the studies of the information objects (documents) and systems to the research of the users (the cognitive turn) [4]
3 and to the research of the creators of information (the social turn) [19]

These steps characteristic by the conceptual change and also by the extension of the interest of LIS from information system in the narrower sense to information system in the broader sense [9] occurred during the so-called paradigmatic turns [12] in library and information science and they have fatal consequences for this science.

By the term 'information system in the narrower sense', we mean a system consisting of the components (documents, librarians) and activities (acquiring, cataloging, storage and so on) connected with the mediation of information. 'Information system in the narrower sense' does not include creators and users of information, but creators and users belonging to the surrounding of the system. 'Information system in the broader sense' includes both creators and users of information. Creators of information are part of the inputs; users are part of the outputs of the system.

The consequences of the paradigmatic turns can be observed from a general (related to LIS itself) and from a special (related to the area of the documents for visually impaired users) viewpoint. The general consequences are as follows:

- LIS loses its identity (in the first case of the previous list, it becomes a part of computer science; in the second, it becomes a part of cognitive science; and in the third case, it becomes a part of sociology of knowledge)
- a rupture between LIS and its practical applications – librarianship takes place (librarians work with the material carriers of information – documents, not with abstract information, and they are interested primarily in the document delivery itself, not in the studying of the document users or creators who are an important surrounding near the outputs and inputs of the information system in the narrower sense)

In the area of providing information for a user with visual disability, the paradigmatic turns have the following consequences:

- a replacement of the term "document" with the term "information" leads to a loss of interest in a specific encoding of information which plays an important role in the area of the document delivery to visually impaired users
- very small space within LIS is devoted to the issues of an acquiring, cataloging, storage and retrieval of the documents for visually impaired users (most libraries lack the basic types of documents as Braille books and electronic books and their funds which consist of other blind friendly formats are very small)[2]; attention is focused on the visually impaired users[3] as a social group for which libraries can provide certain services (see [20] where it is shown that most services provided by libraries to the

[2] As we can see in [20] about 40% of the libraries in the Czech Republic provide some kind of service for visually impaired users, but only 15% can offer them Braille books and, in diameter, every library has only 2.674 audio books. As we can see in [33], online electronic recourses are offered only by unofficial libraries of the civic associations which do not follow the librarian rules.

[3] Of course, the user is the aim of the librarian activities and such activities should especially respect user needs. But the librarianship core consists of librarian activities themselves even if their user orientation is crucial.

visually impaired people are not services connected with blind-friendly documents if we do not include the borrowing of audio books)

Recently, a response has occurred to this dismal state in the framework of the theory and practice of LIS. In the framework of LIS theory, there has been a calling for the rehabilitation of the concept of document [13], [16], [24], [31] and, in the practice, the study "Functional requirements for bibliographic records" (FRBR) has been created [15], which proposes the concept of bibliographic universe. We can see that attention of LIS is beginning to refocus on the information system in the narrower sense.

The article aims to show that the classical document paradigm in information science has the greatest potential to grasp the issues related to providing information to persons with visual disabilities and it aims to ascertain whether the FRBR study is usable in this area.

The article is divided into two parts. In the first part, the paradigmatic turns in information science are briefly presented with an examination of their impact on the issues connected with users with visual disabilities. The second part briefly describes the structure of the bibliographic universe and examines how it is possible to model documents for users with visual impairment and associated processes. The model of the bibliographic universe is applied to the situation of the already existing documents for visually impaired users.

Methodologically, the article is based on the information system analysis (it especially analyses relationships of the information system in the narrower sense to its inputs and outputs and there is also an analysis of the intrinsic structure of the system, with a particular focus on the documents). There is described and used entity-relationship approach to a model of the bibliographic universe on which FRBR is based.

We believe that such a theoretical analysis of the conditions that influence LIS and a theoretical model of the bibliographic universe can contribute to the better practice of the document delivery to users with visual disabilities.

2. Paradigmatic turns in information science and documents for users with visual impairment

There have been three paradigmatic turns [12] in information science. In the framework of the first turn, the term "document" has been replaced with the term "information" [8] and an institution doing documentation has become information system in the narrower sense. In the course of the next two paradigmatic turns, an emphasis on information system in the narrower sense has been replaced with the focus on the system surrounding. An emphasis on the inquiry into the user of information is characteristic for the so-called cognitive turn [4]. After the cognitive turn, there was a social turn which put the creator of information in the centre of information science [19].

2.1. From document to information

Rafael Capurro and Birger Hjørland [8] state that an effort of the science of documents (documentation) to get closer to computer science is in the background of the replacement of the term "document" with the term "information". Due to this, documentation [5], [25] has become information science [6].

Information is, in the framework of information science, understood as a semantic content different from its sign representation [2]. It has led to the situation that library and information science has switched from the focus on the material carriers of information (documents) to the focus on their content (information).

In the terms of users with visual impairment, it is a quite problematic decision. From a viewpoint of information content, a classical black-print book and its Braille version could be considered to be identical information objects. Nevertheless, the first type of document does not provide information to a user with visual impairment, while the second type does.

2.2. From information system to user of information

The cognitive turn [3], [4], [21] has transferred the emphasis from the information system in the narrower sense to a user of information. Cognitively oriented scholars are not interested in the research of information represented in a document, but they are interested in the research of information represented in the mind of a user [21]. It leads to the preferring of research oriented on the interface between the information system and user. Nevertheless, the inquiry into the intrinsic structure of the information system (ontology) has taken a backseat.

But an efficiency of the mediation of information depends mainly on the intrinsic qualities of information system and of documents which are mediated by the system. An interface for the document retrieval itself only represents the internal structure of the information system. An accessibility of the interface depends primarily on the accessibility of the information system. The accessibility of information is connected with the interface only secondarily.

In the Czech milieu, of the majority of research on the relationship between a library and disabled user are user-oriented [20] – they are interested in what kind of an output in the form of services can be provided by a library to users with disabilities, but they are not interested in a document typology, in a way of cataloging various kinds of documents or in a way of sign representations of metadata in the retrieval system.

2.3. From users to creators of information

The social turn [11], [12], [17], [19], [30] has switched attention of information science to creators of information. Socially oriented information scientists are interested mainly in a social conditionality of information, a user who is understood as a rational individual is disappearing from their reflections [18]. A distinction between active creators and users of information is not so strict [17]. Roles of creators and users are dynamically changing; a creator is becoming a user and a vice versa. The result of such a dynamical activity is an information system.

From the viewpoint of users with visual impairment, socially oriented scholars in library and information science rather examine the social conditionality of an inaccessibility of information resources than ways in which particular documents and systems can become accessible. In practice, it is manifested by an interest of librarians in the political solutions which can change the access of libraries to this group of users [14]. Questions of which kinds of documents should be acquired, how to catalog and store such types of documents, or in which way these document should be offered to the concrete users, are rather marginal.

2.4. From creators of information to bibliographic universe

Theory and practice of LIS is beginning to return to the classical document paradigm and to the information system in the narrower sense. The original attempts to solve the problem of the relationship between information and document through the distinction of information-as-knowledge, information-as-process and information-as-thing – document [7] are replaced with efforts to rehabilitate the concept of document [13], [16], [24], [31].

In practice, there is an effort to create a model of what the subject of the cataloging is, and within this framework, there has been created the concept of bibliographic universe and its structure is thoroughly described in the study "Functional Requirements for Bibliographic Records" (FRBR) [15]. It is possible to say that there again occurs a focus on the information system in the narrower sense.

The FRBR study is an effective tool for an inquiry into the creation, cataloging, storage, retrieval and delivery of the documents intended for visually impaired users. The study is oriented on the information system in the narrower sense, even if it also provides a model of the relationship of such a system to its surrounding (to creators and users of information).

It has a potential to distinguish between several levels of abstraction of the document (it distinguishes document content, sign representation, material implementation of the content

and concrete exemplar of the document). Due to these advantages, it allows the possibility to distinguish between different versions of the same work which are intended for the user with visual impairment (large types, Braille, electronic text and so on). At the same time, it is possible to create with FRBR a model of the relationship of the document for visually impaired user to the original inaccessible documents (for example, a relationship between the Braille publication and its black-print pattern).

3. Functional requirements for bibliographic records and documents for visually impaired users

The study of FRBR [15] is a model of so-called *bibliographic universe* which is defined as an area related to the collections of the memory institutions, i.e. to the collections of the libraries, archives and museums [32]. FRBR is not only about the collections of such institutions, but also about everything connected with them. Nevertheless, it is primarily focused on the documents themselves and it deals with others only if they are in the relationship to the documents.

It is necessary to say that FRBR is not a model of a bibliographic record which can be defined as set of data about some objects, but it is a model of objects themselves to which data of the bibliographic record refer. This fact is given by FRBR's focus on users of information which are interested in the retrieval of the documents, not in the retrieval of bibliographic records. Due to this, bibliographic record is, in the framework of FRBR, understood as a sign representation of the currently existing objects, attributes and relationships which are modelled by the conceptual model used for the designing of relational database systems.

Bibliographic universe is divided into three categories: *entities*, *attributes* and *relationships* [15]. Entities are works, expressions, manifestations and items (i.e. documents themselves), persons, corporate bodies, concepts, objects, events and places (i.e. things that are in some sense related to the documents). Attributes are properties of entities which are expressed by data of a bibliographic record and which are used for the retrieval and identification of entities. Relationships are relations between entities which can also be taken into account by a bibliographic record.

3.1. Entities

FRBR [15] distinguishes entities of three kinds. A core of the model is made by *group 1 entities* which are a model of the documents themselves on the various levels of abstraction. Entities of the first group are: *work*, *expression*, *manifestation* and *item*. Between group 1 entities, there exist the primarily relationships "is realized through" (work – expression), "is embodied in" (expression – manifestation), and "is exemplified by" (manifestation – item). The hierarchical structure of the Group 1 Entities we can see on the following picture.

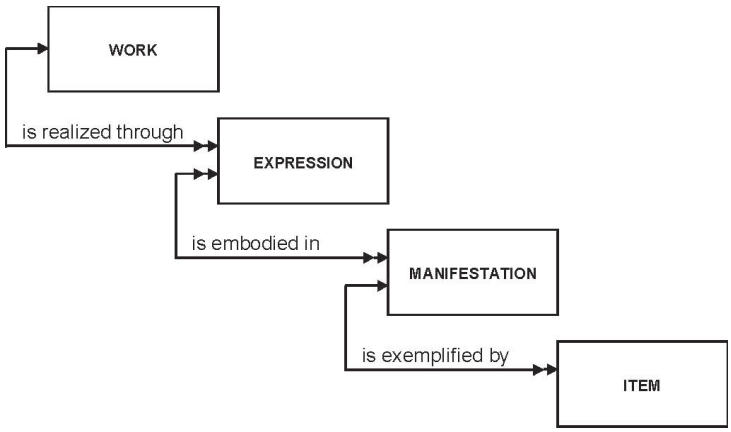

Figure 1. Group 1 Entities [15]

Group 2 entities are *person* and *corporate body* which are related to the group 1 entities by the "responsibility" relationships "is created by" (work – group 2 entity), "is realized by" (expression – group 2 entity), "is produced by" (manifestation – group 2 entity) and "is owned by" (item – group 2 entity).

Group 3 entities are *concept*, *object*, *event* and *place*. Entity "work" is related to the entities of the first, second and third group by the "subject" relationship "has as subject". In our work, we deal only with entities of the first group.

Group 1 entities are hierarchically organised as generic and specific concepts (including specific differences) and individuals. A work and expression are entities which are purely abstract and which express an intellectual or artistic content of the document. A work is, for example, "The Little Prince" by Antoine de Saint-Exupéry; an expression is, for example, its French version "Le Petit Prince" realised by the author or its Czech translation "Malý princ" realised by Zdeňka Stavinohová. Consequently: Work + realisation = expression.

Contrary, entities manifestation and item relate to the physical form of the work and expression. If an expression is embodied in some material carrier, a manifestation (which is inherently connected with material condition) is created. Consequently: Expression + embodiment = manifestation. A manifestation is the original French "Le Petit Prince" published in Braille by Deutsche Blindenstudienanstalt in 1998 [27] or the Czech translation "Malý princ" by Zdeňka Stavinohová published in black-print by Albatros in 2002 [28] or electronic book "Malý princ" based on Stavinohová's translation published by Masaryk University in 2004 [26] or audio recording "Malý princ" published on CD by Popron in 2008 [28] which is also based on the given translation.

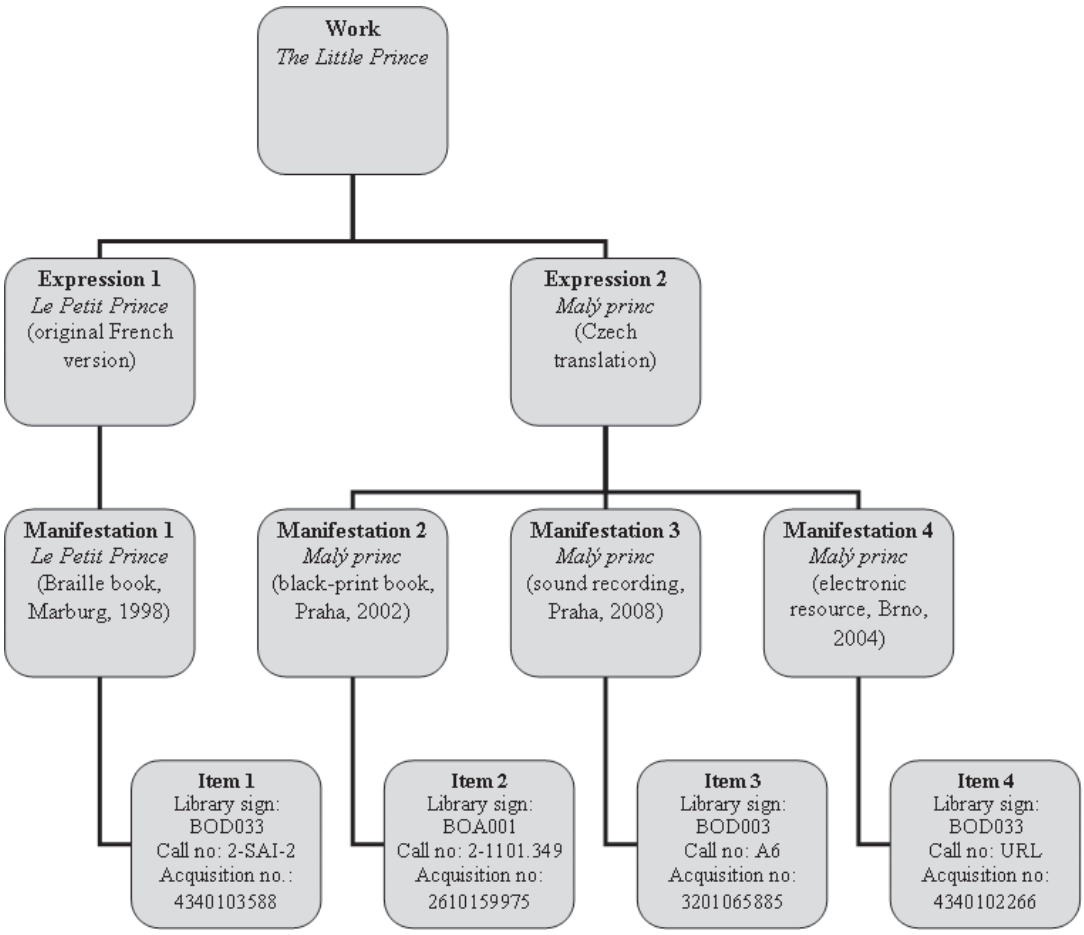

Figure 2. Hierarchical Structure of Group 1 Entities

Items are particular individuals of the manifestation. If a manifestation is exemplified, an item is created. Consequently: Manifestation + exemplification = item. The item is, for example, the particular unit of the Braille publication "Le Petit Prince" published in 1998 by Deutsche Blindenstudienanstalt owned by University Library for Students with Special Needs at Masaryk University which has the call number 2-SAI-2 and acquisition number 4340103588. We can hierarchically display the relationship between Group 1 entities using the previous exemplars by the diagram as follows. Data are obtained from the union catalog of Masaryk University [1].

Hierarchical structure of group 1 entities, if it is represented by data of the bibliographic record, allows the visually impaired user

- to find a work which he is interested in,
- to find all expressions of the work and to decide on the preferred one,
- to find all manifestation of the preferred expression and to check if it is in the accessible form,
- to decide on one of the accessible document forms,
- to achieve item of the preferred document.

In the catalogues of libraries for visually impaired users, the advantages of the hierarchical entity structure (without a connection to FRBR) are used through the combining of the records for different manifestations of one work [33]. Several records for the manifestations are displayed as one record for the work. The online library interface [34] of the K. E. Macan Library and Printing House for the Blind can be used as an exemplar. Such a record is displayed in the following figure:

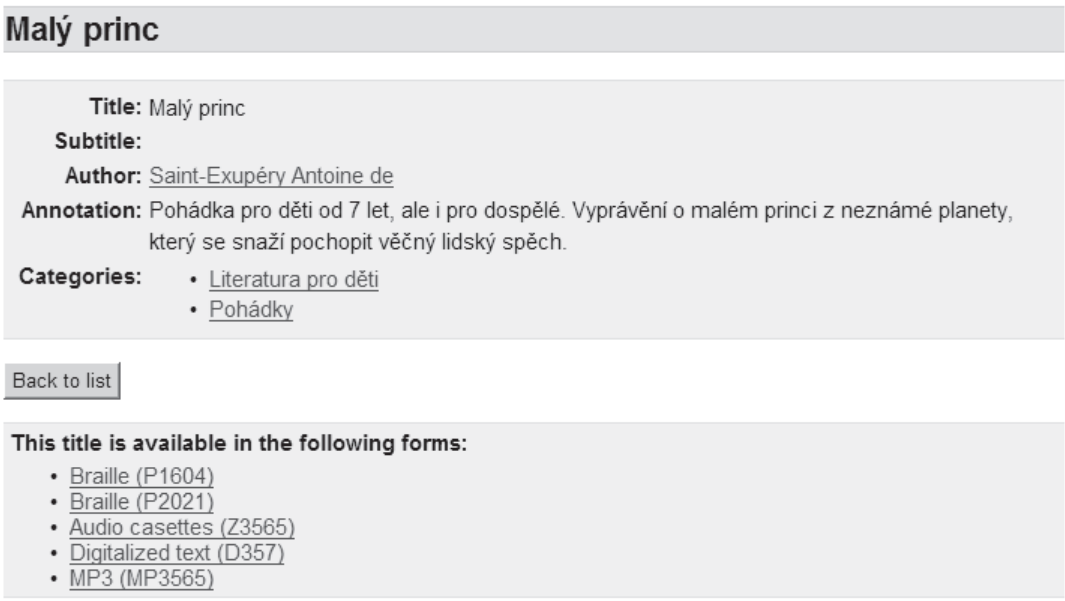

Figure 3. The Bibliographic Record for the Work Connected with the Records for the Manifestations (screenshot from [34])

Some libraries which consistently follow the librarian rules often leave relationships work – expression – manifestation – item without a taking into account even if the librarian rules allow to express such relationships.

We can register that an accessibility of the documents for visually impaired users is connected with the level of a manifestation, i.e. with the way of the physical implementation of a work and expression. A manifestation is a document in its own sense – it is a material carrier of information encoded by signs. Information, on the other hand, if we understand it in the classical sense as a semantic content of the document is connected with the entity work and with its relationship "has as subject" to the other entities. Here (in practice) a distinction

has manifested between the information and document paradigm in information science. The first paradigm does not allow the accessibility of the document for visually impaired user to be taken into account, while second does.

3.2. Attributes

Attributes are properties of entities which are used for the precise identification of the given entity [15]. Attributes are defined as logical objects, not as data in a bibliographic record. In the FRBR, there are provided only attributes which occur in a bibliographic record itself, there cannot be found attributes attached to the bibliographic record through the authority records (i.e. records for person, corporate body, subject heading and so on).

Every entity has several defined attributes [15], some of which apply to the given entity in general, and some of which are related only to a certain kind of subentity.

From a viewpoint of the interests of visually impaired users, attributes of the manifestations are important, especially such attributes that are related to a carrier of information and to a way of the data encoding. The user searches for the relevant information carrier according to these attributes represented by data of the bibliographic record. For effective dissemination of information to users with visual impairment, library catalogues should quote these data in the bibliographic records.

The important attributes defined by FRBR [15] mainly are:

- *form of carrier*
- *capture mode*
- *terms of availability*
- *access restrictions on the manifestation*
- *typeface (printed book)*
- *type size (printed book)*

The form of carrier basically influences the accessibility of the document to persons with visual impairment. For example, a standard black-printed book is a carrier which is not available for most of these users. Video recordings are accessible only audibly. Audio recordings, however, belong to the set of documents which are available for this group of users.

Electronic resources are accessible if we consider a capture mode of the document. Textual electronic resources are generally available; audiovisual electronic resources are accessible only audibly; resources where the graphical component prevails are not available.

Due to this it is very useful for visually impaired user to have the opportunity to choose the type of the carrier if he searches the catalog. For example, in "Library Gateway for Visually Impaired" [22], there is such an opportunity in the basic search interface as we can see in the following figure.

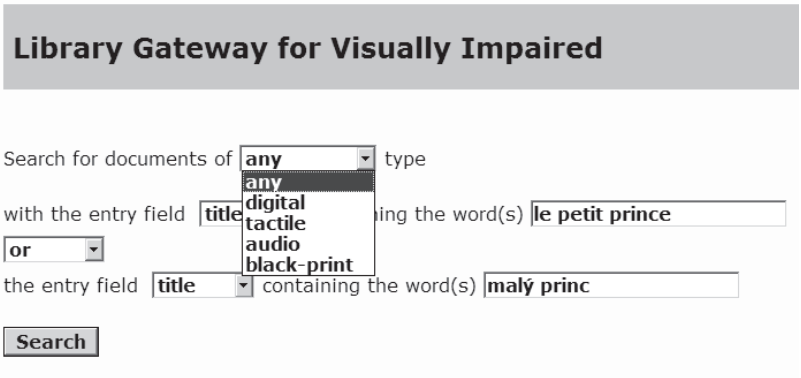

Figure 4. Search interface with a Resolution of Form of Carrier (screenshot from [22])

Access restriction on the manifestation plays an important role if the manifestation is made on the basis of the exception to copyright law exclusively for the needs of visually impaired users.

For the blind user, it is important whether the book is printed in black or in Braille (typeface). For the partially sighted user, it is useful to know the size of the types (type size).

We see that for the needs of information mediation for users with visual impairment, attributes which are related to the document as a material carrier of information play a crucial role. Attributes connected with a nonmaterial content of the document, i.e. attributes of a work, are not, from our viewpoint, so important.

3.3. Relationships

Relationships serve to the representations of the connections between entities. Entities are precisely identified by their attributes, relationships provide next information. Relationships are often detectable by the analysis of the document itself which can include phrases such as "edition", "version", "based on", "translated from", amongst others.

For the needs of visually impaired users, the relationships depicted on the high level diagrams which have been introduced in the section dealing with entities **(3.1) [QA: number of the chapter "2.1" was replaced with number "3.1"; this is right number of the chapter dealing with "entities"]** are important. Other relevant relationships are *manifestation-to-manifestation relationships* and *whole/part manifestation-to-manifestation relationships* [15].

Manifestation-to-manifestation relationships are fundamental for our work. One of such relationships is the *relationship of alternate*. This relationship occurs, for example, between the manifestations of "The Little Prince" published in black-print, Braille, sound and electronic form which is displayed in Figure 2.

Libraries for visually impaired users often publish manifestations based on the manifestations which are not accessible for persons with visual impairment [33]. A relationship between the manifestation made in such a way and its pattern is the relationship of alternate. For a visually impaired user this relationship is very important since the user often learns information only about pattern manifestation which is not in the accessible form. If the relationship of alternate is taken into account, it also helps the user to retrieve the accessible variants of the document. As we can see in the following picture, in the record for the Braille manifestation of the "Le petit prince" there is also included the "Original version note" which consists of information about the pattern manifestation (Figure 5 is a screenshot from [22]).

Figure 5. The Record for the Manifestation with the Relationship to the Original Pattern Manifestation (screenshot from [22])

Whole/part manifestation-to-manifestation relationship is, for example, a relationship between the film and its sound track which can exist as a component of the film itself or can be on the separate carrier. Information about a possibility to achieve the separate sound track of a film can be useful for visually impaired users.

We see again that from a viewpoint of users with visual impairment, the relationships on the level of a material carrier of the document are important. From the perspective of abstractly understood information objects, the needs of visually impaired users do not differ from the needs of other users.

Conclusion

Our aim was to reflect the issues of documents for visually impaired users in the context of library and information science. We have stated that there are a surprisingly small number of theoretical studies which deal with this problem in the framework of the domain. This fact we have tried to explain by the focus of library and information science on the different concepts and on the different components of the information system in the broader sense. The changes of perspective have appeared within the so-called paradigmatic turns in the discipline. In the course of the first turn, the concept of document has been replaced with the concept of information, the second turn has focused its attention on users of information, and the third one has switched to creators of information.

We have seen that, from a viewpoint of users with visual impairment, these turns seem to be unfortunate for their small emphasis on the inquiry into the material information carriers and into the activities connected with them. But an accessibility of information for users with visual impairment depends on the intrinsic qualities of the documents and on the information system which serves to their organising. For this reason, we welcome efforts to new thinking about the concept of document and also the FRBR study.

We believe that, for the effective information mediation to users with visual disability, it is necessary to create theoretical studies dealing with documents intended for this group of users from a viewpoint of document paradigm which is slowly returning to library and information science. These studies can be supportive for the building of collections and libraries intended to satisfy information needs of visually impaired users. The FRBR study is a relatively quality tool for the theoretical grasping these issues.

Acknowledgements

The contribution has been created in the framework of the project OP VK CZ.1.07/2.2.00/15.0225 “Universal Learning Design – Innovation of Document Formats (FormIn)”.

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