Mental models of the bibliographic universe. Part 1: Mental models of descriptions

Jan Pisanski and Maja Žumer
University of Ljubljana, Slovenia

Abstract

Purpose: This article aims to present the results of the first two tasks of a user study looking into mental model of the bibliographic universe and especially their comparison to the FRBR conceptual model, which has not yet been user tested.

Design/methodology/approach: The study employed a combination of techniques for eliciting mental models and consisted of three tasks, two of which, card sorting and concept mapping, are presented herein. Its participants were 30 individuals residing in the general area of Ljubljana, Slovenia.

Findings: Cumulative results of concept mapping show a strong resemblance to FRBR. Card sorts did not produce conclusive results. In both tasks, participants paid special attention to the original expression, indicating that a special place for it should be considered.

Research limitations/implications: Study was performed using a relatively small sample of participants living in a geographically limited space using relatively straight-forward examples.

Practical implications: Some solid evidence is provided for adoption of FRBR as the conceptual basis for cataloguing.

Originality/value: This is the first widely published user study of FRBR, applying novel methodological approaches in the field of LIS.

Keywords: FRBR, card sorting, concept mapping, user studies, mental models

Paper Type: Research paper

1. Introduction

As libraries hold increasing amounts of information, it is of utmost importance to design library catalogues to help users find the information they seek more efficiently. Since same works can be found in libraries in many different versions, it would be of benefit to allow for a display of, among others, shorter lists of results rather than the long and usually puzzling lists of different editions of different works in no particular order. However, current cataloguing practices, following standards based on card catalogues, cannot efficiently
support the user tasks of finding, identifying, selecting and obtaining resources/information in a consistent manner. Therefore a fresh look at the bibliographic universe is needed.

One possible answer is the Functional Requirements for Bibliographic Records (FRBR) model. FRBR is a conceptual model of the bibliographic universe, which was developed by International Federation of Library Associations and Institutions (IFLA) and published in 1998. It is the first “official” model of its kind and at least in theory it could form the conceptual basis for a new and improved catalogue design. However, FRBR is more than a decade old and has not yet been proven. Just as important is the distinct lack of user studies concerned with the model.

Therefore, we performed a study of the non-librarians’ mental models of the bibliographic universe, which allows for comparison of user views with the FRBR conceptual model, more specifically with the Group 1 entities, described later in the article. We wanted to see whether the FRBR structure would be confirmed by mental models of individuals. The study was split into three tasks: card sorting, concept mapping and comparison task, in order to get a well-rounded view of mental models of the bibliographic universe, but also to test the techniques. Participants were asked to work in two very different contexts; with real-life materials in hand (for comparison task) and with only descriptions (for the other two tasks). Although none of the three techniques is well-used in library science, card sorting is fairly frequent in information science. While our use of card sorting was straight-forward, we used a relatively fresh approach for the other two tasks. For concept mapping we asked the participants to establish connections between the cards used in the card sorting example. Comparison task was based on semi-structured interviews, during which we were able to observe the elements of the books that were mentioned by the participants and also to obtain all possible reasons for the two items in a pair not to be substitutable. The second part of the task consisted of ranking pairs of items according to perceived substitutability/similarity of the items in a pair. In this paper we present the results of the first two tasks.
2. Background

2.1 FRBR

The Functional Requirements for Bibliographic Records conceptual model was developed by a Study Group of the Cataloguing Section of the International Federation of Library Associations and Institutions (IFLA). The Final Report (FRBR, 1998) describes how the purpose of the study was to “delineate in clearly defined terms the functions performed by the bibliographic record with respect to various media, various applications and various user needs”. The four users tasks, specified in the FRBR study, are:

- Find (to find entities that correspond to user’s search criteria)
- Identify (to identify an entity; e.g. to confirm that the entity described corresponds to the entity sought)
- Select (to select an entity that is appropriate to the user’s needs)
- Obtain (to acquire or obtain access to the entity described).

The FRBR conceptual model presents a general view of the bibliographic universe (FRBR, 1998). As FRBR report doesn't explicitly define bibliographic universe, herein bibliographic universe is defined as intellectual and artistic creations, the entities needed for their creation and use, as well as relations among them, following on Fattahi’s (1997) definition of “totality of bibliographic entities and their relationships”. Similarly, Wilson (1968) called bibliographic universe “the totality of things over which bibliographic control is or might be exercised”.

The basic elements of the FRBR model are the result of logical analysis of data in current bibliographic records. There are three basic groups of entities.

Entities of Group 1

Products of intellectual or artistic endeavour

- Work – a distinct intellectual or artistic creation
• **Expression** – the intellectual or artistic realization of a *work* in the form alphabetic, numeric, musical, or choreographic notation, sound, image, object, movement, etc., or any combination of such forms.
• **Manifestation** – the physical embodiment of an *expression* of a *work*
• **Item** – a single exemplar of a *manifestation*

**Entities of Group 2**

*Entities responsible for the content, production, dissemination or custodianship of Group 1 entities*

• **Person** – an individual
• **Corporate Body** – an organization and/or a group of individuals and/or organizations

**Entities of Group 3**

*Subjects of intellectual or artistic endeavour*

• **Concept** – an abstract notion or idea
• **Object** – a material thing
• **Event** – an action or occurrence
• **Place** – a location

In addition, both Group 1 and 2 entities can also be subjects of a *work*.

We will now take a closer look at the Group 1 entities. *Work* is an intellectual or artistic creation, *expression* is an intellectual or artistic realization of a *work*, *manifestation* is a physical embodiment of an *expression*, while *item* is a single exemplar of a *manifestation*. While the first two entities are completely abstract, *manifestation* is more concrete, whereas only *item* is something physical, in the sense of one being able to hold it in one’s hand.

As theoretical descriptions can be somewhat vague, we will use the example of *The Da Vinci Code* by Dan Brown for further clarification. *Items* are different copies of the same edition of the book (for instance my copy, my library’s copy…). A particular edition, in the physical sense of the word, is called a *manifestation* by FRBR (e.g. edition published by Bantam in 2003). However books are more than just physical objects. One may be interested in the

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1 In case of digital objects, *item* can only be seen on the computer screen.
original text, in a particular French translation, or in an abridged edition of the original version of the work *The Da Vinci Code*. Thus, the Bantam 2003 edition is a *manifestation* that contains Brown’s original text (*expression*) of *The Da Vinci Code* (*work*).

As Aalberg and Žumer (2008) point out, *work* is the cornerstone of FRBR. It serves as a mechanism for pulling together all of the different “versions”. If we refer back to the stated problem of puzzling catalogue displays, we can see that grouping editions by *work* would help. However, only recognizing *works* is not necessarily enough, as there are other relationships between entities in the bibliographic universe. FRBR provides a framework for displays based on bibliographic entities and relationships between these entities rather than bibliographic records. Usually a well-known *work* has several *expressions*, each of which is embodied in several different *manifestations* of which a library has at least one *item*. This suggests a hierarchical structure to the display, which is reflected in the rather simplistic views of most current FRBR implementations. But often one will find *manifestations* that contain more than one *expression* of the same *work* (e.g. same text in different languages) or more than one *work* (e.g. foreword, illustrations, etc., in addition to the “main” *work*). Therefore, true FRBR displays should not really be hierarchical but in fact have network structure, not unlike the one found in World Wide Web, especially since there are also other inherent relationships between entities in bibliographic universe (e.g., a *work* may be a sequel to another *work*). However, in present day OPAC displays mostly only the hierarchy between *manifestations* and *items* is present and catalogues are very much linear in their structure.

Users are presented with usually long and seemingly unordered lists of results at *manifestation* level (i.e. information on editions of books usually listing publication date and publisher). This is a direct result of the input of bibliographic data, which is done at this level: cataloguers describe *manifestations* (including some attributes of *works* and *expressions*) based on a particular *item* (library’s copy). Of course, user displays do not necessarily have to reflect the way data is stored. But on the other hand, what you can get out of a catalogue depends on what you put into it. While current information and communication technology allows for unplanned use of bibliographic information, there are still limitations: if information is not provided or if it is recorded in an unstructured or non-standardised manner, it cannot be used to full extent by means of automatic processing.

### 2.2 Mental models
The two things one notices when researching mental models are a great variety of - sometimes mutually exclusive - definitions of the term and a great number of authors, e.g. Rouse and Morris (1986), Spicer (1998), Michell and Dewdney (1998), Doyle and Ford (1998), Cañas et al. (2001), discussing this phenomenon of multiple definitions. Michell and Dewdney (1998) see potential for LIS research in mental models' interdisciplinarity, but warn of the »terminological labyrinth«.

In the remainder of the text, Norman's definition of mental models from *The Design of Everyday Things* (1998) is going to be used. According to Norman, mental models are models people have of themselves, others, the environment and the things they interact with. Mental models are formed through experience, training and instruction. They are an internal representation of the outside world. Laypersons' mental models usually differ from experts' mental models which Norman calls conceptual models. Mental models vary with time and the knowledge and experience acquired. Usually, there is a tendency for user's mental model to become closer to conceptual model. In libraries, both users and librarians have their own mental models of a library system, with librarians' mental models usually closer to the conceptual model (Michell and Dewdney, 1998). In case of FRBR this is perhaps even clearer to see, as the conceptual model is relatively new.

The importance of mental models is perhaps most vividly explained by Butow (2007), who suggests that not only do users not care how something works; they also do not care if their perceptions are accurate or true. They expect the user interface to reflect their own model as much as possible.

It is possible for several mental models to exist within one person. For example, someone who designed and then used a system may have two different mental models of that system (Carroll and Olson, 1987). Similarly, Spicer (1988) attributes variation in mental models to the context of use. People watching, repairing or making programs for television can have entirely different mental models of the concept of »television«. It is not hard to translate this line of reasoning to books.

3. Motivation
While FRBR is declaratively user oriented, there were no user studies performed during its creation process. In fact, the IFLA Study Group decided not to perform user studies for practical reasons, given the timeframe and the international scope of the study (Madison, 2005). That does not imply that the Study Group had no user data to work with. On the contrary, all of the individuals involved with the creation of the FRBR conceptual model are world-class experts in their respective fields and have encountered many users and usages of catalogues along the way. However, no formal user studies that would look into the phenomenon of bibliographic universe were performed and therefore we cannot really know how catalogue users and others will react to FRBR. As Carlyle (2006) states: we do not know whether FRBR will meet its goals. In fact, Working Group on the Future of Bibliographic Control proposed to stop activities connected with Resource Description and Access (RDA) as long as FRBR, which should form the conceptual basis of cataloguing in the future, is not further explored. Others realize this as well. A Delphi study by Zhang and Salaba (2009) found that experts rank the need to verify that FRBR is appropriate with user studies very highly among the issues in the area of the FRBR model.

There appear to be two possible ways to study users in connection with FRBR. The more practical one would be performing user studies of systems which take FRBR into consideration. However, there are as of yet no true FRBR-based catalogues, which would work on larger scale. As paradoxical as it may sound, one of the biggest reasons for this situation lies in the fact that FRBR has not been user tested yet. However, even if we had a full FRBR implementation to perform a user study on, the results would be influenced not only by FRBR, but also by the particular implementation. While a handful of FRBR-based, or rather FRBR-like, implementations exist and early studies indicate enthusiasm for such catalogues on part of the end-users (Kilner (2005), Jepsen (2007)) we still cannot really claim to know much about how users view the bibliographic universe.

The second, far more theoretical, solution is to study mental models of the bibliographic universe. This was the approach chosen and the main research question was formulated as:

Do mental models of individuals resemble the FRBR conceptual model of bibliographic universe?
Since this was an exploratory study, we wanted to get general results. We decided to use different methods, with particular emphasis on the ability of each individual method to elicit mental models. We were also interested in the effects of combining different methods of mental model elicitation to get a more compact picture of the phenomenon observed.

We wanted to see whether we would be able to find a structure similar to FRBR in people's mental models. Then we could safely assume that the FRBR model is appropriate, at least for the population studied, and that, if correctly implemented, users will have no trouble using FRBR-based OPACs.

Imperfect conceptual models and/or imperfect mental models do not necessarily equal unusable systems. Bawden (2003), in a slightly different context, gives a telling example: doctors treated diseases, although admittedly not necessarily to full effect, long before they knew what caused them. Much more to the point, current catalogues work without a true conceptual model. However, that doesn’t mean that they cannot be improved.

4. Review of literature and related studies

4.1 Card sorting

Card sorting has a fairly rich history in the field of psychology and is relatively commonly used there (Budhwar, 2000). Participants are asked to sort or group cards with some information on them (textual or images). It is often used as a means of eliciting mental models (Fiore et al., 2003). This technique is used to group various categories in menus and sub-menus of various applications or web sites. While there have been a number of uses of card sorting in LIS (e.g., Michell and Dewdney, 1998, Faiks and Hyland, 2002, Cooper, 2002), by far the closest study to ours is Allyson Carlyle's (1999, 2001) work on voluminous works. The fifty participants of Carlyle's research were told to sort 47 objects (or rather photocopies of these objects: books, videotapes, calendars…) in some way related to A Christmas Carol by Charles Dickens. Carlyle was interested in how participants sorted these objects, based on similarity, with the goal of finding the objects at a later time in mind. Although Carlyle does not mention it, one could say that users' mental models of the bibliographic universe of some kind were obtained at a certain level. Words, such as »library« and »catalogue« were consciously omitted from the instructions, in order not to interfere with the research. This trick came in handy in our work, as well.
4.2 Concept mapping

Concept mapping is a technique for representing knowledge as graphs. Knowledge graphs are networks of concepts, which consist of nodes and links (Lanzing, 1997). Not only is concept mapping used in many different fields; the name itself can refer to different methodologies with different results (Jackson and Trochim, 2002). Jackson and Trochim describe concept mapping methods as being aimed at representing mental models of individuals. Despite intensive search, we have not identified any studies using concept mapping in library science. According to Lanzing (1997) concept mapping can be used to design a complex structure, such as a large website.

At first concept mapping was not a part of our study. In fact, we included the exercise only after our pilot study showed that the criterion used in card sorting was not entirely clear to the participants. What we refer to as concept mapping is actually a natural and logical next step as we were looking for a solution that would help us better understand the mental models and their consistency.

5. Research

5.1 Methods

Card sorting can be used to describe how individuals obtain and use concepts of objects to make understanding of the world around them easier. Participants are given cards with some information on them and asked to arrange/cluster them according to criteria which are either specified by the researcher or decided by each individual participant. The resulting groups of cards can be analysed according to their similarity, co-occurrence of cards in the same group, etc.

In this research participants were given a set of cards describing instances of FRBR entities and were asked to group them in at least three groups according to a preset criterion of level of abstractness. This was done with two sets of cards.

Cluster analysis based on similarity of cards sorts was then performed. Also, the notion of a core mental model was identified by the most frequent co-occurrences of cards, based on sorts made by all participants.
For concept mapping participants are usually asked to establish and specify relationships between concepts. The result for each participant is therefore represented as a directional graph, which can be analysed. Analysis may include counting frequencies of specific links, calculating shortest distances between concepts, identifying graph segments, etc.

In this research participants were asked to present a derivation chain of instances of FRBR entities described on cards. They arranged the cards on the table and described the structure of links. Frequencies of these links were then analysed.

5.2 Participants

The study was conducted with 30 participants, residing in or in vicinity of Slovenia's capital, Ljubljana. Participants of the study were not chosen based on a particular criterion, other than that they were willing to take part in the study that could take anywhere from 30 minutes to in excess of 2 hours. They also did not receive any sort of remuneration or benefit for taking part. These circumstances made it difficult to recruit participants; therefore the study was conducted during a longer period of time, between July 2007 and February 2008. While admittedly we would probably have gotten more conclusive results if we chose to focus on a more homogenous group, we decided to perform the first study in a less strict environment that would support learning on-the-fly and provide a more general view.

Participants came from a variety of backgrounds. Out of 30 participants, 11 were male. Seven participants were in their twenties, six were in their thirties, another six in their forties, ten in their fifties, while one participant was older. One participant only finished elementary school, twelve finished high school (six of them were former or current university students), two finished two-year college programs, thirteen obtained a university degree and another two had a PhD.

Participants were first presented with the instruction sheet. After filling out the demographic data questionnaire, they were ready for the three tasks, which they performed in sequence after reading the appropriate instructions. After having performed the three tasks, we also asked the participants whether they thought they had trouble with any of the tasks and which tasks they preferred.
6 Task 1: Card Sorting

6.1 Data collection

The first task asked of the participants to sort cards containing descriptions of various instances of FRBR group 1 entities into at least three groups based on the criterion of concrete/abstract (physical/non-physical) nature. We asked for at least three groups to avoid having respondents splitting cards into just general “abstract” and “concrete” groups. Card sorting was performed on two separate examples (Hlapec Jernej in njegova pravica and The Da Vinci Code), in order to detect any inconsistencies. Also, participants were asked to name/describe groups in an attempt to find more user-friendly names for the entities. Participants were instructed not to pay attention to the descriptions but rather to what those descriptions were of or represented.

The two examples were chosen for particular reasons, mostly because they were thought to be known to all participants. We did not expect, or indeed need, the participants to know about the contents, but rather wanted examples that would at least sound familiar to the participants. Also, we looked for examples that exhibited rich variety in publication.

Hlapec Jernej in njegova pravica is a novel by Slovenian author Ivan Cankar, written at the turn of the 20th century. It is often considered to be one of the classical works of Slovenian literature. On the other hand, The Da Vinci Code is a popular fiction novel by American author Dan Brown.

There were 13 cards used for the example of Hlapec Jernej in njegova pravica and 14 for The Da Vinci Code, which also expanded into the territory of motion pictures and audio books. Descriptions were worded in such a way that they would not remind participants of catalogues and we also tried to avoid using exactly the same attributes on the cards referring to the same entity, as to not get results based on similarity of descriptions. For similar reasons, we also decided not to have examples of items for every manifestation. The translations of descriptions are presented in Tables 1 and 2.

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<th>Table 1: Cards in the <em>Hlapec Jernej in njegova pravica</em> example</th>
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<th>Table 2: Cards in <em>The Da Vinci Code</em> example</th>
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Each description was deemed to represent the FRBR entity connected with the most concrete attribute it contained. Therefore the ideal FRBR supported card sort we were looking for in the case of the *Hlapec Jernej* example was such:

9 10  
**Works**

1 7 13
**Expressions**

2 3 5 11 14
**Manifestations**

4 8 12
**Items**

Similarly, for *The Da Vinci Code* example we were expecting results of the card sort to look like this:

8 10 14
**Works**

2 3 5 7
**Expressions**

1 4 6 11 12 13
**Manifestations**

9
**Items**

### 6.2 Data analysis

Most of the participants found the task difficult or puzzling. They asked for further explanation and often expressed their dissatisfaction with the criterion or the design of the task. Actually, the naming and description of the criterion for Task 1 were found to be critical during the design stage of the study and much consideration was given to the appropriate
naming of the criterion. If participants asked for more explanation, they were told that a book can be a concrete physical object, but it can also be something more abstract.

Some participants failed to sort cards according to the criterion given and rather sorted them using their own criteria. In these cases the criteria used most commonly were language and physical format, as well as a combination of both with the original criterion. Some also based the sorts on the richness of descriptions themselves, which is not the same as basing it on the concrete/abstract nature of the things described (e.g., compare descriptions 1 and 4 in Table 2, which both describe manifestations but are not equally rich in description). Between the two sorts participants were reminded of the criterion and those that did not follow it during the first sort were strongly encouraged to do so with the second sort.

No two participants performed any of the sorts exactly the same. Also, none of the sorts completely followed FRBR. In FRBR terms, participants obviously had the most trouble distinguishing between expressions and manifestations, often making just one big pile of editions or splitting these into two or three piles according to language.

As participants used different criteria, it is not surprising that the names of the groups they provided were heterogeneous, as well. Even when participants made groups that more or less corresponded to FRBR entities, the names given to these groups were not consistent among the participants. Clearly, we were unable to obtain suggestions for more user-friendly names for FRBR entities that we had hoped for.

On the other hand, even when participants used the same names for groups these groups were not the same. For the Hlapec Jernej example 7 participants all used the category name editions or similar. However, none of these groups contained exactly the same cards. In part this can be attributed to forming separate categories for non-Slovenian examples, although clearly some participants did not make the distinction between the expression and the manifestation aspects of editions. For The Da Vinci Code example 12 participants referred to editions.

Table 3: Frequencies of pairs of cards appearing in the same group for the Hlapec Jernej example

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14
In Tables 3 and 4 frequencies of co-occurrences of cards in groups are presented. For example, from Table 3 one can see that cards 1 and 2 were sorted in the same group by seven participants. (Please refer to Table 1 for explanation of card numbers in Table 3 and to Table 2 for card numbers in Table 4). In both examples manifestations were the most frequently sorted cards into the same pile. However, there is a difference. While in the Hlapec Jernej example only manifestations in the same language were among the pairs with the highest frequency of co-occurrence, for The Da Vinci Code all of the pairs of book manifestations were relatively high. Also, the cards pertaining to the movie The Da Vinci Code were frequently put in a separate group, whereas the dramatisation in the first sort was generally considered in the same group as novel and original expression. Both of these occurrences could be explained by participants changing their focus from language to form for the second sort.

Of the non-FRBR pairs, pairs containing the novel and the original expressions were relatively frequently sorted into the same pile in both cases (15 times for Hlapec Jernej and 22 times for The Da Vinci Code). It is interesting to note that other expressions were more

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frequently sorted together with *manifestations*. Not only that, but in the *Hlapec Jernej* example the pairing of the two non-original *expressions*, which were both in the book form, actually had the second highest frequency. This would suggest that original *expressions* might have to be treated differently in FRBR.

We also performed an analysis of the most distinct groupings of cards. Working from the most frequent pairings towards the less frequent ones, we made groups based on co-occurrence of cards. To illustrate: in the *Hlapec Jernej* example pairs with the five highest frequencies were 2 and 3 (frequency of 24), 1 and 13 (23), 11 and 14 (20), 1 and 2 (17), as well as 1 and 3 (17). For the first three pairs we made 3 separate groups. Thus, at the frequency of 20, these groups were \{2, 3\}, \{11, 14\}, \{1, 13\}. However, because card 1 appeared together with 2 (as well as 3) at the frequency of 17, the groups where these cards had previously appeared were merged. Therefore, at the frequency of 17 there were two distinct groups: \{11, 14\} and \{1, 2, 3, 13\}.

It has to be said that using this process in both cases by the frequency of 12 there was only one group left and relatively few cards were part of a pair that had a frequency of 17 or higher. If we consider a cut-off frequency of 15 participants, we obtain these groups:

*Hlapec Jernej*

2 3 1 13 5 Other language *expressions* and *manifestations* (E, M)
11 14 Slovenian *manifestations* (M)
7 10 9 *Works* and original *expression* (W, E)
8 12 Two *items* (I)

*Da Vinci Code*

6 13 1 4 11 7 Slovenian *expression* and (both original and Slovenian) *manifestations* (E, M)
3 8 Novel and original *expression* (W, E)
5 12 14 Film (W, E, M)

Here we can clearly see the divide between original and other *expressions* in both cases.

Based on the data obtained, we performed cluster analysis using Ward method. Cluster analysis is a technique used for combining observations into groups. Each group is homogenous with respect to certain characteristics and each group should be different from
other groups based on these same characteristics (Sharma, 1996). Ward method is considered to be a simple, yet popular, method which allows for drawing tree diagrams (Doreian et al., 2005). Unlike most other clustering methods it does not compute the distances between clusters, but rather forms clusters by maximizing homogeneity within clusters (Sharma, 1996).

Using the R software (http://www.r-project.org/) package’s hclust command for Ward method we produced dendrograms for the *Hlapec Jernej* (Figure 1) and *The Da Vinci Code* example (Figure 2).

We looked at the two main clusters in both cases. In both Figure 1 and Figure 2 the cluster on the right, broadly speaking, contains those participants that more or less thought in terms of concrete and abstract, while the clusters on the left include participants who generally grouped by language (Figure 1) or by form (Figure 2). Even if only the clusters on the right are observed for both examples, original *expressions* still tended to be grouped together with the original *work*.
However, as can be deduced from Figures 1 and 2, in general we could not find groups of constantly similar mental models. Had the mental models been consistent, the two dendrograms would have been more similar.
7 Task 2: Concept mapping

7.1 Data collection

Our method differed from usual concept mapping on two very important issues: it was constrained to a large degree and it did not explicitly include concepts, but rather instances of these concepts. Usually concept mapping requires participants to come up with concepts. We felt that in our case asking participants to directly come up with entities would not be productive. Therefore, we asked them to make a map of examples of concepts that we had prepared for them. In this sense, our variation of the method is similar to ACSMM (Analysis-Constructed Shared Mental Models), where concepts are also provided to participants in advance (Johnson, O’Connor, 2008). Similarly to the ACSMM, we also wanted to obtain an overall representation of individual mental models.

Participants were given the same cards used in card sorting for Hlapec Jernej in njegova pravica and asked how these cards are inter-related and, more specifically, “What comes out of what?” They were told not to necessarily think in terms of chronological order and that the resulting graphs need not be linear. Again, participants were asked to describe the resulting “concept maps”. We did not specifically ask participants to draw connections between cards, although we did make the suggestion. Therefore, in large part we had to make implicit assumptions about the relationships. We also specifically referred to making connections between the individual cards, not groups of cards.
Plate 1: An example of a concept map

We photographed the concept maps with a digital camera. We also asked participants to explain their concept maps and recorded their explanations with an audio device. An example of a real-life concept map made by participant U4 is presented in Plate 1 for better understanding. It has to be pointed out that some of the other participants did not make concept maps that were visually as distinctive. This phenomenon of different layouts was also described by Johnson and O’Connor (2008). Just like Johnson and O’Connor, we decided to offset this problem by interpreting implicit information. In our analysis of concept maps connections between cards were induced from positions of cards arranged by participants and any additional observation made by participants.

In Figure 3, a concept map in line with FRBR is presented for the example of Hlapec Jernej in njegova pravica. As stated for Task 1, there are two works, three expressions, five manifestations and three items. As there were only three items in the example, three Work – Expression – Manifestation – Item chains can be observed, denoted with white arrows in Figure 3.
Figure 3: An interpretation of a concept map according to FRBR

7.2 Data analysis

It has to be noted that participants were sometimes vague in their descriptions and that some of their observations cannot be objectively included in the study. For instance, if a participant referred to some cards being closer than others, we did not include that admittedly very important information in the study mainly due to vagueness of terms referring to distance. For practical reasons, we represented all distances to be the same. More importantly, sometimes it was difficult to assess whether two cards belonged on the same hierarchical level. Also, some participants clearly had difficulty expressing their mental models just by spacing out cards on a table.

As FRBR is based on the Work-Expression-Manifestation-Item progression, it was interesting to note that 14 of the 30 participants formed at least one such chain. Of these, one participant formed two such chains and three others established all three possible chains. Ten more participants established at least one Work-Expression-Manifestation or Expression-Manifestation-Item progression. Of these, only three created more than one chain, while only one made both a Work-Expression-Manifestation and an Expression-Manifestation-Item chain.
Based on our pilot study with 3 participants, we were expecting to get structures similar to FRBR structure in our main study. However, where in the pilot study we got results that clearly showed the original text and the two translations as being on the same level, results of the main study were more heterogeneous. Seventeen participants formed models where originals in general or at least the original expression were placed higher up in the hierarchy. Some of these maps can be seen in Figure 4 (refer to Table 1 for the card descriptions).

![Figure 4: Some examples, where at least the original expression (7) is higher up in the hierarchy](image)

In our conversation with the participants we detected four possible reasons for higher placing of the originals:

- chronology of events
- preference for the original as translations may have changed the meaning/flow of text
- personal preference (preference for Slovenian text, as some of the participants did not speak the other languages, mentioned in the example, well)
- perception of the original as being unique and of higher importance and value
- perception that original text is a surrogate of work.

It has to be noted that Hlapec Jernej in njegova pravica is considered a classical work of Slovenian literature and as such lends itself well to this kind of interpretations. Therefore, the results may have been different, if we had used another - perhaps more modern - example for
this task. However, as in the card sorting task more participants actually sorted together the original expression with the novel in the *The Da Vinci Code* example than in the *Hlapec Jernej* example, it could well mean that original expressions in general need special consideration in any conceptual model of the bibliographic universe.

Putting the original higher up the order resulted in asymmetrical structures, where different levels cannot be discerned easily, if at all. Of course, asking a question, such as »What comes out of what? «, is bound to have its drawbacks, as people may assume that they are being asked for chronological order and therefore fail to consider the possibility of relations between concepts at the same level. That is to say, while original text does, by default, come chronologically before all of the translations etc. and in fact usually forms the basis for all other expressions, it can be considered (as in FRBR) as being equal to the other expressions.

In fact, some of the participants had trouble understanding »original text«, as it can be understood as author's handwritten manuscript. Seven participants also associated it with dramatization. What this practically means is that the vast majority of participants did not make a separate level for (all) expressions. However, as 17 participants did put the two non-Slovenian expressions (cards 1 and 13) on the same level, it would appear that they grasped their function in the exercise. Therefore it is interesting that only 9 participants had all three expressions (cards 1, 7 and 13) on the same level. Of these, only three participants (U16, U20 and U24) made clear delineation between expressions and manifestations, as seen in Figure 5. However, one of them (U24) listed dramatization among Slovenian manifestations.

![Figure 5: The four most FRBR-like individual mental models](image-url)

It has to be said that 12 of the participants generally seemed to only make branches based on language but rarely made further distinctions within these groups, essentially performing a

card sort based on a different criterion. This is evidenced by occasional somewhat irrational switching of, for example, *manifestations* and *items*. Although we specifically asked the participants about relationships between pairs of cards, some were obviously still under the influence of the card-sorting exercise and had trouble adjusting to the demands of the new exercise.

English translations may be the most interesting subset of cards to observe, as it is well structured and generally did not suffer from occasional misunderstanding like Slovenian examples did. From Figure 6 we can clearly see that participants made very varied structures. Both participants U10 and U11 made FRBR-like structures for English examples, whereas others made linear or even inverted structures. Participant U13 did not even include all of the English examples in the same branch, the reason being that, as an example of an older book in the British Library, the *item* (card 4) was thought to have been more precious and therefore closer to the originals.

Figure 6: A comparison of different concept maps made by participants U10, U11, U12, U13 and U14
Figure 7: All of the explicit connections between cards established by participants in Task 2

As we can see from Figure 7, which depicts all of the direct connections between different cards (the thicker the line, the greater the frequency), in general, concept maps were similar to FRBR.

In Figure 8 we see all the connections that were made by at least 9 participants. This number was chosen for cut-off point because it includes all of the FRBR connections and the presentation is not overcrowded. Here, the larger numbers refer to cards, whereas the smaller numbers are the frequencies of individual connections between cards, also indicated by the thickness of lines.

We took a list of all of the explicit connections between cards and counted the times they appeared. It has to be mentioned that we used ordered pairs, meaning there was a direction to each pair of vertices in a graph. It is very important to understand that the use of ordered pairs precluded connections between cards on the same level. This had particular influence on the top level, where, if a card was found to be a dead end, we included it as belonging to the next lower level, unless otherwise stated by the participant. In turn, even with FRBR-like structures, dramatisation was, basically, reduced to being just another expression of a work.
If we compare Figures 8 and 9, we can observe that connections from the original expression (7) to the dramatisation (10), as well as direct connections from the novel (work; card 9) to the Slovenian manifestations (cards 11 and 14) and also the connection between an older English item (4) and a newer English manifestation (3) appear in addition to FRBR structure. However, their frequencies are relatively low, compared to the most FRBR connections.

Figure 8: Connections that were made by at least 9 participants. Cards are represented as nodes (large numbers), frequencies of links are indicated by smaller numbers.
Again, we used R software package to perform the cluster analysis using Ward method and to obtain dendrogram, shown in Figure 10. For the purpose of this discussion, we will consider three clusters. The most interesting cluster, consisting of 13 participants, is to be found on the extreme right side of the figure and is identified by the solid line. We will refer to this as the first cluster. It contains the most FRBR-like concept maps. Participant U16 and, by way of only including direction, also participant U20 had concept maps exactly corresponding to FRBR. It is important to note that these two were the only two concept maps that were exactly the same.

The larger cluster on the left side (dotted line; the second cluster; 13 participants) also resembled FRBR with one notable exception: concept maps in this cluster did not contain connections between the original Slovenian text and the Slovenian manifestations.

Figure 9: FRBR structure represented with the same nodes as Figure 8
The relatively small cluster in the middle (no line; third cluster), containing concept maps of four individuals, had no apparent relationship to FRBR.

In Figures 11, 12 and 13 the graphs of frequencies of connections within each of the three clusters are presented. For the first cluster, we decided to only use frequencies above 2, for the second frequencies above 4 and for the third cluster frequencies of more than 1.

In Figure 11 we can see strong FRBR-like connections in the part of the graph pertaining to Slovenian examples. Whereas the link between the novel and the original expression is quite clear, links to other expressions are not as strong. Also, FRBR structure is very clearly visible for the lower part, i.e. links from expressions to manifestations and from manifestations to items.
For the second cluster, we can observe that there are no connections between the Slovenian expression and the two manifestations in Figure 12. Instead, a direct link from the novel (9) to the manifestations (11, 14) can be seen. On the other hand, a strong connection between the original Slovenian text and the dramatisation is established. Also, links from the novel to the two foreign expressions are relatively strong. This would suggest that participants in this group did not see the role of the original text in accordance with FRBR.
Figure 12: Frequencies of connections for the second cluster
Figure 13: Frequencies of connections for the third cluster

Figure 13 presents a picture of the middle cluster that is more open to interpretation, mostly because the number of participants in this cluster was relatively low. Unlike with the other two clusters, there is no clear resemblance to FRBR. For illustration, among the most frequently listed connections were the relationships between the novel (9) and the unique original item (8) as well as between a particular Slovenian manifestation (11) and the Croatian manifestation (5).

Using the single linkage (nearest-neighbour) method of hierarchical clustering, a different dendrogram was produced, as seen in Figure 14. Here, the distance between two clusters is represented by the minimum of the distance between all possible pairs in the two clusters (Sharma, 1996). As we can observe in Figure 14, using this method, the FRBR-like maps (the cluster marked with a line) are generally joined at a lower level than the non-FRBR-like maps.
8. Conclusions

The first thing that one notices when viewing the results of the card sorting and concept mapping tasks is that the participants did not have a common mental model of the bibliographic universe: not only did different individuals have different mental models, elicited mental models also changed, not only with tasks but also between the card sorts in Task 1. However, concept mapping task did produce a “cumulative” mental model that highly resembled FRBR. Also, generally speaking, the mental models that were most alike were the most FRBR-like. This represents the most important finding of this part of the broader study and provides an answer to the basic research question. We also saw that in both exercises the original expression was often given a special position, not bundled with the other expressions but rather much closer to the work in question. In fact, in some cases it seemed to be considered as a surrogate of work. This indicates that the original expression requires a special consideration within any conceptual model of the bibliographic universe and should be addressed in any future developments of FRBR.
While card sorting did not work as well as we had hoped, since participants did not exclusively sort based on the criterion that was asked of them, we did gain some important information. It was clear that the dual (concrete/abstract) nature of the bibliographic universe is not something that lay people generally focus on or even think about (unlike e.g., language and format). However, that should not imply that FRBR is not needed.

As we wanted to get a well-rounded view of the bibliographic universe, results of the third task, comparison task, which is to be presented in a separate article, are also important. Therefore, a more thorough examination, taking into account all of the results of the study, is to be published in that article.

References:


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