An example of library and museum cooperation: the FRBR$_{OO}$ conceptual model

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Museums and libraries are at the same time close relatives and rather different entities. Both types of institutions share the same mission of preserving cultural heritage and the same responsibility when it comes to producing, storing, and disseminating information about that cultural heritage. On the other hand, the collections held in one and the other display characteristics that make it, at first sight, difficult to envision a common framework for their description. Most library holdings are non-unique copies of 'publications,' in the broadest sense of the term, i.e., non-unique exemplars of products obtained as the result of more or less industrialised processes, and the cultural context in which either those physical copies or their immaterial content came into being is not regarded as particularly relevant in library catalogues, while museums are mainly concerned with unique items – the uniqueness of which is counterpoised by a focus on the cultural and social circumstances under which they were produced and through which they are interrelated. Therefore, although museum and library cooperation has been increasingly presented as highly desirable for a number of years, there are few practical examples of such cooperation, at least in the field of cataloguing.

However, the boundaries between the respective typologies of museum and library collections are less sharp than it seems. Libraries do also hold unique items, such as manuscripts, and museums may also have to deal with exemplars of (more or less) 'industrially' produced series of artefacts, such as art and photograph prints. Besides, libraries hold resources that are about museum items, and museums hold resources that are related in some way to library items – e.g., paintings that are representations of characters from famous

textual works. It does therefore make sense indeed to strive to cooperate and find a way to make our databases interoperable through a common conceptual model.

Chronology and Methodology

It is a striking coincidence that the library community and the museum community endowed themselves almost simultaneously with conceptual models for the information they produce. IFLA, the International Federation of Library Associations and Institutions, approved the FRBR model in 1997 and had it published in the following year.[1] ICOM CIDOC, the International Committee for Documentation of the International Council of Museums, released a preliminary version of CIDOC CRM in 1998.[2]

The acronym FRBR stands for: *Functional Requirements for Bibliographic Records*, which was the title of a study conducted from 1991 to 1997 by an IFLA Group as a response to the Stockholm Conference (August 1990), one of whose main concerns was: 'Can cataloguing be considerably simplified?'[3] FRBR only deals with the information conveyed by bibliographic records (including headings) and holdings records; the information contained in authority records is addressed in a second model that was developed later, FRAD (for: *Functional Requirements for Authority Data*),[4] and subject relationships are the focus of a third model, FRSAD (*Functional Requirements for Subject Authority Data*),[5] which is the youngest member of the so-called 'FR family.'

As all CIDOC members will know, work on the CIDOC CRM began in 1996 under the auspices of the ICOM-CIDOC Documentation Standards Working Group. In 2000, the

[1] IFLA Study Group on the functional requirements for bibliographic records. *Functional requirements for bibliographic records:* final report. Munich, Germany: K. G. Saur, 1998. Also available online: <http://www.ifla.org/en/publications/functional-requirements-for-bibliographic-records>.
[2] See <http://www.cidoc-crm.org/previous_releases_cidoc.html> and <http://www.cidoc-crm.org/official_release_cidoc.html>.
[3] Madison, Olivia M. A. 'The Origins of the IFLA Study on Functional Requirements for Bibliographic Records.' *Cataloging & Classification Quarterly*, 2005, 39(3/4), 15-37.
[4] IFLA Working Group on Functional Requirements and Numbering of Authority Records (FRANAR). *Functional requirements for authority data: a conceptual model*. Munich, Germany: K. G. Saur, 2009.
[5] IFLA Working Group on the Functional Requirements for Subject Authority Records (FRSAR). *Functional Requirements for Subject Authority Data (FRSAD): A Conceptual Model*. Berlin: De Gruyter Saur, 2011. Also available online: <http://www.ifla.org/files/classification-and-indexing/functional-requirements-for-subject-authority-data/frsad-final-report.pdf>.

CIDOC CRM Special Interest Group (CIDOC CRM SIG) was formed for the sole purpose of developing the model further. CIDOC CRM became in 2006 an ISO standard, ISO 21127.[6]

It was not until 2003 that a joint group was officially established to the purpose of harmonising museums' and libraries' conceptualisations. The International FRBR/CIDOC CRM Harmonisation Group was formed as both a working group affiliated to the IFLA FRBR Review Group, and a subgroup of the CIDOC CRM SIG. One of the first tasks of the Harmonisation Group was to list the differences between library information and museum information, and define the challenge of developing a unified model for descriptions of both unique and non-unique items.

From the very beginning, it was decided that CIDOC CRM would be used as our reference point, and that its formalism would be the 'target language' into which FRBR was to be 'translated.' Basing on that principle, the Group examined all attributes and relationships declared in the original definition of FRBR (which was expressed in the entity-relationship formalism), and strove to extract their semantics as accurately as possible. Once the Group's members had agreed on the meaning and all implications of the definition of each individual attribute and relationship, they expressed that attribute or relationship in the CIDOC CRM formalism – i.e., re-using a CIDOC CRM structure every time it seemed feasible, or declaring new subclasses and subproperties of extant CIDOC CRM classes and properties in the contrary case. Each of the 'attributes' declared in FRBR was thus transformed into one or more than one 'property' in the resulting model, which was named $FRBR_{OO}$, where OO refers to the transformation from entity-relationship to object-oriented formalism.

Both models were impacted by this process. Some notions in the FRBR conceptualisation were deemed too vague to be plugged to CIDOC CRM such as they stood, and had to be refined. On the other hand, some new classes had to be introduced in CIDOC CRM, so that they could be declared as super-classes for some concepts defined in the FR family. Eventually, some notions inherent to library practice were deemed sufficiently relevant for museums for them to be included in CIDOC CRM itself rather than its extension $FRBR_{OO}$.

From 2003 to 2009, the Harmonisation Group worked on the 'translation' of the FRBR model, which led to the release of $FRBR_{OO}$ version 1.0 in June 2009. From 2009 to 2012, the

[6] ISO Technical Committee 46 'Information and documentation,' Subcommittee SC4 'Technical Interoperability.' *Information and documentation -- A reference ontology for the interchange of cultural heritage information. ISO 21127:2006.* ISO, Geneva, 2006. A revised version is under preparation.

group focused on the integration of FRAD and FRSAD, i.e., notions relating to authority data. This work was completed during the group's latest meeting in Heraklion in April 30th-May 2nd 2012. Version 2.0 of $FRBR_{OO}$, containing the conceptualisation of the entire FR family, should be released in the near future.

The FR family

The three models that comprise the FR family are characterised by a relatively small number of entities, for each of which many attributes are defined. These entities reflect the way cataloguers organise their work. They first receive a physical thing (a book, a map, a score, a DVD, a CD…), which is normally already provided with a shelfmark number (its unique identifier), and they examine it. They extrapolate from that examination a number of characteristics which should normally be found on any other copy of the same publication; as a consequence, the bibliographic record they create is reputed to describe the publication itself. In some cases, they will provide that bibliographic record with a uniform title that serves to collocate all the various publications that happen to contain the same intellectual production, and they will provide that uniform title with some additional elements (e.g., a statement of the language used) that serve to differentiate among those publications. In FRBR parlance, the physical thing is an instance of the Item entity, the publication is an instance of the Manifestation entity, the abstract thing referred to by the differentiating combination of the uniform title and its additional elements is an instance of the Expression entity, and the abstract thing referred to by the collocating uniform title (without its additional elements) is an instance of the Work entity.

In the case of unique products such as manuscripts, the distinction between Manifestation and Item becomes blurred. The Manifestation entity actually matches the mathematical notion of 'a set:' an instance of Manifestation consists of the abstract definition of a set of items. It could be said that a Manifestation is the intension of a set, while all the Items that exemplify a Manifestation are the extension of a set. As any mathematical set, a manifestation can have many elements, or just one (of course, it can also have none, but then it is no longer relevant for documentation). When it has only one element, it becomes difficult, in practice, to draw the line between the abstract definition of the characteristics of the set, and the unique physical carrier that displays all those characteristics. Consequently, $FRBR_{OO}$

did not recognise the notion of Manifestation per se, but split it into two distinct (and disjoint) classes, F3 Manifestation Product Type (the abstract type exemplified by any copy of a given publication) and F4 Manifestation Singleton (a unique physical object, such as a manuscript).

The distinction between Work and Expression was something totally new for the CIDOC CRM conceptualisation. When the harmonisation process began, both notions could only be mapped to E73 Information Object, which covers indifferently the ideational features of an intellectual product and the actualisation or realisation of that intellectual product. CIDOC CRM had therefore to be modified. This is the reason why two new classes were introduced in version 4.2.5 (May 2008) of the model: E89 Propositional Object and E90 Symbolic Object. An instance of E89 Propositional Object consists solely of concepts, and an instance of E90 Symbolic Object consists of signs (or, to put it more accurately, of Saussurean signifiers). E73 Information Object is declared as a subclass of both E89 Propositional Object and E90 Symbolic Object. In $FRBR_{OO}$, F1 Work is declared as a subclass of E89 Propositional Object only, and F2 Expression as a subclass of E73 Information Object (and therefore, indirectly, as a subclass of both E89 Propositional Object and E90 Symbolic Object).

This shows that the harmonisation process involved actual cooperation between libraries and museums: librarians accepted to correct the oversimplifications of their model and to transform it into an extension to CIDOC CRM, while representatives for the CIDOC accepted to make the CIDOC CRM evolve in order to accommodate the FRBR model.

Any of the aforementioned four entities – Work, Expression, Manifestation, and Item – can be connected to either Person or Corporate Body, two entities that are subsumed in the CIDOC CRM notion of E39 Actor. Besides, the Work entity can be connected to any other entity through the 'subject relationship,' meaning that a given work can be about any instance of any entity. This relationship corresponds to the CIDOC CRM property *P129 is about (is subject of)* from E89 Propositional Object to E1 CRM Entity.

The so-called 'authority work,' which forms a significant part of the cataloguing process, consists of managing the various appellations that serve to refer to instances of any of the aforementioned entities, using them as the basis for the creation of structured and disambiguated identifiers for those instances according to specific rules, and stating the relationships that exist between and among instances of some of those entities (e.g., between two instances of Person, or between a person and a corporate body, etc.). The process through which standardised forms of appellations are created and assigned to any kind of things

(including instances of E39 Actor or E38 Image) was deemed useful enough in the museum context for it to be imported in CIDOC CRM. This is the reason why class E42, which was originally labelled Object Identifier, was renamed just Identifier in version 4.2.2 of CIDOC CRM (August 2007); originally, it covered mainly inventory numbers, and was extended to any kind of conventional way of referring uniquely to any kind of thing (either physical or conceptual).

Various Types of Works

The original version of the FRBR model recognised a single Work entity, which served to cover any kind of 'distinct intellectual or artistic creation.'[7] While $FRBR_{OO}$ retains a very broad and generic class named F1 Work that corresponds to the original Work entity, the Harmonisation Group felt the need for some refinements that can prove useful for the description of museum items as well.

$FRBR_{OO}$ distinguishes between two notions that are declared as subclasses of F1 Work: F14 Individual Work, and F15 Complex Work. An individual work is the sum of concepts that is uniquely and completely expressed in a given 'text' (in the broadest sense of that term,[8] i.e., a given set of signs presented as a whole; those signs need not necessarily be of linguistic nature only, e.g., they can be visual, or musical), while a complex work is a constellation of works that are deemed sufficiently related to each other, in a given cultural environment, to be reputed to form a single entity or 'family.'[9] Inevitably, determining the boundaries of any complex work is largely an arbitrary process: are a novel and the movie based on that novel members of the same complex work, or not? In the context of the original FRBR model, such a question used to lead (and occasionally still does) to lengthy, heated, and perfectly pointless discussions, because the conceptual framework of the model required that members of a complex work should be regarded as mere expressions of that work, not as works in their own

[7] IFLA Study Group on the functional requirements for bibliographic records. *Functional requirements for bibliographic records…,* p. 17.
[8] See Gunder, Anna. 'Forming the Text, Performing the Work: Aspects of Media, Navigation, and Linking.' *Human IT,* 2001, 5(2-3), 81-206. Also available online: <http://www.hb.se/bhs/ith/23-01/ag.htm> [cited 18 May 2012]. 'As I see it, all man-made products are systems of signs. All these sign systems can be considered as texts, presenting works. […] The sign system may consist of alphanumeric characters, spoken language, music, still pictures or moving pictures, to mention only a few examples.'
[9] I am using the term 'family' here in reference to Patrick Wilson's definition of 'a Work' as 'a family of texts.' See Wilson, Patrick. *Two Kinds of Power: an Essay in Bibliographic Control*. Berkeley: University of California Press, 1968, reprint 1978, 9.

right, which forbade them to have their own various expressions in turn. In $FRBR_{OO}$ this difficulty is solved, since any member of a complex work can itself be a complex work. The notion of complex work can be useful in museum practice as well, e.g. in the case of art prints that exist in several distinct states. Using the CIDOC CRM alone, such a case can only be modelled through property *P130 shows features of (features are also found on),* which is not entirely satisfying, or through the explicit instantiation of the activity of E11 Modification that resulted in the alteration of the plate that served to print the two distinct states of the art print, which is precise but verbose (and not necessarily useful, if the date of the modification is unknown).[10] Using $FRBR_{OO}$, all states of an art print are modelled as instances of F14 Individual Work that are members of a single instance of F15 Complex Work that serves to identify the art print as an abstract documentation unit comprising all its various states.

Also, $FRBR_{OO}$ distinguishes a third subclass of F1 Work: F21 Recording Work. It covers works the essence of which consists of capturing some aspects of a fleeting moment, e.g. through photographing, filming, or making sound recordings. Once again, such notions can be useful in museums as well.

The fourth subclass of F1 Work declared in $FRBR_{OO}$ is extremely important. It is F16 Container Work, a notion that covers works the essence of which consists of adding value to expressions of other works through various processes, e.g. by juxtaposing them, as in an anthology (this notion is specialised as F17 Aggregation Work), or by editing them and providing them with an appropriate layout, as publishers do with the texts they publish (this notion is specialised as F19 Publication Work), or by performing them (this notion is specialised as F20 Performance Work). In museum practice, F17 Aggregation Work can be a useful class, when it comes to collages or works of appropriation art. The way $FRBR_{OO}$ addresses performances was already presented twice to CIDOC, on the occasion of the Annual Conferences of 2008 and 2010,[11] as the cultural heritage of performing arts is of equal interest to both museums and libraries, and I will therefore not linger on this point here.

[10] Of course, if that date is known, there is no other way to model that information element.

[11] Doerr, Martin, Bekiari, Chryssoula, and Le Boeuf, Patrick. 'FRBR$_{OO}$, a Conceptual Model for Performing Arts.' *2008 Annual Conference of CIDOC, Athens, September 15-18, 2008.* Available online: <http://cidoc.mediahost.org/archive/cidoc2008/Documents/papers/drfile.2008-06-42.pdf> [cited 18 May 2012].
Dionissiadou, Ifigenia. 'Archives Incorporating Museum Objects: the Case of Performing Arts.' *2010 Annual Conference of CIDOC, Shanghai, China, November 8-10, 2010.* Available online: <http://cidoc.meta.se/2010/full_papers/dionissiadou.pdf> (text), <http://cidoc.meta.se/2010/presentations/pp_dionissiadou.pdf> (slide presentation) [cited 18 May 2012].

Authority Control

As mentioned above, version 2.0 of $FRBR_{OO}$, which will be released in the course of 2012, will be augmented with a section on authority data. Authority control consists of establishing controlled access points that serve to uniquely identify any thing that is deemed to be of interest for users, and to ensure that such things can be retrieved under other forms of appellation under which they may happen to be known. Controlled access points can be created for persons or corporate bodies (e.g., 'Leonardo, da Vinci, 1452-1519' which identifies a person who can also be searched under 'Леонардо, да Винчи, 1452-1519'), for products of the mind (e.g., 'Dur̈er, Albrecht, 1471-1528. Kleine Passion' which can also be searched under 'Dur̈er, Albrecht, 1471-1528. Gospel for the unlearned'), or for subjects of works that are neither persons, nor corporate bodies, nor products of the mind, but just 'topics' (e.g., 'Mural painting and decoration' which can also be searched under 'Wall-painting').

In $FRBR_{OO}$, F50 Controlled Access Point is regarded as a specific case (a subclass) of F13 Identifier, which in turn is a subclass of F12 Nomen. The Latin word 'nomen' was used by the FRSAD model to cover signs or arrangements of signs that serve to refer to any kind of thing; it will be taken up by version 2.0 of $FRBR_{OO}$, in replacement of the label 'Name' that was used for class F12 in version 1.0 of $FRBR_{OO}$. F12 Nomen is declared as a subclass of the CIDOC CRM class E41 Appellation. A given instance of F12 Nomen that serves to identify a given instance of E1 CRM Entity is mentioned in an instance of F35 Nomen Use Statement that forms part of a given instance of F34 KOS (Knowledge Organization System). Normally, instances of F35 Nomen Use Statement should not be arbitrary, but should be based on actual references to instances of F52 Name Use Activity which prove that the *nomen* is likely to be understood by at least one group of people (e.g., the existence of a book in Russian in which Leonardo da Vinci is named 'Леонардо да Винчи' in Cyrillic script bears evidence of the existence of the *nomen* 'Леонардо да Винчи').

Authority data is to play a crucial part in supporting interoperability between databases of various institutions. It is important to ensure that access points created by museums and libraries for the same notion but which happen to be unidentical (because the rules used in these two types of institutions are not the same, of for a number of other reasons) are interconnected through references to common URIs. Otherwise, even though we now have a common ontology for libraries and museums by combining $FRBR_{OO}$ and CIDOC CRM, it

will be impossible to interrelate, say, the description of a painting in a museum database and the description of a study of that same painting in a bibliographic database. Libraries endowed themselves with a very useful tool, VIAF (Virtual International Authority File), [12] a cooperative effort hosted by OCLC, envisioned as 'a building block for the Semantic Web' that 'matches and links the authority files of national libraries and groups all authority records for a given entity into a merged "super" authority record that brings together the different names for that entity'. [13] Any future cooperation between museums and libraries on the Semantic Web will only be possible at the price of similar alignment efforts. The *Linked Open Data Recommendation for Museums* available from the ICOM Web site[14] paves the way to the assignment of URIs for museum objects and should be taken into account in any initiative that aims at cooperation of some sort between libraries and museums.

Introducing Events in FRBR

The notion of event was not absent altogether from the FRBR model, but it was limited, such as the *FRBR Final Report* was originally written, to events referred to in subject headings.[15] In CIDOC CRM, E5 Event is a central notion, which serves to interrelate products, actors, places, and time-spans. The harmonisation process consisted therefore also of introducing events every time they were needed, which contributed to add much precision to the model.

Since the FRBR model can be said to be work-centred, the first event mentioned in $FRBR_{OO}$ is F27 Work Conception, i.e., the event through which a work comes into being. But this is a controversial notion. When does a work begin to exist? In a way, it depends on how we understand the work notion itself. In the absence of any other information, we often tend to regard the date of the earliest known publication of a work as an indication of when the work began to exist; but strictly speaking, such a date pertains to the manifestation level, it is only an approximation or a surrogate for the work date. If we happen to know when the earliest known 'text' (again, in the broadest sense of that term) of a work was completed, we

[12] See <http://viaf.org/>.
[13] <http://www.oclc.org/viaf/> [cited 18 May 2012].
[14] <http://network.icom.museum/fileadmin/user_upload/minisites/cidoc/AGM_2011/LoD_For_Museums_v1.6.pdf> [cited 18 May 2012].
[15] However, during the first meeting of the FRBR/CIDOC CRM Harmonisation Group in 2003, Tom Delsey, one of the main originators of the FRBR model, admitted that nothing prevents the Event entity declared in the FRBR model from being used for other purposes, although this is not explicit in the *FRBR Final Report*.

also tend to regard the completion of that process as the 'birth' of the work. Intuitively, we tend to think that the work only begins once its first expression is finished. But such a view, no matter how 'intuitive' it may seem, and though it may seem supported by the practice followed, e.g., in dictionaries of works, conflates into one the notions of 'work' and 'earliest known expression.' In the FRBR model, a work is distinct from its earliest known expression, the same way as it is distinct from any other of its expressions. The date of completion of the earliest known expression of a work pertains to the expression level, not to the work level. In order to solve that difficulty, it was decided, in $FRBR_{OO}$, to define the notion of 'work conception' as covering the process through which the initial idea for a work occurs in someone's mind. Not necessarily the mind of the person who does actually create the earliest known expression, however: someone can order a specific work from someone else, who may never have thought of creating such a work before. F27 Work Conception is declared as a subclass of the CIDOC CRM class E65 Creation.

The second event encountered in $FRBR_{OO}$ is F28 Expression Creation. It is a very peculiar activity, in that it results simultaneously in the creation of a new expression and the production of a physical carrier for that new expression. As long as the expression only exists in someone's mind, it is not reputed to exist in an absolute sense according to $FRBR_{OO}$; expressions become documentation units only from the moment they can be found on physical carriers. As a consequence, F28 Expression Creation is declared as a subclass of both E12 Production and E65 Creation, although these two CIDOC CRM classes comprise activities that result in the coming into being of instances of two classes that, in the CIDOC CRM, are declared as disjoint: E28 Conceptual Object, and E24 Physical Man-Made Thing. Of course, this does not mean that $FRBR_{OO}$ confuses the expression and its carrier (e.g., a text and the unique manuscript on which that text can be found); this simply reflects the fact that F28 Expression Creation consists of two simultaneous and totally inseparable processes, one that affects the intellectual world, and one that affects the physical world.

One might think that the next event in $FRBR_{OO}$ is something like 'manifestation creation.' But it is not so. As mentioned above, the Manifestation entity was split into two distinct classes in $FRBR_{OO}$: F3 Manifestation Product Type, and F4 Manifestation Singleton. An instance of F4 Manifestation Singleton can be either the carrier of a new, original expression (e.g., an author's manuscript), or a copy of a pre-existing expression (e.g., a manuscript produced in a mediaeval scriptorium). In the first case, the activity that provokes the existence of that instance of F4 Manifestation Singleton is an instance of F28 Expression

Creation; in the second case, it is simply an instance of E12 Production. The creation of an instance of F3 Manifestation Product Type could be modelled as an instance of E83 Type Creation, as F3 is a subclass of E55 Type. But $FRBR_{OO}$ also declares a specific class for activities that result in a new publication coming into being. That class is F30 Publication Event, which is a subclass of F28 Expression Creation because publishing is defined in $FRBR_{OO}$ as the activity that consists of establishing the complete set of signs that makes up the contents of the publication (i.e., an instance of F24 Publication Expression).

The production of all the individual copies of a publication, i.e., of instances of F5 Item, is modelled as an instance of F32 Carrier Production Event, a class that is declared in $FRBR_{OO}$ as a subclass of the CIDOC CRM class E12 Production.

Other types of events were introduced in $FRBR_{OO}$, and I will review them here only briefly. F29 Recording Event, a subclass of F28 Expression Creation, corresponds to all kinds of activities that result in recordings (a notion that covers photographs, videotapes and other types of animated images, sound recordings, etc.). F33 Reproduction Event, a subclass of E12 Production, corresponds to all kinds of activities that result in reproductions (i.e., essentially, photocopies, microforms, and digitisations). The difference between a 'recording' and a 'reproduction' is, in many cases, merely functional and somewhat arbitrary: what differentiates a photograph, on the one hand, from a photocopy, a microform or a digitisation, on the other hand, is that no particular creativity is supposed to be involved in a reproduction process; the resulting object is assumed to be 'identical,' as far as certain functionalities are concerned, to the original object.

F31 Performance, a subclass of E7 Activity, corresponds to all kinds of actions that consist of behaving in a particular way in order to communicate either directly or indirectly to an audience.

Some events were introduced more specifically in order to address issues relating to authority control. F40 Identifier Assignment is basically the same class in $FRBR_{OO}$ as E15 Identifier Assignment in the current version of CIDOC CRM (as already mentioned above, this is no coincidence, but the consequence of an intentional change in CIDOC CRM). It is an activity that consists of combining signs of any nature (i.e., instances of E90 Symbolic Object) in order to create identifiers (i.e., instances of F13 Identifier or of its subclass F50 Controlled Access Point) that serve to refer uniquely to any instances of E1 CRM Entity. When such identifiers incorporate appellations taken from a natural language, e.g., 'Leonardo da Vinci' or 'Mural painting and decoration,' their relevance is warranted in authority data by the fact

that those appellations are or were actually used by a given group of people, a notion covered by a specific class, as already mentioned above: F52 Name Use Activity. Authority data relating to a person or a group may contain information about that person's or group's main field of activity, a notion covered by the F51 Floruit class. Two further events correspond to the process through which titles are assigned to instances of F15 Complex Work: the title of a complex work is known through the title of expressions that are deemed to be representative for the work (F42 Representative Expression Assignment), for which in turn some manifestations are deemed to be representative (F41 Representative Manifestation Assignment). For instance, I can know that the title of the work entitled *Seitsemän veljestä* is *Seitsemän veljestä* because the expressions that I deem representative for that work are entitled *Seitsemän veljestä,* and I know that those expressions are entitled *Seitsemän veljestä* because they are called that way on manifestations that I deem representative for them. If I encounter a manifestation entitled *Seven Brothers,* or a manifestation entitled *Seitsemän veljestä Suomesta*, I will not regard the expressions contained in either of these manifestations as representative for the work, and I will not use either of these two titles as an element for the preferred controlled access point for the work (although I can use them for variant access points).

What Remains to Be Done

Presumably, version 2.0 of $FRBR_{OO}$ will not be the last one. There is still space for further work. The introduction to the *FRBR Final Report* contains the following sentence: 'Certain aspects of the model merit more detailed examination. The identification and definition of attributes for various types of material could be extended through further review by experts and through user studies. In particular, the notion of "seriality" and the dynamic nature of entities recorded in digital formats merit further analysis.'[16] As it can be inferred from this sentence, two very important types of resources were only partially modelled in the FRBR model: continuing resources, and digital resources. As a consequence, they are only partially modelled in $FRBR_{OO}$ as well, since the principle that was scrupulously followed in the harmonisation process was to take into account the FRBR model such as it stood, even

[16] IFLA Study Group on the functional requirements for bibliographic records. *Functional requirements for bibliographic records…,* p. 5.

though some concepts that were only implicit in the original FRBR model were made explicit and developed in $FRBR_{OO}$.

Issues relating to digital resources are dealt with in CRM_{dig}, an extension to the CIDOC CRM specifically devoted to the provenance of digital objects. As Martin Doerr and Maria Theodoridou put it, CRM_{dig} 'is particularly appropriate to describe typical workflows (acquisition, processing, synthesis, presentation) creating a complex semantic network of relationships.'[17] I have not investigated in detail if CRM_{dig} addresses all the issues that the original FRBR model left untackled, but it certainly forms a significant starting point. $FRBR_{OO}$ does indeed include developments on digital publishing; but I wonder if these developments can be deemed relevant and sufficient to cover all cases of Web publishing. As I am far from being a specialist in that matter, however, I find it wiser to leave the question open.

'Continuing resources' is a generic term for two types of resources that have always been regarded as particularly tricky: serials (i.e., periodicals and bibliographic series), and integrating resources (i.e., both loose-leaf publications and updating digital resources). Although the original FRBR model occasionally mentions some peculiarities of serials, it cannot be said that serials are fully taken into account, which leads to serious difficulties whenever one tries to analyse information about serials strictly within the FRBR framework.[18] Certainly, it would not be very complicated to add some specific classes and properties to $FRBR_{OO}$ in order to model title changes, splits, mergers, and other events that make the life of serials so enthralling. Some work has been done in that direction, but no outcome has been made public so far. When it comes to integrating resources, however, it seems that everything remains to be done. As far as I know, and unless I am mistaken, integrating resources are not specifically accounted for in the original FRBR model, nor in $FRBR_{OO}$. Perhaps they do not need to; perhaps FRBR and $FRBR_{OO}$ already tacitly contain all that is required in order to adequately model integrating resources. But it might be worth checking.

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[17] Doerr, Martin, and Theodoridou, Maria. 'CRM_{dig}: A Generic Digital Provenance Model for Scientific Observation.' *TaPP '11: 3rd USENIX Workshop on the Theory and Practice of Provenance, June 20-21, 2011, Heraklion, Crete, Greece*. Available online: <http://static.usenix.org/event/tapp11/tech/final_files/Doerr.pdf> [cited 21 May 2012], p. 4.

[18] See, among other resources: Jones, Ed. 'The FRBR Model as Applied to Continuing Resources.' *Library Resources & Technical Services*, 2005, 49(4), 227-242.
Shadle, Steve. 'FRBR and Serials: An Overview and Analysis.' *The Serials Librarian*, 2006, 50(1-2), 83-103.
Tarango, Adolfo R. 'FRBR for Serials: Rounding the Square to Fit the Peg.' *ALA Annual Conference, June 30, 2008.*

The Work Notion in Libraries and in Museums

The structural importance of the Work entity is a striking feature of the FRBR model. That fairly abstract notion is linked to the ‘collocating function’ that librarians have always thought their catalogues should perform. The ‘collocating function’ means that users should be enabled to retrieve easily all various editions of all various versions of a given product of the mind, no matter how diverse the titles of those editions and versions can be. Such a preoccupation does not seem to be primary in the museum world. Although ‘work of art’ is a common phrase, the work notion is not as central in museums as in libraries. It would not occur to a museum curator to expect a museum database to ‘collocate’ all ‘variant versions’ of a painting or sculpture regarded as being the ‘same work:’ each individual painting or sculpture is regarded in museums as an autonomous piece of art, which may have some privileged relations to other autonomous pieces of art. A copy of the Mona Lisa is not interpreted as just another ‘expression’ of the ‘work’ known as the Mona Lisa. Even when Giorgio de Chirico reuses the same iconographic elements over and over again, the resulting images are not analysed by art historians and museum curators simply as distinct ‘expressions’ of one ‘work.’ Preparatory sketches are also documented as autonomous pieces of art that perform a specific function with regard to a given piece of art, not as alternative expressions of that piece of art. This explains, I think, why the Work notion was originally absent from the CIDOC CRM, and why it proved at first somewhat difficult to accommodate the Work/Expression dichotomy in that model.

When a painter such as Giorgio de Chirico paints twice the same subject, the resulting paintings are regarded as two distinct artworks. When a painter such as Leonardo da Vinci modifies over and over again his *Virgin and Child with Saint Anne,* each modification makes the previous version invisible and the resulting painting is regarded as a single artwork (even though the intermediary versions are documented through copies). When an artist such as Piranesi modifies his etching plates, the resulting prints are regarded as distinct states of what is identified as basically a single artwork. The combination of $FRBR_{OO}$ and CIDOC CRM makes it possible to account for all those situations. The F15 Complex Work class is a useful construct that makes it possible to express a sense of unity among distinct products of the mind, while preserving their own status as works.

Conclusion: From CIDOC CRM and $FRBR_{OO}$ to Linked Data

Now that $FRBR_{OO}$ exists, what can it be used for? The current buzz word is Linked Data, and obviously $FRBR_{OO}$ and CIDOC CRM have a part to play in that domain. Libraries and museums do not need to merge their databases: each type of institution can hold on to the way they view and structure their information; but $FRBR_{OO}$ and CIDOC CRM are tools for the integration of the knowledge contained in the databases produced by different types of cultural heritage institutions. On the Semantic Web, it is possible to dream of mediation systems that could process complex queries on museum and library databases. But once again, the necessary condition for the efficiency of such systems and the relevance of returned answers is the accuracy and uniqueness of URIs. $FRBR_{OO}$ is an achievement in library and museum cooperation; such cooperation will have made one significant step forward when there is an agreement between museums and libraries on common rules for URI assignment. There is still much to be done, and Linked Data offers us an exciting opportunity for increased cooperation between libraries and museums!