

The Nature and Characteristics of Bibliographic Relationships in RDA Cataloging Records in OCLC at the Beginning of RDA Implementation

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Abstract

This research examines the characteristics and types of bibliographic relationships in Resource Description and Access (RDA) book cataloging records produced in OCLC after RDA implementation. Data was sampled ($n = 1,550$), coded, and analyzed for work-to-work, expression-to-expression, and manifestation-to-manifestation relationships. Results show work-to-work bibliographic relationships are most frequently recorded in both PCC records (57.4%) and non-PCC (59.5%); expression-to-expression are recorded the least in PCC (8.3%) and non-PCC (15.8%); and manifestation-to-manifestation relationships fall between with PCC (34.4%) and non-PCC (24.7%). This study also investigates the MARC fields used to record relationships and common characteristics in cataloging records with bibliographic relationships.

Introduction

Cataloging data created by RDA helps information users find, identify, select, and obtain bibliographic resources.¹ The global cataloging community has established a strong theoretical and practical foundation since Charles Ammi Cutter's publication of *Rules for a Dictionary Catalog*, 4th edition, 1904.² The rich history of cataloging codes is evidence of a thriving, collaborative effort to support improved resource discovery. Landmark cataloging standards reflect the community's principle-based practice from the *Paris Statement of Principles* (1961); *International Standard for Bibliographic Description* (ISBD); *AACR2* (1981) and its revisions; MARC 21 Formats; *Statement of International Cataloging Principles* (2009); and *Resource Description and Access* (RDA, 2010-).

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From 2005-2015, the Joint Steering Committee for the Development of RDA (JSC) was responsible for maintaining the newest international cataloging standard, *Resource Description and Access* (RDA), with the Committee of Principles. In 2015, a new governing structure for RDA was announced. In November 6, 2015, the JSC was renamed RDA Steering Committee, and the Committee of Principles was renamed RDA Board. The RDA Board and the RDA Steering Committee currently guide the development of RDA as a global cataloging standard. The new governing structure is expected to be firmly established by 2019.³

The International Federation of Library Associations and Institutions (IFLA) Study Group on the Functional Requirements for Bibliographic Records developed an entity-relationship model as a tool to obtain a generalized view of the bibliographic universe in its *Functional Requirements for Bibliographic Records: Final Report*. It was intended to be independent from any cataloging code.⁴ The final FRBR report was first published in 1998 and later updated in 2009. Almost a decade was devoted to formulating the conceptual model of FRBR and the related Functional Requirements for Authority Data (FRAD), first published in 2009.⁵ Later, Functional Requirements for Subject Authority Data (FRSAD) was approved in 2010 and issued in its final form in 2011.⁶ FRBR and FRAD were the first conceptual models used as the underlying framework in RDA. FRSAD was added later as RDA subject standards were developed. The original RDA introduction of April 2012 stated: “a key element in the design of RDA is its alignment with the conceptual models for bibliographic and authority data developed by the International Federation of Library Associations and Institutions (IFLA)”.⁷

IFLA is developing the latest conceptual model of bibliographic data needed by users. Currently, the IFLA Library Reference Model (LRM) is only available in draft.⁸ The RDA Steering Committee agreed at its November 2016 meeting to adopt the draft IFLA Library Reference Model as a conceptual model for the future development of Resource Description and Access. This new model will replace the Functional Requirements family of models (FRBR, FRAD, and FRSAD) that are superseded by the LRM.⁹ The vocabularies from the new model have been published on the RDA Registry and will be a major part of the complete overhaul of RDA in its RDA Toolkit Restructure and Redesign (3R) Project.¹⁰ Revised terminology from LRM were included in the RDA Toolkit Release, February 14, 2017.¹¹

In the history of cataloging practice, RDA is the first cataloging standard founded on an explicit conceptual model: FRBR. The instruction and user tasks in RDA were closely tied to the FRBR and FRAD models. Our research will investigate RDA entities and relationships as defined by these conceptual models and standardized in RDA. As Barbara Tillett stated in [What is FRBR? A Conceptual Model for the Bibliographic Universe](#), “FRBR offers us a fresh perspective on the structure and relationships of

bibliographic and authority records, and also a more precise vocabulary to help future cataloging rule makers and system designers in meeting user needs".¹² The implementation of the new cataloging standard, RDA, in 2013, became a unique opportunity to investigate bibliographic relationships in RDA records.

The FRBR model identifies three groups comprising eleven entities in the bibliographic universe. Group 1 refers to the products of intellectual or artistic endeavor—work, expression, manifestation, and item. Group 2 stands for those entities responsible for the intellectual or artistic content, the production and dissemination, or the custodianship of such products -- person, family, and corporate body. Group 3 refers to an additional set of entities that, together with the entities in the first and second groups, may serve as the subject of a work such as concept, object, event, and place. The entity-relationship model comprises descriptions of entities, relationships, and attributes that reflect the nature and characteristics of the bibliographic universe. One of the FRBR family of models, Functional Requirements for Authority Data (FRAD) further assists the analysis of attributes of these eleven entities and relationships among them, which are the central focus of authority data.¹³ One of the strengths of RDA, as defined in its objectives and principles (RDA 0.4), is the functionality of records produced under the standard.¹⁴ These records are more responsive to user needs than records created under past cataloging standards. The principle of 'relationships' states that "the data describing a resource should indicate significant relationships between the resource described and other resources."¹⁵ The explicit underlying conceptual models of FRBR and FRAD in RDA assist catalogers to better understand and create metadata for bibliographic relationships, which ultimately assists users with improved information discovery.

Bibliographic relationships for the Group 1 entities are included in several RDA sections and related LC-PCC Policy Statements (LC-PCC PS). RDA Chapter 17 provides instructions and general guidelines on recording primary relationships between work, expression, manifestation, and item. Primary relationships, the hierarchical relationships between work, expression, manifestation, and item in the FRBR Group 1 entities, are defined as:

- a) the relationship between a work and an expression through which that work is realized and the reciprocal relationship from the expression to the work;
- b) the relationship between an expression of a work and a manifestation that embodies that expression and the reciprocal relationship from the manifestation to the expression; and

c) the relationship between a manifestation and an item that exemplifies that manifestation and the reciprocal relationship from the item to the manifestation.¹⁶

In its first iteration, RDA provides instructions for three techniques to use in recording bibliographic relationships: recording the identifier for the work, expression, manifestation, or item¹⁷; using authorized access point(s) for the work or expression¹⁸; and constructing structured or unstructured notes to describe the relationship(s). However, LC/PCC policies for RDA chapter 17 are not supplied under the current implementation scenario.

In RDA, Chapters 25-28 cover bibliographic relationships between different instances of the FRBR Group 1 entities: related works, related expressions, related manifestations, and related items. RDA Appendix J includes a list of relationship designators to be used to specify the nature of relationships between works, expressions, manifestations and items in the bibliographic description.

Under AACR2 standards, catalogers recorded some bibliographic relationships, but the instructions were not as explicit as under RDA. The practice of explicitly recording and identifying the types of bibliographic relationships in cataloging records is relatively new. Recent research has demonstrated that it is important for user discovery. An empirical study by Hider and Liu in 2013 confirmed that users frequently used bibliographic information regarding related works and manifestations.¹⁹

Our research investigated the RDA cataloging practices of PCC and non-PCC OCLC member institutions reflected in OCLC book cataloging records. We analyzed the nature and extent of RDA cataloging practices represented in new RDA book records first contributed to OCLC in April 2013, which was the first full month of RDA cataloging implementation by the Library of Congress, other national libraries, and other participating libraries. All records were full encoding level input by either OCLC participants (l) or PCC members (blank). No batch process or any other encoding level were included. The primary purpose of our research was to identify the relationships recorded between works, expressions, and manifestations (RDA 2012 version, Chapters 24-27) in these records and to identify the characteristics and extent of specific bibliographic relationships. RDA resource-to-resource relationships in cataloging records may be expressed with an identifier, a structured or unstructured description (e.g., note), and/or authorized access points. Because RDA and Library of Congress/PCC core requirements varied, the researchers kept the PCC and non-PCC sample records separate. These record groups were also separately analyzed because the cataloging standards vary -- PCC member libraries contribute high quality records conforming to approved standards, while non-PCC libraries contribute full cataloging.

These were the instructions the catalogers were following when they created the records. Specific MARC fields used were also identified, as well as other specific characteristics of the bibliographic relationships in the records.

The goal of our study was to answer the following questions from an analysis of the sample:

- What percentage of the sample has bibliographic relationships between works, expressions, and manifestations?
- What are the types of these relationships?
- What are the categories of bibliographic relationships, based on RDA work-to-work, expression-to-expression, and manifestation-to-manifestation?
- What are the preferred methods of explicitly expressing the bibliographic relationships?
- To what extent do bibliographic relationships appear by discipline, as defined by the Dewey Decimal Classification (DDC) assigned to the bibliographic records?
- What is the extent of bibliographic relationships in the records by language, country, and date of publication?

Literature review

The purpose of bibliographic control can be traced to an early statement by Charles A. Cutter in 1904 on the “objects of the catalog” and the “means” for attaining the objects in his *Rules for a Dictionary Catalog*.²⁰ Cutter’s objectives of a library catalog were further developed in Seymour Lubetzky’s cataloging code of 1960.²¹ These objectives were: “first, to facilitate the location of a particular publication, i.e., of a particular edition of a work, which is in the library. Second, to relate and display together the editions which a library has of a given work and the works which it has of a given author.”²² In 1991, Barbara Tillett restated Lubetzky’s second objective as follows: a library catalog should group related materials together (a collocation function) and display the associated bibliographic records.²³ Before the FRBR model, bibliographic relationships were studied empirically in several doctoral dissertations. Seminal works by Tillett (1987)²⁴, Smiraglia (1992)²⁵, and Vellucci (1995)²⁶ contributed significantly to our understanding of the nature and characteristics of bibliographic relationships. Based on her 1987 dissertation, Tillett reported on bibliographic relationships.²⁷ In 1991, Tillett further defined

bibliographic relationships as “an association between two or more bibliographic items or works” and noted that bibliographic relationships have been incorporated in library catalogs for more than a century.²⁸ She developed a taxonomy of bibliographic relationships based on the analysis of 24 cataloging codes and defined seven categories of bibliographic relationships.²⁹ The latter are paraphrased as:

1. Equivalence relationships refer to relationships between exact copies of the same manifestation of a work, or between an original item and its reproductions, as long as the intellectual and artistic content and authorship are preserved. Examples include copies, issues, facsimiles and reprints, photocopies, microforms, and other reproductions.
2. Derivative relationships refer to relationships between a bibliographic item and a modification based on that same item, including variations or versions of another work. Examples include editions, revisions, translations, summaries, abstracts, digest, adaptations, changes in genre, paraphrases, etc.
3. Descriptive relationships refer to relationships between a bibliographic item or work and a description, criticism, evaluation, or review of that work. Examples include annotated editions, casebooks, commentaries, critiques, etc.
4. Whole-part (or part-whole) relationships refer to relationships between a component part of a bibliographic item or work and its whole. Examples include excerpts from other titles, collections and their constituent parts, or monographic series.
5. Accompanying relationships refer to relationships between a bibliographic item and the bibliographic item it accompanies. Examples include supplements, concordances, indexes, etc.
6. Sequential relationships refer to relationships between bibliographic items that continue or precede one another. Examples include successive titles of a serial, sequels of a monograph, or a numbered series, etc.
7. Shared characteristic relationships refer to relationships between a bibliographic item and other bibliographic items that are not otherwise related but which share common characteristics. Examples include access point, language, date of publication, or country of publication.

Tillett asserted that two “functions” of the library catalog -- finding and collocation -- are only achieved with sufficient bibliographic description and the display of related items and groups of bibliographic records.³⁰ The conceptual structure defines the framework that encompasses the items to be described in the catalog, the elements in the items, and relationships among items. Therefore, the conceptual structure is a rationale to guide the creation and use/searching of the catalog.³¹ She examined and reported on linking techniques in catalog records for: “catalog entries,” “uniform titles,” “series statements,” and “addition to the physical descriptions,” among others.³² Tillett’s equivalence relationships were later described in RDA as relationships between manifestation-to-manifestation. Her derivative relationships were described in RDA as expression-to-expression or work-to-work relationships. Categories such as whole-part, accompanying, and sequential relationships were described in RDA as work-to-work or expression-to-expression relationships. She defined shared characteristics of bibliographic relationships between items in relation to language, date of publication, country of publication, and others.

In 1992, Smiraglia observed that derivative bibliographic relationships occurred often, and furthermore, developed a taxonomy of derivative relationships.³³ Based on the “work” concept, he refined the definition of the derivative relationships, stating that “derivative bibliographic relationships exist between any new conception of a work and its original source (the progenitor), or, its successor, or both.”³⁴

In a later work by Smiraglia and Leazer, seven different categories of derivation were explained as follows:

- “1. Simultaneous derivations: works that are published in two editions simultaneously, or nearly simultaneously ...
2. Successive derivations. Works that are revised one or more times, and issued with statements such as ‘second ... edition,’ [and] works that are issued successively with new authors. ...
3. Translations
4. Amplifications, including illustrated texts, musical setting, and criticisms, concordances and commentaries. ...
5. Extractions, including abridgements, condensations and excerpts

6. Adaptations, including simplification, screenplays, librettos, arrangements of musical works, and other modifications
7. Performances including sound, visual ... recordings.
8. Predecessors, works from which a progenitor is clearly derived (e.g., a short story from which a novel is derived)³⁵

Smiraglia & Lezer (1999) acknowledged that the concept of “work” has been difficult and inconsistent as defined by scholars and in cataloging rules; accordingly, the authors suggested an operational definition.³⁶ A bibliographic entity has two properties -- physical and intellectual. The physical properties comprise bibliographic characteristics such as physical description and bibliographic data regarding title, names, and publication information. “Work” is defined as the intellectual content of a bibliographic entity. They strongly agreed that with these definitions, the two concepts are completely separable. Any variation in the linguistic content of a work is considered a new work. A bibliographic family was defined as a set of related bibliographic works, and the bibliographic family linked through standardized access points in the catalog.

Smiraglia and Lezer studied derivative bibliographic relationships using OCLC WorldCat records.³⁷ They identified bibliographic families, as well as the size of each family and its bibliographic characteristics. Almost a third of progenitor works in the sample had bibliographic families greater than one. The mean family size for all families was 1.77, and the mean family size for families exhibiting derivation was 3.54. Derivative bibliographic relationships were found more frequently in the academic collection (about 50%) than the general collections in WorldCat. Some bibliographic characteristics of derivative relationships were related to the age of the progenitor work, the collection type (e.g., humanities, fiction), and the popularity of works. However, disciplines, forms, mediums, and genre had no influence on derivation of works.

Using a sample of 1,000 bibliographic records in COBISS (Slovenia Cooperative Bibliographic System and Services), Marija Petek studied derivative bibliographic relationships.³⁸ The proportion of derivative works was about 25%, the mean size of all bibliographic families was 1.57, and the mean size of families having more than one member was 3.2. Among the derivation types in the records under study, successive derivations occurred most often (65%). There was a significantly lower percentage of simultaneous derivations (10.7%) and translations (9.1%). The proportion of unexpressed derivative relationships was about 59% of all relationships. These bibliographic records did not contain data on

relationship information, such as code for original language, translators, authors of adaptations, edition area, note area, etc.

Applying the FRBR model's work concept, Bennett, Lavoie, and O'Neill shared some interesting statistics in a sample of cataloging records and work clusters in WorldCat.³⁹ Based on their analysis and assuming that each bibliographic record in WorldCat described a manifestation, they estimated that 47 million manifestations could be traced back to about 32 million distinct works. They estimated about 78% of works in WorldCat contain a single manifestation, about 20% of all works include two or more manifestations, and only 1% contain more than 20 manifestations. Bennett, Lavoie, and O'Neill further classed the works as elemental, simple, or complex works. Elemental works containing a single expression and single manifestation accounted for the largest proportion (78%), while complex works containing multiple expressions accounted for the smallest proportion (6%).⁴⁰ They identified six categories of complex works, including these five: augmented works, revised works collected/selected works, multiple translations, and multiple forms of expression. The authors concluded that the largest benefit of applying the FRBR model to these records was in improved descriptions of complex works. As a result, these descriptions helped users to identify many work expressions and supported improved user navigation and discovery.

In 2012, Arsenault and Noruzi, analyzed work-to-work bibliographic relationships in Canadian publications according to the FRBR model.⁴¹ Among the 28,633 monographic records, a total 1,261 records (about 4.4%) demonstrated work-to-work relationships. The most frequently recorded work-to-work relationship was supplement (59%), followed by successor (24%), transformation (10%), and adaptation (6%). The majority of successor works appeared in literature, while the majority of supplements were in the disciplines of social science, language, science, and technology. Bibliographic relationships most frequently occurred in the literature class (about 26%), while the fewest relationships were found in philosophy, psychology, and religion. Arsenault and Noruzi also noted that catalogers and publishers sometimes missed recording the bibliographic relationships.⁴²

The FRBR *Final report* described relationships: "Relationships serve as the vehicle for depicting the link between one entity and another, and thus as the means of assisting the user to "navigate" the universe that is represented in a bibliography, catalogue, or bibliographic database".⁴³ The report emphasized that a relationship was not operative unless the entities on each side of the relationships were explicitly identified and recorded.

Prior to implementation of RDA, a series of RDA-related research appeared in *Cataloging & Classification Quarterly*. In 2012, Picco and Repiso presented FRBR as the most significant change in the cataloging world since ISBD. They reported on the contributions of the FRBR and FRAD models in RDA instructions relating to the representation of bibliographic relationships.⁴⁴ They noted that FRBR and FRAD models are closely incorporated into RDA instructions -- four sections were on entities and six sections on relationships, while four among twelve appendices were designated for relationships. Their analysis focused on the RDA primary relationships among the Group 1 entities (work, expression, manifestation, and item) and relationships between works, expressions, manifestations, and items. They presented types of relationships and the conventions used to represent them in RDA.

Also in 2012, Riva & Oliver described the history of RDA development in relation to FRBR and FRAD in their "Evaluation of RDA as an Implementation of FRBR and FRAD."⁴⁵ They conducted an in-depth study of RDA by examining RDA instructions in relation to the FRBR and FRAD models. Their research analyzed the alignment of RDA entities, attributes, and bibliographic relationships in relation to FRBR and FRAD models. They examined commonalities and differences of the vocabularies and instructions in FRBR, FRAD and RDA. For example, four RDA user tasks (to find, identify, select, and obtain) are identical to the terms used in FRBR. Four RDA user tasks related to authority data (to find, identify, clarify and understand) showed some divergence from the FRAD authority-related user tasks (find, identify, contextualize, and justify). The RDA standard was subsequently updated several times. The user tasks based on FRAD were redefined in the RDA 0.0 Purpose and Scope (2017 February release): "The data created using RDA to describe an entity associated with a resource (an agent, concept, etc.) are designed to assist users performing the following tasks:" find, identify, clarify, and understand.⁴⁶

In 2012, Tami Morse examined bibliographic relationships in sheet maps by applying Tillett's taxonomy, Smiraglia's categories of derivation, FRBR, and RDA.⁴⁷ Correlations of relationships among these taxonomies are extensively analyzed and demonstrated. Morse concluded that RDA explicitly uses Tillett's taxonomy and FRBR's instance relationships to categorize bibliographic relationships. Her research confirmed that Tillett's taxonomies were frequently applied in map records. However, some of Smiraglia's categories of derivation were not apparent in bibliographic records of sheet maps. Morse noted that the two models by Tillett and Smiraglia were developed primarily based on textual resources.

Subsequently in 2013, Hider and Liu reported an empirical study on the RDA core elements and how they were used in supporting user information tasks in the setting of a medium-sized academic library.⁴⁸

Using a think-aloud research method, they asked users to verbalize their thoughts relating to their use of the various elements in catalog records. The researchers discovered that only 37 RDA elements were used. The most commonly used elements were title proper, followed by the term for the concept. Most RDA core elements were never used by information seekers. In contrast, non-core elements such as other title information, mode of issuance, related work, related manifestation, and the summarization of content were more frequently used.

A case study in 2013 by Noruzi and Arsenault examined work-to-work bibliographic relationships in the FRBR context by analyzing supplementary relationships recorded in 2009 Canadian national catalog records.⁴⁹ Publications such as teacher's guide, student manual, answer key, and workbook were evaluated. The findings showed that about 47% of all Canadian works with supplementary bibliographic relationships were educational material. The distribution of educational work-to-work relationships most often appeared in science (27%), technology (22%), and social sciences (20%).

In a 2016 study involving careful examination of RDA instructions, Wallheim reported a deficiency in operational definitions in RDA regarding recording bibliographic relationships.⁵⁰ He studied relationships between different works, expressions, manifestations, and items by analyzing a sample of relationship designators from Appendix J. The author found a lack of instructions or consistent cataloger "guidance on when and on what ground to assign relationship designators" and reported this as a serious and fundamental problem.⁵¹

Our research focused only on relationships within FRBR Group 1: work-to-work, expression-to-expression, and manifestation-to-manifestation. RDA 2012 version defined these relationships as associated or related works in RDA 24.1.3. Related Work, Expression, Manifestation, and Item:

- the term "related work" refers to a work that is related to the work represented by an identifier, an authorized access point, or a description (e.g., an adaptation, commentary, supplement, sequel, part of a larger work);
- the term "related expression" refers to an expression related to the expression represented by an identifier, an authorized access point, or a description (e.g., a revised version, a translation); and
- the term related manifestation refers to a manifestation related to the resource being described (e.g., a manifestation in a different format).⁵²

The RDA 2012 version identified no core, or required elements to be included in the bibliographic description according to RDA 24.3, stating : “The recording of relationships between works, expressions, manifestations, and items is not required except for the primary relationships as specified under 17.3.”⁵³ For the purposes of this research, primary relationships as defined in RDA 17.4.1 were not included. We focused on the relationships between works, expressions, and manifestations covered by the 2012 RDA instructions and related LC-PCC policy statements in these chapters:

- Chapter 25. Related works
- Chapter 26. Related expressions
- Chapter 27. Related manifestations
- RDA Appendix J (J2-J4)

Data collection and sampling

The researchers requested RDA new MARC records entered into the OCLC Connexion database during April 2013. The data request was submitted using the OCLC Research Office standard research data application form. The data parameters were limited to MARC21 bibliographic records that were full-level RDA cataloging for monographs, separated by PCC or non-PCC member library input. The record sample included the first record version contributed to OCLC in April 2013, without further modification. The specific limiters selected were:

- BLvl = m, the bibliographic level for monographs;
- encoding level for full-level cataloging, either “blank” for PCC member cataloging agencies or “I” for non-PCC cataloging agencies; and
- the standard MARC input for RDA records: both MARC 040 subfields, \$b eng and \$e RDA.

The total number of monographic records in the sample was 17,371 records entered in April 2013. Upon analysis of the MARC-XML RDA records received, we realized that the files contained records of some map, music, and video formats because our original request for the data set did not specify Type “a” in the 008 MARC field. As a result, we further filtered the file to limit to book records only (13,941), resulting in a final data set of 5,569 PCC records and 8,372 non-PCC records.

We used a systematic sampling method to limit the number of cataloging records to be analyzed. The random number helps researchers avoid any human bias.⁵⁴ The first record number “2” was randomly selected to begin sampling both the PCC records file and the non-PCC records file. Each subsequent ninth record was selected to complete the samples. The final sample consisted of 619 PCC records and 931 non-PCC records.

Specific MARC fields from each sample record were selected and recorded in Excel spreadsheets, keeping the PCC and non-PCC record samples separate. The researchers selected specific bibliographic data collected from the 008 field and the variable fields of each cataloging record. Language, country of publication, and publication date were collected from the 008 field. Variable field data, such as classification, descriptive elements and primary relationships, was also collected to help the researchers understand bibliographic relationships in context and to categorize records. Finally, variable field data for non-primary (horizontal) bibliographic relationships relating to other works, expressions, and manifestations was collected from selected MARC fields. The researchers selected data for analysis from these MARC fields from each sample record. The researchers selected fields predicted to contain relationship information, as well as fields with potential data that would assist the researchers to clarify relationships. The researchers predicted that DDC would not be included in every record; therefore, other classification schemes were collected for possible conversion to DDC.

MARC fields recorded from each sample record:

From the 008 field (to identify shared characteristics of records with relationships):

language (Lang)

place of publication (Ctry)

date of publication (Dates)

From variable fields:

001 (OCLC control number; served as an accession number across spreadsheets)

041 (Language code)

007 (physical characteristics)

082 (DDC call number by PCC, only subfield \$a)

092 (DDC by member library, only subfield \$a)

050 (LC call number by PCC, only subfield \$a)

090 (LCC by member library, only subfield \$a)

055 (Classification numbers assigned in Canada, only subfield \$a)

060 (Nat. Lib of Medicine call number, only subfield \$a)

070 (Nat. Lib of Agriculture call number, only subfield \$a)

1XX fields: 100, 110, 111, 130 (names or preferred title access points; helped identify relationships)

2XX fields: 240, 245, 246, 250, 264 (elements for manifestation served to clarify relationships)

338 field (carrier type; served to exclude non-book formats)

4XX fields (series statements; served to identify relationships)

5XX fields (general and specialized notes; served to identify relationships)

6XX fields: 600, 610, 611, 630 (subject access entries and terms; served to identify disciplines and clarify context)

7XX fields (access points for names and titles with relationships)

8XX fields (series access points; served to identify relationships)

During data collection, the researchers assigned general DDC classification for 390 bibliographic records lacking DDC numbers using these methods. Library of Congress numbers (LCC) were converted to DDC classification numbers utilizing the “Dewey Class Number = LC Class Number” bibliographic correlation search in LC’s Classification Web. For records lacking DDC or LCC numbers, a general DDC classification was assigned based on the record’s first Library of Congress Subject Heading, using the “LC Subject Heading = Dewey Class number” correlation search. For records lacking any classification or LCSH, researchers assigned DDC by using DDC 22nd edition Summaries⁵⁵ along with a careful examination of other bibliographic data in the record (e.g., subject access points). Occasionally, the researchers performed a broader online search to identify the subject matter.

When data collection was completed, the researchers devised a system of codes identifying horizontal bibliographic relationships based on the 2012 RDA Appendix J. The research was focused on work-to-work, expression-to-expression, and manifestation-to-manifestation relationships.⁵⁶

Coding of bibliographic relationships and preliminary testing

To capture relationship information, the researchers individually examined each sample record and recorded and categorized the relationship information. Particular attention was focused on data elements identifying bibliographic relationships -- including identifiers, structured or unstructured notes, and access points. Relationship information contained in 2012 RDA Chapters 24-27 and RDA Appendix J was consulted. Evaluating correctness or incorrect application of the MARC and RDA standards in each record were outside the scope of this study.

Standardized lists for coding work, expression, and manifestation relationships were developed based on RDA 2012 version Appendix J relationship information. Relationships were limited to RDA 2012 version relationship instructions, in force as of April 2013 (April 2012 Update), because these were the instructions the catalogers followed to create the records included in the sample.

A pre-test was conducted to assess the researcher's data collection and bibliographic relationships coding methods. The researchers tested the method using the first 50 sample records from both the PCC and non-PCC record groups and manually coded relationships between works, expressions, and manifestations for each record. For each printed record, a researcher assigned and recorded codes for the RDA relationships expressed in the record. Anomalies and confusing relationships were discussed in depth. If the nature of the specific relationship was unclear, researchers coded the record for the broader relationship. For example, ***based on (work)*** is the relationship designator defined as "A work used as the source for a derivative work".⁵⁷ More specific relationship designators listed under it in the Appendix are ***abridgement of (work)*** and ***adaptation of (work)***. If none of the specific relationships were appropriate for coding a bibliographic relationship, the researchers coded for the general relationship designator. For example, if abridgement or abstract were not appropriate concepts, the researchers assigned the general code for ***based on (work)***. This pre-testing allowed the researchers to think more thoroughly about the coding method, data elements and attributes collected, and the nature of bibliographic relationships.

After the pre-test, the researchers developed guidelines for coding relationships in the bibliographic records based on the 2012 RDA Appendix J, which defined the code names and their definitions, coding examples, exceptions, and special-case decisions. For example, a government publication Shipping List number in a record's general note field was not recorded as a relationship. However, a government publication general note such as **NUREG-0581, Rev.2** was recorded as unstructured revision note, as it identified a relationship between expressions. The MARC field 500 note, "Originally presented as the author's thesis (doctoral)," was considered an unstructured note for an expression relationship while a 500 note, "First published in the UK as The fall of the Reich in 2000," was identified as an unstructured note for a manifestation relationship. Occasionally, further searching on related resources in OCLC Connexion and/or online was necessary to evaluate whether the bibliographic information truly described a bibliographic relationship. The researchers found some relationships difficult to code, for example a 500 field unstructured note: "Selection of the author's articles appearing weekly since 2000 in the column... in the newspaper" We coded this as a WW (work-to-work) relationship. Another example was a 500 field unstructured note that we coded as an EE (expression-to-expression) relationship: "The first part of the author's habilitation ([University, date]) was published under the title ... ([University, date])."

The researchers examined each record in the total sample of 1550. Using the relationship coding guidelines, the researchers assigned specific codes to the print MARC records to identify the relationship information. Researchers consulted on the validity of coding whenever questions arose. Coding required a significant effort. For each record, the relationship code and type was recorded next to the related MARC field. For example, 'WW 830 contained in series' was the code used to indicate a work-to-work relationship expressed in a MARC 830 field (preferred series title). All MARC fields with relationships were collected and the raw data contained all relationships recorded per record. After coding was completed, a research assistant recorded the relationship codes in an Excel spreadsheet, along with the record ID number (OCLC number), and associated MARC fields.

The PHP programming language, although most commonly associated with dynamic webpages, can also be used to collect, analyze, and parse data. With the help of our research assistant, a series of custom-written PHP scripts were used to categorize, clean, and otherwise analyze the data, which were stored in .csv files. The researchers specified the data collected for each spreadsheet. The sample record number remained constant across all spreadsheets. No other tools or software were used.

Data analysis

General characteristics of data

The sample of 1550 records consisted of 619 PCC records (39.9%) and 931 non-PCC records (60.1%). More than 43.4% (673 titles) were published in the United States, followed by China 5.9% (91 records), Germany 4.4% (69 titles) and Korea 3.8% (58 titles). The CJK materials were about 12% of the total sample. Titles in the sample were published in 111 countries. Resources in English language (53.1%) were the most popular, followed by Spanish (7.48%), Chinese (5.9%), and German (4.9%). At least 52 languages were identified in the sampled records. Publication dates ranged from dates before 1800 to 2014, although more than 78.3% of the sampled records were published after 2001 (with an error variance of .008 due to non-numeric dates).

Based on DDC classification number analysis, the sample records included all disciplines of academic fields. Social science material was the highest (28%), followed by literature (19.5%), geography & travel (12.9%), applied sciences (11.9%), arts (7.1%), natural sciences (6.2%), and religion (6.1%). The lowest percentages (8% in total) included the categories of languages, philosophy, and general classes.

Bibliographic relationships

Researchers focused on relationships between works (WW), expressions (EE), and manifestations (MM) -- also called as "horizontal" relationships.⁵⁸ Horizontal bibliographic relationships were represented in about 54% of all sample records, about 58% in the PCC record sample, and 51.34% in the non-PCC record sample. In records with relationships, many of the records represented more than one relationship (15.67 % of PCC records and 12.4% of non-PCC records).

Types and methods of recording bibliographic relationships: PCC records

The types and methods of recording bibliographic relationships were analyzed separately for PCC and non-PCC records. A total of 605 occurrences of WW, MM, EE relationships were found in the 619 sampled PCC records. Among those horizontal relationships, the work relationships were recorded most frequently (57.4%), followed by manifestation relationships (34.4%) and expression relationships (8.3%). Some PCC records contained more than one relationship or more than one type of relationships (WW, EE, or MM). For example, a record entitled *Aircraft* contained a 776 field for print version (MM relationship) and an 830 field (WW relationship), while another record entitled *Islam and international*

law contained both a 505 field (WW relationships) and an 830 field (WW relationship). About 15.67 % of PCC records with relationships contained two or more types of relationships (e.g., a record with WW relationships as well as EE and/or MM relationships).

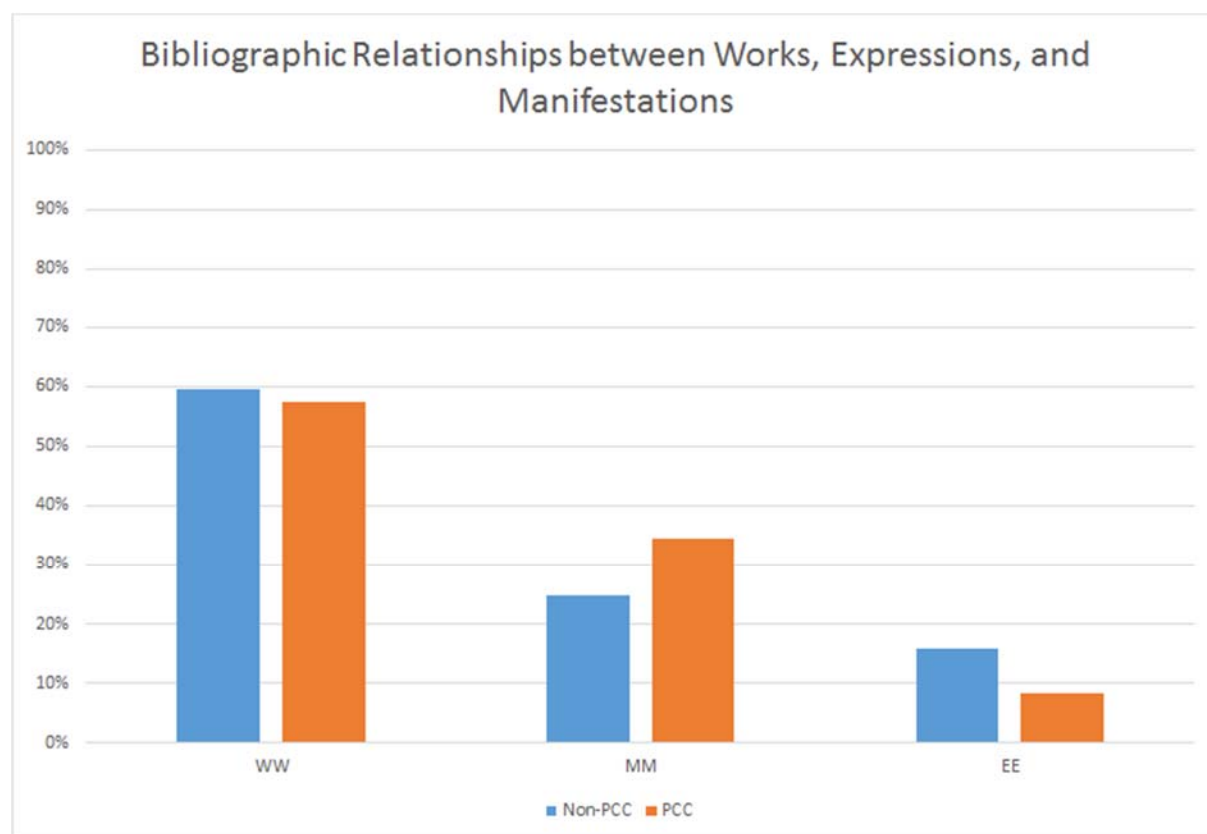


Figure 1. Bibliographic relationships between works, expressions, and manifestations.

Within work relationships in the PCC records, whole-part work relationships appeared most frequently (99.1%), followed by derivative work relationships (0.6%), then accompanying work relationships (0.3%). The whole-part work relationships were recorded in MARC fields 490, 500 505, 700, 730, 740, 773, 800, 810, and 830. More than half of the whole-part work relationships were only recorded in MARC fields 830, 810, and 800 (58.7%). The remainder of the whole-part work relationships were recorded in MARC fields 490 alone (20.4%) and 505 contents note (14.5%). Less than 1% of work-to-work relationships were the derivative and accompanying work relationships. In general, derivative work relationships were recorded in the 500 note fields, as *abridgement of (work)* or *based on (work)*, while accompanying work relationships were recorded in 520 field as *augmented by (work)*.

Within expression relationships in PCC records, derivative relationships were represented most frequently (94%), followed by whole-part relationships (6%). In derivative relationships, translation and revision were the most common types of expression relationships. The MARC fields most frequently used to represent all derivative relationships were fields 041 (31.9%), and 240 (29.8%). The MARC fields used for recording expression relationships in notes varied. The 500 fields with revision notes were most often used (14.9%), followed by translation notes recorded in either fields 500 or 546 combined (14.9%). MARC fields 130 and 775 were less frequently used. In general, whole-part expression relationships were recorded in MARC fields 700 and 730.

All manifestation relationships in PCC records were equivalent relationships represented by the MARC fields 020 (identifier for different manifestation), 500, 520, 530, 533, 775, 776 and 856. The MARC fields most often used were 776 (39.9%) and 856 (29.8%), followed by field 500 with an unstructured note *also issued as* (9.6%).

Types and methods of recording bibliographic relationships: Non-PCC records

In the 931 non-PCC sample records, a total of 823 WW, MM, or EE relationships were recorded. The work relationships were most commonly recorded (59.5%), followed by manifestation relationships (24.7%), and expression relationships (15.8%). About 12.4% of non-PCC records contained two or more types of relationships. Among work relationships (WR), whole-part relationships were most commonly recorded (95.3%), followed by accompanying relationships (2.9%), derivative relationships (1.6%), and sequential relationships (0.2%).

Whole-part work relationships were recorded in MARC fields 246, 490, 500, 501, 505, 520, 700, 710, 730, 740, 773, 800, 830, and 856. The most commonly used MARC fields were 830 (57.6%), 490 (11.7%), 505 content notes (11.5%), 740 (5.3%), 500 note (4%), and 800 (3.9%). Less than 5% of the work-to-work relationships were accompanying, derivative, or sequential work relationships. Accompanying work relationships were recorded in MARC fields 500 (64%), 700 (14%), 730 (14%), and 520 (7%). The most common MARC fields used for derivative work relationships were 500 (25%) and 730 (25%). These MARC fields were used much less frequently: 520, 710, 787 and 846.

Within the expression relationships (ER), 87% represented derivative expression relationships, while the rest were whole-part expression relationships (13%). The MARC fields most frequently used to record the derivative expression relationships were: 041 (27.3%), 240 preferred title with language of translation (24.7%), and the 500 *translation of* note (22.1%). The MARC fields less frequently used were

500 revision note (13.2%), with small percentages in MARC fields 546, 730, and 130. For the whole-part expression relationships, MARC fields 700 (47%) and 740 (24%) were used most frequently. These MARC fields were used much less frequently: 730, 505 and 800.

Within the manifestation relationships (MR), equivalent manifestation relationships appeared most frequently, almost 96 percent. The MARC fields most often used were: 776 (37.8%), 500 note (21%), 856 (12.2%), and 020 (10.2%). The MARC fields less frequently used were 530 (7.1%), followed by small percentages in 533, 534, 580, 775, and 787 fields. Less than 4% represented whole-part and accompanying manifestation relationships. MARC fields 500 and 856 were used for those relationships.

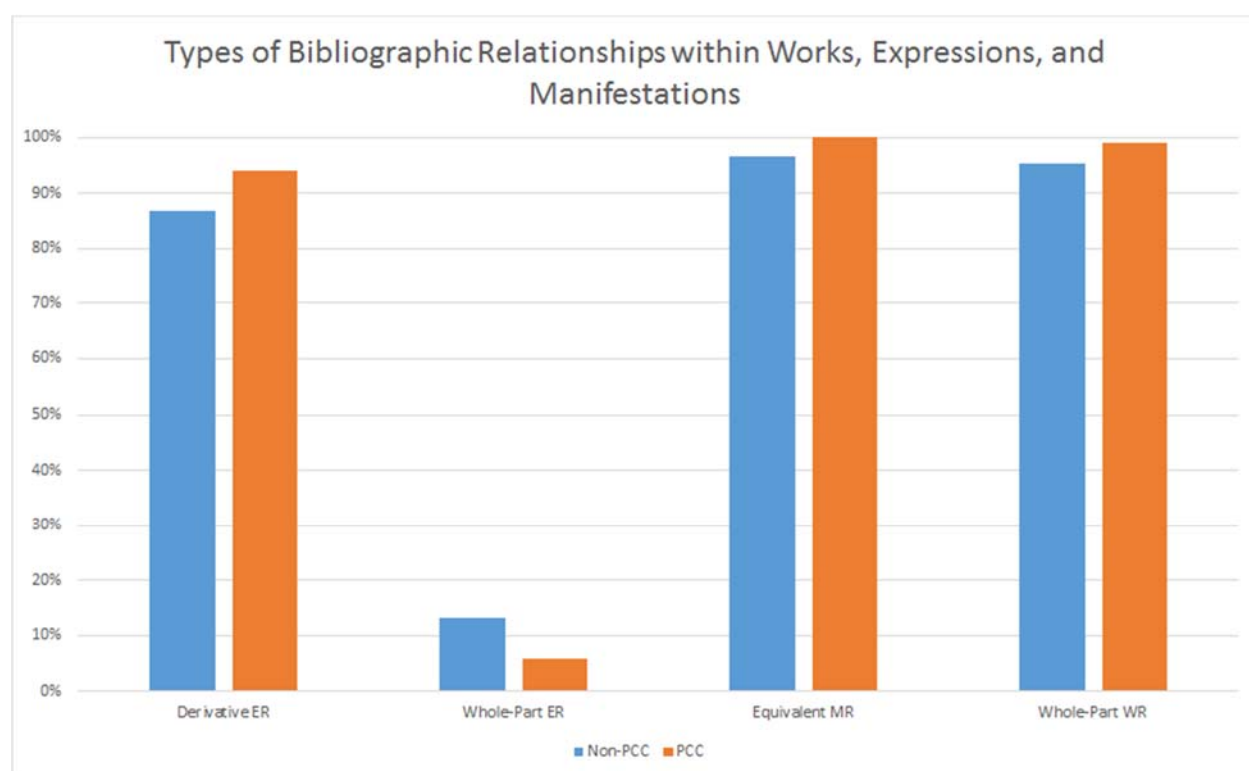


Figure 2. Types of bibliographic relationships within works, expressions, and manifestations.

Discussion of the findings

Horizontal bibliographic relationships were represented in about 54% in the sample: about 58% in the PCC records and 51.34% in non-PCC records. Within records with relationships, work-to-work (WW) relationships were the most common type of relationship in both the PCC (57.4%) and non-PCC records

(59.5%). Expression-to-expression (EE) relationships were least common in both the PCC (8.3%) and non-PCC (15.8%) records. Manifestation-to-manifestation (MM) relationships occurred more frequently than expression relationships in both the PCC (34.4%) and non-PCC (24.7%) records. There was a noticeable difference in cataloging practice of PCC and non-PCC groups in recording expression-to-expression and manifestation-to-manifestation relationships (over 10% variance).

The findings also showed specific of types of relationships within work-to-work (WW) and expression-to-expression (EE) relationships. Within WW relationships, whole-part relationships were predominant (99% in PCC and 95% in non-PCC), with small percentages in derivative relationships (0.6% in PCC and 1.6% for non-PCC), and accompanying relationships (0.3% in PCC and 1.6% in non-PCC). Three MARC fields were most commonly used to record WW relationships: 800, 810, and 830 (59% in PCC and 62% in non-PCC).

EE relationships were primarily derivative relationships (94% in PCC and 87% in non-PCC). The MARC fields most commonly used to record EE relationships were the 041 field (32% in PCC and 27% in non-PCC); the 240 field (30% in PCC and 25% in non-PCC); and the 500 field (15% in PCC and 22% in non-PCC).

Manifestation-to-manifestation relationships represented equivalent relationships in the PCC record group (100%) and the non-PCC record group (96%). The most common MARC field used was the 776 field (40% in PCC and 38% in non-PCC). The MARC fields used less frequently were 856 (30% in PCC and 12% in non-PCC) and 500 (10% in PCC and 21% in non-PCC). This shows a wide range of cataloging practice between the PCC and non-PCC groups.

In the final analysis of bibliographic relationships in this sample, over 90 percent represented the whole-part work relationships (WW), derivative expression relationships (EE), and equivalent manifestation relationships (MM).

For the PCC group, a total of twenty-two MARC fields were used to record all of the bibliographic relationships. The most commonly used MARC fields by frequency from most to least were: 830, 776, 490, 856, 500, and 505. These six MARC fields contained more than 82% of bibliographic relationship information in PCC records. All relationships (WW, EE, and MM) were chiefly represented in these six MARC fields. To record work relationships, MARC fields 830, 490, 505 and 810 were most commonly used (92%). To record expression relationships, MARC fields 041, 240, 500, and 546 were most frequently used (86%). To record manifestation relationships, the most commonly used MARC fields

were: 776, 856, and 500 (88%). Among the relationships, EE relationships were recorded mainly in unstructured notes in 5XX fields, with less common use of more structured and granular bibliographic data, i.e. MARC field 775, etc.

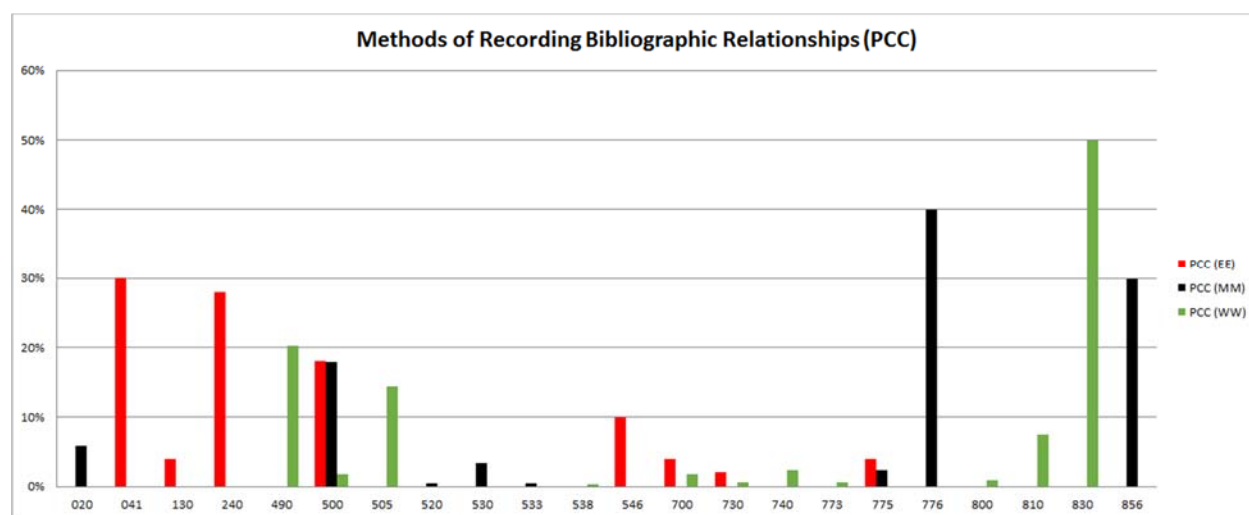


Figure 3. Methods of recording bibliographic relationships (PCC).

Catalogers need to take more time and effort to apply the new standards for bibliographic relationships at a granular level, using specific relationship designators and MARC fields for structured description (7XX), in order to communicate these relationships more effectively and ultimately help users with improved information discovery. Perhaps catalogers need more training and confidence in order to utilize all of the new RDA elements that could represent relationships. The researchers suggest that expanded practical examples in both RDA instructions and LC-PCC Policy Statements would assist catalogers in recording bibliographic relationships more effectively. Improved complex examples with accompanying explanation would also be beneficial. Some additional open access examples from the cataloging community would assist catalogers with fewer subscription resources or tools.

For the non-PCC group, a total of twenty-seven MARC fields were used for representing WW, EE and MM relationships. The MARC fields most commonly used by frequency from most to least were 830, 500, 776, 490, and 505, representing almost 69% of the total bibliographic relationships. Three MARC fields (830, 490, and 505) represented more than 77% of work-to-work relationships. Compared to the PCC group, this group used the 505 contents field less frequently. For expression-to-expression relationships, three MARC fields alone (500, 041, and 240) represented more than 76% of these

relationships. This indicates a higher reliance on a few fields and on the use of the MARC field 500 for an unstructured expression relationship. Finally, four MARC fields (776, 500, 856, and 020) represented more than 72% of the manifestation-to-manifestation relationships. Within the non-PCC group, there is more reliance on unstructured note fields. Structured relationships in 7XX MARC fields are underutilized significantly.

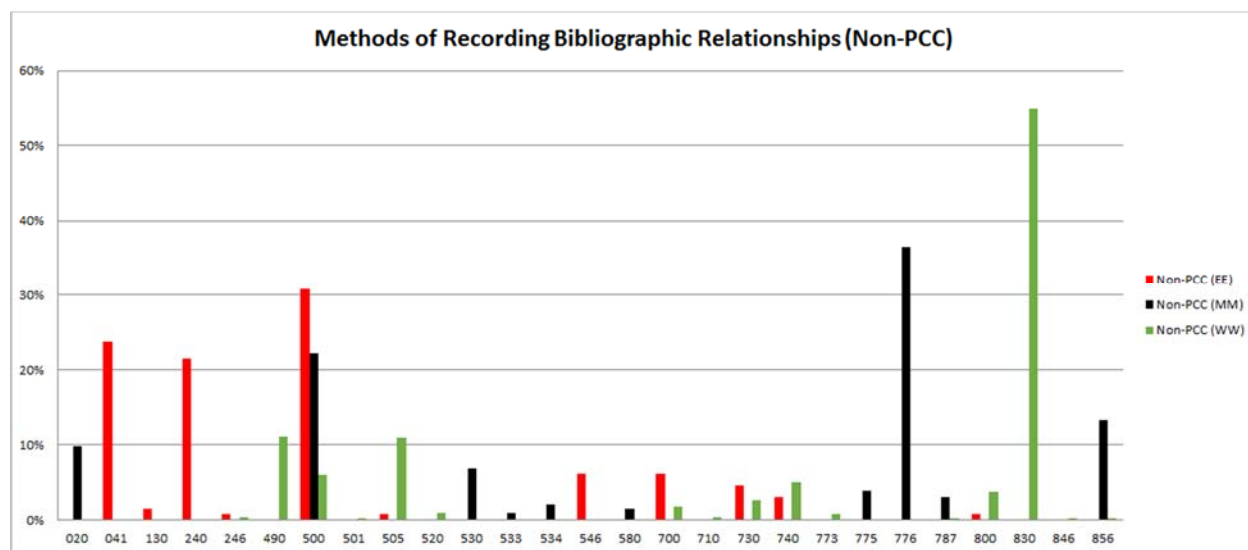


Figure 4. Methods of recording bibliographic relationships (Non-PCC).

Overall, the 830 field is the MARC field most frequently used for recording bibliographic relationships (PCC and non-PCC). This is not surprising, but it suggests that other fields such as 7XX fields for structured description could be used more frequently. Whole-part work relationships are well represented and recorded (field 830), but we suggest that many other relationships are underrepresented in bibliographic records. For example, accompanying, derivative, or sequential work relationships were very low in our sample, less than 5% of the work-to-work relationships, and we hypothesize that these relationships exist more frequently, but were not recorded. In addition, because of the popularity of using 5XX fields for unstructured description of all types of relationships, we also suggest that the specific nature of the relationships could be clarified by increased use of relationship designators and structured description in 7XX fields. Derivative relationships are the most frequently recorded relationship in our sample for expression relationships; however, if the reciprocal relationships were recorded in each related record, for instance, ‘translation of’ and ‘translated as,’ we would have expected a higher frequency of 7XX fields.

Other characteristics of records with bibliographic relationships

Cataloging records containing bibliographic relationships between works, expressions, and manifestations were analyzed in relation to place, language, and date of publication, as well as DDC classes of publications. The researchers were interested in determining whether these shared attributes of bibliographic records reflect a difference in the bibliographic relationships recorded. For example, in relation to place of publication, resources published in the U.S. (43% of the total) represented the highest percent of relationships (54% for PCC and 45% for non-PCC). Titles published in other countries were, by frequency of relationships: China including Taiwan (8.6% in non-PCC, 2% in PCC); Germany (6% in PCC, 5% in non-PCC) UK (4.4% in non-PCC, 4.1% in PCC); Italy (5.6% in PCC, 1.6% in non-PCC); Japan (3.5% in PCC, 2.6% in non-PCC); and Korea (3.3% in non-PCC, 2.5% in PCC).

Languages of resources in the sample were analyzed. PCC records in English and German languages represented the highest percent of MM and EE relationships compared to records for resources in other languages, while English and Italian materials represented the highest percent of WW relationships. Among non-PCC records, MM and WW relationships frequently appeared in English and Chinese language materials, while EE relationships frequently appeared in English, German and French materials. These results are not surprising because more than 53% of the sample records were English language materials. More research is needed to analyze why English materials appear to represent more relationships than non-English materials. Awareness of this data could help catalogers pay attention to capturing relationships for non-English resources in order to prevent possible bias in bibliographic description.

Publications published after 2010 represented the highest percent of relationships (92% in PCC and 53% in non-PCC). However, publications published 2000-2009 represented this percent of relationships (4% in PCC and 19% in non-PCC). Publications published earlier than 2000 represented this percent of relationships (.05% in PCC and 26.4% in non-PCC). These results are normalized as our sample contained 66% of resources published after 2010 and 13% of resources published during 2000-2009. In all, 79% of resources in the sample were published 2000 and later. In all, 20.3% of all resources in the sample were published 2000 or earlier (with an error variance of .008 due to non-numeric dates). There is a significant gap in cataloging practice for recording relationships for newer resources as compared to older resources. It appears that PCC member libraries contributed a much greater percent of recently published RDA records than the non-PCC libraries in our sample. It appears that relationships in records

for older materials are not recorded as carefully. Awareness of this data could help catalogers avoid this possible bias and pay attention to capturing relationships for older materials.

The researchers analyzed the extent that bibliographic relationships in general appeared by discipline, as defined by the DDC classes. In the PCC records, relationships were represented most frequently in the social sciences (44.1%), followed by literature (16.2%); technology, (9.1%); geography & history (7.8%); natural sciences (6.3%); languages (6.1%); arts (4.6%); religion (3.5%); philosophy & psychology (1.3%); and the general class (1%). Resources in the general class together with philosophy and religion classes had the lowest percent of all relationships. The non-PCC records showed a similar distribution of relationships by disciplines. The social science class was highest (24.4%), followed by literature (20.2%); technology (17.1%); geography & history (14.6%); natural sciences (8.4%); religion (5.6%); arts (5.5%); philosophy & psychology (2.6%); languages (1.6%); and the general class (less than 1%). The top five classes were the same in both record groups. For the PCC and non-PCC record groups together, titles in the general class, philosophy & psychology, and languages showed fewer relationships. It is interesting to note that PCC and non-PCC practice in the languages discipline varied by almost 5%.

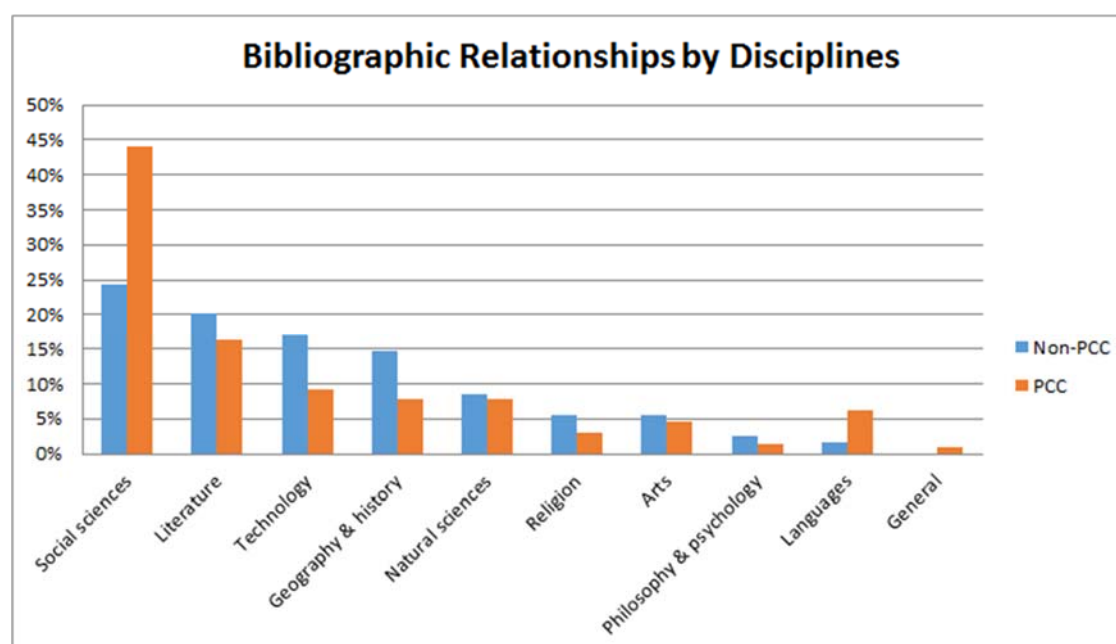


Figure 5. Bibliographic relationship by disciplines.

These research findings are similar to a previous study which reported that bibliographic relationships frequently occurred in the literature class (about 26%), while the fewest relationships appeared in the philosophy, psychology, and religion classes.⁵⁹ Our study shows the social sciences had the most frequent bibliographic relationships, almost 20% higher in PCC records compared to non-PCC records. It is also surprising that relationships in PCC records in the social sciences are recorded much more frequently than in literature.

Conclusions and future research

This research examined how the RDA instructions regarding bibliographic horizontal relationships were recorded in the RDA book cataloging records in OCLC during the first month of RDA implementation by national and member libraries (April 2013). This is a landmark implementation of the new international cataloging standard. Using a sample of cataloging records first contributed to OCLC during April 2013, the researchers separated PCC and non-PCC records into two groups and analyzed the bibliographic relationships, which are a key concept in cataloging using RDA.

Among the bibliographic relationships recorded, our research showed that within work-to-work relationships around 97% represented whole-part work relationships; within expression-to-expression relationships around 90% represented derivative expression relationships; and within manifestation-to-manifestation relationships around 98% represented equivalent manifestation relationships. It appears that at the beginning of the implementation period, catalogers are still new and unused to this practice of analyzing and recording relationships. These three types of bibliographic relationships may be the most familiar to catalogers, and, it appeared that catalogers recorded these relationships most frequently as a part of standard cataloging practice. However, records did not display a variety or specificity of other relationships identified in RDA. For example, catalogers often used unstructured notes alone to represent relationships, without adding more specific and structured relationship information to the record. The limited MARC fields used for relationships illustrated a lack of variety in representing various relationships and the specific nature of relationships. In addition, when authorized access points and structured notes were used (7XX fields), our sample data showed that catalogers often did not assign relationship designators. The researchers speculate that the scope and variety of RDA relationship designators in Appendix J may not have been easy for catalogers to apply in cataloging practice. Since the implementation of RDA, catalogers may have gained more experience and expertise

in applying RDA instructions and may have improved the practice of recording bibliographic relationships. However, our findings could be incorporated into improved RDA training and teaching, especially concerning underrepresented relationships and the specific nature of relationships. Ultimately, if our long-time goal is to display these work-to-work, expression-to-expression, and manifestation-to-manifestation relationships in a fully actionable linked data environment, we need to encourage catalogers to create more granular and structured bibliographic relationship data. Further study is needed to determine what progress has been made in recording relationships, recording the specific nature of relationships, and recording reciprocal relationships in related records. In particular, more detailed analysis is needed both on the use of subfield “i” in the 7XX structured note fields and on the way relationships are recorded (by structured or unstructured note, identifier, or access point).

This research was limited to book cataloging records first contributed to OCLC the first month after RDA implementation. Researchers examined only the horizontal relationships between works, expression and manifestations; other significant relationships were excluded, e.g., primary relationships between work, expression, and manifestation or relationships between works and subjects, etc. The research also confirmed that there are other horizontal relationships that need to be acknowledged in our cataloging standard. Relationships such as whole work-to-part expression or derivative expression-to-work need to be further studied.

More research on the nature of relationships in RDA cataloging records is important, especially since RDA is undergoing major revisions based on the ILFA Library Reference Model. It would be interesting to use this research as benchmark data, and, in the future, periodically compare progress made in recording bibliographic relationships since the first implementation of RDA. It would also be interesting to identify the bibliographic relationships in non-book formats and identify how they are different or similar from book cataloging practice. It would be productive for future researchers to examine and identify those relationships not recorded or underrepresented. Our data shows three types of relationships, whole-part relationships, derivative relationships, and equivalent relationships, were recorded at a much higher frequency than other types of relationships. Analysis of cataloging practice for recording bibliographic relationships at regular intervals would be valuable, because our standards are continually revised. In addition, examining other types of bibliographic relationships would enrich

our understanding of bibliographic relationships, help catalogers enhance metadata creation with improved bibliographic relationship data, and ultimately improve user information navigation and discovery.

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