Investigating Mental Models of Cataloguers as the First Step Towards the Development of Intuitive Cataloguer's Tools

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Abstract

The roles library professionals play in bibliographic information systems are constantly evolving with the changing information environment and demanding users. In terms of Functional Requirements for Bibliographic Records (FRBR) (1998), the new paradigm relating to the bibliographic universe is driving new requirements for data preparation and that represents a dramatic change in how cataloguers think; in other words, in their mental models (Rose, 2012: 129).
Therefore, a study of the cataloguers' mental models of the bibliographic universe was carried out to investigate whether the FRBR structure would be confirmed by mental models of cataloguers. Our method for elicitation of mental models is based on concept mapping, which is well suited for representing mental models of individuals (Jackson & Trochim, 2002: 312). The findings of our study show that on average cataloguers' mental models resemble the FRBR conceptual model.

Keywords: Bibliographic information systems, Functional Requirements for Bibliographic Records (FRBR), Cataloguers, Mental models, Concept mapping

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1 Introduction

Changes on the web have an effect on users' behaviour, their expectations, strategies and mental models, when using library catalogues (Yu & Young, 2004: 168). Svenonius (2000: 63) emphasizes that most of online catalogues were developed with the card catalogue paradigm in mind. This paradigm is obsolete in light of an increasingly electronic environment and current trends, such as Semantic Web. Users prefer simple, intuitive tools, like Google, which cannot carry out the objectives of the catalogue either (Yee, 2005: 78). Library catalogues are confronted with great challenges in meeting users' information needs and facilitating information seeking. The role of library professionals, such as cataloguers, indexers and metadata librarians, in bibliographic information systems are also constantly evolving with the changing information environment and demanding users.

The FRBR model could therefore be seen as one possible attempt to develop bibliographic information systems that function more effectively and provide better user services during the process of accessing bibliographic resources. It should also be an opportunity to shift at last from the card-catalogue paradigm to a real automated catalogue paradigm (Žumer & Le Boeuf, 2006: 4). However, the library community has been slow to implement the changes.

2 FRBR as a basis for development of cataloguing systems

Developed by a group of cataloguing experts and based on a long tradition of cataloguing codes, principles, practices and theory, the FRBR entity-relationship model holds great potential to develop more efficient bibliographic information systems, improve cataloguing efforts and better manage resources in a digital environment (Zhang & Salaba, 2009: 6).

Zhang and Salaba (2009: 104) point out that one of the most important challenges in the implementation of the FRBR conceptual model might be the development of new full-scale FRBR systems that are not dependent on older practices. The purpose is not to replace an old tool with a new one, only to do the same work better and more quickly, as it happened before. As the

model proposes a more complex as well as more intuitive representation of the bibliographic universe, the data creation according to FRBR is different (Rose, 2012: 129). Separating attributes and relationships of a bibliographic description into four separate WEMI (Work – Expression – Manifestation – Item) components represents a dramatic change in how cataloguers think. Rose (2012: 129) describes some changes and looks for reasons behind them. Cataloguers would no longer describe an item top-to-bottom, back-to-front. Some attributes of a bibliographic description belong to the work, some to the expression others to the manifestation and others to the item. In conventional cataloguing, the cataloguer also records the work-level and expression-level attributes in the same bibliographic record. In a FRBR-based catalogue, the work-level attributes, for example, would probably be imported from a separately created work authority record.

There are several FRBRized cataloguing systems worldwide, including Virtua, VisualCat, AquaBrowser and Endeca to name just a few (Chang et al., 2013: 12), which implement FRBR to various degrees.

As the first step on the way to FRBRized cataloguing system, we need to understand cataloguers' mental models of the bibliographic universe and compare them with FRBR. Therefore, a study of mental models of the bibliographic universe was performed to see whether the FRBR structure would be confirmed by mental models of cataloguers. This research is the first step towards the development of intuitive cataloguer's tools.

3 Elicitation of mental models using concept maps

3.1 Mental models

Mental models represent people's views of the world, of themselves, of their own capabilities, the environment and the things they interact with, as well of the tasks that they are asked to perform (Norman, 1983: 7). The author further stresses few characteristics that need to be taken into consideration when observing mental models: mental models are incomplete, unstable and unscientific; abilities to run mental models are limited; mental models do not have firm boundaries (Norman, 1998: 8). For this reason, their elicitation is not easy.

Laypersons' mental models usually differ from experts' mental models, which Norman calls conceptual models. The ideal would be that any information system is consistent with the designer's conceptualization and the user's mental model (Norman, 1983: 14).

Users as well as librarians have their own mental models of a library system, with librarians' mental models usually closer to the conceptual model (Michell & Dewdney, 1998: 276). In case of FRBR, this is perhaps even clearer to see, as an entity-relationship model of the bibliographic universe is more familiar to cataloguing librarians, but less widely known outside the discipline or profession (Cossham, 2013).

Several studies of the non-librarians' mental models of the bibliographic universe were conducted over last five years (Pisanski & Žumer, 2010a; 2010b; 2012). A variety of mental model elicitation procedures (e.g. card sorting, comparison task, interviews, concept mapping) were used to obtain a more well –rounded view of mental models and thus test the intuitiveness of FRBR. As mental models were relatively successfully captured via concept maps in previous studies, this methodology for acquiring mental models of the bibliographic universe was used in our study.

3.2 Concept mapping

Lanzing (1997) defined concept mapping as a technique for representing knowledge as graphs. Knowledge graphs are networks of concepts, which consist of nodes (points/vertices) and links (arcs/edges). Nodes represent concepts and links represent the relations between concepts. Jackson and Trochim (2002: 312) argue that this methodology is well suited for representing mental models. Since FRBR relationships can best be represented as a graph, we can apply this methodology to investigate cataloguers' perception of the bibliographic universe.

However, it is important to differentiate between the output of such an elicitation process, which is only incomplete external representation of mental models, and the mental models themselves, which exist only in people's minds and cannot be directly observed and represented. To provide the reliability and validity of concept mapping, it is necessary to take into account that: some units are more difficult to code than others; some categories are harder to understand than others; subsets of categories can sometimes be confused with larger categories (Jackson & Trochim, 2002: 328).

3.4 Bibliographic universe

One of the problems of discussing the FRBR model is it abstract nature, as "The model ... represents, as far as possible, a generalized view of the bibliographic universe" (Functional Requirements for Bibliographic Records, 1998: 5). For this reason, the model is abstract and general and does not include rules which depend on a particular cultural environment or bibliographic tradition and practice (e.g., in the criteria used to define precise boundaries of a work).

For the purpose of this study, the explanation of FRBR entities is in the context of current cataloguing practice. Descriptions of WEMI (Work – Expression – Manifestation – Item) entities are represented as bundles of statements made at different levels of abstraction, from the most abstract work level to the most concrete item level (a vice versa).

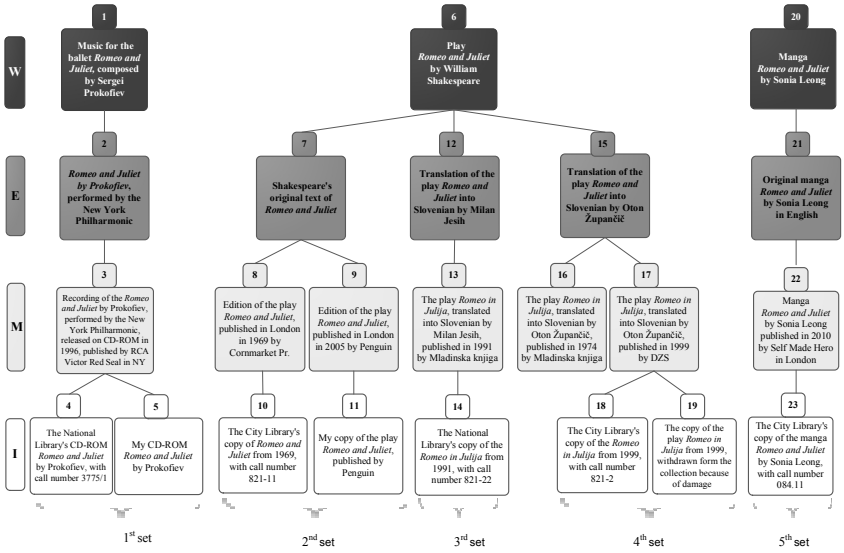

Figure 1. Concept map in line with FRBR

In figure 1, the example (Romeo and Juliet) used for our test is presented as a concept map in line with FRBR. The graph shows three different works: William Shakespeare's original play Romeo and Juliet, Sergei Prokofiev's music for the ballet Romeo and Juliet and Sonia Leong's manga Romeo and Juliet. Expressions, in a specific language or form, identify a distinct exter-

nalizations of each work. Manifestations reflect the way content is published. Items are the actual copies that exist of a particular manifestation e.g. in different libraries.

4 A study of the cataloguers' mental models of the bibliographic universe

The study was conducted in June 2014 among 30 Slovenian cataloguers from seven libraries. Participants were given a set of cards with descriptions of instances of FRBR entities (seen in fig. 1) and were asked to produce a concept map by establishing connections between the cards based on the question "What comes out of what?" or "What is related to what?"

In addition, participants were asked to describe the resulting "concept maps". We photographed the concept maps and recorded their explanations. Based on the position of cards and participants explanations, a directed graph was created for each participant.

Twenty-three cards were used for concept mapping at the beginning. After our pilot study with three participants showed that too much time was spent reviewing and memorizing cards, rather than connecting them, we decided to reduce the number of cards for each participant. Therefore, the cards were split into five sets, as seen in Figure 1, and five different combinations of those sets were used for the task.

4.1 Results of concept mapping

Although no individual mental model was exactly like FRBR, most individual mental models were close to FRBR. We noted that 20 of the 30 participants formed at least one WEMI chain. Of these, 12 participant formed two such chains, but none established all three possible chains.

Four participants (P20, P30, K12 and K27) had the most FRBR-like mental model with only one different placing card. It is interesting to note that manga is FRBR-unlike in three of these concept maps (cards 20–23), as seen in figure 2.

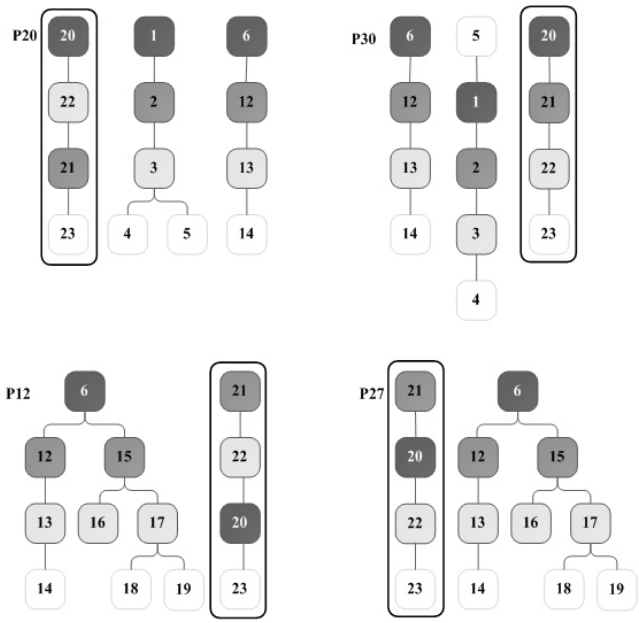

Figure 2. The four most FRBR-like mental models

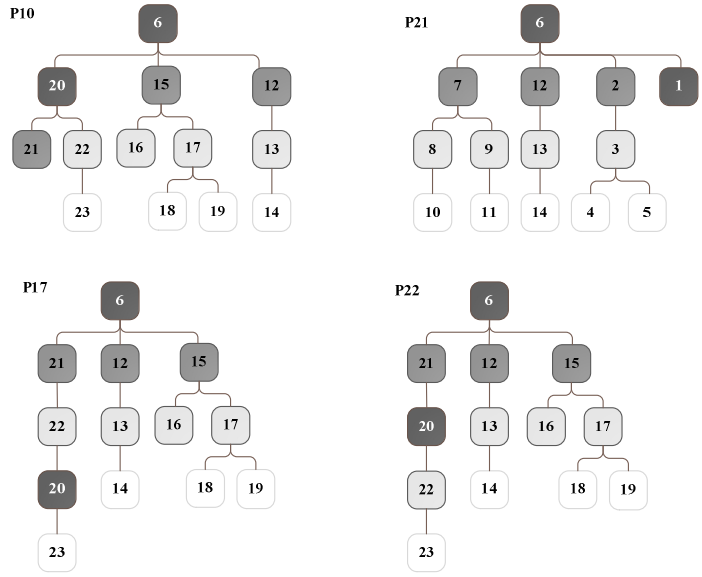

Figure 3. Some examples, where the original work (6) is higher up in the hierarchy

11 participants formed models where Shakespeare's work was placed higher up in the hierarchy than works for the manga and music for the ballet and that linked all these related works together. A close connection between the original work and other works was detected. Some of these maps can be seen in figure 3. This would suggest that a special place for the original work might be proposed in any conceptual model of the bibliographic universe.

Even though we specifically asked the participants about relationships between pairs of cards, six of participants sorted cards in groups randomly or using their own criteria. All items were the most frequently sorted into the same pile.

4.2 Average graph

We wanted to obtain an overall representation of individual mental models. First, we took a list of all explicit connections between cards and counted the times they appeared. To get an overview, we made an average graph based on frequencies of connections above the threshold. Six was chosen as the threshold, which is one third of all possible connections, as recommended in Pisanski et al. (2013: 5).

In figure 4, all connections that were made by at least six participants are superimposed over the FRBR structure for better understanding. The large numbers represent cards (nodes). The smaller numbers are the frequencies of connections between cards, also indicated by thickness and pattern of lines (links). Solid lines are FRBR connections that were made by at least six participants, while dashed lines represent FRBR connections that were made by less than six participants. Dotted lines are non-FRBR connections.

The results indicate that the most FRBR-like mental model was the one for Slovenian (Jesih's) translation (cards 6, 12, 13 and 14) with the 13 of the 18 possible WEMI chains. As it is well structured (with only one expression, manifestation and item) it generally did not suffer from misunderstanding. Other Slovenian translation was also relatively close to FRBR with at least 10 WEMI connections.

A somewhat lower frequency was noted for the English version of the play. Less than six FRBR connections were between manifestation and item (cards 8 and 10). We can notice one direct relationships between English manifestations (cards 8 and 9) which appears in addition to the FRBR structure. Relationship between concepts at the same level may be due to chronological order (8 come chronologically before 9).

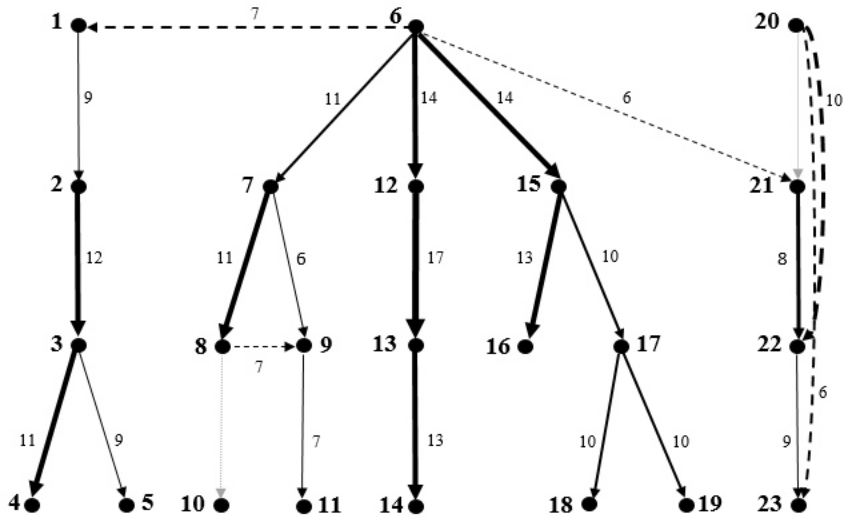

Figure 4.
The average graph of most common links superimposed over FRBR structure

Also, the music chain (cards 1–5) is relatively strong with nine or more FRBR-like connections established between entities. In addition to the FRBR, seven connections were made directly between original work (6) and work for music (1).

The manga Romeo and Juliet results are most unlike FRBR. Less than six connections were made between work and expression (cards 20 and 21). Instead, 10 explicit connections were made directly between the work and manifestation (cards 20 and 22) and six directly between original work (6) and manifestation for manga (21) and between work and item (cards 20 and 23). Problems probably appeared because of uncertainty about the meaning of "original manga in English". Therefore, the results may have been different if we used another description for this card or even another example for this task.

4.3 Discussion of results

It has to be noted that none of the participants produced the exact same map as the one suggested by FRBR, even though some of the cataloguers had heard of FRBR before. While individuals had very different mental models,

the average graph, obtained by using the sum of all of the frequencies of established links between descriptions showed FRBR-like features.

Certainly, some limitations of the study need to be outlined. Since we did not specifically ask participants to draw connections between cards, in certain cases we had to make implicit assumptions about the relationships.

Some of the participants tried to interpret the task, so that they imagined a situation in which they would make such concept maps. While some referred to cataloguing or finding books, cataloguers' perspectives remain highly influenced by their profession's traditional principles of information organization. It need to be taken into consideration that mental models may be influenced by Slovenian cataloguing practice, so within other environments or different cataloguing traditions, results could probably be different.

Due to the small sample size, generalization of the results need to be treated with caution. It cannot be generalized to the whole population of cataloguers, but it does offer some insight into their mental models. However, based on our results, FRBR can be considered as intuitive from cataloguers' as well as users' standpoint and as such an appropriate basis for development of new cataloguing system.

5 Conclusion

The last two decades have seen a revolution in the way in which information is sought, obtained, and stored, particularly with the introduction of Functional Requirements for Bibliographic Records (FRBR) (1998). These changes raise some questions about the role library professionals might play in this technology-rich environment, which require new skills. The success depends on the ability to adjustment to this environment and changes.

The important changes that FRBR may bring are changes in cataloguer awareness and better understanding of the entities and relationships that are of interest to end users of bibliographic data (Žumer, 2011). As FRBR proposes a more complex representation of the bibliographic universe, the data preparation is not an easy task, so cataloguers need more efficient and intuitive tools.

In order to understand the potential of FRBR as the conceptual basis for future cataloguing systems, we tried to investigate how cataloguers perceive

the entities and relationships between those entities. In our study, concept mapping as a method for elicitation mental models was successfully applied to the mental models of the bibliographic universe.

As indicated by the results of previous studies of users' mental models (Pisanski & Žumer, 2010a, 2010b, 2012), FRBR is intuitive for users. The findings of our study show that on average cataloguers' mental models also resemble the FRBR conceptual model. Therefore, we could support claims that FRBR is an intuitive conceptual model of the bibliographic universe also from cataloguers' standpoint, at least for the population studied. Then, if correctly implemented, could (or rather, should) be used as the foundation for development of new cataloguing systems.

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