RESEARCH AND DEVELOPMENT OF FRBR-BASED SYSTEMS TO SUPPORT USER INFORMATION SEEKING

Dr. Yin Zhang
Dr. Athena Salaba
School of Library & Information Science, Kent State University
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PRESENTATION OUTLINE

1. FRBR FAMILY MODELS
2. STANDARDS AND PRACTICE
3. APPLICATION
4. IMPLEMENTATION
5. RESEARCH
1. FRBR FAMILY MODELS

FRBR FAMILY MODELS OVERVIEW

Diagram showing relationships between Work, Theme, Expression, Manifestation, Item, Person, Corporate Body, Family, and Ownership.
FRBR FAMILY MODELS OVERVIEW

FRBR MODEL

- Developments:
  - FRBR Review Group (Identifiers, Namespace, Aggregates, Harmonization of Family)
  - FRBRoo – harmonization with ICOM-CIDOC Conceptual Model (ICOM-CIDOC CRM)

- Delphi Study Findings:
  - The FRBR model area included issues regarding:
    - model evaluation,
    - model modification,
    - model expansion, and
    - other related models
  - The panel raised the largest number of issues in this area
  - FRBR model verification and validation using real data, applied in different communities, stands out as the most critical issue in this area
2. IMPLICATIONS TO STANDARDS AND PRACTICE

FRBR AND RELATED STANDARDS: DEVELOPMENTS

- International Cataloguing Principles
- International Standard Bibliographic Description (ISBD)
- Resource Description and Access (RDA)
- Dublin Core Metadata Initiative (DCMI)
- Machine Readable Cataloging (MARC)
- RDA/ONIX Framework
- Resource Description Framework (RDF) and Linked Data
FRBR AND RELATED STANDARDS: DELPHI STUDY

- This area includes mainly issues regarding:
  - the development of standards,
  - mapping of FRBR with existing standards, and
  - other related standards

- Developing cataloging rules in line with FRBR was considered the most critical issue in this area:
  - FRBR is just a conceptual model and thus bibliographic records should be redefined/remodeled properly in line with FRBR
  - Critical to implementation, at least in the library environment

3. FRBR APPLICATION
APPLICATIONS EXPLORED

- Types of resources:
  - Works of art, cultural objects
  - Classical texts
  - Fiction
  - Hand-press materials
  - National literature
  - Live performing arts
  - Moving images
  - Music
  - Continuing resources, aggregates

- Settings:
  - Libraries
  - Consortia
  - Digital Libraries, Internet Archives, Institutional Repositories
  - Museums

FRBR APPLICATION: DELPHI STUDY

- The FRBR application area included issues regarding FRBR application in a specific setting, discipline, or collection
- Topping the list is the issue of a lack of FRBR application guidelines and examples
- Panel members pointed out possibly confusing and challenging points in practical applications:
  - “...understanding separation of work, expression and manifestation;”
  - “…how to know what elements/relationships are significant to different types of materials or different collections so [we] can develop appropriate systems to address that.”
4. FRBR IMPLEMENTATION

FRBR SYSTEMS DEVELOPMENT

Overall, current FRBR implementations can be divided into two broad categories:

1. implementing FRBR in online library catalogs (either general library collections or specific types of library collections), and
2. implementing FRBR in nontraditional library settings, such as special collections, museums, digital collections, archives, and Internet resources.
FRBR SYSTEMS DEVELOPMENT – TYPES OF PROJECTS

- **Full-scale working systems**
  - Such systems support regular services or functions. For example,
    - OCLC Worldcat.org
    - UCLA Library – Film and Television Archive OPAC.

- **Prototypes or experimental systems**
  - Such systems are prototypes or experimental test systems developed to simply explore FRBR implementations.
  - These systems do not support real live library services. For example,
    - Libraries Australia’s demonstration system illustrates prototype service with stale data rather than its production service.

- **Supporting software tools, algorithms, and utilities**
  - Such implementation efforts are devoted to certain aspects of the catalog systems such as the FRBRization of MARC records and the creation of user interfaces based on the FRBR model. For example,
    - OCLC FRBR Work-Set Algorithm, which converts MARC bibliographic records to conform to FRBR at the work entity level.
    - The Library of Congress has developed the FRBR Display Tool, which allows libraries to display their resources by clustering bibliographic records according to the FRBR model.

FRBR SYSTEMS DEVELOPMENT: DELPHI STUDY

- The FRBR system development area included issues regarding efforts to help FRBRize existing systems or build new FRBR systems.

- Top critical issues:
  - **Issue 1**: Need to develop and test tools/software that will facilitate the FRBRization processes;
  - **Issue 2**: Need to explore, develop, and test various means of FRBR implementation;
  - **Issue 3**: Need to address the FRBRization of existing data from a variety of differing standards and practices; and
  - **Issue 4**: Need to explore, design, and develop effective user interfaces in general, with result displays, in particular, based on the FRBR model.
5. FRBR research

Critical Issues and Challenges in FRBR Research

- FRBR Research
  FRBR-related efforts in the form of theoretical discussion, exploration, and development as well as evaluation and implementation

- According to our Delphi study (Zhang & Salaba, 2009), four of the five critical issues facing FRBR research are related to user research:
  - Issue 1: User studies on FRBR-based systems to ensure that implementations benefit end-users;
  - Issue 2: User research on FRBR-based displays;
  - Issue 3: Examination of end-user tasks with empirical research;
  - Issue 4: Automatic processing of databases or full-text electronic resources to facilitate FRBR implementation; and
  - Issue 5: Development of semiotic frameworks and research to ensure effective communication between users and FRBR systems.

- KSU IMLS-funded FRBR project addresses Issue 4 by FRBRizing legacy data such as MARC records (See 5A of this presentation) and Issues 1-3 and 5 by conducting a series of FRBR user studies (See 5B of this presentation)
5A. Kent State IMLS FRBR Research Project

FRBRization

**WORK-LEVEL FRBRIZATION PROCEDURE**

- The FRBRization procedures for identifying and grouping works for our project are based on the OCLC FRBR workset algorithm (Hickey & Toves, 2005).
  - The original source of the algorithm is:
  - Based on several rounds of evaluations, the KSU FRBR team has added to and refined some of the algorithm’s steps.
THE COLLECTION

- For this experiment, the collection used was extracted from WorldCat for LoC records at the end of December 2007.

- This collection includes:
  - 13,624,251 bibliographic records
  - 7,283,635 authority records

OVERALL IMPLEMENTATION PROCEDURES

- The OCLC work-set algorithm covers essentially two major processes:
  - Processing Authority Records
  - Processing Bibliographic Records and Creating Work-sets
The BibKey Patterns

There are four basic BibKey Patterns:

- Pattern 1: `<author>/<title>`
- Pattern 2: `<uniform title>`
- Pattern 3: `<title>/<name(s)>`
- Pattern 4: `<title>/<control number>`

The LC Collection: Bibliographic Records by Pattern

Note that the KSU LC BibKey pattern distribution is similar to the one reported in the 2005 OCLC Workset Algorithm paper, shown below.
LOC WORKSETS BY PATTERN

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Overall</th>
<th>Single-record workset</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Count</td>
<td>Percent</td>
</tr>
<tr>
<td>Pattern 1</td>
<td>8,477,369</td>
<td>73.21%</td>
</tr>
<tr>
<td>Pattern 2</td>
<td>242,713</td>
<td>2.10%</td>
</tr>
<tr>
<td>Pattern 3</td>
<td>2,267,440</td>
<td>19.58%</td>
</tr>
<tr>
<td>Pattern 4</td>
<td>592,138</td>
<td>5.11%</td>
</tr>
<tr>
<td>Total</td>
<td>11,579,660</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

EXPRESSION AND MANIFESTATION LEVEL FRBRIZATION – SAMPLE

- The sample:
  - From the multiple-record work-sets, we selected those that contained at least 10 records to explore FRBRization at expression and manifestation level
  - Sample size:
    - 12,579 work-sets (1% of the multiple-record work-sets)
    - 273,866 records (2% of the entire LoC collection bib records)
EXPRESSION AND MANIFESTATION LEVEL
FRBRIZATION - ALGORITHM

Previous work and basis:
- Mapping and importance ratings of attributes and MARC fields on user tasks:
  - Functional Analysis of the MARC 21 Bibliographic and Holdings Formats by Network Development and MARC Standards Office, Library of Congress
  - IFLA FRBR Report, Tables 6.1-6.4
  - KSU FRBR project evaluation based on cataloging standards & practice
- MARC records analysis
- FRBR work-set analysis

BACKGROUND PROCESS FOR ALGORITHM DEVELOPMENT
- Mapping FRBR attributes to MARC codes
- Mapping User Tasks to Attributes & Relationships & MARC codes
  - Analysis is based on FRBR User Tasks (e.g. the LoC “search” was mapped to FRBR “find”)
- Evaluation of the importance of each attribute/MARC mapping in finding, identifying or selecting Group 1 entities with a focus on Expression & Manifestation
  - Evaluation & rating scale based on:
    - FRBR evaluation of Attributes & Relationships – primary rating
    - LoC analysis of MARC fields, mapping to FRBR attributes & relationships and value of importance – secondary rating
    - KSU FRBR project evaluation based on standards & practice
EXPRESSION AND MANIFESTATION LEVEL
FRBRization - Attributes

- **Expression:**
  - Form of expression
  - Language of expression
  - Music – arranged statement for music
  - Music – type of score
  - Serials - Extended frequency of issue
  - Cartographic – Scale
  - Cartographic - Projection

- **Manifestation:**
  - Identifier
  - Manifestation title
  - Form of carrier
  - Series statements
  - Statement of reasonability
  - Serials – Numbering
  - Edition/issue designation
  - Date of publication/distribution
  - Publisher/distributor
  - Visual material – presentation format
  - Microform – reduction ration
  - Microform/projection – generation
  - Microform/projection – polarity
  - Extent of carrier
  - Image – color
  - Physical medium
  - Dimensions of carrier
  - Capture mode
  - Electronic resources – System requirements
  - Electronic resources – File characteristics
  - Electronic resources – Mode of access

Expressions in a Workset Distribution

<table>
<thead>
<tr>
<th>Expressions-per-workset</th>
<th>Number of worksets</th>
<th>%</th>
<th>Cumulative %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3,794</td>
<td>30.2%</td>
<td>30.2%</td>
</tr>
<tr>
<td>2</td>
<td>2,119</td>
<td>22.2%</td>
<td>62.4%</td>
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<tr>
<td>3</td>
<td>1,480</td>
<td>11.8%</td>
<td>75.0%</td>
</tr>
<tr>
<td>4</td>
<td>1,227</td>
<td>9.8%</td>
<td>84.8%</td>
</tr>
<tr>
<td>5</td>
<td>827</td>
<td>7.0%</td>
<td>81.8%</td>
</tr>
<tr>
<td>6</td>
<td>610</td>
<td>4.8%</td>
<td>86.6%</td>
</tr>
<tr>
<td>7</td>
<td>423</td>
<td>3.4%</td>
<td>89.9%</td>
</tr>
<tr>
<td>8</td>
<td>302</td>
<td>2.4%</td>
<td>92.3%</td>
</tr>
<tr>
<td>9</td>
<td>225</td>
<td>1.8%</td>
<td>94.1%</td>
</tr>
<tr>
<td>10</td>
<td>154</td>
<td>1.2%</td>
<td>95.3%</td>
</tr>
<tr>
<td>11</td>
<td>103</td>
<td>0.8%</td>
<td>96.1%</td>
</tr>
<tr>
<td>12</td>
<td>74</td>
<td>0.6%</td>
<td>97.7%</td>
</tr>
<tr>
<td>13</td>
<td>56</td>
<td>0.4%</td>
<td>98.1%</td>
</tr>
<tr>
<td>14</td>
<td>46</td>
<td>0.4%</td>
<td>98.5%</td>
</tr>
<tr>
<td>15</td>
<td>35</td>
<td>0.3%</td>
<td>98.8%</td>
</tr>
<tr>
<td>16</td>
<td>37</td>
<td>0.3%</td>
<td>99.1%</td>
</tr>
<tr>
<td>17</td>
<td>31</td>
<td>0.2%</td>
<td>99.3%</td>
</tr>
<tr>
<td>18</td>
<td>21</td>
<td>0.2%</td>
<td>99.5%</td>
</tr>
<tr>
<td>19</td>
<td>20</td>
<td>0.2%</td>
<td>99.7%</td>
</tr>
<tr>
<td>20</td>
<td>17</td>
<td>0.1%</td>
<td>99.8%</td>
</tr>
<tr>
<td>21</td>
<td>7</td>
<td>0.1%</td>
<td>99.9%</td>
</tr>
<tr>
<td>Total</td>
<td>12,579</td>
<td>100.0%</td>
<td></td>
</tr>
</tbody>
</table>

Overall distribution in the sample

- Minimum: 1
- Maximum: 276
- Average: 3.6
MANIFESTATIONS PER EXPRESSION DISTRIBUTION

<table>
<thead>
<tr>
<th>Number of Ms in an E</th>
<th>Frequency</th>
<th>%</th>
<th>Cumulative %</th>
</tr>
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<td>9,915</td>
<td>21.9%</td>
<td>66.4%</td>
</tr>
<tr>
<td>3</td>
<td>2,990</td>
<td>6.3%</td>
<td>72.7%</td>
</tr>
<tr>
<td>4</td>
<td>1,665</td>
<td>3.7%</td>
<td>76.4%</td>
</tr>
<tr>
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<td>1,357</td>
<td>2.9%</td>
<td>79.3%</td>
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<tr>
<td>6</td>
<td>1,111</td>
<td>2.4%</td>
<td>81.7%</td>
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<td>7</td>
<td>962</td>
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<td>83.8%</td>
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<td>8</td>
<td>686</td>
<td>1.5%</td>
<td>85.3%</td>
</tr>
<tr>
<td>9</td>
<td>1,090</td>
<td>2.4%</td>
<td>87.7%</td>
</tr>
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<td>1,874</td>
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<td>91.8%</td>
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<tr>
<td>11</td>
<td>1,328</td>
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<td>94.7%</td>
</tr>
<tr>
<td>12</td>
<td>1,007</td>
<td>2.2%</td>
<td>96.9%</td>
</tr>
<tr>
<td>13</td>
<td>717</td>
<td>1.6%</td>
<td>98.5%</td>
</tr>
<tr>
<td>14</td>
<td>565</td>
<td>1.2%</td>
<td>99.7%</td>
</tr>
<tr>
<td>15</td>
<td>409</td>
<td>1.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>16</td>
<td>369</td>
<td>0.8%</td>
<td>100.0%</td>
</tr>
<tr>
<td>17</td>
<td>357</td>
<td>0.8%</td>
<td>100.0%</td>
</tr>
<tr>
<td>18</td>
<td>249</td>
<td>0.5%</td>
<td>100.0%</td>
</tr>
<tr>
<td>&gt;=19</td>
<td>2,281</td>
<td>5.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Total</td>
<td>45,775</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

Overall distribution in the sample

<table>
<thead>
<tr>
<th>Minimum</th>
<th>Maximum</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3,395</td>
<td>6.0</td>
</tr>
</tbody>
</table>

FRBRIZATION ISSUES AND CHALLENGES

- Algorithm related
- Legacy data, current cataloging practices and standards related
ALGORITHM RELATED CHALLENGES

- Processing titles
  - Trailing “English”, “Tragedy of” and “Comedy of” in titles
- Other titles not used in mappings
- Partial matching
- Source of data
  - Coded data vs. free text

CHALLENGES DUE TO LEGACY DATA

- Typos and coding problems
- Missing important elements
  - 240s in AT pattern
  - 130s in bibliographic records
  - 041s for translated works
- Current cataloging practice
  - Musical works – Genre headings
  - Some TV and radio programs have been controlled and collocated with the use of uniform titles while others have not
- The algorithm cannot recognize duplicate records, and therefore they are considered separate manifestations.
5B. FRBR User Research

- FRBR related user research overview
- User studies we have done for the Kent State IMLS-funded FRBR project

Gaps in FRBR User Research

- FRBR user research has been the least addressed facet of FRBR research and development.
  - There has been a lack of user validations of the model
  - Very few FRBR implementation projects conducted or reported user studies
  - Very few evaluative comparisons of existing FRBR prototype systems.

- To a great extent, the current FRBR application and implementation efforts have reflected the views of the designers and researchers with user considerations rather than the user views.

- As FRBR is widely embraced by library communities, future cataloging standards, library practice, and system development are expected to undergo major changes based on the model, it is essential to have a thorough understanding of the FRBR model, and its implications supported by solid user evaluations of pilot FRBR system implementations.
Recent FRBR User Research

- Recent FRBR research that directly engages users:
  - Carlyle & Becker (2008) pre-tested a survey instrument to be used to examine the phenomenon of the known-item search by users of online catalogs. The purpose of the research was to evaluate the FRBR model as it pertains to describing entities that may help library users effectively search online catalogs.
  - Sadeh (2007, 2008) reported a usability study of a discovery and delivery system, which has a user interface designed based on surveying users’ needs, preferences, behavior patterns, and evaluations of previous versions of the interface. The search results groupings are based on FRBR.
  - Pisanski & Žumer (2010a, 2010b): The research focused on non-librarians’ mental models of the bibliographic universe and compared them with the FRBR model.
  - FRBR user research for the Kent State IMLS-funded FRBR project

User Study of Existing FRBR Prototypes

- Systems included:
  - OCLC FictionFinder (http://fictionfinder.oclc.org)
  - WorldCat.org (http://www.worldcat.org)
  - Libraries Australia’s FRBR prototype system (http://ll01.nla.gov.au)

- Methods used:
  - Screen captures
  - Eye-tracking
  - Think-aloud protocols
  - Survey interviews
  - Focus groups
    - academic library users (hereinafter AL)
    - public library users (hereinafter PL)
USER TASKS

- Search tasks are designed around the following general user task categories as defined by FRBR:
  a) to find materials corresponding to the user’s stated search criteria;
  b) to identify an entity;
  c) to select an entity appropriate to the user’s needs; and
  d) to acquire or obtain access to the described entity (IFLA, 1998).

- In addition, participants were asked to search their regular online catalogs and the FRBR systems for their own tasks.

FINDINGS: FEATURES USERS LIKE

<table>
<thead>
<tr>
<th>Feature</th>
<th># of users</th>
<th>Fiction Finder</th>
<th>WorldCat</th>
<th>Libraries Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface (user friendly, easy to use, appealing)</td>
<td>37</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Related items links in descriptions (collaboration by author, subject, similar)</td>
<td>36</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Refining options</td>
<td>35</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Additional information (ratings, reviews, price, audience, summaries, format icons, etc.)</td>
<td>21</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Sorting options (by date, format, language, etc.)</td>
<td>21</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Availability/holdings information</td>
<td>20</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Single search box</td>
<td>19</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Terminology and labeling (clear, easy to understand)</td>
<td>14</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Organization and presentation of information (results page, description)</td>
<td>11</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>FRBR display (by format, language, editions)</td>
<td>0</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Searching in specified fields</td>
<td>8</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Advanced search option</td>
<td>6</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Spelling or search suggestion “Did you mean...”</td>
<td>5</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Subject clouds option</td>
<td>5</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>External links (to Amazon, etc.)</td>
<td>2</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Keyword search option</td>
<td>2</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Browse option</td>
<td>1</td>
<td></td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Return query in search box</td>
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<td>✓</td>
</tr>
<tr>
<td>Subject search option</td>
<td>1</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>
FINDINGS: SYSTEM IMPROVEMENTS

Suggestions for system improvements based on think-aloud and post session interviews:

<table>
<thead>
<tr>
<th>Suggested Features</th>
<th># of Users</th>
<th>Fiction Finder</th>
<th>World Cat</th>
<th>Libraries Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add more links to related works (collaboration via “more like this,”</td>
<td>39</td>
<td>12</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>hyperlinked subjects, hyperlinked authors, series links, linked keywords,</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>linked cited works, linking other formats from a desired work)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grouping and displaying information in results page (group into categories,</td>
<td>34</td>
<td>7</td>
<td>10</td>
<td>17</td>
</tr>
<tr>
<td>arrange by language, date, author in alphabetical order, title in alphabetical</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>order if an author search, multiple criteria)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Add sorting options (by multiple criteria, age groups, date, language, relevance,</td>
<td>34</td>
<td>11</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>etc.)</td>
<td></td>
<td></td>
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<tr>
<td>Interface display (less clutter, larger font, color to differentiate</td>
<td>25</td>
<td>7</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>sorting and refining options, aesthetically pleasing, use column display, use</td>
<td></td>
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<tr>
<td>bold letters for library information, highlight searched terms in results page,</td>
<td></td>
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<tr>
<td>highlight resource summaries)</td>
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<tr>
<td>Labeling and terminology used (e.g., “find edition” should change to “libraries,”</td>
<td>24</td>
<td>13</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>clarify “language” choices for site interface so they are not confused as to</td>
<td></td>
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<tr>
<td>material/resource language, change terms in advanced search options, etc.)</td>
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</tr>
</tbody>
</table>

DESIGNING A FRBR PROTOTYPE INTERFACE

- Participatory design study
- FRBR displays - WEM
  - Work-level display of results
    - Author search
    - Title search
    - Subject search
  - Expression level display of results
    - Form as primary, language as secondary
    - Language as primary, form as secondary
  - Manifestation display
- Structured interview survey
- Participants: 25 academic library users
- Completed data collection, at data analysis stage
IN PROGRESS

- Data analysis
  - Work-displays are the most confusing
  - Expression displays with a combination of form & language are the most favored

- Finalizing prototypes
  - Two or three alternatives of FRBR interpretations
  - Incorporate current catalog features

- Testing prototypes
  - Develop FRBR-based tasks to test prototypes
  - Test prototypes
  - Compare prototypes to current library catalogs

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  - Grace Brinker (Graduate Assistant)
MORE INFORMATION

Project website:
http://frbr.slis.kent.edu

Contact information:
Yin Zhang (yzhang4@kent.edu)
Athena Salaba (asalaba@kent.edu)

Thanks!!

Questions and Suggestions?