$\mathbf{LRM_{OO}}$
object-oriented definition and mapping from the IFLA Library Reference Model

Prepared by the IFLA LRM_{OO} Working Group
with the CIDOC CRM Special Interest Group

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1. Introduction

This document contains a comprehensive description of the object-oriented definition of the IFLA Library Reference Model (IFLA LRM), a model in the form of a formal ontology interpreting IFLA LRM. IFLA LRM was approved as an IFLA standard in August 2017. IFLA LRM consolidates and succeeds the three models in the IFLA FR family of conceptual models (FRBR, FRAD, FRSAD).

Now superseded, $FRBR_{OO}$ version 2.4, approved as an IFLA standard in 2016, reflected the three IFLA entity-relationship models in the FR family in a formulation designed as a compatible extension to the museum community's model, the CIDOC Conceptual Reference Model (CIDOC CRM). The role of the LRM_{OO} model is to provide a similar equivalent for IFLA LRM.

LRM_{OO} is developed from $FRBR_{OO}$ version 2.4, but taking into account decisions made in IFLA LRM, continuing the mutual influence and cycles of development between the models (Riva & Žumer 2018). In keeping with its aim to provide an object-oriented rendering of IFLA LRM, LRM_{OO} is a core model at a high-level of generality, reducing specialised subclasses and properties in comparison to $FRBR_{OO}$. Examples have also been thoroughly revised throughout (Riva, Žumer & Aalberg 2022).

A major release of CIDOC CRM in 2022 (version 7.1.2) was the basis for the 2023 update of its corresponding ISO standard (ISO 21127:2023 Information and documentation – A reference ontology for the interchange of cultural heritage information[1]). Minor corrections noted during the ISO process resulted in the official CIDOC CRM release (version 7.1.3) in February 2024. LRM_{OO} is also taking the opportunity to integrate this latest CRM release, including modifications to terminology and style that have been recently adopted in the CRM family.

The document comprises the following sections:

- Section 1, Introduction, describes the rationale, history and methodology of the development of this model.
- Section 2, Scope, clarifies both what the model includes and what is not included.
- Section 3, Status, provides information relating to the formal adoption process of the document.
- Section 4, Description of the Model, explains the model in context from a functional perspective with the help of a comprehensive graphical representation of all constructs, and describes the format conventions for the formal specifications found in sections 6 and 7.
- Section 5, Class and Property Hierarchies, puts LRM_{OO} in context with CIDOC CRM. Since the object-oriented model reuses, wherever appropriate, large parts of ISO 21127, the CIDOC Conceptual Reference Model, this section also provides a comprehensive list of all constructs used from CIDOC CRM version 7.1.3. Some of these constructs appear only in the mapping in section 8 and not in sections 6 and 7, because they are generic in nature.
- Sections 6 and 7 list the complete class and property definitions that make up the model. Whereas the description in section 4 serves an overall understanding, these sections are the reference for the individual declarations.
- Section 8 provides the mappings from the IFLA LRM entity-relationship model to the object-oriented model LRM_{OO} and the reverse. This section defines the transition from one form to the other, and serves as information for further understanding of the intended meaning of the object-oriented definition. It is also a proof that the object-oriented form is an alternative view of the IFLA LRM model, and a proof of completeness of the object-oriented form with respect to the original.
- Section 9 defines a small number of residual classes and properties that were declared in $FRBR_{OO}$ that expand on those required for alignment with IFLA LRM.
- Section 10 lists all classes and properties declared in the superseded model $FRBR_{OO}$ version 2.4 and aligns them with the LRM_{OO} model, and provides migration instructions.
- Section 11 provides a brief bibliography.

[1] ISO 21127:2014 was based on CIDOC CRM version 5.0.4 (December 2011).

2. Scope

LRM_{OO} takes its functional scope from the scope of the IFLA Library Reference Model. It aims to be a high-level conceptual reference model for bibliographic information managed by libraries of all kinds. As with IFLA LRM, it covers bibliographic data, which is broadly understood to include metadata traditionally considered strictly bibliographic as well as metadata viewed as name or subject authority data. Basic holdings information, to the extent that it appears in IFLA LRM, is included via constructs existing in CIDOC CRM. However, administrative metadata used to manage the internal functions of libraries and bibliographic agencies is excluded from the scope of LRM_{OO}, as it is also excluded by both IFLA LRM and CIDOC CRM.

The LRM_{OO} model includes all classes and properties required, in addition to classes and properties already declared in CIDOC CRM, to express the concepts covered by IFLA LRM. Classes that are exact equivalences of CIDOC CRM classes are not declared within LRM_{OO}, even when those classes are required as direct equivalences to IFLA LRM classes. LRM_{OO} is strictly an extension of CIDOC CRM and cannot be implemented without using key classes and properties from CIDOC CRM.

LRM_{OO} only expands on IFLA LRM in a few limited areas. The situation where a work incorporates a pre-existing work so that all of its expressions must include an expression of the first work is modelled with two specific properties, *R75 incorporates (is incorporated in)* between the works and *R74 uses expression of (has expression used in)* between the expressions. Additionally, LRM_{OO} provides for grouping works that share a common concept, such as being set in the same fictional universe, an idea that has often been discussed under the term “superwork”, through the property *R10 is member of (has member)* which links a work to the CIDOC CRM class E28 Conceptual Object. And finally, LRM_{OO} includes modelling of performances with the class F31 Performance and the property *R80 performed (is performed in)* to link the performance event to the work performed. Recording performances is one type of expression creation and this is expressed with the property *R81 recorded (is recorded in)*.

LRM_{OO} is designed as an extension to the CIDOC CRM model which opens a route to semantic interoperability and exchange of data with other communities in the wider heritage sector. The family of models that use CIDOC CRM as a base is diverse and growing. The development methodology ensures each new family model is harmonised or at least compatible, which allows for multiple extensions to be adopted together, based on the needs of the implementation.

LRM_{OO} does not include refinements for particular types of resources. All these aspects can be fully represented with more general supertypes in LRM_{OO} or CIDOC CRM. Any extensions to IFLA LRM for resource types could be the object of further extensions to LRM_{OO}.

LRM_{OO} is a conceptual model and as such is primarily intended for a technical audience engaged in designing and implementing data structures that include bibliographic information, in particular when this is with the intention of enabling integration with data from other heritage communities. The adoption of object-oriented techniques makes the model suited for working with linked data and semantic web technologies. This document presumes basic familiarity with conceptual modelling and particularly with object-oriented formulations, the conventions adopted in CIDOC CRM and with IFLA LRM.

3. Status

LRM$_{OO}$ is a shared model between two heritage communities represented by two international associations: the library community represented by IFLA (the International Federation of Library Associations and Institutions) and the museum community represented by ICOM (the International Council of Museums) working through the CIDOC Conceptual Reference Model Special Interest Group (CIDOC CRM SIG). As such, the model is developed and maintained through joint work and the result is subject to the appropriate approval processes in both communities (Riva, Žumer & Aalberg 2023).

The IFLA Bibliographic Conceptual Models Review Group (BCM RG) charged the LRM$_{OO}$ Working Group in August 2017, as soon as IFLA LRM received final IFLA standards approval. In October 2017 the Review Group submitted its proposal to develop an IFLA standard to the IFLA Committee on Standards. The LRM$_{OO}$ Working Group carried out its work in consultation with both the IFLA BCM RG and the CIDOC CRM SIG, participating in the meetings of both groups and making working drafts publicly available on the CIDOC CRM website. Draft version 0.9.3 included all proposals approved up to and including CIDOC CRM SIG meeting #54, September 13-16, 2022 in Rome, and editorial modifications made for consistency. The document was released for a formal IFLA worldwide review from February to April 2023. All worldwide review comments were addressed in version 0.9.5 which included solutions adopted at CIDOC CRM SIG meeting #55, May 9-12, 2023, in Heraklion, Crete, Greece. LRM$_{OO}$ was approved by the CIDOC CRM SIG in May 2023. Draft version 0.9.5 was approved by the IFLA BCM RG at its meeting on August 22, 2023, during the IFLA World Library and Information Congress in Rotterdam, The Netherlands. Version 0.9.6 was then submitted to the IFLA Advisory Committee on Standards for review and was recommended for approval February 4, 2024. Final endorsement from the IFLA Professional Council in April 2024 resulted in approved version 1.0 which is available in the IFLA repository as well as on the CIDOC CRM SIG website. Version 1.1.1 integrates into the class and property declarations the first-order logic (FOL) statements that describe the model's structure. New section 8.4 adds the mapping from LRM$_{OO}$ to IFLA LRM following the existing mapping in the other direction, from IFLA LRM to LRM$_{OO}$ and CIDOC CRM.

A note about the linkage to the PRESS$_{OO}$ model: the class F18 Serial Work and its property *R11 has issuing rule (is issuing rule of)*. Although included in the LRM$_{OO}$ class declarations in section 6, F18 Serial Work should be implemented only in conjunction with an implementation of PRESS$_{OO}$, as the class is not otherwise used within LRM$_{OO}$.

Several residual classes and properties previously declared in the superseded model FRBR$_{OO}$ version 2.4 are retained as a supplement for the convenience of implementations that previously took advantage of their more granular correspondence to certain elements found in FRAD. Their full declarations are found in section 9 of this document.

4. Description of the Model

The CIDOC CRM is an ontology in the sense used in computer science. More specifically, the model is expressed in terms of the primitives of semantic data modelling. As such, it consists of:

- classes, which represent general notions in the domain of discourse, such as the CIDOC CRM class E21 Person which represents the notion of person;
- properties, which represent the binary relations that link the individuals in the domain of discourse, such as the CIDOC CRM property *P152 has parent* linking a person to one of the person's parents.
- properties of properties (".1 properties"), such as the property *P14.1 in the role of*, of the CIDOC CRM property *P14 carried out by (performed)*.

These .1 properties do not appear in the property hierarchy list, but are included as part of their base property declaration and are referred to in the class declarations. They all have the implicit quantification "many to many".

In understanding the models, it is important to keep in mind that the classes and properties declared in the models are entity types, that is, types or categories of classes or properties. Individual entities are recorded as individual instances of the appropriate classes or properties.

4.1. Characteristics of Properties

In mathematics and logic three features are used to characterize properties that have the same class as both domain and range. These are transitivity, symmetry, and reflexivity. Where applicable, the scope notes of properties explicitly state whether the property is transitive or not, symmetric or asymmetric, reflexive or irreflexive. The formal definitions of these terms is found in the following table.

Table 1. Definitions of characteristics of properties

transitive	A property P is transitive if the domain and range is the same class and for all instances x, y, z of this class the following is the case: If x is related by P to y and y is related by P to z, then x is related by P to z. The intention of a property as described in the scope note will decide whether a property is transitive or not. For example, the property *P121 overlaps with* between instances of E53 Place is not transitive, while the property *P89 falls within (contains)* between instances of E53 Place and the property *P46 is composed of (forms part of)* between instances of E18 Physical Thing are both transitive.
symmetric	A property P is symmetric if the domain and range are the same class and for all instances x, y of this class the following is the case: If x is related by P to y, then y is related by P to x. The intention of a property as described in the scope note will decide whether a property is symmetric or not. An example of a symmetric property is E53 Place. *P122 borders with*: E53 Place. The names of symmetric properties have no parenthetical form, because reading in the range-to-domain direction is the same as the domain-to-range reading.
asymmetric	A property P is asymmetric if the domain and range are the same class and for all pairs of instances x, y of this class the following is the case: If x is related by P to y, then y is not related by P to x. In CIDOC CRM asymmetry is mostly used in properties denoting part-whole relationships, when the whole cannot be a part of itself. An example of such an asymmetric property is E18 Physical Thing. *P46 is composed of (forms part of)*: E18 Physical Thing. An asymmetric property is always also irreflexive.
reflexive	A property P is reflexive if the domain and range are the same class and for all instances x of this class the following is the case: x is related by P to itself. The intention of a property as described in the scope note will decide whether a property is reflexive or not. An example of a reflexive property is E53 Place. *P89 falls within (contains)*: E53 Place.
irreflexive	A property P is irreflexive if the domain and range are the same class and for all instances x of this class the following is the case: x is not related by P to itself. An example of an irreflexive property is E33 Linguistic Object. *P73 has translation (is translation of)*: E33 Linguistic Object. A property that is asymmetric is always also irreflexive.

4.1.1. Inheritance

Inheritance is a construct frequently used in modelling and the isA (inheritance) relationship is used to define one class as a more specialized version of another. A specialized class (subclass) implies a subset, since any instance of the subclass also counts as an instance of the class it inherits from (superclass). A property that is defined for a class will also apply on any of its subclasses. It is worth underlining that inheritance is a modelling construct, it is a relationship between types of things. CIDOC CRM, and its extensions, is formulated as a class system with inheritance. Property P with domain A and range B will also be a property between any possible subclasses of A and of B.

4.1.2. Shortcuts

Some properties are declared as shortcuts of longer, more comprehensively articulated paths that connect the same domain and range classes as the shortcut property via one or more intermediate classes. For example, the property E18 Physical Thing. *P52 has current owner (is current owner of):* E39 Actor, is a shortcut for a fully articulated path from E18 Physical Thing through E8 Acquisition to E39 Actor. We distinguish the following terms:

Shortcut: An instance of the fully-articulated path always implies an instance of the shortcut property. However, the converse may not be true; an instance of the fully-articulated path cannot always be inferred from an instance of the shortcut property.

Inverse shortcut: An instance of the shortcut property always implies an instance of the fully-articulated path. However, the converse may not be true; an instance of the shortcut property cannot always be inferred from an instance of the fully-articulated path.

Strong shortcut: An instance of the fully-articulated path always implies an instance of the strong shortcut property and an instance of the fully-articulated path can always be inferred from an instance of the strong shortcut property.

4.2. Overview of the Model

LRM_{OO} declares 16 classes and 37 properties, in addition to those used from CIDOC CRM. In comparison, IFLA LRM has 11 entities, 37 attributes and 36 relationships.

The core of the model is the WEMI (Work, Expression, Manifestation, Item) classes which were first defined in FRBR, and the relationships linking them together. As an object-oriented model, LRM_{OO} brings out the events that result in the creation of instances of the WEMI classes, using specific creation classes that are linked to the WEMI classes by specific properties. These creation classes are subclasses of the CIDOC CRM classes E65 Creation or E12 Production, and in turn both of these classes are subclasses of the basic E7 Activity class. Since instances of E39 Actor (to which the IFLA LRM entity LRM-E6 Agent is mapped) can *P14i perform* instances of E7 Activity, an agent can be linked to the creation or modification of any WEMI instance. This is shown in Illustration 1 below.

Not illustrated in the diagram is that any E7 Activity can also be linked to a specific instance of E52 Place using the *P7 took place at (witnessed)* property or with an instance of E53 Time-span using the *P4 has time-span (is time-span of)* property.

The F27 Work Creation class in LRM_{OO} comprises activities by which instances of F1 Work come into existence and can serve to document the period a work was coming into existence and the circumstances of it, when these are known. In many cases Work Creation coincides with the existence of the first known complete expression of that work. Similarly, the F28 Expression Creation class comprises activities that result in instances of F2 Expression coming into existence. An instance of expression is considered to be created when it is captured on a carrier other than the creator's brain. Expression Creation necessarily requires creating a realisation (R19) of an instance of F1 Work in the instance of F2 Expression being created. The creation of an instance of expression coincides with the creation of the first instance of F3 Manifestation that *R4 embodies (is embodied in)* this instance of expression.

The F32 Item Production Event class comprises the activities that produce one or more instances of F5 Item, and requires the materialization (R27) of an instance of F3 Manifestation that each instance of F5 Item *R7 exemplifies (is exemplified by)*.

The F33 Reproduction Event class, a specialisation of the F30 Manifestation Creation class, can use as its source material either a specific instance of F5 Item using the *R29 reproduced object (was object reproduced by)*

property or a specific instance of F3 Manifestation using *R30 reproduced publication (was publication reproduced by)* instead. In either case, a new instance of F3 Manifestation is created by the event.

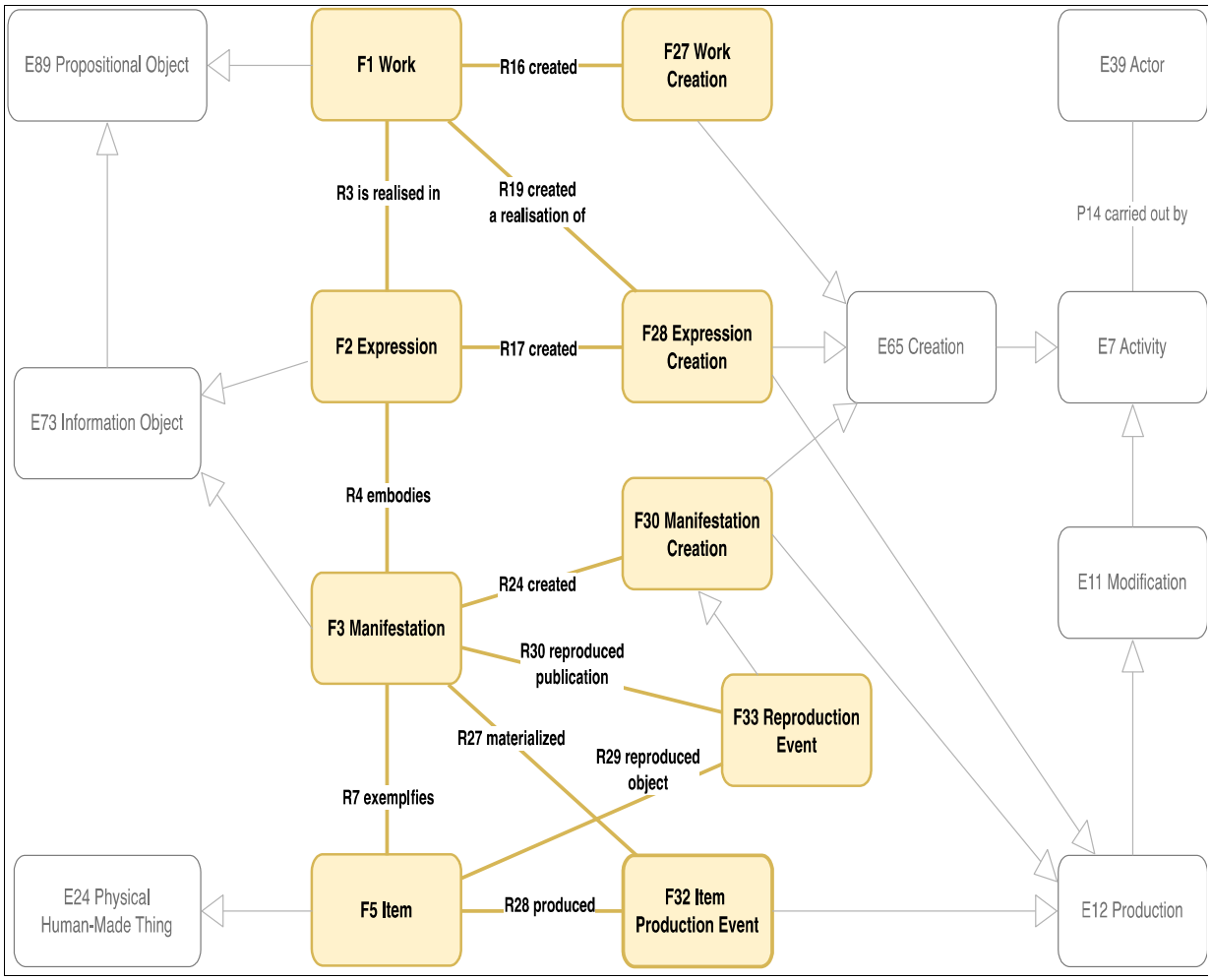

Illustration 1. LRM$_{OO}$ classes and properties and their connections to CIDOC CRM classes

4.2.1. Incorporation of expressions into new works

Incorporation of pre-existing expressions into expressions of new works, although a frequent occurrence, is an aspect not included in the 2017 version of IFLA LRM. A proposed extension is under consideration. Examples include poems set to music or reusing music in new compositions. In LRM$_{OO}$ this is covered by two properties, *R74 uses expression of (has expression used in)* and *R75 incorporates (is incorporated in)*. The latter is a relationship between expressions, where the first expression includes as an integral part the second expression (which is a realisation of a different work). *R74 uses expression of* deals with the work level: all expressions of the first work will include some expression of the second. A well known example is Beethoven's 9th Symphony, which uses an expression of 'An die Freude' by Friedrich Schiller (but it can be any language version).

4.2.2. Representative attributes and representative expressions

The work attribute LRM-E2-A2 Representative Expression Attribute was introduced in IFLA LRM to enable specifying essential characteristics of a work (such as original language, original instrumentation, intended audience), associated with the canonical expression, most often the one considered original. In LRM$_{OO}$, this is achieved with the property *R79 has representative expression attribute (is representative expression attribute of)* which associates an instance of F1 Work with an instance of F55 Type. The type system is suitably selected to cover the category of attribute which is of interest. In addition, the property *R73 takes representative attribute from (bears representative attribute for)* may be applied to associate a work with the representative expression, the one that the attributes are taken from.

4.2.3. WEMI properties

Some properties declared in LRM_{OO} enable full mapping to IFLA LRM relationships. *R77 accompanies or complements (is accompanied or complemented by)* provides a mapping at a suitable level of granularity for the LRM-R20 accompanies/complements relationship between two works. *R68 is inspired by (is inspiration for)* serves as a direct equivalent of the IFLA LRM inspiration relationship LRM-R21 between two works. *R76 is derivative of (has derivative)* is declared as the equivalent to the IFLA LRM relationship LRM-R24. This property is connecting two expressions and it enables recording the exact derivation chain, when known. It is an important complement to the more general work-to-work derivation relationship, *R2 is derivative of (has derivative)*, which corresponds to the IFLA LRM transformation relationship LRM-R22.

The work-to-work property *R67 has part (forms part of)* is declared as the equivalent to IFLA LRM relationship LRM-R18. It allows modelling structural composition of works.

The symmetric property *R78 has alternate* provides an equivalent to the alternate relationship between manifestations, LRM-R29. These properties are summarized in Illustration 2.

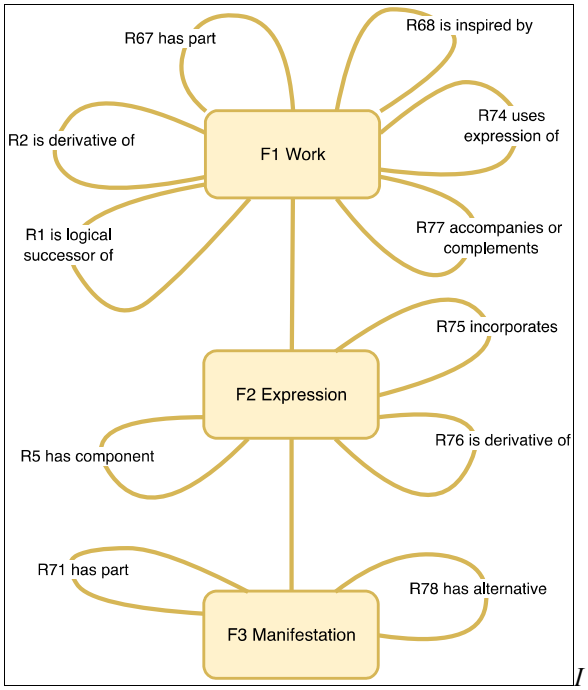

Illustration 2. Properties of WEM classes

4.2.4. Performances

LRM_{OO} includes the class F31 Performance which comprises activities where an instance of F1 Work is presented or communicated directly or indirectly to an audience, such as a theatrical play or musical work. The main usage of this class is to enable more elaborate or explicit documentation of recorded performances. In LRM_{OO}, the property *R80 performed (is performed in)* is used to express the association between an instance of F31 Performance and the instance of F1 Work it conveys, and the property *R81 recorded (is recorded in)* allows for the documentation of the association that exists between the outcome of an instance of F28 Expression Creation which involved a performance recording, and the instance of F31 Performance that it is a recording of. This is shown below in Illustration 3. Additionally, more elaborated documentation of performances and the recording of performances can be achieved by using existing classes and properties in CIDOC CRM.

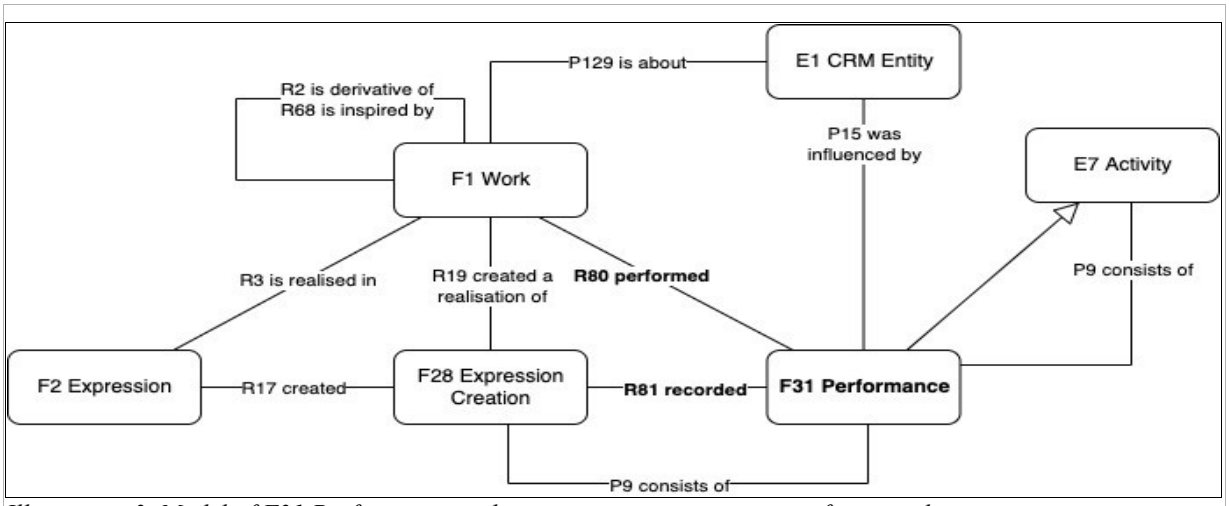

Illustration 3. Model of F31 Performance and its use in expression creation for recordings

4.3. Naming conventions

LRM$_{OO}$ follows the naming conventions that have been applied throughout the CIDOC CRM family of models:

- Classes are identified by numbers preceded by the letter "F" and are named using noun phrases (nominal groups) using title case (initial capitals) as mnemonics for the content of the scope note. For example, F28 Expression Creation.
- Properties are identified by numbers preceded by the letter "R," and are named in both directions using verbal phrases in lower case as mnemonics for the content of the scope note. Properties with the character of states are named in the present tense, such as *R4 embodies*, whereas properties related to events are named in past tense, such as *R19 created a realisation of (was realised through)*.
- Properties with similar semantic content operating between different domains and/or ranges are given the same verbal phrase as property label, however their names are unique due to their different property identifiers. For example, property *R16 created (was created by)* with domain F27 Work Creation and range F1 Work is has an identifier distinct from property *R17 created (was created by)* which has domain F28 Expression Creation and range F2 Expression.
- The letters "F" and "R" were chosen during the development of FRBR$_{OO}$ and are to be understood as the first two letters of "FRBR". This choice does not have any other meaning. They correspond respectively to the letters "E" and "P" in the CIDOC CRM naming conventions, where "E" historically meant "entity" (although the CIDOC CRM "entities" are now consistently called "classes"), and "P" means "property".
- Since LRM$_{OO}$ developed from FRBR$_{OO}$, the same identifiers already assigned to classes and properties in FRBR$_{OO}$ are retained when those classes and properties continue to be defined in LRM$_{OO}$. The identifiers for those classes and properties defined in FRBR$_{OO}$ that are deprecated in LRM$_{OO}$ are not reused, even though this results in gaps in the numbering. See section 10 for details of the evolution of all FRBR$_{OO}$ classes and properties in their transition to LRM$_{OO}$. All classes and properties newly declared in LRM$_{OO}$ are assigned the next available identifier at the end of the sequence.
- Property names should be read in their non-parenthetical form for the domain-to-range direction, and in parenthetical form for the range-to-domain direction. Reading a property in range-to-domain direction is equivalent to the inverse of that property. Following a current notational practice in OWL knowledge representation language, inverse properties are represented in this text by adding a letter "i" following the identification number and the parenthetical form of the full property name, such as *R1i has successor*, which is the inverse of *R1 is logical successor of*.
- Properties with a range that is a subclass of CIDOC CRM class E59 Primitive Value (such as E1 CRM Entity. *P3 has note*: E62 String, for example) have no parenthetical name form, because reading the property name in the range-to-domain direction is generally not regarded as meaningful.
- Properties that have identical domain and range may be symmetric or transitive. Instantiating a symmetric property implies that the same relation holds for both the domain-to-range and the range-to-domain directions. An example of this is E53 Place. *P122 borders with*: E53 Place. The names of symmetric properties have no parenthetical form, because reading in the range-to-domain direction is the same as the domain-to-range reading. Transitive asymmetric properties, such as E4 Period. *P9 consist of (forms part of)*: E4 Period, have a parenthetical form that relates to the meaning of the inverse direction.
- Properties of properties are identified by "R", followed by the number of the base property extended with ".1" and are named in one direction using a verbal phrase in lower case in the present tense. For example: the property *R2.1 has type* of the property *R2 is derivative of (has derivative)*.

4.4. Property quantifiers

Quantifiers for properties are provided for the purpose of semantic clarification only, and should **not** be treated as implementation recommendations. Therefore, the term "cardinality constraints" is avoided here, as it typically pertains to implementations.

The following table lists all possible property quantifiers occurring in the CIDOC CRM family of models by their notation, together with an explanation in plain words. For optimal clarity, two widely accepted notations are used redundantly in this document, a verbal and a numeric one. The verbal notation uses phrases such as "one to many", and the numeric one, expressions such as "(0,n:0,1)". While the terms "one", "many" and "necessary" are

quite intuitive, the term “dependent” denotes a situation where a range instance cannot exist without an instance of the respective property. In other words, the property is “necessary” for its range (Meghini & Doerr 2018).

Table 2. Property quantifiers and their definitions

many to many (0,n:0,n)	Unconstrained: An individual domain instance and range instance of this property can have zero, one or more instances of this property. In other words, this property is optional and repeatable for its domain and range.
one to many (0,n:0,1)	An individual domain instance of this property can have zero, one or more instances of this property, but an individual range instance cannot be referenced by more than one instance of this property. In other words, this property is optional for its domain and range, but repeatable for its domain only. In some contexts this situation is called a “fan-out”.
many to one (0,1:0,n)	An individual domain instance of this property can have zero or one instance of this property, but an individual range instance can be referenced by zero, one or more instances of this property. In other words, this property is optional for its domain and range, but repeatable for its range only. In some contexts this situation is called a “fan-in”.
many to many, necessary (1,n:0,n)	An individual domain instance of this property can have one or more instances of this property, but an individual range instance can have zero, one or more instances of this property. In other words, this property is necessary and repeatable for its domain, and optional and repeatable for its range.
one to many, necessary (1,n:0,1)	An individual domain instance of this property can have one or more instances of this property, but an individual range instance cannot be referenced by more than one instance of this property. In other words, this property is necessary and repeatable for its domain, and optional but not repeatable for its range. In some contexts this situation is called a “fan-out”.
many to one, necessary (1,1:0,n)	An individual domain instance of this property must have exactly one instance of this property, but an individual range instance can be referenced by zero, one or more instances of this property. In other words, this property is necessary and not repeatable for its domain, and optional and repeatable for its range. In some contexts this situation is called a “fan-in”.
one to many, dependent (0,n:1,1)	An individual domain instance of this property can have zero, one or more instances of this property, but an individual range instance must be referenced by exactly one instance of this property. In other words, this property is optional and repeatable for its domain, but necessary and not repeatable for its range. In some contexts this situation is called a “fan-out”.
many to many, necessary, dependent (1,n:1,n)	An individual domain instance and range instance of this property must have at least one instance of this property. In other words, this property is necessary and repeatable for its domain and range.
one to many, necessary, dependent (1,n:1,1)	An individual domain instance of this property can have one or more instances of this property, but an individual range instance must be referenced by exactly one instance of this property. In other words, this property is necessary and repeatable for its domain, and necessary but not repeatable for its range. In some contexts this situation is called a “fan-out”.
many to one, necessary, dependent (1,1:1,n)	An individual domain instance of this property must have exactly one instance of this property, but an individual range instance can be referenced by one or more instances of this property. In other words, this property is necessary and not repeatable for its domain, and necessary and repeatable for its range. In some contexts this situation is called a “fan-in”.
one-to-one, necessary (1,1:0,1)	An individual domain instance of this property must have exactly one instance of this property, but an individual range instance cannot be referenced by more than one instance of this property. In other words, this property is necessary and not repeatable for its domain, and optional but not repeatable for its range.
one to one, necessary, dependent (1,1:1,1)	An individual domain instance and range instance of this property must have exactly one instance of this property. In other words, this property is necessary and not repeatable for its domain and for its range.

The CIDOC CRM family of models defines some dependencies between properties and the classes that are their domains or ranges. These can be one or both of the following:

- the property is necessary for the domain
- the property is necessary for the range, or, in other words, the range is dependent on the property.

The possible kinds of dependencies are defined in the table above. Note that if a dependent property is not specified for an instance of the respective domain or range, it means that the property exists, but the value on one side of the property is unknown. In the case of optional properties, the methodology proposed does not distinguish between a value being unknown or the property not being applicable at all. For example, one may know that an object has an owner, but the owner is unknown. In the CIDOC CRM family of models this case cannot be distinguished from the fact that the object has no owner at all. Of course, such details can always be specified by a textual note.

Note that the quantification of all properties of properties, ".1" properties, is "many-to-many" and, therefore, does not appear explicitly in their definitions.

4.5. Presentation conventions

All instances of E41 Appellation are presented within single quotation marks, whether they are used for themselves or just to refer to the things they name. Any punctuation mark that follows an instance of E41 Appellation is placed outside the single quotation marks, as it does not belong to the appellation itself.

Furthermore, all references to instances of E90 Symbolic Object in the form of a content model are presented within single quotation marks, such as 'abc'. By content model we mean the symbol sequence the symbolic object consists of.

British spelling is used throughout the original English version of this document, except for occasional quotations and examples.

4.6 Conventions used in First-Order Logic representations

Following the practice in CIDOC CRM, the class and property declarations in LRM_{OO} include logical axioms which provide an additional formal expression of the model. These expressions correspond to the constraints of semantic modeling. The axioms are placed under the heading 'In First Order logic'.

There are several options for writing statements in first-order logic. The CIDOC CRM SIG has adopted a standard compact notation widely used in text books and scientific papers. The definition of the symbols used is given in the table below.

For instance, the subclass link between E21 Person and E20 Biological Object can be formulated in first-order logic as the axiom:

$$(\forall x)\,[E21(x) \Rightarrow E20(x)]$$

(reading: for all individuals x, if x is an E21 Person then x is an E20 Biological Object).

In the definitions of classes and properties in this document the universal quantifier(s) are omitted for simplicity, so the above axiom is simply written:

$$E21(x) \Rightarrow E20(x)$$

Likewise, the domain constraint on property *P152 has parent* can be formulated in first-order logic as the axiom:

$$P152(x,y) \Rightarrow E21(x)$$

(reading: for all individuals x and y, if x is an *P152 has parent* of y, then x is an E21 Person).

Properties of properties, indicated by a '.1' after the property number, are described by predicate symbols with three arguments. For example, the property *P14.1 in the role of* is described as the predicate symbol corresponding to property *P14 carried out by (performed)*:

$$P14(x,y) \Rightarrow E7(x)$$

$$P14(x,y) \Rightarrow E39(y)$$

P14(x,y,z) ⇒P14(x,y) ∧E55(z)

These basic considerations should be used by the reader to understand the logical axioms that are used in the definition of the classes and properties.

Table 3. Symbolic Operators in First-Order Logic Representation

Symbols	Name	reads	Meaning
Operators			
∧	conjunction	and	(φ ∧ ψ) is true if and only if both *φ* and *ψ* are true
∨	disjunction	or	(φ ∨ ψ) is true if and only if at least one of either φ or ψ is true
¬	negation	not	¬φ is true if and only if *φ* is false
⇒	implication	implies, if … then ...	(φ ⇒ ψ) is true if and only if it is not the case that *φ* is true and *ψ* is false
⇔	equivalence	is equivalent to, if … and only if …	φ ⇔ ψ is true if and only if both *φ* and *ψ* are true or both φ and ψ are false
Quantifiers			
∃	existential quantifier	exists, there exists at least one	
∀	Universal quantifier	forall, for all	

5. Class and Property Hierarchies

Although they do not provide comprehensive definitions, compact monohierarchical presentations of the class and property isA hierarchies have been found to significantly aid in the comprehension and navigation of models in the CIDOC CRM family, and are therefore provided below.

The class hierarchies presented below have the following format:

- Each line begins with a unique class identifier, consisting of a number preceded by the letter “F”.
- A series of em dashes (“—”) follows the unique class identifier, indicating the hierarchical position of the class in the isA hierarchy.
- The English label of the class appears to the right of the em dashes.
- The index is ordered by hierarchical level, in a “depth first” manner, from the smaller to the larger subhierarchies.
- Classes that appear in more than one position in the class hierarchy as a result of multiple inheritance are shown first in roman typeface, then in italic typeface.

The property hierarchies presented below have the following format:

- Each line begins with a unique property identifier, consisting of a number preceded by the letter “R”.
- A series of em dashes (“—”) follows the unique property identifier, indicating the hierarchical position of the property in the isA hierarchy.
- The English label of the property appears to the right of the em dashes, followed by its inverse name in parentheses for reading in the range to domain direction.
- The domain class for which the property is declared.
- The range class that the property references.
- The index is ordered by hierarchical level, in a “depth first” manner, from the smaller to the larger subhierarchies, and by property number between equal siblings.
- Properties that appear in more than one position in the property hierarchy as a result of multiple inheritance are shown in an italic typeface.

In the LRM_{OO} class and property hierarchies aligned with CIDOC CRM class and property hierarchies, distinct layouts are used for classes and properties from LRM_{OO}, on the one hand, and for classes and properties from CIDOC CRM, on the other hand.

5.1. LRM$_{OO}$ class hierarchy

The labels in italics indicate the second or subsequent listing of a class that appears in more than one place in the hierarchy.

Table 4. LRM$_{OO}$ Class Hierarchy

ID	LRM$_{OO}$ Class Name	LRM$_{OO}$ Subclass Name
F1	Work	
F18	—	Serial Work [PRESS$_{OO}$]
F2	Expression	
F3	Manifestation	
F5	Item	
F12	Nomen	
F27	Work Creation	
F28	Expression Creation	
F30	Manifestation Creation	
F33	—	Reproduction Event
F31	Performance	
F32	Item Production Event	
F33	*Reproduction Event*	
F36	Script Conversion	
F55	Collective Agent	
F11	—	Corporate Body
F39	—	Family

5.2. LRM$_{OO}$ class hierarchy, aligned with portions of the CIDOC CRM class hierarchy

LRM$_{OO}$ class hierarchy with CIDOC CRM 7.1.3 direct superclasses added as the first columns. The labels in italics indicate the second or subsequent listing of a class that appears in more than one place in the hierarchy.

Table 5. LRM$_{OO}$ Class Hierarchy aligned with CIDOC CRM

ID	CRM Class Name	ID	LRM$_{OO}$ Class Name	LRM$_{OO}$ Subclass Name
E89	Propositional Object	F1	Work	
		F18	—	Serial Work [PRESS$_{OO}$]
E73	Information Object	F2	Expression	
E73	Information Object	F3	Manifestation	
E24	Physical Human-Made Thing	F5	Item	
E89	Propositional Object	F12	Nomen	
E65	Creation	F27	Work Creation	
E65	Creation	F28	Expression Creation	
E65	Creation	F30	Manifestation Creation	
		F33	—	Reproduction Event
E12	Production	F28	*Expression Creation*	
E12	Production	F30	*Manifestation Creation*	
		F33	—	*Reproduction Event*
E7	Activity	F31	Performance	
E12	Production	F32	Item Production Event	
E12	Production	F33	*Reproduction Event*	
E29	Design or Procedure	F36	Script Conversion	
E74	Group	F55	Collective Agent	
		F11	—	Corporate Body
		F39	—	Family

5.3. List of CIDOC CRM classes used in LRM$_{OO}$

The list in this section identifies the classes in CIDOC CRM version 7.1.3 referred to by LRM$_{OO}$. In addition to classes that appear as the range of LRM$_{OO}$ properties, relevant uses include: appearance in the mapping from IFLA LRM in section 8 or as an element of a path in a mapping statement, reference as immediate superclass of classes defined in the model, or as the domain or range of referred CRM properties.

Table 6. CIDOC CRM Classes used in LRM$_{OO}$

Class ID	**Class Name**		**Class ID**	**Class Name**
E1	CRM Entity		E52	Time-span
E4	Period		E53	Place
E7	Activity		E54	Dimension
E11	Modification		E55	Type
E12	Production		E56	Language
E13	Attribute Assignment		E58	Measurement Unit
E18	Physical Thing		E60	Number
E19	Physical Object		E61	Time Primitive
E21	Person		E62	String
E22	Human-Made Object		E65	Creation
E24	Physical Human-Made Thing		E66	Formation
E25	Human-Made Feature		E70	Thing
E28	Conceptual Object		E73	Information Object
E29	Design or Procedure		E74	Group
E30	Right		E78	Curated Holding
E33	Linguistic Object		E89	Propositional Object
E36	Visual Item		E90	Symbolic Object
E39	Actor		E94	Space Primitive
E41	Appellation		E99	Product Type

5.4. LRM$_{OO}$ property hierarchy

Range classes from CIDOC CRM are in bold.

Table 7. LRM$_{OO}$ Property Hierarchy

ID		Property Name	Class – Domain	Class – Range
R1		is logical successor of (has successor)	F1 Work	F1 Work
R3		is realised in (realises)	F1 Work	F2 Expression
R4		embodies (is embodied in)	F3 Manifestation	F2 Expression
R5		has component (is component of)	F2 Expression	F2 Expression
R7		exemplifies (is exemplified by)	F5 Item	F3 Manifestation
R8		combines (is combined to form)	F12 Nomen	F12 Nomen
R10		is member of (has member)	F1 Work	**E28 Conceptual Object**
R11		has issuing rule (is issuing rule of) [PRESS$_{OO}$]	F18 Serial Work	**E29 Design or Procedure**
R15		has fragment (is fragment of)	F2 Expression	**E90 Symbolic Object**
R16		created (was created by)	F27 Work Creation	F1 Work
R17		created (was created by)	F28 Expression Creation	F2 Expression
R19		created a realisation of (was realised through)	F28 Expression Creation	F1 Work
R24		created (was created through)	F30 Manifestation Creation	F3 Manifestation
R27		materialized (was materialized by)	F32 Item Production Event	F3 Manifestation
R28		produced (was produced by)	F32 Item Production Event	F5 Item
R29		reproduced object (was object reproduced by)	F33 Reproduction Event	F5 Item
R30		reproduced publication (was publication reproduced by)	F33 Reproduction Event	F3 Manifestation
R33		has string	F12 Nomen	**E62 String**
R35		is specified by (specifies)	F12 Nomen	F2 Expression
R36		uses script conversion (is script conversion used in)	F12 Nomen	F36 Script Conversion

ID		Property Name	Class – Domain	Class – Range
R54		has language (is language of)	F12 Nomen	**E56 Language**
R56		has related form (is related form of)	F12 Nomen	F12 Nomen
R67		has part (forms part of)	F1 Work	F1 Work
R68		is inspired by (is inspiration for)	F1 Work	F1 Work
—	R2	is derivative of (has derivative)	F1 Work	F1 Work
R69		has physical form (is physical form of)	F3 Manifestation	**E55 Type**
R70		has dimension (is dimension of)	F3 Manifestation	**E54 Dimension**
R71		has part (is part of)	F3 Manifestation	F3 Manifestation
R73		takes representative attribute from (bears representative attribute for)	F1 Work	F2 Expression
R74		uses expression of (has expression used in)	F1 Work	F1 Work
R75		incorporates (is incorporated in)	F2 Expression	F2 Expression
R76		is derivative of (has derivative)	F2 Expression	F2 Expression
R77		accompanies or complements (is accompanied or complemented by)	F1 Work	F1 Work
R78		has alternate	F3 Manifestation	F3 Manifestation
R79		has representative expression attribute (is representative expression attribute of)	F1 Work	**E55 Type**
R80		performed (is performed in)	F31 Performance	F1 Work
R81		recorded (is recorded in)	F28 Expression Creation	F31 Performance

5.5. LRM_{oo} property hierarchy, aligned with portions of the CIDOC CRM property hierarchy

The CIDOC CRM 7.1.3 direct superproperty of each of the LRM_{oo} properties is inserted in the immediately preceding line. When a CIDOC CRM property appears a second or subsequent time in the table, its property ID is given in italics. LRM_{oo} properties that are defined as shortcuts do not appear in this table. The table also does not include LRM_{oo} properties that are noted as being outside of CIDOC CRM scope.

Table 8. LRM_{oo} Property Hierarchy aligned with CIDOC CRM

Property ID		Property Name	Class – Domain	Class – Range
P130		shows features of (features are also found on)	**E70 Thing**	**E70 Thing**
—	R1	is logical successor of (has successor)	F1 Work	F1 Work
—	R3	is realised in (realises)	F1 Work	F2 Expression
P165		incorporates (is incorporated in)	**E73 Information Object**	**E90 Symbolic Object**
—	R4	embodies (is embodied in)	F3 Manifestation	F2 Expression
P148		has component (is component of)	**E89 Propositional Object**	**E89 Propositional Object**
—	R5	has component (is component of)	F2 Expression	F2 Expression
P128		carries (is carried by)	**E18 Physical Thing**	**E90 Symbolic Object**
—	R7	exemplifies (is exemplified by)	F5 Item	F3 Manifestation
P148		has component (is component of)	**E89 Propositional Object**	**E89 Propositional Object**
—	R8	combines (is combined to form)	F12 Nomen	F12 Nomen
P106		is composed of (forms part of)	**E90 Symbolic Object**	**E90 Symbolic Object**
—	R15	has fragment (is fragment of)	F2 Expression	**E90 Symbolic Object**
P94		has created (was created by)	**E65 Creation**	**E28 Conceptual Object**
—	R16	created (was created by)	F27 Work Creation	F1 Work
—	R17	created (was created by)	F28 Expression Creation	F2 Expression
P16		used specific object (was used for)	**E7 Activity**	**E70 Thing**
—	R19	created a realisation of (was realised through)	F28 Expression Creation	F1 Work
P94		has created (was created by)	**E65 Creation**	**E28 Conceptual Object**
—	R24	created (was created through)	F30 Manifestation Creation	F3 Manifestation
P16		used specific object (was used for)	**E7 Activity**	**E70 Thing**
—	R27	materialized (was materialized by)	F32 Item Production Event	F3 Manifestation
P108		has produced (was produced by)	**E12 Production**	**E24 Physical Human-Made Thing**
—	R28	produced (was produced by)	F32 Item Production Event	F5 Item
P16		used specific object (was used for)	**E7 Activity**	**E70 Thing**
—	R29	reproduced object (was object reproduced by)	F33 Reproduction Event	F5 Item
—	R30	reproduced publication (was publication reproduced by)	F33 Reproduction Event	F3 Manifestation

Property ID		Property Name	Class – Domain	Class – Range
P3		has note	**E1 CRM Entity**	**E62 String**
—	R33	has string	F12 Nomen	**E62 String**
P67i		is referred to by	**E1 CRM Entity**	**E89 Propositional Object**
—	R35	is specified by (specifies)	F12 Nomen	F2 Expression
P2		has type	**E1 CRM Entity**	**E55 Type**
—	R54	has language (is language of)	F12 Nomen	**E56 Language**
P148		has component (is component of)	**E89 Propositional Object**	**E89 Propositional Object**
—	R67	has part (forms part of)	F1 Work	F1 Work
P130		shows features of (features are also found on)	**E70 Thing**	**E70 Thing**
—	R68	is inspired by (is inspiration for)	F1 Work	F1 Work
— —	R2	is derivative of (has derivative)	F1 Work	F1 Work
P2		has type	**E1 CRM Entity**	**E55 Type**
—	R69	has physical form (is physical form of)	F3 Manifestation	**E55 Type**
P43		has dimension	**E70 Thing**	**E54 Dimension**
—	R70	has dimension (is dimension of)	F3 Manifestation	**E54 Dimension**
P148		has component (is component of)	**E89 Propositional Object**	**E89 Propositional Object**
—	R71	has part (is part of)	F3 Manifestation	F3 Manifestation
P130		shows features of (features are also found on)	**E70 Thing**	**E70 Thing**
—	R74	uses expression of (has expression used in)	F1 Work	F1 Work
P165		incorporates (is incorporated in)	**E73 Information Object**	**E90 Symbolic Object**
—	R75	incorporates (is incorporated in)	F2 Expression	F2 Expression
P130		shows features of (features are also found on)	**E70 Thing**	**E70 Thing**
—	R76	is derivative of (has derivative)	F2 Expression	F2 Expression
P2		has type	**E1 CRM Entity**	**E55 Type**
	R79	has representative expression attribute (is representative expression attribute of)	F1 Work	**E55 Type**
P130		shows features of (features are also found on)	**E70 Thing**	**E70 Thing**
—	R80	performed (is performed in)	F31 Performance	F1 Work

5.6. LRM$_{OO}$ Properties of Properties (.1 Properties)

Properties of properties have an LRM$_{OO}$ property as their domain and the CIDOC CRM class E55 Type as their range. The domain property is presented in full with its own domain and range classes.

Table 9. LRM$_{OO}$ .1 Properties

Property ID	**Property Name**	**Property – Domain**	**Class – Range**
R2.1	has type	F1 Work. R2 **is derivative of (has derivative)**: F1 Work	**E55 Type**
R56.1	has type	F12 Nomen: R56 **has related form (is related form of)**: F12 Nomen	**E55 Type**
R76.1	has type	F2 Expression. R76 **is derivative of (has derivative)**: F2 Expression	**E55 Type**

5.7. List of CIDOC CRM properties used in LRM$_{OO}$

The list in this section identifies the properties in CIDOC CRM version 7.1.3 referred to by LRM$_{OO}$. Relevant uses include: appearance in the mapping from IFLA LRM in section 8 or as an element of a path in a mapping statement, reference as immediate superproperty of properties defined in the model, or in a path appearing in a property declaration.

Table 10. CIDOC CRM Properties used in LRM$_{OO}$

ID		Property Name	Class – Domain	Class – Range
P2		has type (is type of)	**E1 CRM Entity**	**E55 Type**
P3		has note	**E1 CRM Entity**	**E62 String**
P9		consists of (forms part of)	**E4 Period**	**E4 Period**
P14		carried out by (performed)	**E7 Activity**	**E39 Actor**
P15		was influenced by (influenced)	**E7 Activity**	**E1 CRM Entity**
P16		used specific object (was used for)	**E7 Activity**	**E70 Thing**
P19		was intended use of (was made for)	**E7 Activity**	**E71 Human-Made Thing**
P31		has modified (was modified by)	**E11 Modification**	**E18 Physical Thing**
P33		used specific technique (was used by)	**E7 Activity**	**E29 Design or Procedure**
P43		has dimension (is dimension of)	**E70 Thing**	**E54 Dimension**
P46		is composed of (forms part of)	**E18 Physical Thing**	**E18 Physical Thing**
P49		has former or current keeper (is former or current keeper of)	**E18 Physical Thing**	**E39 Actor**
P50		has current keeper (is current keeper of)	**E18 Physical Thing**	**E39 Actor**
P51		has former or current owner (is former or current owner of)	**E18 Physical Thing**	**E39 Actor**
P54		has current permanent location (is current permanent location of)	**E19 Physical Object**	**E53 Place**
P55		has current location (currently holds)	**E19 Physical Object**	**E53 Place**
P67		refers to (is referred to by)	**E89 Propositional Object**	**E1 CRM Entity**
P72		has language (is language of)	**E33 Linguistic Object**	**E56 Language**
P75		possessed (is possessed by)	**E39 Actor**	**E30 Right**
P76		has contact point (provides access to)	**E39 Actor**	**E41 Appellation**
P82		at some time within	**E52 Time-span**	**E61 Time Primitive**

ID		Property Name	Class – Domain	Class – Range
P86		falls within (contains)	**E52 Time-span**	**E52 Time-span**
P89		falls within (contains)	**E53 Place**	**E53 Place**
P90		has value	**E54 Dimension**	**E60 Number**
P91		has unit (is unit of)	**E54 Dimension**	**E58 Measurement Unit**
P94		has created (was created by)	**E65 Creation**	**E28 Conceptual Object**
P103		was intended for (was intention of)	**E71 Human-Made Thing**	**E55 Type**
P104		is subject to (applies to)	**E72 Legal Object**	**E30 Right**
P106		is composed of (forms part of)	**E90 Symbolic Object**	**E90 Symbolic Object**
P107		has current or former member (is current or former member of)	**E74 Group**	**E39 Actor**
P108		has produced (was produced by)	**E12 Production**	**E24 Physical Human-Made Thing**
P109		has current or former curator (is current or former curator of)	**E78 Curated Holding**	**E39 Actor**
P125		used object of type (was type of object used in)	**E7 Activity**	**E55 Type**
P128		carries (is carried by)	**E18 Physical Thing**	**E90 Symbolic Object**
P129		is about (is subject of)	**E89 Propositional Object**	**E1 CRM Entity**
P130		shows features of (features are also found on)	**E70 Thing**	**E70 Thing**
P140		assigned attribute to (was attributed by)	**E13 Attribute Assignment**	**E1 CRM Entity**
P141		assigned (was assigned by)	**E13 Attribute Assignment**	**E1 CRM Entity**
P148		has component (is component of)	**E89 Propositional Object**	**E89 Propositional Object**
P151		was formed from (participated in)	**E66 Formation**	**E74 Group**
P165		incorporates (is incorporated in)	**E73 Information Object**	**E90 Symbolic Object**
P168		place is defined by (defines place)	**E53 Place**	**E94 Space Primitive**
P170		defines time (time is defined by)	**E61 Time Primitive**	**E52 Time-span**
P186		produced things of product type (is produced by)	**E12 Production**	**E99 Product Type**
P190		has symbolic content (is symbolic content of)	**E90 Symbolic Object**	**E62 String**

6. LRM$_{OO}$ Class Declarations

The classes of LRM$_{OO}$ are comprehensively declared in this section using the following format:

- Class labels are presented as headings in bold face, preceded by the class' unique identifier.
- The line "Subclass of:" declares the superclass of the class, being the class from which this class inherits properties.
- The line "Superclass of:" is a cross-reference to the subclasses of this class.
- The label "Scope note:" precedes the textual definition of the concept the class represents.
- The label "Examples:" precedes a list of examples of instances of this class. If the example is also an instance of a subclass of this class, the unique identifier of the subclass is added in parenthesis. If the example instantiates two classes, the unique identifiers of both classes are added in parenthesis. Examples may be followed by an explanation in brackets.
- The label "In First Order Logic:" precedes the formal logical presentation of the class' superclasses.
- The label "Properties:" declares the list of the class's properties (that is, the properties of which the class is the domain).
- Each property is represented by its unique identifier, its forward and reverse labels, and the range class that it links to, separated by a colon.
- Inherited properties are not represented.
- Properties of properties (.1 properties) are provided indented and in parentheses beneath their respective domain property.

F1 Work

Subclass of: E89 Propositional Object

Superclass of: F18 Serial Work [PRESS$_{OO}$ class]

Scope note: This class comprises distinct intellectual ideas conveyed in artistic and intellectual creations, such a poems, stories or musical compositions.

A Work is the outcome of an intellectual process of one or more persons. Inherent to the notion of work is the existence of recognisable realizations of the work in the form of one or more expressions. Works are often regarded as finished and discrete e.g. when declared as such by the creator of the work or based on the elaboration or logical coherence of its content. However, works may be recognized as existing but unfinished e.g. if the creators deliberately or accidentally never explicitly finished a particular Expression but have left behind partial expressions.

In the absence of explicit information about the initial conception, which is rarely available, the first expression created constitutes witness of the beginning of existence of a Work.

A Work can evolve over time, such as through revised editions. A Work may be elaborated by one or more Actors simultaneously, in parallel, or over time. Additional expressions of a Work can continue to be created over time.

The boundaries of a Work have nothing to do with the value of the intellectual achievement but only with the dominance of a concept.

The main purpose of this class is to enable bringing together intellectually equivalent Expressions in order to display to a user all available alternatives of the same intellectual or artistic content.

Examples:

- Agatha Christie's 'Murder on the Orient Express' [novel]
- Mary Shelley's 'Frankenstein, or, The Modern Prometheus' [novel]
- Ursula K. Le Guin's 'The Earthsea trilogy' [set of novels]
- Ursula K. Le Guin's 'The Tombs of Atuan' [novel which is part of 'The Earthsea trilogy']
- Homer's 'Odyssey' [ancient Greek epic poem]
- Dante's 'Divina Commedia' [narrative poem]
- William Shakespeare's 'The Tragedy of Hamlet, Prince of Denmark' [play]
- Henry Gray's 'Anatomy of the human body' [scholarly work / reference work]
- René Goscinny and Albert Uderzo's 'Astérix le Gaulois' [cartoon]
- the 'Dewey Decimal Classification' (DDC) [library classification system]
- the Ordnance Survey's 1:50 000 'Landranger series' [collection of maps]
- Ludwig van Beethoven's 'Symphony No. 9 in D minor' [symphony]
- Johann Sebastian Bach's 'Goldberg Variations' [compositions for keyboard]
- Daniel Humair and Damien Varaillon's 'Hommage à John Coltrane' [musical improvisation]
- John Lennon and Paul McCartney's 'I want to hold your hand' [song]
- François Truffault's 'Jules et Jim' [movie]
- Alfred Hitchcock's 'Psycho' [movie]
- Auguste Rodin's 'Le penseur' ('The thinker') [art]
- Pablo Picasso's 'Guernica' [art]
- Katsushika Hokusai's '神奈川沖浪裏' ('The Great Wave') [art]

In First Order Logic:

F1(x) ⇒E89(x)

Properties: R1 is logical successor of (has successor): F1 Work

R2 is derivative of (has derivative): F1 Work

(R2.1 has type: E55 Type)

R3 is realised in (realises): F2 Expression

R10 is member of (has member): E28 Conceptual Object

R67 has part (forms part of): F1 Work

R68 is inspired by (is inspiration for): F1 Work

R73 takes representative attribute from (bears representative attribute for): F2 Expression

R74 uses expression of (has expression used in): F1 Work

R77 accompanies or complements (is accompanied or complemented by): F1 Work

R79 has representative expression attribute (is representative expression attribute of): E55 Type

F2 Expression

Subclass of: E73 Information Object

Scope note: This class comprises the intellectual or artistic realisations of Works in the form of identifiable immaterial objects, such as texts, poems, jokes, musical or choreographic notations, movement pattern, sound pattern, images, multimedia objects, or any combination of such forms. The substance of F2 Expression is signs.

An Expression is the outcome of the intellectual or creative process of realizing a Work. Subsequent expressions conveying the same work may be created over time.

Expressions do not depend on a specific physical carrier and can exist on one or more carriers simultaneously. As far as bibliographic practice is concerned, only instances of F2 Expression that are externalised on physical carriers other than both the creator's brain and an auditor's brain are taken into account.

The form of F2 Expression is an inherent characteristic of the F2 Expression. Differences in form imply different Expressions (e.g., from text to spoken word, a transcript of a recording). Similarly, differences in language or means of performance imply different Expressions (e.g., translations or arrangements for different instruments). Thus, if a text is revised or modified, the result is considered to be a new F2 Expression. While theoretically any change in signs will result in a new Expression, conventionally the context and use will determine the rules for distinguishing among expressions.

An instance of F2 Expression which includes spoken or written text may be multiply instantiated as an instance of E33 Linguistic Object. This allows for the association of the E56 Language of the text with the instance of F2 Expression by using the property *P72 has language (is language of)*.

Examples:

- the original text (in English) by Agatha Christie for her novel 'Murder on the Orient Express'
- the German text of 'Murder on the Orient Express' (as translated by Elisabeth van Bebber and published with the title 'Mord im Orientexpress')
- the text of the abridged English version of 'Murder on the Orient Express' (as published by HarperCollins)
- the narrated English text of 'Murder on the Orient Express' by David Suchet
- the English text of Homer's 'Odyssey' translated by Robert Fagles
- the English text of Homer's 'Odyssey' translated by Richmond Lattimore
- 'Dewey Decimal Classification', 23rd edition (DDC23) [English edition]
- 'Classification décimale de Dewey', 23e édition [French translation of DDC23]
- the performance of Bach's 'Goldberg Variations' by Angela Hewitt at St. Thomas Church (Leipzig Germany) in November 2020
- the performance of Bach's 'Goldberg Variations' by Angela Hewitt in Christuskirche (Berlin) on 14-17 December 2015
- the musical score for Bach's 'Goldberg Variations' (as published by Balthasar Schmid in 1741)
- Beethoven's original score for Symphony No. 9 (as expressed by Beethoven's original hand-written manuscript held by the Berlin State Library)
- the score for Beethoven's Symphony No. 9 that was edited by Jonathan Del Mar and published by Bärenreiter in 1997

- the original cut of Hitchcock's movie 'Psycho'
- the censored version of Hitchcock's movie 'Psycho' that was released in Britain (with stabbing sounds and visible nude shots removed)
- the first plaster version of 'The Thinker' sculpture made by Auguste Rodin around 1881
- large scale version of Auguste Rodin's 'The Thinker' created at the Fonderie Alexis Rudier in 1904

In First Order Logic:

F2(x) ⇒E73(x)

Properties: R5 has component (is component of): F2 Expression

R15 has fragment (is fragment of): E90 Symbolic Object

R75 incorporates (is incorporated in): F2 Expression

R76 is derivative of (has derivative): F2 Expression
(R76.1 has type: E55 Type)

F3 Manifestation

Subclass of: E73 Information Object

Scope note: This class comprises products rendering one or more Expressions. A Manifestation is defined by both the overall content and the form of its presentation. The substance of F3 Manifestation is not only signs, but also the manner in which they are presented to be consumed by users, including the kind of media adopted.

An F3 Manifestation is the outcome of a publication process where one or more F2 Expressions are prepared for public dissemination, but it may also be a unique form created directly on some material carrier without the intent of being formally published.

An instance of F3 Manifestation typically incorporates one or more instances of F2 Expression representing a distinct logical content and all additional input by a publisher such as text layout and cover design. Additionally an F3 Manifestation can be identified by the physical features for the medium of distribution, if applicable. For example, publications in the form of hard-cover and paperback editions would be two distinct instances of F3 Manifestation, even though authorial and editorial content are otherwise identical in both publications.

In the case of industrial products such as printed books or music CDs, but also digital material, an instance of F3 Manifestation can be regarded as the prototype for all copies of it. In these cases, an instance of F3 Manifestation specifies all of the features or traits that instances of F5 Item display in order to be copies of a particular publication. In the case of industrial products, instances of F3 Manifestation are also instances of E99 Product Type, normally nowadays identified by characteristic identifiers such as ISBN numbers.

Examples:

- the publication 'Murder on the Orient Express / Agatha Christie', published by Collins Crime Club in 1934
- the publication of 'Murder on the Orient Express / Agatha Christie', published by HarperCollins in 2017
- the publication 'Mord im Orientexpress : ein Hercule-Poirot-Roman / Agatha Christie', published by Deutscher Bücherbund in 1975
- the publication 'Murder on The Orient Express / Agatha Christie', narrated by David Suchet, audio book (audio CD) published by HarperCollins in 2005
- the HTML-version of Homer's 'Odyssey' with English text by S. H. Butcher and A. Lang, available online from the Gutenberg Project
- the publication 'The Illustrated Odyssey', published by Sidgwick & Jackson Ltd in 1980, containing the translated text by E.V. Rieu, an introduction by Jacquetta Hawkes and photographs by Tim Mercer
- the publication 'The Odyssey of Homer' published by Harper & Row in 1967, containing an introduction and the English translation of the Greek poem by Richmond Lattimore
- the CD publication 'Bach Goldberg Variations', published by Hyperion Records in 2016, containing a CD with Angela Hewitt's performances of Bach's 'Goldberg Variations' recorded

in Christuskirche (Berlin) on 14-17 December 2015 and a booklet with an introduction to the music by Angela Hewitt in English, French and German

- the manuscript known as 'The Book of Kells'
- the publication containing a text entitled 'Pop Culture' (authored by a person named 'Richard Memeteau'), issued in 2014 by the publisher named 'Zones' and distributed in EPUB2 format by a distributor named 'Editis' and identified by ISBN '978-2-35522-085-2'
- the publication entitled 'Alfred Hitchcock's Psycho: 60th Anniversary Edition', containing one Blu-ray disc with two cuts of the movie, released in 2020

In First Order Logic:

F3(x) ⇒E73(x)

Properties: R4 embodies (is embodied in): F2 Expression

R69 has physical form (is physical form of): E55 Type

R70 has dimension (is dimension of): E54 Dimension

R71 has part (is part of): F3 Manifestation

R78 has alternate: F3 Manifestation

F5 Item

Subclass of: E24 Physical Human-Made Thing

Scope note: This class comprises physical objects (printed books, scores, CDs, DVDs, CD-ROMS, etc.) that were produced by (P186i) an industrial process involving a given instance of F3 Manifestation. As a result, all the instances of F5 Item associated with a given instance of F3 Manifestation are expected to carry the content defined in that instance of F3 Manifestation, although some or even all of them may happen to carry a content that significantly differs from it, due to either an accident in the course of industrial production, or subsequent physical modification or degradation.

An instance of F5 Item that consists of a physical object or set of objects with clear physical boundaries is also an instance of E22 Human-Made Object. An instance of F5 Item that is stored on a part of a larger physical support (such as an electronic file among others on a disc) can also be considered to be an instance of E25 Human-Made Feature.

The notion of F5 Item is only relevant with regard to the production process, from a bibliographic point of view. The physical units managed by cultural heritage institutions in their holdings are a distinct notion: a unit of holdings certainly can be equal to an instance of F5 Item, but it also can be either "bigger" than one (e.g., when two instances of F5 Item are bound together (in the case of printed books)), or "smaller" than one (e.g., for incomplete holdings, such as when only one CD from a two-CD set is held). From an operational point of view, cultural heritage institutions typically do *not* manage instances of F5 Item, but physical holdings units, instances of E19 Physical Object, although for libraries in most cases this is not significant because each item corresponds with a single unit. When this is not the case, the linkage between items and the units relevant for collection management can be recorded through the *P46 is composed of (forms part of)* property between instances of F5 Item and instances of E19 Physical Object. If needed, an instance of E19 Physical Object can be typed as a unit through the *P2 has type (is type of)* property.

Examples:

- the copy of 'Murder on the Orient Express / Agatha Christie', HarperCollins 2017, that is held by the Deichman public library in Oslo, Norway, and which is identified by inventory number '9138513'
- John Smith's copy of 'Murder on the Orient Express / Agatha Christie', HarperCollins 2017, with the owner's ex libris stamped on the inside of the cover page
- the copy of the first edition of Bach's 'Goldberg Variations' held by the National Library in France with corrections made by the composer, and additional music in the form of fourteen canons on the Goldberg ground
- the manuscript known as the 'Book of Kells' (owned by Trinity College in Dublin)
- the bronze statue of Auguste Rodin's 'The Thinker', cast at the Fonderie Alexis Rudier in 1904 held at the Musée Rodin in Paris, France since 1922

- the ebook ‘Pop Culture’ by Richard Memeteau in EPUB2 format, received by the National Library of France through digital legal deposit on 1st February 2016 to which the legal deposit number DLN-20160201-6 has been assigned. In the catalogue, this item is identified with a unique number: LNUM20553886
- the copy of the electronic file named ‘cidoc_crm_version_7.1.3.pdf’ on my hard drive containing the text of official version 7.1.3 of the ‘Definition of the CIDOC Conceptual Reference Model’

In First Order Logic:
F5(x) ⇒E24(x)

Properties: R7 exemplifies (is exemplified by): F3 Manifestation

F11 Corporate Body

Subclass of: F55 Collective Agent

Scope note: This class comprises organisations and groups of two or more people and/or organisations acting as a unit.

To be considered an instance of F11 Corporate Body a gathering of people needs to bear a name and exhibit organisational characteristics sufficient to allow the body as a whole to participate in the creation, modification or production of an E73 Information Object. Groups such as conferences, congresses, expeditions, exhibitions, festivals, fairs, etc. are modelled as F11 Corporate Bodies when they are named and can take collective action, such as approving a report or publishing their proceedings.

Examples:

- The International Machaut Society
- The British Library
- The Jackson Five [pop band]
- Municipalité régionale de comté de Portneuf [regional municipality in Quebec]
- Symposium on Glaucoma

In First Order Logic:
F11(x) ⇒F55(x)

F12 Nomen

Subclass of: E89 Propositional Object

Scope note: This class comprises associations between an instance of any class, and signs or arrangements of signs that are used to refer to and identify that instance.

Signs include alphanumeric characters, ideograms, notations such as chemical structure symbols, sound symbols, etc. The scripts or type sets for the symbols used to compose an instance of F12 Nomen have to be sufficiently specified. Spelling variants are regarded as different nomens, whereas the use of different fonts (visual representation variants) or different digital encodings do not change the identity.

An arbitrary combination of signs or symbols cannot be regarded as an appellation or designation until it is associated with something in some context. In that sense, the F12 Nomen class can be understood as the reification of a relationship between an instance of E1 CRM Entity and an instance of E41 Appellation. Two instances of F12 Nomen can happen to be associated with equivalent strings and yet remain distinct, as long as they refer to distinct instances of E1 CRM Entity. Furthermore, two instances of F12 Nomen referring to the same instance of E1 CRM Entity may be associated with equivalent strings, and remain distinct as long as they are associated with distinct properties of the F12 Nomen class (for example, having the same spelling in different languages, or being defined in different controlled vocabularies).

An instance of F12 Nomen associates a combination of signs with an instance of E1 CRM Entity on the basis of a cultural or linguistic convention: by associating a string with anything, the instance of F12 Nomen establishes a meaning that is not inherent in the instance of E62 String

that is associated with it. Depending on context of use, nomens associated with equivalent strings can be associated with instances of different things in the real world even within the same language (polysemy and homonymy). Conversely, the same thing can be referred to through any number of nomens (synonymy). In the controlled environment of a bibliographic information system, though, homonymy is avoided.

Instances of F12 Nomen are assigned and associated with instances of E1 CRM Entity either formally (such as by bibliographic agencies) or informally through common usage. When they are assigned formally, the construction of the instances of E62 String that represent them may follow predetermined rules.

Examples:

- '杜甫' as the name for a Chinese poet of the 8th century, rendered in simplified Chinese characters
- 'Du Fu' as the name for a Chinese poet of the 8th century, rendered in Pinyin romanised form
- 'Tu Fu' as the name for a Chinese poet of the 8th century, rendered in another romanised form
- 'Thơ Đô Phủ' as the name for a Chinese poet of the 8th century, rendered in a Vietnamese form
- 'جامعة صفاقس' as the name for Sfax University (Tunisia), rendered in Arabic in Arabic script
- 'Ğāmi'aẗ Ṣafāqis' as the name for Sfax University (Tunisia), rendered in transliterated Arabic
- 'Université de Sfax' as the name for Sfax University (Tunisia), rendered in French
- '3-[(2S)-1-methylpyrrolidin-2-yl]pyridine' as the term for nicotine, rendered in the IUPAC nomenclature of organic chemistry
- 'Murders in the rue Morgue' as the title of the textual work by Edgar Allan Poe, in English
- 'Poe, Edgar Allan, 1809-1849. Murders in the rue Morgue' as the name of the textual work, formulated as a controlled author/title access point appropriate for an English language catalogue
- 'modelling' as the term for the activity, in English using British spelling
- 'modeling' as the term for the activity, in English using American spelling
- 'Maxwell equations' as the term for these equations, formulated as the preferred subject access point from LCSH, http://lccn.loc.gov/sh85082387, as of 27 March 2012 [date of last update]
- 'Equations, Maxwell' as the term for these equations, formulated as a variant subject access point, from the same source
- 'Gontcharova, Nathalie (1881-1962)' as the name of the Russian artist, formulated as an preferred access point from the authority file of the National Library of France, http://catalogue.bnf.fr/ark:/12148/cb119547494/PUBLIC, as of 11 March 2015 [date of last update]
- 'Gončarova, Natal′â Sergeevna (1881-1962)' as the name of the Russian artist, formulated as a variant access point for a personal name, transliterated using ISO 9:1995 'Information and documentation — Transliteration of Cyrillic characters into Latin characters — Slavic and non-Slavic languages', also from the authority file of the National Library of France
- 'Гончарова, Наталья Сергеевна (1881-1962)' as the name of the Russian artist, formulated as a variant access point in Cyrillic script, also from the authority file of the National Library of France
- '595.7' as a classification number for insects (the taxonomic class Insecta), in the 23rd edition of the Dewey Decimal Classification
- 'Insecta' as a term for insects (the taxonomic class Insecta), used as the caption for the class '595.7' in the English language 23rd edition of the Dewey Decimal Classification
- 'spa' as a code to designate the language Spanish, drawn from set 2 (3-letter language identifiers) of 'ISO 639 – Code for individual languages and language groups' (ISO 639:2023)

In First Order Logic:

F12(x) ⇒E89(x)

Properties: R8 combines (is combined to form): F12 Nomen

R33 has string: E62 String

R35 is specified by (specifies): F2 Expression

R36 uses script conversion (is script conversion used in): F36 Script Conversion

R54 has language (is language of): E56 Language

R56 has related form (is related form of): F12 Nomen

(R56.1 has type: E55 Type)

F18 Serial Work *[PRESS$_{OO}$]*

[Editor's note: Transfer this class, along with its property R11, to PRESS$_{OO}$ once version 2.0 has a stable draft. It will link up to LRM$_{OO}$ via the superclass F1 Work. Implement this class only in conjunction with an implementation of PRESS$_{OO}$.]

Subclass of: F1 Work

Scope note: This class comprises works that are, or have been, planned to result in sequences of Expressions or Manifestations with common features. Whereas a work can acquire new members during the time it evolves, Expressions and Manifestations are identified with a certain state achieved at a particular point in time. Therefore there is in general no single Expression or Manifestation representing a complete serial work, unless the serial work has ended.

Serial Works may or may not have a plan for an overall expression.
The retrospective reprinting of all issues of a Serial Work at once, in the form of a monograph, is regarded to be another member of the F1 Work, which contains the Serial Work and the Work realised in the monograph. This does not make the monograph part of the Serial Work.

Examples:

- the periodical entitled 'The UNESCO Courier', ISSN '0041-5278'
- the periodical entitled 'Courrier de l'UNESCO', ISSN '0304-3118' [French edition of the periodical titled 'The UNESCO Courier', ISSN '0041-5278']
- the series entitled 'L'évolution de l'humanité', ISSN '0755-1843' [a monograph series comprising volumes that were published from 1920 on, and some of which were reprinted, with different physical features and rearranged in a different order, from 1968 on, in a distinct series also entitled 'L'évolution de l'humanité', ISSN '0755-1770']

In First Order Logic:

F18(x) ⇒F1(x)

Properties**:** R11 has issuing rule (is issuing rule of): E29 Design or Procedure

F27 Work Creation

Subclass of: E65 Creation

Scope note: This class comprises activities by which instances of F1 Work come into existence. An instance of F27 Work Creation can serve to document the period a work was coming into existence and the circumstances of it, when these are known.

An instance of F27 Work Creation marks the initial creation of an instance of F1 Work through expressions or other externalisations that are sufficiently elaborated so that the characteristic conceptual identity of the work could be recognized as existing.

In many cases this will coincide with the first known complete externalisation of an expression of the work. In other cases, the initial creation of an instance of F1 Work may be inferred from multiple, or later, expressions or other forms of evidence. For instance, commissioning of a work may explicitly be agreed on after the presentation of an already complete and detailed elaboration of the work that was not made public. Performances may be prior to written expressions, as in the case of Shakespeare's works.

The work, as an intellectual construction, may evolve from its initial creation onwards, until the last known expression of it.

An instance of E39 Actor with which a work is associated through the chain of properties F1 Work. *R16i was created by:* F27 Work Creation. *P14 carried out by (performed):* E39 Actor corresponds to the notion of the "creator" of the work.

In the situation where an expression of one instance of F1 Work serves as source material for the creation of the first expression of a new instance of F1 Work, the direct relationship between the

works is indicated using the property *R2 is derivative of (has derivative)* between the two instances of F1 Work. The link to the specific source expression is indicated with the property *P16 used specific object (was used for)* using the path: F1 Work(1). *R3 is realised in:* F2 Expression(1). *P16i was used for:* F27 Work Creation. *R16 created*: F1 Work(2).

Examples:

- Agatha Christie creating 'Murder on the Orient Express'
- Mary Shelley creating 'Frankenstein, or, The Modern Prometheus'
- Dante creating the poem 'Divina Commedia'
- William Shakespeare creating 'The Tragedy of Hamlet, Prince of Denmark'
- René Goscinny and Albert Uderzo (collaboratively) creating 'Astérix le Gaulois'
- Ludwig van Beethoven composing his Symphony No. 9
- Johann Sebastian Bach composing the 'Goldberg Variations'
- the making of 'Jules et Jim', directed by François Truffault
- the making of 'Psycho', directed by Alfred Hitchcock
- Auguste Rodin creating 'Le Penseur' ('The Thinker')
- Picasso creating 'Guernica'
- Pascal Bonnefois and Marie-Louise Ollier creating 'Yvain ou Le chevalier au lion : concordance lemmatisée' [a concordance for the novel 'Le chevalier au lion' by Chrétien de Troyes, based on the 1960 edition by Mario Roques]

In First Order Logic:

F27(x) ⇒E65(x)

Properties**:** R16 created (was created by): F1 Work

F28 Expression Creation

Subclass of: E12 Production
E65 Creation

Scope note: This class comprises activities that result in instances of F2 Expression coming into existence. An instance of F2 Expression is considered to be created when it is captured on a carrier other than the creator's brain.

Although F2 Expression is an abstract entity, a conceptual object, the creation of an expression inevitably also affects the physical world: when you scribble the first draft of a poem on a sheet of paper, you produce an instance of F3 Manifestation and an instance of F5 Item. F28 Expression Creation is a subclass of E12 Production because the recording of the expression causes a physical modification of the E18 Physical Thing that serves as the carrier. The creation of an instance of F2 Expression coincides with the creation of the first instance of F3 Manifestation that *R4 embodies (is embodied in)* this instance of F2 Expression.

The *P2 has type (is type of)* property can be used to specify the type of the instance of F28 Expression Creation (i.e., activities such as translating, revising, or arranging music are types of creation process). The type of the process is distinct from the type of result even though the typology frequently used for instances of the resulting F2 Expressions may imply the category of the instance of the F28 Expression Creation.

An instance of F28 Expression Creation may use as source material one or more specific instances of F2 Expression. When the source expression is documented this is also expressed by the property *R76 is derivative of (has derivative)*.

Examples:

- Agatha Christie writing the original manuscript for 'Murder on the Orient Express'
- Elisabeth van Bebber creating the German translation of 'Murder on the Orient Express'
- Angela Hewitt performing the 'Goldberg Variations' at St. Thomas Church (Leipzig Germany) in November 2020
- Angela Hewitt performing the 'Goldberg Variations' in Christuskirche (Berlin) on 14-17 December 2015 (for a CD production)
- Beethoven scripting the original score for the 9th symphony

- Jonathan Del Mar editing and creating the score for Beethoven's 9th symphony (as published by Bärenreiter in 1997)
- the making of the original cut of Hitchcock's movie 'Psycho'
- the making of the censored version of Hitchcock's movie 'Psycho' that was released in Britain
- Auguste Rodin making the first plaster version of 'The Thinker' sculpture
- the making of the large-scale version of 'The Thinker' by the 'Fonderie Alexis Rudier in 1904

In First Order Logic:

F28(x) ⇒E12(x)
F28(x) ⇒E65(x)

Properties: R17 created (was created by): F2 Expression
R19 created a realisation of (was realised through): F1 Work
R81 recorded (is recorded in): F31 Performance

F30 Manifestation Creation

Subclass of: E12 Production
E65 Creation

Superclass of: F33 Reproduction Event

Scope note: This class comprises the activities of selecting, arranging and presenting one or more instances of F2 Expression on a carrier or other persistent presentation means with the purpose of communicating it to some public. It includes the specification of the presentation as to sensory impression (such as visual appearance or audio rendition).

Examples:

- the process of creating the publication 'Murder on the Orient Express / Agatha Christie', published by HarperCollins in 2017, including deciding the format, typesetting the text, designing the cover and other features of the publication
- the process of making the HTML-version of the English text of Homer's 'Odyssey' (translated by S. H. Butcher and A. Lang), which is available online from the Gutenberg Project
- the process of making the engraved copper plates for the first edition of Bach's 'Goldberg Variations' by Balthasar Schmid
- the process of making the CD publication 'Bach Goldberg Variations', published by Hyperion Records in 2016, including the process of recording the performance, editing, and typesetting the booklet, and design of the overall publication

In First Order Logic:

F30(x) ⇒E12(x)
F30(x) ⇒E65(x)

Properties: R24 created (was created through): F3 Manifestation

F31 Performance

Subclass of: E7 Activity

Scope note: This class comprises activities where an instance of F1 Work is presented or communicated directly or indirectly to an audience, such as a theatrical play, a musical work or a choreographic work.

Performances can be identified at various levels of granularity, but an instance of F31 Performance is always associated with a single identified instance of F1 Work. An instance of F31 Performance may consist of other instances of F31 Performance as parts, such as a piano concerto that has multiple movements. In addition, a complete run of equivalent performances of the same work can also be seen as an instance of F31 Performance, with the individual performances as parts.

Activities that include performing multiple individual works, e.g., that are put together as a program for a show or concert, but where the activity as a whole is not associated with an

instance of F1 Work, should be represented as instances of E7 Activity consisting of individual instances of F31 Performances as parts (the property *P9 consists of (forms part of)* expresses the relationship).

Instances of F31 Performance may be created according to specific staging directions, be based on specific known instances of F2 Expression (such as translations), or be influenced by or include elements that relate to different works other than the single work the performance is dominated by. This can be documented using the properties *P16 used specific object (was used for)* or *P15 was influenced by (influenced)*.

Examples:

- the performance of a Yiddish translation of the textual work entitled 'King Lear', as directed by Sergei Radlov, in Moscow, at the Moscow State Jewish Theatre, on February 10, 1935
- the performance of the ballet entitled 'Rite of spring', as choreographed by Pina Bausch, in Avignon, at the Popes' Palace, on July 7, 1995
- the performance of the operatic work entitled 'Dido and Aeneas', as directed by Edward Gordon Craig and conducted by Martin Shaw, in London, Hampstead Conservatoire, on May 17, 18, and 19, 1900
- the performance of Verdi's 'La Traviata' at the Salzburg Festival in 2005, that was staged by Willy Decker, directed by Brian Large and featuring Anna Netrebko and Rolando Villazón
- the performance of Michel Fokine's choreography and libretto (choreographic work) for Stravinsky's 'The Firebird' by the Mariinsky Orchestra and Ballet at the Mariinsky Theatre in Saint Petersburg, June 2008
- the performance of Daniel Humair and Damien Varaillon's improvisation 'Hommage à John Coltrane' in the Bal Blomet (Paris), on 18 January 2018

In First Order Logic:

F31(x) ⇒E7(x)

Properties: R80 performed (is performed in): F1 Work

F32 Item Production Event

Subclass of: E12 Production

Scope note: This class comprises activities that result in one or more instances of F5 Item coming into existence. The production of a series of physical objects (printed books, scores, CDs, DVDs, CD-ROMs, etc.), producing a unique item (writing a manuscript on parchment, painting a watercolour, etc.), and the creation of a new copy of a file on an electronic carrier are all regarded as instances of F32 Item Production Event.

For mass-produced items, the production process (no matter whether it is a book, a sound recording, a DVD, a cartographic resource, etc.) strives to produce items all as similar as possible to a prototype that displays all the features that all the copies of the publication should also display, which is reflected in the property *R27 materialized:* F3 Manifestation.

Examples:

- the printing and binding of copies of the paperback edition of the HarperCollins 2017 publication 'Murder on the Orient Express / Agatha Christie', by CPI Ltd (UK)
- the printing of copies of the score of Bach's 'Goldberg Variations' by Balthasar Schmid in 1741
- the casting of Auguste Rodin's 'The Thinker' at the Fonderie Alexis Rudier in 1904
- the production of the items of the CD publication 'Bach Goldberg Variations', published by Hyperion Records in 2016, including the pressing of the CDs, the printing of the booklet and cover, assembling the parts, etc.

In First Order Logic:

F32(x) ⇒E12(x)

Properties: R27 materialized (was materialized by): F3 Manifestation

R28 produced (was produced by): F5 Item

F33 Reproduction Event

Subclass of: E12 Production
F30 Manifestation Creation

Scope note: This class comprises activities that consist in producing items of a new instance of F3 Manifestation that preserve both the content and layout found on items of a pre-existing instance of F3 Manifestation. The individual instance or instances of F5 Item that was or were used as a source for this process may be precisely identified or not. Such activities result in products known as facsimiles, reproductions, reprints, reissues, or new releases.

Examples:

- the 2014 publication of Daniel Wilson's 'Caliban: the missing link' by Cambridge University Press [a facsimile edition of the 1873 publication by Macmillan]
- the 2015 publication of Harry Partch's 'Two studies on ancient Greek scales' by Schott [which reproduces Harry Partch's holograph manuscript]
- the 2007 publication of Hubert Reeve's 'Malicorne: réflexions d'un observateur de la nature' published by Éditions du Seuil as number 179 in the series 'Points. Science' (ISBN '978-2-02-096760-0') [a reprint edition of the 1990 publication by Éditions du Seuil in the series 'Science ouverte' (ISBN '2-02-012644-3')]

In First Order Logic:

F33(x) ⇒E12(x)
F33(x) ⇒F30(x)

Properties: R29 reproduced object (was object reproduced by): F5 Item
R30 reproduced publication (was publication reproduced by): F3 Manifestation

F36 Script Conversion

Subclass of: E29 Design or Procedure

Scope note: This class comprises rule sets for converting signs or arrangements of signs from one script or type set to another.

Examples:

- the rules for the transliteration of the Cyrillic script into Latin script codified in ISO 9:1995 'Information and documentation — Transliteration of Cyrillic characters into Latin characters — Slavic and non-Slavic languages' (ISO 9:1995)

In First Order Logic:

F36(x) ⇒E29(x)

F39 Family

Subclass of: F55 Collective Agent

Scope note: This class comprises groups of two or more persons presented as a family and justified by relationships of birth, marriage, adoption, civil union, or similar social or legal status and an assumed common tradition, including examples such as royal families, dynasties, houses of nobility, etc.

Examples:

- House of Tudor
- the brothers Grimm

In First Order Logic:

F39(x) ⇒F55(x)

F55 Collective Agent

Subclass of: E74 Group

Superclass of: F11 Corporate Body
F39 Family

Scope note: This class comprises recognizable groups or organizations of persons that have the potential of acting as a unit to produce some intentional result of bibliographic interest for which they can be collectively considered responsible.

A group of people becomes an instance of F55 Collective Agent when it identifies itself by a name that identifies it within an appropriate context and exhibits sufficient organizational characteristics to permit it to perform actions that reflect agency. Groups that are constituted as meetings, conferences, congresses, expeditions, festivals, fairs, etc. are examples of F55 Collective Agent as long as they self-identify by a specific name, rather than being referred to by a generic description of the gathering, and can act as a unit (such as by publishing their proceedings, or approving a report). These collective actions may be performed by representatives selected by the whole, rather than by all individual members acting together.

Collective Agents may be members of other Collective Agents, although directly or indirectly all Collective Agents are composed of persons. The membership of many types of Collective Agents will continue to evolve over time. A Collective Agent may continue to exist even if it has no members for a time (for example, a committee whose members all resign prior to the expiration of their terms but then a new complement of members is appointed).

Instances of F55 Collective Agent include instances of its subclass F11 Corporate Body: commercial or corporate entities and other legally registered bodies, as well as organizations and associations, musical, artistic or performing groups, governments, and any of their sub-units.

Married couples and other concepts of family (instances of F39 Family) are instances of a subclass of F55 Collective Agent.

In the wider sense, this class also comprises holders of official positions viewed collectively, independent of the current holder of the office, such as the president of a country. In such cases, it is possible that the instance of F55 Collective Agent has only ever had a single member.

A group of persons known by/using a joint pseudonym (i.e., a name that seems indicative of an individual but that is actually adopted as a persona by two or more people acting together) is a case of F55 Collective Agent.

Examples:

- International Federation of Library Associations and Institutions (F11)
- 81st World Library and Information Conference (F11)
- Bibliothèque nationale de France (F11)
- Exxon-Mobil (F11)
- The Beatles (F11)
- the brothers Grimm (F39)
- the President of the Swiss Confederation
- Nicolas Bourbaki [collective pseudonym of a group of 20th century French mathematicians also known as the ‘Association des collaborateurs de Nicolas Bourbaki’]
- Ellery Queen [joint pseudonym for detective fiction of cousins Frederic Dannay and Manfred Bennington Less who also wrote separately]

In First Order Logic:

$F55(x) \Rightarrow E74(x)$

7. LRM$_{OO}$ Property Declarations

The properties of LRM$_{OO}$ are comprehensively declared in this section using the following format:

- Property labels are presented as headings in bold face, preceded by unique property identifiers.
- The line “Domain:” declares the class for which the property is defined.
- The line “Range:” declares the class to which the property points, or that provides the values for the property.
- The line “Subproperty of:” is a cross-reference to any superproperties the property may have, in either CIDOC CRM or LRM$_{OO}$. All LRM$_{OO}$ properties that fall under the scope of the CIDOC CRM are, either directly or indirectly, subproperties of at least one CIDOC CRM property. However, this line remains empty for LRM$_{OO}$ properties that are shortcuts of more developed paths that involve CIDOC CRM properties and/or their LRM$_{OO}$ subproperties. In some cases the superproperty of a property may be listed as *Outside of CIDOC CRM Scope*. This indicates that the property that should be its superproperty is outside of the coverage of CIDOC CRM.
- The line “Superproperty of:” is a cross-reference to any subproperties the property may have.
- The line “Quantification:” declares the possible number of occurrences for domain and range class instances for the property. Possible values are enumerated in section 4.4.
- The label “Scope note:” precedes the textual definition of the concept the property represents.
- The line “Full path:” declares the chain of CIDOC CRM and/or LRM$_{OO}$ properties of which the LRM$_{OO}$ property is a shortcut. The path is also described textually at the end of the scope note.
- The label “Properties:” introduces any properties the property may have (.1 properties).
- The label “Examples:” precedes a list of examples of instances of this property.
- The label “In First Order Logic:” precedes the formal logical presentation of the property’s domain and range, superproperties, and other formal constraints on its application.

R1 is logical successor of (has successor)

Domain: F1 Work

Range: F1 Work

Subproperty of: E70 Thing. P130 shows features of (features are also found on): E70 Thing

Quantification: many to many (0,n:0,n)

Scope note: This property associates an instance of F1 Work which logically continues the content of another instance of F1 Work with the latter. This property is not transitive. It is asymmetric and irreflexive.

Examples:

- Ursula K. Le Guin's novel 'The Tombs of Atuan' (F1) *is logical successor of* Ursula K. Le Guin's novel 'A Wizard of Earthsea' (F1).
- Miguel de Cervantes' 'Segunda Parte del Ingenioso Cavallero Don Quixote de la Mancha' (F1) *is logical successor of* Miguel de Cervantes' 'El ingenioso hidalgo Don Quixote de la Mancha' (F1).
- The TV series 'Breaking Bad' (F1) *is logical successor of* the TV series 'Better Call Saul' (F1).
- The first 'Star Wars' trilogy, 1977-1983 (F1) *is logical successor of* the second 'Star Wars' trilogy, 1999-2005 (F1).

  [Note that the logical order does not follow, in either of the two last examples, the chronological order of creation]

In First Order Logic:

$R1(x,y) \Rightarrow F1(x)$
$R1(x,y) \Rightarrow F1(y)$
$R1(x,y) \Rightarrow P130(x,y)$
$R1(x,y) \Rightarrow \neg R1(y,x)$

R2 is derivative of (has derivative)

Domain: F1 Work

Range: F1 Work

Subproperty of: F1 Work. R68 is inspired by (is inspiration for): F1 Work

Quantification: many to many (0,n:0,n)

Scope note: This property associates an instance of F1 Work which modifies the content of another instance of F1 Work with the latter. This property is transitive, asymmetric and irreflexive.

This property is equivalent to the path: F1 Work(1). *R3 is realised in:* F2 Expression(1). *R17i was created by:* F28 Expression Creation. *P16 used specific object*: F2 Expression(2). *R3i realises*: F1 Work(2). That is, F1 Work(1). *R2 is derivative of:* F1 Work (2), without needing to specify the specific expressions involved in the derivation.

Full path: F1 Work(1). R3 is realised in: F2 Expression(1). R17i was created by: F28 Expression Creation. P16 used specific object: F2 Expression(2). R3i realises: F1 Work(2)

Properties: R2.1 has type: E55 Type

This property allows for specifying the kind of derivation, such as adaptation, summarisation, etc.

Examples:

- The movie 'Murder on the Orient Express' directed by Kenneth Branagh (F1) *is derivative of* the novel 'Murder on the Orient Express' by Agatha Christie (F1) with *has type* Movie adaptation (E55).

- The movie ‘A Clockwork Orange’ directed by Stanley Kubrick (F1) *is derivative of* the novel ‘A Clockwork Orange’ by Anthony Burgess (F1) with *has type* Movie adaptation (E55).
- Seth Grahame-Smith’s novel ‘Pride and prejudice and zombies’(F1) *is derivative of* Jane Austen’s novel ‘Pride and prejudice’ (F1) with *has type* Parody (E55).

In First Order Logic:

R2(x,y) ⇒F1(x)
R2(x,y) ⇒F1(y)
R2(x,y) ⇒R68(x,y)
R2(x,y) ⇔(∃uzw) [F2(u) ∧R3(x,u) ∧F28(z) ∧R17i(u,z) ∧F2(w) ∧P16(z,w) ∧R3i(w,y)]
R2(x,y,z) ⇒R2(x,y) ∧E55(z)
R2(x,y) ∧R2(y,z) ⇒R2(x,z)
R2(x,y) ⇒¬R2(y,x)

R3 is realised in (realises)

Domain: F1 Work

Range: F2 Expression

Subproperty of: E70 Thing. P130 shows features of (features are also found on): E70 Thing

Quantification: one to many, necessary, dependent (1,n:1,1)

Scope note: This property associates an instance of F2 Expression with an instance of F1 Work.

This property expresses the association that exists between an expression and the work that this expression conveys. Our factual knowledge of how a given work is historically realised into expressions is often limited. Therefore, this property makes it possible to express the association between an instance of F2 Expression and the instance of F1 Work it conveys without identifying the particular instances of F2 Expression that were part of a chain of derivation from the source.

Examples:

- Agatha Christie’s work entitled ‘Murder on the Orient Express’ (F1) *is realised in* the original text written by Agatha Christie for the novel (F2).
- Agatha Christie’s work entitled ‘Murder on the Orient Express’ (F1) *is realised in* the German translation created by Elisabeth van Bebber (F2).
- Agatha Christie’s work entitled ‘Murder on the Orient Express’ (F1) *is realised in* the narration of the English text by David Suchet (F2).
- Dante’s work entitled ‘Inferno’ (F1) *is realised in* the Italian text of Dante’s ‘Inferno’ as found in the authoritative critical edition ‘La Commedia secondo l’antica issolu’ a cura di Giorgio Petrocchi, Milano: Mondadori, 1966-67 (= ‘Le Opere di Dante Alighieri’, Edizione Nazionale a cura della Società Dantesca Italiana, VII, 1-4) (F2).
- Johann Sebastian Bach’s ‘Goldberg Variations’ (F1) *is realised in* the score of the ‘Goldberg Variations’ (as published by Balthasar Schmid in 1741) (F2).
- Auguste Rodin’s work ‘The Thinker’ (F1) *is realised in* the first plaster version of ‘The thinker’ (F2) that Auguste Rodin made around 1881.
- Auguste Rodin’s work ‘The Thinker’ (F1) *is realised in* the large-scale version of ‘The thinker’ (F2) created at the Fonderie Alexis Rudier in 1904.

In First Order Logic:

R3(x,y) ⇒F1(x)
R3(x,y) ⇒F2(y)
R3(x,y) ⇒P130(x,y)
R3(x,z) ∧R3(y,z) ⇒x=y

R4 embodies (is embodied in)

Domain: F3 Manifestation

Range: F2 Expression

Subproperty of: E73 Information Object. P165 incorporates (is incorporated in): E90 Symbolic Object

Quantification: many to many, necessary, dependent (1,n:1,n)

Scope note: This property associates an instance of F3 Manifestation with one or more instances of F2 Expression which are rendered by this instance of F3 Manifestation. The manifestation formats the expression(s) in the way they are to be presented to some public, including specifying the intended sensory impression (such as visual appearance or audio rendition).

Examples:

- The publication 'Murder on the Orient Express / Agatha Christie', published by Collins Crime Club in 1934 (F3) *embodies* the original text in English by Agatha Christie (F2).
- The publication 'Mord im Orientexpress: ein Hercule-Poirot-Roman / Agatha Christie', published by Deutscher Bücherbund in 1975 (F3) *embodies* the German translation by Elisabeth van Bebber (F2).
- The publication 'The Illustrated Odyssey', published by Sidgwick & Jackson Ltd in 1980 (F3) *embodies* the translated text by E. V. Rieu (F2), the introductory text by Jacquetta Hawkes (F2) and photographs by Tim Mercer (F2).
- The publication entitled 'Alfred Hitchcock's Psycho: 60th Anniversary Edition' which was released in 2020 (F3), *embodies* the original cut of the movie (F2) and the censored version that was released in Britain (F2).
- The publication identified by ISBN '2-222-00835-2' (F3) *embodies* the text of Marin Mersenne's 'Harmonie universelle' (F2).
- The CD publication 'Bach Goldberg Variations' published by Hyperion Records in 2016 (F3), *embodies* Angela Hewitt's performances of Bach's 'Goldberg Variations' recorded in Christuskirche (Berlin) on 14-17 December 2015 (F2).

In First Order Logic:

R4(x,y) ⇒F3(x)
R4(x,y) ⇒F2(y)
R4(x,y) ⇒P165(x,y)

R5 has component (is component of)

Domain: F2 Expression

Range: F2 Expression

Subproperty of: E89 Propositional Object. P148 has component (is component of): E89 Propositional Object

Quantification: many to many (0,n:0,n)

Scope note: This property associates an instance of an F2 Expression X with a structural component Y that conveys a part of the overall work realized by X, such as volumes, chapters, or sections. This property is transitive, asymmetric and irreflexive.

Any part of an expression that conveys complete propositions, such as a single phrase, can be documented using the more general property *P148 has component (is component of)*.

Any part of an expression that does not completely follow meaningful boundaries, such as lines or pages of text or portions visible on images, can be documented using the property *P106 is composed of (forms part of),* and not with *R5 has component (is component of)*. Fragments, in particular, can be documented with the more specific property *R15 has fragment (is fragment of)*.

This property does not cover the relationship that exists between expressions that are realisations of different works, where one is re-used in a new, larger expression. Such a relationship is modelled by *R75 incorporates (is incorporated in)*.

Examples:

- The musical notation for Bach's 'Goldberg Variations' (F2) *has component* the musical notation for 'Variatio 1. a 1 Clav' (F2).
- The Italian text of Dante's textual work entitled 'Divina Commedia' (F2) *has component* the

Italian text of Dante's textual work entitled 'Inferno' (F2).

- The musical notation of Mozart's Singspiel entitled 'Die Zauberflöte' (F2) *has component* the musical notation of Mozart's aria entitled 'Der Hölle Rache', also known as 'The Queen of the Night's Aria' (F2).
- The visual content of the map entitled 'Wales – The Midlands – South West England', scale 1:400,000, issued by Michelin in 2005 (F2) *has component* the visual content of the inset entitled 'Liverpool', scale 1:200,000, set within the compass of the map titled 'Wales – The Midlands – South West England', scale 1:400,000, issued by Michelin in 2005 (F2).

In First Order Logic:

$R5(x,y) \Rightarrow F2(x)$
$R5(x,y) \Rightarrow F2(y)$
$R5(x,y) \Rightarrow P148(x,y)$
$R5(x,y) \wedge R5(y,z) \Rightarrow R5(x,z)$
$R5(x,y) \Rightarrow \neg R5(y,x)$

R7 exemplifies (is exemplified by)

Domain: F5 Item

Range: F3 Manifestation

Subproperty of: E18 Physical Thing. P128 carries (is carried by): E90 Symbolic Object

Quantification: many to one, necessary (1,1:0,n)

Scope note: This property associates an instance of F3 Manifestation with an instance of F5 Item that is one of its exemplars or its only exemplar.

Instances of F5 Item correspond to the kinds of physical unit(s) specified in the manifestation, regardless of possible later changes.

Even though an item may exhibit defects with respect to the intended manifestation, it is still regarded to carry the manifestation, as long as it is produced or made accessible as a functional item by its creators.

Examples:

- The item held by the Deichman public library in Oslo, identified by inventory number '9138513' (F5) *exemplifies* the publication 'Murder on the Orient Express / Agatha Christie', HarperCollins 2017 (F3).
- The item held by the National Library of France and identified by shelf mark 'Res 8 P 10' (F5) *exemplifies* the edition of Amerigo Vespucci's textual and cartographic work entitled 'Mundus novus' issued in Paris ca. 1503-1504 (F3).

In First Order Logic:

$R7(x,y) \Rightarrow F5(x)$
$R7(x,y) \Rightarrow F3(y)$
$R7(x,y) \Rightarrow P128(x,y)$

R8 combines (is combined to form)

Domain: F12 Nomen

Range: F12 Nomen

Subproperty of: E89 Propositional Object. P148 has component (is component of): E89 Propositional Object

Quantification: many to many (0,n:0,n)

Scope note: This property associates an instance of F12 Nomen with another instance of F12 Nomen where the string of the domain instance of F12 Nomen includes the complete symbolic content of the string of the range instance of F12 Nomen. This property is not transitive. It is asymmetric and irreflexive.

Examples:

- ‘The Adoration of the Shepherds (Coventry)’ as a controlled access point for the work (F12) *combines* ‘The Adoration of the Shepherds’ as the preferred title of the work (F12).
- ‘The Adoration of the Shepherds (Coventry)’ as a controlled access point for the work (F12) *combines* ‘Coventry’ as a term that refers to a place (F12).
- ‘Guillaume, de Machaut, ca. 1300-1377’ as a controlled access point for the French composer and poet (F12) *combines* ‘ca. 1300-1377’ as a term that refers to a time-span (F12).
- ‘Guillaume, de Machaut, ca. 1300-1377’ as a controlled access point for the French composer and poet (F12) *combines* ‘Guillaume de Machaut’ as a name for the person (F12).
- ‘Univerza v Ljubljani. Oddelek za bibliotekarstvo’ as a controlled access point for a corporate body (F12) *combines* ‘Univerza v Ljubljani’ as a controlled access point for a parent corporate body (F12).
- ‘Univerza v Ljubljani. Oddelek za bibliotekarstvo’ as a controlled access point for a corporate body (F12) *combines* ‘Oddelek za bibliotekarstvo’ the preferred name that refers to a subordinate corporate body (F12).
- ISBN-10 ‘978-002-002-0’ as an identifier for the publication entitled ‘Nigeria’s international economic relations’ (F12) *combines* ‘978’ as a code indicating the Nigerian ISBN Agency (F12).
- ISBN-10 ‘978-002-002-0’ as an identifier for the publication entitled ‘Nigeria’s international economic relations’ (F12) *combines* ‘002’ as a code indicating the Nigerian Institute of International Affairs (F12).
- ISBN-10 ‘978-002-002-0’ as an identifier for the publication entitled ‘Nigeria’s international economic relations’ (F12) *combines* ‘002’ as a code for the publication entitled ‘Nigeria’s international economic relations’ (F12).
- ‘History -- France -- 14th century’ as a controlled subject term for the concept (F12) *combines* ‘History’ as the preferred term for the concept (F12). [Subject term constructed according to the order and syntax prescribed in the Library of Congress Subject Headings (LCSH) subject headings language.]
- ‘History -- France -- 14th century’ as a controlled subject term for the concept (F12) *combines* ‘France’ as the preferred term for the country (F12). [Subject term constructed according to the order and syntax prescribed in the Library of Congress Subject Headings (LCSH) subject headings language.]
- ‘History -- France -- 14th century’ as a controlled subject term for the concept (F12) *combines* ‘14th century’ as the preferred term for the time-span (F12). [Subject term constructed according to the order and syntax prescribed in the Library of Congress Subject Headings (LCSH) subject headings language.]
- ‘595.7096’ as a classification number for insects in Africa (F12) *combines* ‘595.7’ as the classification number for the taxonomic class Insecta (insects) (F12). [Classification number according to the 23rd edition of the Dewey Decimal Classification (DDC23).]
- ‘595.7096’ as a classification number for insects in Africa (F12) *combines* ‘096’ as the notation corresponding to the continent Africa (F12). [Classification number constructed using the geographic regions table in the 23rd edition of the Dewey Decimal Classification (DDC23).]
- ‘Orange (Colour)’ as a controlled subject term for the concept (F12) *combines* ‘Orange’ the English language term for the colour (F12). [Terms combined according to the syntax of the Art and Architecture Thesaurus (AAT).]
- ‘Orange (Colour)’ as a controlled subject term for the concept (F12) *combines* ‘Colour’ the English language term for the concept (F12). [Terms combined according to the syntax of the Art and Architecture Thesaurus (AAT).]

In First Order Logic:

$R8(x,y) \Rightarrow F12(x)$
$R8(x,y) \Rightarrow F12(y)$
$R8(x,y) \Rightarrow P148(x,y)$
$R8(x,y) \Rightarrow \neg R8(y,x)$

R10 is member of (has member)

Domain: F1 Work

Range: E28 Conceptual Object

Subproperty of: Outside of CIDOC CRM Scope

Quantification: many to many (0,n:0,n)

Scope note: This property associates an instance of F1 Work with an instance of E28 Conceptual Object that represents a generalization of the work. The property can be used to group variant, alternative or related works that are considered to share a common concept.

Whereas instances of F1 Work are always realised in instances of F2 Expression, there is no particular expression that fully conveys the instance of Conceptual Object that a work may be a member of.

Intended usage of the property includes what is discussed as "superwork" in the library community. Typical examples are novels that can be grouped by fictional universes or common characters, paintings or graphical works that exist as a family of alternatives, musical compositions that are referred to as the same although they exist as particular versions that are each identified as an individual work. The instance of E28 Conceptual Object that has works as members will often be constructed for a specific purpose, such as bibliographic organization or retrieval.

Examples:

- Auguste Rodin's 'Le penseur' (E28) *has member* Auguste Rodin's 'Le penseur' in monumental size (F1). [In original size this sculpture *forms part of* (R67i) Rodin's 'La Porte de l'Enfer' (F1); in monumental size it is an autonomous work. All scale variants *are members of* (R10) the superwork 'Le penseur'(E28).]
- Edward Munch's 'Madonna' (E28) *has member* Edward Munch's black and white graphical work 'Madonna' (F1).
- Edward Munch's 'Madonna' (E28) *has member* Edward Munch's painting 'Madonna' (F1).
- Ludwig van Beethoven's opera Op. 72 'Fidelio' (E28) *has member* Ludwig van Beethoven's opera 'Leonore, oder Der Triumph der ehelichen Liebe' (the initial version that was performed in 1805) (F1).
- Ludwig van Beethoven's opera Op. 72 'Fidelio' (E28) *has member* Ludwig van Beethoven's opera 'Fidelio' (the final version that was first performed in 1814) (F1).
- The fictional universe created by Terry Pratchett referred to as 'Discworld' (E28) *has member* Terry Pratchett's novel 'The Light Fantastic' (F1).
- The fictional universe created by Terry Pratchett referred to as 'Discworld' (E28) *has member* 'Where's my Cow', a picture book by Terry Pratchett and Melvyn Grant (F1).

In First Order Logic:

R10(x,y) ⇒F1(x)
R10(x,y) ⇒E28(y)

R11 has issuing rule (is issuing rule of) *[PRESS$_{OO}$]*

[Editor's note: Transfer this property to PRESS$_{OO}$ once version 2.0 has a stable draft. Implement this property only in conjunction with an implementation of PRESS$_{OO}$.]

Domain: F18 Serial Work

Range: E29 Design or Procedure

Quantification: many to many (0,n:0,n)

Scope note: This property associates an instance of F18 Serial Work with the instance of E29 Design or Procedure that specifies the issuing policy planned by this instance of F18 Serial Work, such as sequencing pattern, expected frequency and expected regularity.

This property is a shortcut of the path from F1 Work, restricted to F18 Serial Work, through *R19i was realised through*, F30 Manifestation Creation, *P16 used specific object* to E29 Design or Procedure.

Full path: F18 Serial Work. R19i was realised through: F30 Manifestation Creation. P16 used specific object (was used for): E29 Design or Procedure

Examples:

- The serial entitled ‘Quarterly journal of pure and applied mathematics’, identified by ISSN ‘1549-6724’ (F18) *has issuing rule* to be issued every three months, on a regular basis, with each issue being numbered according to the pattern ‘Vol. 1, no. 1 (2005)’ that was observed by the Library of Congress’s cataloguers on an exemplar of the first issue (E29).

In First Order Logic:

R11(x,y) ⇒F18(x)
R11(x,y) ⇒E29(y)
R11(x,y) ⇒(∃z) [F30(z) ∧R19i(x,z) ∧P16(z,y)]

R15 has fragment (is fragment of)

Domain: F2 Expression

Range: E90 Symbolic Object

Subproperty of: E90 Symbolic Object. P106 is composed of (forms part of): E90 Symbolic Object

Quantification: many to many (0,n:0,n)

Scope note: This property associates an instance of E90 Symbolic Object with an instance of F2 Expression of which it is a fragment. The fragment is not itself an instance of F2 Expression as it does not express any instance of F1 Work. When the fragment consists of intelligible words it is an instance of E33 Linguistic Object.

An instance of E90 Symbolic Object is only considered a fragment of an instance of F2 Expression when related to its occurrence in a known or assumed whole by the *R15 has fragment (is fragment of)* property. The size of an instance of E90 Symbolic Object ranges from more than 99% of an instance of F2 Expression to tiny bits (a few words from a text, one bar from a musical composition, one detail from a still image, a two-second clip from a video, etc.).

An instance of E90 Symbolic Object can become a fragment of an instance of F2 Expression through the deterioration over time of a carrier of the expression, such as when only fragments of a manuscript of an ancient text survive. Typically instances of E90 Symbolic Object that are of interest as fragments of expressions are formed deliberately, such as when excerpts are taken from a text by the compiler of a collection of excerpts, or citations from one expression are used in another text.

Examples:

- The ancient Greek text of the four stanzas from an ode by Sappho (E33) that were quoted by Pseudo-Longinus in his textual work entitled ‘On the sublime’ *is fragment of* the complete ancient Greek text, now irremediably lost, of Sappho’s ode currently identified as Sappho’s poem #2 (F2).
- The phrase ‘Beati pauperes spiritu’ (E33) *is fragment of* the Latin text of the Gospel according to St. Matthew (F2). [excerpt from Matthew 5,3]
- The stanza ‘Nel mezzo del cammin di nostra vita / mi ritrovai per una selva oscura / ché la diritta via era smarrita’ (E33) *is fragment of* the Italian text of Dante Alighieri’s ‘Inferno’ from the ‘Divina Commedia’ (F2).
- The widely recognized ominous four-note opening motif (E73) *is fragment of* Beethoven’s Fifth Symphony (F2).
- The melting clock (E36) *is fragment of* the painting ‘Persistence of Memory’ by Salvador Dali, 1931 (F2).

In First Order Logic:

R15(x,y) ⇒F2(x)
R15(x,y) ⇒E90(y)
R15(x,y) ⇒P106(x,y)

R16 created (was created by)

Domain: F27 Work Creation

Range: F1 Work

Subproperty of: E65 Creation. P94 has created (was created by): E28 Conceptual Object

Quantification: one to many, necessary, dependent (1,n:1,1)

Scope note: This property associates the initial creation of a work and the instance of F1 Work that was created.

Examples:

- Agatha Christie creating 'Murder on the Orient Express' (F27), *created* the work 'Murder on the Orient Express' (F1).
- Mary Shelley creating 'Frankenstein, or, The Modern Prometheus' (F27), *created* the work 'Frankenstein, or, The Modern Prometheus' (F1).
- Dante creating the poem 'Divina Commedia' (F27), *created* the work 'Divina Commedia' (F1).
- William Shakespeare creating 'The Tragedy of Hamlet, Prince of Denmark'(F27), *created* the work 'The Tragedy of Hamlet, Prince of Denmark' (F1).
- René Goscinny and Albert Uderzo (collaboratively) creating 'Astérix le Gaulois' (F27) *created* the work 'Astérix le Gaulois' (F1).
- The work creation event of Ludwig van Beethoven composing his 'Symphony No. 9' (F27) *created* the work 'Beethoven's Symphony No. 9' (F1).
- Johann Sebastian Bach composing the 'Goldberg Variations' (F27) *created* the work the 'Goldberg Variations' (F1).
- The making of 'Jules et Jim', directed by François Truffault (F27) *created* the work 'Jules et Jim' (F1).
- The making of 'Psycho', directed by Alfred Hitchcock (F27) *created* the work 'Psycho' (F1).
- Auguste Rodin creating 'Le Penseur' (The Thinker) (F27), *created* the work 'Le Penseur' (The Thinker) (F1).
- Picasso creating 'Guernica' (F27) *created* the work 'Guernica' (F1).

In First Order Logic:

$R16(x,y) \Rightarrow F27(x)$
$R16(x,y) \Rightarrow F1(y)$
$R16(x,y) \Rightarrow P94(x,y)$

R17 created (was created by)

Domain: F28 Expression Creation

Range: F2 Expression

Subproperty of: E65 Creation. P94 has created (was created by): E28 Conceptual Object

Quantification: one to many, necessary, dependent (1,n:1,1)

Scope note: This property associates an instance of F2 Expression that was externalised during a particular instance of F28 Expression Creation event with that particular creation event. An instance of expression creation creates an instance of expression and also creates any expressions that are parts of that expression.

Examples:

- Agatha Christie creating the text for her novel 'Murder on the Orient Express' (F28) *created* the original English text of Agatha Christie's 'Murder on the Orient Express' (F2).
- Elisabeth van Bebber creating the text of her translation of Agatha Christie's 'Murder on the Orient Express' (F28) *created* the German text of Agatha Christie's 'Murder on the Orient Express' (F2).
- Ludwig van Beethoven composing his 'Symphony No. 9' (F28) *created* the original score for the 9th Symphony (F2).
- The making of the censored version of Hitchcock's movie 'Psycho' (F28) *created* the original version (cut) of the movie that was released in Britain (F2).
- The making of the first plaster version of 'The Thinker' sculpture by Auguste Rodin (F28) *created* the plaster version of 'The Thinker' (F2).

- The making of the large-scale version of 'The Thinker' by the Fonderie Alexis Rudier in 1904 (F28) *created* the large-scale version of 'The Thinker' (F2).

In First Order Logic:

R17(x,y) ⇒F28(x)
R17(x,y) ⇒F2(y)
R17(x,y) ⇒P94(x,y)

R19 created a realisation of (was realised through)

Domain: F28 Expression Creation

Range: F1 Work

Subproperty of: E7 Activity. P16 used specific object (was used for): E70 Thing

Quantification: many to one, necessary, dependent (1,1:1,n)

Scope note: This property associates an instance of F28 Expression Creation with the instance of F1 Work which was externalised in an instance of F2 Expression created by this creation event.

Examples:

- Agatha Christie writing the text for her novel 'Murder on the Orient Express' (F28) *created a realization of* Agatha Christie's 'Murder on the Orient Express' (F1).
- Elisabeth van Bebber creating the text of her translation of Agatha Christie's 'Murder on the Orient Express' (F28) *created a realization of* Agatha Christie's 'Murder on the Orient Express' (F1).
- Ludwig van Beethoven composing his 9th symphony (F28*) created a realization of* Beethoven's 'Symphony No. 9' (F1).
- The making of the censored version of Hitchcock's movie 'Psycho' (F28) *created a realization of* Hitchcock's movie 'Psycho' (F1).
- Auguste Rodin making the first plaster version of 'The Thinker' sculpture (F28) *created a realization of* Auguste Rodin's 'The Thinker' (F1).
- The making of the large-scale version of 'The Thinker' by the Fonderie Alexis Rudier in 1904 (F28) *created a realization of* Auguste Rodin's 'The Thinker' (F1).

In First Order Logic:

R19(x,y) ⇒F28(x)
R19(x,y) ⇒F1(y)
R19(x,y) ⇒P16(x,y)

R24 created (was created through)

Domain: F30 Manifestation Creation

Range: F3 Manifestation

Subproperty of: E65 Creation. P94 has created (was created by): E28 Conceptual Object

Quantification: one to many, necessary, dependent (1,n:1,1)

Scope note: This property associates the instance of F3 Manifestation that was created during a particular instance of F30 Manifestation Creation with that instance of F30 Manifestation Creation event.

Examples:

- The process of creating the publication 'Murder on the Orient Express / Agatha Christie' as published by HarperCollins in 2017 (F30) *created* 'Murder on the Orient Express / Agatha Christie' published by HarperCollins in 2017 (F3).
- The process of making the HTML-version of the English text of Homer's 'Odyssey' (as available online from the Gutenberg Project) (F30) *created* the HTML-version of the English text of Homer's 'Odyssey' (F3).
- The process of making the CD publication 'Bach Goldberg Variations' (as published by Hyperion Records in 2016) (F30) *created* 'Bach Goldberg Variations', published by Hyperion Records in 2016 (F3).

In First Order Logic:

R24(x,y) ⇒F30(x)
R24(x,y) ⇒F3(y)
R24(x,y) ⇒P94(x,y)

R27 materialized (was materialized by)

Domain: F32 Item Production Event

Range: F3 Manifestation

Subproperty of: E7 Activity. P16 used specific object (was used for): E70 Thing

Quantification: many to many (0,n:0,n)

Scope note: This property associates an instance of F32 Item Production Event with the set of signs provided by the publisher to be carried by all of the produced items (i.e., the instances of F5 Item) and any other physical features foreseen as integral to the instance of F3 Manifestation that is materialised.

Examples:

- The production of copies of the paperback edition of the HarperCollins 2017 publication 'Murder on the Orient Express / Agatha Christie' (F32) *materialized* the publication 'Murder on the Orient Express / Agatha Christie' published by HarperCollins 2017 (F3).
- The printing of the score of Bach's 'Goldberg Variations' by Balthasar Schmid in 1741 (F32) *materialized* the publication Bach's 'Goldberg Variations' as published by Balthasar Schmid in 1741 (F3).

In First Order Logic:

R27(x,y) ⇒F32(x)
R27(x,y) ⇒F3(y)
R27(x,y) ⇒P16(x,y)

R28 produced (was produced by)

Domain: F32 Item Production Event

Range: F5 Item

Subproperty of: E12 Production. P108 has produced (was produced by): E24 Physical Human-Made Thing

Quantification: one to many, necessary, dependent (1,n:1,1)

Scope note: This property associates an instance of F32 Item Production Event with any one of the produced items (i.e., the instances of F5 Item).

Examples:

- The production of copies of the paperback edition of the HarperCollins 2017 publication 'Murder on the Orient Express / Agatha Christie' (F32) *produced* the copy (item) of this publication that is held by the Deichman public library in Oslo, Norway, and which is identified by inventory number '9138513' (F5).
- The printing of the score of Bach's 'Goldberg Variations' by Balthasar Schmid in 1741 (F32) *produced* the copy of this score (item) that is held by the National Library in France (F5).
- The second print run, occurring in 1978, of the publication dated of 1972 and entitled 'The complete poems of Stephen Crane, edited with an introduction by Joseph Katz' (identified by ISBN '0-8014-9130-4') (F32) *produced* Universitätsbibliothek Passau's holding identified by call number '00/HT 4801.978 K2' (F5).

In First Order Logic:

R28(x,y) ⇒F32(x)
R28(x,y) ⇒F5(y)
R28(x,y) ⇒P108(x,y)

R29 reproduced object (was object reproduced by)

Domain: F33 Reproduction Event

Range: F5 Item

Subproperty of: E7 Activity. P16 used specific object (was used for): E70 Thing

Quantification: many to many, necessary (1,n:0,n)

Scope note: This property associates an instance of F33 Reproduction Event with an instance of F5 Item it reproduces.

Examples:

- The activity performed by Schott when producing the 2015 publication of Harry Partch's 'Two studies on ancient Greek scales' (F33) *reproduced object* Harry Partch's holograph manuscript of 'Two studies on ancient Greek scales' (F5).

In First Order Logic:

R29(x,y) ⇒F33(x)
R29(x,y) ⇒F5(y)
R29(x,y) ⇒P16(x,y)

R30 reproduced publication (was publication reproduced by)

Domain: F33 Reproduction Event

Range: F3 Manifestation

Subproperty of: E7 Activity. P16 used specific object (was used for): E70 Thing

Quantification: many to many, necessary (1,n:0,n)

Scope note: This property associates an instance of F33 Reproduction Event with an instance of F3 Manifestation it reproduces.

Examples:

- The activity performed by Cambridge University Press when producing the 2014 publication of Daniel Wilson's 'Caliban: the missing link' (F33) *reproduced publication* the 1873 publication of Daniel Wilson's 'Caliban: the missing link' by Macmillan (F3).
- The activity performed by the Éditions du Seuil when producing the 2007 publication of Hubert Reeve's 'Malicorne: réflexions d'un observateur de la nature' as number 179 in the series 'Points. Science' (identified by ISBN '978-2-02-096760-0') (F33) *reproduced publication* the 1990 publication by the Éditions du Seuil in the series 'Science ouverte' (identified by ISBN '2-02-012644-3') (F3).

In First Order Logic:

R30(x,y) ⇒F33(x)
R30(x,y) ⇒F3(y)
R30(x,y) ⇒P16(x,y)

R33 has string

Domain: F12 Nomen

Range: E62 String

Subproperty of: E1 CRM Entity. P3 has note: E62 String

Quantification: many to one, necessary (1,1:0,n)

Scope note: This property associates an instance of F12 Nomen with a sign or arrangement of signs that is used to refer to something through that instance of F12 Nomen.

Examples:

- The English word 'poison' as a term for toxic substances, in written form in the Latin alphabet (F12) *has string* the letters p, o, i, s, o, n with no intervening spaces (E62).

- The English word ‘poison’ as a term for toxic substances, notated in the International Phonetic Alphabet (F12) *has string* the string of characters ['pɔɪzᵊn] (E62).
- The French word ‘poison’ as a term for toxic substances, in written form in the Latin alphabet (F12) *has string* the letters p, o, i, s, o, n with no intervening spaces (E62).
- The French word ‘poison’ as a term for toxic substances, notated in the International Phonetic Alphabet (F12) *has string* the string of characters [pwa'zɔ̃] (E62).

In First Order Logic:

R33(x,y) ⇒F12(x)
R33(x,y) ⇒E62(y)
R33(x,y) ⇒P3(x,y)

R35 is specified by (specifies)

Domain: F12 Nomen

Range: F2 Expression

Subproperty of: E1 CRM Entity. P67i is referred to by: E89 Propositional Object

Quantification: many to one, necessary, dependent (1,1:1,n)

Scope note: This property associates an instance of F12 Nomen with an instance of F2 Expression which documents, defines or provides evidence for the particular nomen in the stated sense.

Examples:

- ‘acoustic surface wave device’ as a term for the device (F12) *is specified by* INSPEC Thesaurus version January 1973 (F2).
- ‘595.7’ as a classification number for the taxonomic class Insecta (insects) (F12) *is specified by* the 23rd edition of the Dewey Decimal Classification (DDC) (F2).
- ‘Martin Doerr’ as the name of a co-chair of the CIDOC CRM SIG (F12) *is specified by* the statement on the title page of the Definition of the ‘CIDOC Conceptual Reference Model’, Version 7.1.3, February 2024 (F2).

In First Order Logic:

R35(x,y) ⇒F12(x)
R35(x,y) ⇒F2(y)
R35(x,y) ⇒P67(y,x)

R36 uses script conversion (is script conversion used in)

Domain: F12 Nomen

Range: F36 Script Conversion

Quantification: many to many (0,n:0,n)

Scope note: This property associates an instance of F12 Nomen with an instance of F36 Script Conversion that is used to create the E62 String used in that instance of F12 Nomen from the string used in another instance of F12 Nomen that co-refers with the first nomen (the instances of F12 Nomen are related via the *R56 has related form (is related form of)* property). The source of this conversion may or may not be explicitly mentioned.

This property is a shortcut from an instance of F12 Nomen, a subclass of E28 Conceptual Object, through the inverse of *P94 has created (was created by)*, E65 Creation, a subclass of E7 Activity, *P33 used specific technique (was used by)*, to an instance of E29 Design or Procedure used to create it, restricted to its subclass F36 Script Conversion.

Full path: F12 Nomen. P94i was created by: E65 Creation. P33 used specific technique (was used by): F36 Script Conversion

Examples:

- ‘Du Fu’ as the name for a Chinese poet of the 8th century (F12) *uses script conversion* Pinyin (F36).

- ‘Čajkovskij, Petr Il′ič’ as the name of a Russian composer (F12) *uses script conversion* ‘ISO 9:1995 Information and documentation — Transliteration of Cyrillic characters into Latin characters — Slavic and non-Slavic languages’ (F36).

In First Order Logic:

R36(x,y) ⇒F12(x)
R36(x,y) ⇒F36(y)
R36(x,y) ⇔F12(x) ∧F36(y) ∧(∃z) [E65(z) ∧P94i(x,z) ∧P33(z,y)]

R54 has language (is language of)

Domain: F12 Nomen

Range: E56 Language

Subproperty of: E1 CRM Entity. P2 has type (is type of): E55 Type

Quantification: many to many (0,n:0,n)

Scope note: This property associates an instance of F12 Nomen with an instance of E56 Language which is the language used for or associated with the nomen.

Examples:

- ‘Colón Cristóbal’ as a name of the explorer and navigator (F12) *has language* Spanish [encoded as ‘spa’ in set 2 of ISO 639:2023] (E56).
- ‘Columbus Christopher’ as a name of the explorer and navigator (F12) *has language* English [encoded as ‘eng’ in set 2 of ISO 639:2023] (E56).
- ‘Conseil international des musées’ as a name of ICOM, the International Council of Museums (F12) *has language* French [encoded as ‘fre’ in set 2 of ISO 639:2023] (E56).
- ‘Internationaler Museumsrat’ as a name of ICOM, the International Council of Museums (F12) *has language* German [encoded as ‘ger’ in set 2 of ISO 639:2023] (E56).
- ‘Union européenne’ as a name of the European Union (F12) *has language* French [encoded as ‘fre’ in set 2 of ISO 639:2023] (E56).
- ‘Vienna’ as a name of the city which is the capital of Austria (F12) *has language* English [encoded as ‘eng’ in set 2 of ISO 639:2023] (E56).
- ‘Organic chemistry’ as a term for the branch of chemistry concerned with organic compounds (F12) *has language* English [encoded as ‘eng’ in set 2 of ISO 639:2023] (E56).

In First Order Logic:

R54(x,y) ⇒F12(x)
R54(x,y) ⇒E56(y)
R54(x,y) ⇒P2(x,y)

R56 has related form (is related form of)

Domain: F12 Nomen

Range: F12 Nomen

Quantification: many to many (0,n:0,n)

Scope note: This property associates an instance of F12 Nomen with another instance of F12 Nomen which co-refers to the same instance of E1 CRM Entity. This property is not transitive. It is symmetric and irreflexive.

This property is a shortcut for a path from one instance of E89 Propositional Object, restricted to F12 Nomen, which, through the property *P67 refers to (is referred to by)* and its inverse, is associated with the same instance of E1 CRM Entity as another instance of F12 Nomen.

Full path: E89 Propositional Object(1). P67 refers to: E1 CRM Entity. P67i is referred to by: E89 Propositional Object(2)

Properties: R56.1 has type: E55 Type

This property allows for specifying the particular kind of relationship that holds between the domain nomen and the range nomen, such as by being a derivation, an alternative, a lexical variant, etc. Typing the association may cause loss of symmetry.

Examples:

- ‘Čajkovskij, Petr Il′ič’ as the name of the Russian composer (F12) *has related form* ‘Пётр Ильич Чайковский’ as the name of the Russian composer (F12) with *has type* Transliteration (E55).
- ‘The Lord of the Rings’ as the title of the work by J. R. R. Tolkien (F12) *has related form* ‘Le Seigneur des anneaux’ as the title of the work by J. R. R. Tolkien (F12) with *has type* Original language (E55).
- ‘IFLA’ as the name of the international association in the library field (F12) *has related form* ‘International Federation of Library Associations and Institutions’ as the name of the international association in the library field (F12) with *has type* Acronym (E55).
- ‘Siam’ as the name of the country in South Asia (F12) *has related form* ‘Thailand’ as the name of the country in South Asia (F12).
- ‘595.7’ as a classification number referring to the taxonomic class insects (F12) *has related form* ‘Insecta’ as a term referring to the taxonomic class insects (F12). [The latter being the caption for the Dewey Decimal Classification number in the English language 23rd edition.]

In First Order Logic:

$R56(x,y) \Rightarrow F12(x)$
$R56(x,y) \Rightarrow F12(y)$
$R56(x,y) \Rightarrow (\exists z)\,[E1(z) \wedge P67(x,z) \wedge P67i(z,y)]$
$R56(x,y,z) \Rightarrow R56(x,y) \wedge E55(z)$
$R56(x,y) \Rightarrow R56(y,x)$
$\neg R56(x,x)$

R67 has part (forms part of)

Domain: F1 Work

Range: F1 Work

Subproperty of: E89 Propositional Object. P148 has component (is component of): E89 Propositional Object

Quantification: many to many (0,n:0,n)

Scope note: This property associates an instance of F1 Work with another instance of F1 Work that forms part of it in a complementary role to other sibling parts, conceived at some point in time to form together a logical whole, such as the parts of a trilogy. This property is transitive, asymmetric and irreflexive.

Examples:

- Ursula K. Le Guin’s textual work ‘The Earthsea trilogy’ (F1) *has part* Ursula K. Le Guin’s textual work ‘The tombs of Atuan’ (F1).
- Dante Alighieri’s textual work entitled ‘Divina Commedia’ (F1) *has part* Dante Alighieri’s textual work entitled ‘Inferno’ (F1).
- Miguel de Cervantes’ textual work entitled ‘Don Quixote’ (F1) *has part* Miguel de Cervantes’ textual work entitled ‘El ingenioso hidalgo Don Quixote de la Mancha’ (F1).
- Miguel de Cervantes’ textual work entitled ‘Don Quixote’ (F1) *has part* Miguel de Cervantes’ textual work entitled ‘Segunda Parte del Ingenioso Cavallero Don Quixote de la Mancha’ (F1).
- J. R. R. Tolkien’s textual work ‘The Lord of the Rings’ (F1) *has part* J. R. R. Tolkien’s textual work ‘The Two Towers’ (F1).
- Cormac McCarthy’s textual work ‘The Border Trilogy’ (F1) *has part* Cormac McCarthy’s textual work ‘All the Pretty Horses’ (F1).
- Giovanni Battista Piranesi’s graphic work entitled ‘Carceri’ (F1) *has part* Giovanni Battista Piranesi’s graphic work entitled ‘Carcere XVI: the pier with chains’ (F1).
- Ludwig van Beethoven’s musical work entitled ‘Symphony No. 9’ (F1) *has part* Ludwig van Beethoven’s musical work ‘Finale’ (4th movement) (F1).
- Johann Sebastian Bach’s musical work ‘Goldberg Variations’ (F1) *has part* the musical work entitled ‘Variatio 1. a 1 Clav’ (F1).

In First Order Logic:

$R67(x,y) \Rightarrow F1(x)$

R67(x,y) ⇒F1(y)
R67(x,y) ⇒P148(x,y)
R67(x,y) ∧R67(y,z) ⇒R67(x,z)
R67(x,y) ⇒¬R67(y,x)

R68 is inspired by (is inspiration for)

Domain: F1 Work

Range: F1 Work

Subproperty of: E70 Thing. P130 shows features of (features are also found on): E70 Thing

Superproperty of: F1 Work. R2 is derivative of (has derivative): F1 Work

Quantification: many to many (0,n:0,n)

Scope note: This property associates an instance of F1 Work with another instance of F1 Work whose content was inspired by that instance of F1 Work. The content of the range work instance served in some way as a source of ideas for the domain work instance. Neither instance of F1 Work may be a part of the other. This property is not transitive. It is irreflexive.

This property is a shortcut of the path from one instance of F1 Work, through the inverse of *R16 created (was created by)*, F27 Work Creation, *P15 was influenced by (influenced)*, to another instance of F1 Work that provided inspiration for its creation.

Full path: F1 Work(1). R16i was created by: F27 Work Creation. P15 was influenced by: F1 Work(2)

Examples:

- The musical 'West Side Story' (F1) *is inspired by* the play 'Romeo and Juliet' by William Shakespeare (F1).
- The play 'Rosencrantz and Guildenstern are Dead' by Tom Stoppard (F1) *is inspired by* the play 'The Tragedy of Hamlet, Prince of Denmark' by William Shakespeare (F1).
- The musical work 'The Great Gate of Kiev' (F1) from 'Pictures at an Exhibition' by Modest Mussorgsky *is inspired by* the painting 'Plan for a City Gate in Kiev' by Viktor Hartmann (F1).
- The board game 'War of the Ring' by Roberto Di Meglio, Marco Maggi and Francesco Nepitello (F1) *is inspired by* the literary work 'The Lord of the Rings' by J. R. R. Tolkien (F1).
- The literary work 'Girl with a Pearl Earring' by Tracy Chevalier (F1) *is inspired by* the painting 'Girl with a Pearl Earring' by Johannes Vermeer (F1).

In First Order Logic:

R68(x,y) ⇒F1(x)
R68(x,y) ⇒F1(y)
R68(x,y) ⇒P130(x,y)
R68(x,y) ⇔F1(y) ∧(∃z) [F27(z) ∧R16i(x,z) ∧P15(z,y)]
¬R68(x,x)
R68(x,y) ⇒¬R67(x,y) ∧¬R67(y,x)

R69 has physical form (is physical form of)

Domain: F3 Manifestation

Range: E55 Type

Subproperty of: E1 CRM Entity. P2 has type (is type of): E55 Type

Quantification: many to many, necessary (1,n:0,n)

Scope note: This property associates an instance of F3 Manifestation with an instance of E55 Type describing the kind of physical form that characterizes instances of F5 Item carrying this F3 Manifestation.

In the case of instances of manifestations intended to be rendered by mediation (such as with electronic devices), the form also indicates the kind of equipment and software tools necessary.

Examples:

- The publication entitled ‘A clockwork orange’ by Anthony Burgess, published by Penguin Books Ltd in 2008, identified by ISBN ‘0141037229’ (F3) *has physical form* Printed book (E55).
- The sound recording entitled ‘The Glory (????) of the human voice’, identified by label and label number ‘RCA Victor Gold Seal GD61175’, containing recordings of musical works performed by Florence Foster Jenkins (F3) *has physical form* Compact Disc (E55).
- The photograph of Billie Holiday by Carl Van Vechten dated 23 March 1949, owned by the Library of Congress and identified by call number LOT 12735, no. 524 [P&P] (F3) *has physical form* Gelatin silver print (E55).
- The Long Play record entitled ‘Help!’ by The Beatles, released by Parlophone, 6 August 1965, with catalogue number PMC1255 (F3) *has physical form* Vinyl Long Play record (E55).
- The ebook ‘Christianity: the first three thousand years’ by Diarmaid MacCulloch published by Viking in 2010 and identified by ISBN ‘978-1-101-18999-3’ (F3) *has physical form* Digital file in EPUB format for Kobo ebook reader (E55).

In First Order Logic:

R69(x,y) ⇒F3(x)
R69(x,y) ⇒E55(y)
R69(x,y) ⇒P2(x,y)

R70 has dimension (is dimension of)

Domain: F3 Manifestation

Range: E54 Dimension

Subproperty of: E70 Thing. P43 has dimension (is dimension of): E54 Dimension

Quantification: one to many, necessary, dependent (1,n:1,1)

Scope note: This property associates an instance of F3 Manifestation with an instance of E54 Dimension that describes aspects of its symbolic content, such as word counts, or describes the kind of physical form that characterizes instances of F5 Item carrying this F3 Manifestation, such as number of pages.

This inference is an induction along the path that can be modelled as: F3 Manifestation. *R7i is exemplified by:* F5 Item. *P43 has dimension (is dimension of):* E54 Dimension.

It can happen that a given item, or subset of items, originally produced, or intended to be produced, with a certain value for a particular kind of dimension, has a different value for this kind of dimension by accident. This fact should be recorded as a property of F5 Item, and not of F3 Manifestation.

Examples:

- The publication (printed book) entitled ‘Functional Requirements for Bibliographic Records: final report’, published by K. G. Saur in 1998, identified by ISBN ‘3-598-11382-X’ (F3) *has dimension* height (E54) [which *has value (P90)* 24 (E60) and *has unit (P91)* cm (E58)].
- The publication (printed book) entitled ‘A clockwork orange’ by Anthony Burgess, published by Penguin Books Ltd in 2008, identified by ISBN ‘0141037229’ (F3) *has dimension* number of pages (E54) [which *has value (P90)* 176 (E60)].
- The publication (Blu-ray box set) entitled ‘Marvel Agents of S.H.I.E.L.D. the Complete Fourth Season’ produced by abc Studios, released in 2018 and identified by EAN ‘8717418521622’ (F3) *has dimension* number of discs (E54) [which *has value (P90)* 6 (E60)].
- The jigsaw puzzle entitled ‘Map of the New York city subway system’, designed by Stephen J. Voorhies and released around 1954 by the Union Dimes Savings Bank (F3) *has dimension* length and height (E54) [which *has note (P3)* ‘46 x 29 cm’ (E62)].
- The jigsaw puzzle entitled ‘Map of the New York city subway system’, designed by Stephen J. Voorhies and released around 1954 by the Union Dimes Savings Bank (F3) *has dimension* number of pieces (E54) [which *has value (P90)* 76 (E60)].

In First Order Logic:

R70(x,y) ⇒F3(x)

R70(x,y) ⇒E54(y)
R70(x,y) ⇒P43(x,y)
R70(x,y) ⇒(∃z) [F5(z) ∧R7i(x,z) ∧P43(z,y)]

R71 has part (is part of)

Domain: F3 Manifestation

Range: F3 Manifestation

Subproperty of: E89 Propositional Object. P148 has component (is component of): E89 Propositional Object

Quantification: many to many (0,n:0,n)

Scope note: This property associates an instance of F3 Manifestation with a structural part of it that is itself an instance of F3 Manifestation. This property is transitive, asymmetric and irreflexive.

Examples:

- The publication (set of 3 books) containing J. R. R. Tolkien's 'The Lord of the rings' identified by ISBN '0618260587' (F3) *has part* the publication containing J. R. R. Tolkien's 'The two towers' identified by ISBN '0618260595' (F3).
- The compact disc publication issued by Deutsche Grammophon in 1998 and consisting of a recording of Richard Wagner's 'Der fliegende Holländer' as performed in 1991 by Plácido Domingo, Cheryl Studer et al., and conducted by Giuseppe Sinopoli (F3) *has part* a publication consisting of the printed program notes and libretto (F3).
- The compact disc publication issued as a 2-CD set identified as 'M2K 42270' by CBS Records in 1987 and consisting of recordings of J. S. Bach's concertos for keyboard/clavier and strings performed by Glenn Gould (F3) *has part* the compact disc publication identified as 'DIDC 10370' consisting of the Glenn Gould recordings of Bach's 'Concertos nos. 1-4' (F3).

In First Order Logic:

R71(x,y) ⇒F3(x)
R71(x,y) ⇒F3(y)
R71(x,y) ⇒P148(x,y)
R71(x,y) ∧R71(y,z) ⇒R71(x,z)
R71(x,y) ⇒¬R71(y,x)

R73 takes representative attribute from (bears representative attribute for)

Domain: F1 Work

Range: F2 Expression

Quantification: one to many, necessary (1,n:0,1)

Scope note: This property associates an instance of F1 Work with instances of F2 Expression that bear attributes which are used to characterize the work. The instance of F2 Expression in question must be one that realizes that instance of F1 Work. An instance of F2 Expression may or may not serve as source of representative expression attributes for its associated instance of F1 Work. If it does, it may provide one attribute or many. Only one or more than one of the instances of F2 Expression associated with an instance of F1 Work may provide attributes that characterize that instance of F1 Work. The representative expression attributes can all come from the same expression or from more than one expressions.

This property is a shortcut of the path from F1 Work, through the inverse of *P140 assigned attributed to (was attributed by)*, E13 Attribute Assignment, *P16 used specific object (was used for)*, to the instance of F2 Expression that provided the source for the assignment of that particular representative attribute to the Work.

Full path: F1 Work. P140i was attributed by: E13 Attribute Assignment. P16 used specific object: F2 Expression

Examples:

- The work ‘Reading for life, a first book for adults and their tutors’ by Virginia French Allen (F1) *takes representative attribute from* the expression first published in 1987 by Spring Institute for International Studies with ISBN ‘094072300X’ (F2). [One attribute is the value for intended audience, which is adult literacy learners in the English language, another attribute is the language English.]
- The expression of the work ‘Piglet has a bath’ by A. A. Milne, with illustrations by Ernest H. Shepard, realised in the edition published on sealed plastic pages by Dutton Children’s Books in 1998 with ISBN ‘0525460926’ (F2) *bears representative attribute for* the work ‘Piglet has a bath’ by A. A. Milne (F1). [One attribute is the language English; another is the value for intended audience, which is children.]
- The work ‘Fugue in G Minor, BWV 1000’ by Johann Sebastian Bach (F1) *takes representative attribute from* the original expression (F2) (as composed around 1723). [The attribute is lute as the mode of performance; it is now mostly performed on the guitar.]

In First Order Logic:

R73(x,y) ⇒F1(x)
R73(x,y) ⇒F2(y)
R73(x,y) ⇒(∃z) [E13(z) ∧P140i(x,z) ∧P16(z,y)]

R74 uses expression of (has expression used in)

Domain: F1 Work

Range: F1 Work

Subproperty of: E70 Thing. P130 shows features of (features are also found on): E70 Thing

Quantification: many to many (0,n:0,n)

Scope note: This property associates an instance of F1 Work with another instance of F1 Work where all expressions of the former will include some expression of the latter. This property is not transitive. It is irreflexive. This property represents the generalized relationship between works that is described at the expression level using *R75 incorporates (is incorporated in)*.

Examples:

- Ludwig van Beethoven’s ‘Symphony No. 9’ (F1) *uses expression of* the poem ‘An die Freude’ by Friedrich Schiller (F1).
- Franz Schubert’s kunstlied ‘Erlkönig’ (F1) *uses expression of* the poem ‘Erlkönig’ by Johann Wolfgang von Goethe (F1).
- The symphonic poem ‘Vltava’ by Bedřich Smetana (F1) *uses expression of* the melody ‘La Mantovana’ attributed to Giuseppe Cenci (F1).

In First Order Logic:

R74(x,y) ⇒F1(x)
R74(x,y) ⇒F1(y)
R74(x,y) ⇒P130(x,y)
¬R74(x,x)

R75 incorporates (is incorporated in)

Domain: F2 Expression

Range: F2 Expression

Subproperty of: E73 Information Object. P165 incorporates (is incorporated in): E90 Symbolic Object

Quantification: many to many (0,n:0,n)

Scope note: This property associates an instance of F2 Expression with an instance of F2 Expression that is an integral part of the first, but where the latter realises a different instance of F1 Work from the first. This property is transitive, asymmetric and irreflexive.

Examples:

- The 1964 recording of Beethoven's 'Symphony No. 9' by Leonard Bernstein and the New York Philharmonic (F2) *incorporates* the German text of the poem 'An die Freude' by Friedrich Schiller (F2).
- Franz Schubert's score for the kunstlied 'Erlkönig' that was created in 1815 (F2) *incorporates* the German text of the poem 'Erlkönig' by Johann Wolfgang von Goethe (F2).
- Pyotr Ilyich Tchaikovsky's graduation cantata performed by Leslie Head and the Kensington Symphony Orchestra in 1978 (F2) *incorporates* a Russian translation of the poem 'An die Freude' by Friedrich Schiller (F2).

In First Order Logic:

R75(x,y) ⇒F2(x)
R75(x,y) ⇒F2(y)
R75(x,y) ⇒P165(x,y)
R75(x,y) ∧R75(y,z) ⇒R75(x,z)
R75(x,y) ⇒¬R75(y,x)

R76 is derivative of (has derivative)

Domain: F2 Expression

Range: F2 Expression

Subproperty of: E70 Thing. P130 shows features of (features are also found on): E70 Thing

Quantification: many to many (0,n:0,n)

Scope note: This property associates an instance of F2 Expression with another instance of F2 Expression which was its source or one of its sources. This property is not transitive. It is asymmetric and irreflexive.

This property is also a shortcut of the fully developed path: F2 Expression (1). *P16i was used for*: F28 Expression Creation. *R17 created*: F2 Expression (2).

Full path: F2 Expression(1). P16i was used for: F28 Expression Creation. R17 created: F2 Expression(2)

Properties: R76.1 has type: E55 Type

This property allows for specifying the kind of derivation, such as translation, revision, etc.

Examples:

- Elisabeth van Bebber's German text of Agatha Christie's 'Murder on the Orient Express' (F2) *is derivative of* the original text written by Agatha Christie for the novel (F2) with *has type* Translation (E55).
- The text of Agatha Christie's 'Murder on the Orient Express Abridged' (as published by HarperCollins) (F2) *is derivative of* the original text written by Agatha Christie for the novel (F2) with *has type* Abridgement (E55).
- The musical score for Dmitry Sitkovetsky's 'Goldberg Variations' arranged for string (F2) *is derivative of* the musical score for Johann Sebastian Bach's 'Goldberg Variations' (F2) with *has type* Arrangement (E55).
- The score for Beethoven's 9th Symphony edited by Jonathan Del Mar (F2) *is derivation of* Beethoven's original score for the 9th Symphony (F2) with *has type* Revision (E55).

In First Order Logic:

R76(x,y) ⇒F2(x)
R76(x,y) ⇒F2(y)
R76(x,y) ⇒P130(x,y)
R76(x,y) ⇔(∃z) [F28(z) ∧P16i(x,z) ∧R17(z,y)]
R76(x,y,z) ⇒R76(x,y) ∧E55(z)
R76(x,y) ⇒¬R76(y,x)

R77 accompanies or complements (is accompanied or complemented by)

Domain: F1 Work

Range: F1 Work

Quantification: many to many (0,n:0,n)

Scope note: This property associates one instance of F1 Work with another instance of F1 Work which is intended to accompany it or to function as a complement for it. This property is neither transitive nor intransitive. It is generally not symmetric and it is irreflexive.

In many but not all cases, one of the instances of F1 Work is primary and can be used without the other work, while the other is secondary and depends on the first work (such as a work that is a concordance for another work).

In some cases a work may have been created to accompany or complement a specific expression of another work. The link to the source expression can be indicated using the property *P16 used specific object (was used for)* using the path: F1 Work(1). *R3 is realised in:* F2 Expression(1). *P16i was used for:* F27 Work Creation. *R16 created*: F1 Work(2).

This property is a shortcut for the path from one instance of F1 Work to another instance of F1 Work that are linked through *P19 was intended use of (was made for)* and its inverse, both associated with the same instance of E7 Activity.

Full path: F1 Work(1). P19i was made for: E7 Activity. P19 was intended use of: F1 Work(2)

Examples:

- Leigh Lowe's 'Prima Latina: an introduction to Christian Latin. Teacher manual' (F1) *accompanies or complements* Leigh Lowe's 'Prima Latina: an introduction to Christian Latin. Student book' (F1).
- Eric Gill's set of illustrations for the Song of Songs (F1) *accompanies or complements* the 'Song of Songs' in the 1931 publication by the Cranach Press (F1).
- The periodical 'Applied economics quarterly' (ISSN 1611-6607) (F1) *is accompanied or complemented by* the periodical 'Applied economics quarterly. Supplement' (ISSN 1612-2127) (F1).
- The novel 'Le chevalier au lion' by Chrétien de Troyes (F1) *is accompanied or complemented by* the concordance created by Pascal Bonnefois and Marie-Louise Ollier 'Yvain ou Le chevalier au lion : concordance lemmatisée' (F1). [The concordance is specifically based on the 1960 edition of the novel by Mario Roques.]

In First Order Logic:

$R77(x,y) \Rightarrow F1(x)$
$R77(x,y) \Rightarrow F1(y)$
$R77(x,y) \Rightarrow (\exists z)\,[E7(z) \wedge P19i(x,z) \wedge P19(z,y)]$
$\neg R77(x,x)$

R78 has alternate

Domain: F3 Manifestation

Range: F3 Manifestation

Quantification: many to many (0,n:0,n)

Scope note: This property associates one instance of F3 Manifestation with another instance of F3 Manifestation that exemplifies the same instance of F2 Expression, when the two instances of F3 Manifestation can be used as alternatives for each other in particular use cases. This property is transitive and symmetric. It is irreflexive.

The alternative manifestations may be in the same physical form, for example, simultaneous publications in different markets. More frequently, the alternative relationship is established when the alternative manifestations are in different physical forms, designed to enable use of the same content with different playback equipment (such as a DVD and Blu-ray disc version of the same videorecording).

This property is a shortcut for the path from one instance of F3 Manifestation to another instance of F3 Manifestation that are linked through *R4 embodies (is embodied by)* and its inverse, to the same instance of F2 Expression.

Full path: F3 Manifestation. R4 embodies: F2 Expression. R4i is embodied by: F3 Manifestation

Examples:

- Agatha Christie's 'The Sittaford Mystery' published in 1931 in the UK by William Collins & Sons (F3) *has alternate* the simultaneous US edition published as 'The Murder at Hazelmoor' by Dodd, Mead & Co. (F3).
- The LP release of the punk rock band the Soviettes' album titled 'LP III' (F3) *has alternate* the CD release of the punk rock band the Soviettes' album titled 'LP III' (F3).

In First Order Logic:

R78(x,y) ⇒F3(x)
R78(x,y) ⇒F3(y)
R78(x,y) ⇒(∃z) [F2(z) ∧R4(x,z) ∧R4i(z,y)]
R78(x,y) ∧R78(y,z) ⇒R78(x,z)
R78(x,y) ⇒R78(y,x)
¬R78(x,x)

R79 has representative expression attribute (is representative expression attribute of)

Domain: F1 Work

Range: E55 Type

Subproperty of: E1 CRM Entity. P2 has type (is type of): E55 Type

Quantification: many to many (0,n:0,n)

Scope note: This property associates an instance of F1 Work with an instance of E55 Type that describes a category of attribute that is considered essential in characterizing instances of F1 Work. The types of interest will vary depending on the kind of work.

The value of the attribute is considered representative of the instance of F1 Work. It is normally inferred from the values attributed to instances of F2 Expression that realize the work and that are considered canonical or best representative of the work. The values may also be assigned from characteristics abstracted from a more or less nebulous network of similar expressions. There is no requirement to precisely identify one or more expressions which serve as sources for the values of the types serving as representative expression attributes; however, if this is known, an instance of F2 Expression considered representative of an F1 Work may be related to the instance of F1 Work using the R73 *takes representative attribute from (bears representative attribute for)* property.

Examples:

- The work 'Reading for life, a first book for adults and their tutors' by Virginia French Allen (F1) *has representative expression attribute* language 'English' (E56).
- The work 'Piglet has a bath' by A. A. Milne (F1) *has representative expression attribute* intended audience 'children' (E55).
- The work 'Fugue in G Minor, BWV 1000' by Johann Sebastian Bach (F1) *has representative expression attribute* medium of performance 'lute' (E55). [The original 1723 composition was for lute; it is now mostly performed on the guitar.]

In First Order Logic:

R79(x,y) ⇒F1(x)
R79(x,y) ⇒E55(y)
R79(x,y) ⇒P2(x,y)

R80 performed (is performed in)

Domain: F31 Performance

Range: F1 Work

Subproperty of: E70 Thing. P130 shows features of (features are also found on): E70 Thing

Quantification: many to one, necessary (1,1:0,n)

Scope note: This property associates an instance of F31 Performance with an instance of F1 Work.

The property is used to express the association between an instance of F31 Performance and the instance of F1 Work it conveys.

Examples:

- The performance of 'Hamlet' on 17 June 1909 in Berlin, Deutsches Theater, by Alexander Moissi, directed by Max Reinhardt (F31) *performed* William Shakespeare's work 'Hamlet' (F1).
- The performance (at the Salzburg Festival in 2005) of Verdi's 'La Traviata' that was staged by Willy Decker, directed by Brian Large and featuring Anna Netrebko and Rolando Villazón (F31) *performed* Giuseppe Verdi's work 'La Traviata' (F1).
- The performance on July 7, 1995 (at the Popes' Palace in Avignon) of the ballet entitled 'Rite of spring' (F31) *performed* the choreographic work 'Rite of spring' by Pina Bausch (F1).
- The Mariinsky Orchestra and Ballet's performance of Michel Fokine's choreography and libretto (choreographic work) for Stravinsky's 'The Firebird' at the Mariinsky Theatre in Saint Petersburg, June 2008 (F31) *performed* Michel Fokine's choreography and libretto (choreographic work) for Stravinsky's 'The Firebird' (F1).
- The performance of Daniel Humair (drums) and Damien Varaillon (double bass) improvising their 'Hommage à John Coltrane' in the Bal Blomet (Paris), on 18 January 2018 (F31) *performed* Daniel Humair and Damien Varaillon's work 'Hommage à John Coltrane' (F1).

In First Order Logic:

R80(x,y) ⇒F31(x)
R80(x,y) ⇒F1(y)
R80(x,y) ⇒P130(x,y)

R81 recorded (is recorded in)

Domain: F28 Expression Creation

Range: F31 Performance

Subproperty of: Outside of CIDOC CRM Scope

Quantification: many to one (0,1:0,n)

Scope note: This property associates an instance of F28 Expression Creation with an instance of F31 Performance that it records.

This property allows for the documentation of the association that exists between the outcome of an instance of F28 Expression Creation such as a performance recording, and the instance of F31 Performance that it is a recording of. For documenting performances that are more integral and planned parts of an expression creation (such as the recording of a performance solely done for the purpose of audio or video productions), the use of the property *P9 consist of (forms part of)* is more specific (and appropriate).

Examples:

- The Hyperion production (for CD release) of Angela Hewitt performing the 'Goldberg Variations' (F28) *recorded* Angela Hewitt's performance of the 'Goldberg Variations' in Christuskirche (Berlin) on 14-17 December 2015 (F31).
- The Deutsche Grammophon video production of Verdi's 'La Traviata' from the Salzburg Festival in 2005 (F28) *recorded* the live performance of 'La Traviata' that was staged by Willy Decker, directed by Brian Large and featuring Anna Netrebko and Rolando Villazón (F31).
- The Deutsche Grammophon audio production of Verdi's 'La Traviata' from the Salzburg Festival in 2005 (F28) *recorded* the live performance of 'La Traviata' performed by the Vienna Philharmonic, conducted by Carlo Rizzi featuring Anna Netrebko and Rolando Villazón (F31).
- The Belair production (DVD) produced by François Duplat and directed for video by Denis Calozzi, of Michel Fokine's choreography and libretto for Stravinsky's 'The Firebird' (F28) *recorded* the Mariinsky Orchestra and Ballet's performance of Michel Fokine's choreography and libretto (choreographic work) for Stravinsky's 'The Firebird', at the Mariinsky Theatre in Saint Petersburg, June 2008 (F31).

- The Music Development Company production (for CD release) of Daniel Humair (drums) and Damien Varaillon (double bass) performing their improvisation ‘Hommage à John Coltrane’ (F28) *recorded* Daniel Humair and Damien Varaillon’s performance in the Bal Blomet (Paris), on 18 January 2018 (F31).

In First Order Logic:

R81(x,y) ⇒F28(x)

R81(x,y) ⇒F31(y)

8. Mappings between IFLA LRM and LRM$_{OO}$

The IFLA LRM to LRM$_{OO}$ mapping is divided into three sections, respectively the IFLA LRM entities (8.1), attributes (8.2), and relationships (8.3). Each IFLA LRM element is identified by its LRM ID and name, and the definitions are given. However, for the IFLA LRM scope notes, consult the IFLA LRM model definition.

The mappings preferentially use LRM$_{OO}$ constructs, else the most specific CIDOC CRM construct that corresponds. The intention is for it to be feasible to implement these mappings using only LRM$_{OO}$ and the subset of CIDOC CRM indicated in sections 5.3 and 5.7. Thus, the mappings do not use any classes or properties from any other CRM family model. In particular, the classes and properties listed in section 9 are not used. In the cases where the FRAD mapping found in FRBR$_{OO}$ version 2.4 used these classes, this mapping uses their CIDOC CRM superclasses.

The mappings from LRM$_{OO}$ or CIDOC CRM provided for the IFLA LRM entities are strictly equivalent. Most of the mappings for IFLA LRM attributes and relationships are also equivalent. However, in some cases, the granularity of the models differ and more than one mapping in CIDOC CRM applies, depending on the situation covered by the IFLA LRM definition. For these broader IFLA LRM attributes or relationships, more than one mapping is given, and the condition governing the choice is briefly described in the column preceding the mapping.

IFLA LRM entities are always mapped to classes, either in LRM$_{OO}$ or in CIDOC CRM. IFLA LRM attributes are always mapped to a property. This property is presented with a domain corresponding to the IFLA LRM entity that the attribute is the attribute of. The IFLA LRM entity may be a subclass of the actual domain of the property. The mapping is given as a path and the property label is given only in the direction that corresponds with its use. IFLA LRM relationships are also mapped to a property or a path, presented in the direction that corresponds to the IFLA LRM domain-to-range.

Multiple instantiation in the mapping: In some cases the domain must be multiply instantiated as a specific CRM class for the relevant property to be valid. For example, *P72 has language* requires a domain of E33 Linguistic Object. To indicate the language attribute of an F2 Expression, that instance of expression must also be an instance of E33 Linguistic Object for it to be valid as the domain of *P72 has language* and be connected to an instance of E56 Language. This multiple instantiation requirement is given in parentheses after the class.

Mappings to range E55 Type:

- If the values of E55 Type concerned are to come from a particular kind of categorization, that categorization is indicated in curly brackets.

  For example, LRM-E1-A1 Res-Category: the E55 Type is to be drawn from a categorization of types of Res. This is notated: E55 Type {Res:Category}.

- If a specific value of E55 Type is intended, this is indicated with an equals sign and a string in quotes.

  For example, in mappings for creation relationships where the property P14 *carried out by* is used to link the creation event to an instance of E39 Actor responsible for the creation, the statement {P14.1 in the role of: E55 Type = "creator"} is used to state that the agent's role must have been assigned the value "creator". This side-branch of the path is all enclosed in curly brackets.

Notes on specific mappings

Extent: A complete mapping for each dimension being recorded must specify three things:

- The specific dimension being recorded, a value of E54 Dimension, e.g. height
- The numeric value found for that dimension, a value of E60 Number connected to E54 Dimension via *P90 has value*, e.g. 28
- The type of units that are being applied to the measurement to determine the numeric value, a value of E58 Measurement Unit connected to E54 Dimension via *P91 has unit*, e.g. cm
- That both *P90 has value* and *P91 has unit* must be present and that the same instance of E54 Dimension is the domain of both properties, is indicated by "*and"* in the mapping.

Association relationships: The general association relationships LRM-R1, LRM-R33, and LRM-R35, involving LRM-E1 Res, are so broad that they are broader than any CRM properties. Thus they are not mapped. The intention in LRM$_{OO}$ is that more specific refinements of these relationships would be implemented.

8.1. IFLA LRM Entities

LRM ID	LRM Name	LRM Definition	Mapping
LRM-E1	Res	Any entity in the universe of discourse	E1 CRM Entity
LRM-E2	Work	The intellectual or artistic content of a distinct creation	F1 Work
LRM-E3	Expression	A distinct combination of signs conveying intellectual or artistic content	F2 Expression
LRM-E4	Manifestation	A set of all carriers that are assumed to share the same characteristics as to intellectual or artistic content and aspects of physical form. That set is defined by both the overall content and the production plan for its carrier or carriers	F3 Manifestation
LRM-E5	Item	An object or objects carrying signs intended to convey intellectual or artistic content	F5 Item
LRM-E6	Agent	An entity capable of deliberate actions, of being granted rights, and of being held accountable for its actions	E39 Actor
LRM-E7	Person	An individual human being	E21 Person
LRM-E8	Collective Agent	A gathering or organization of *persons* bearing a particular name and capable of acting as a unit	F55 Collective Agent
LRM-E9	Nomen	An association between an entity and a designation that refers to it	F12 Nomen
LRM-E10	Place	A given extent of space	E53 Place
LRM-E11	Time-span	A temporal extent having a beginning, an end and a duration	E52 Time-span

8.2. IFLA LRM Attributes

LRM ID	LRM Entity	LRM Name	LRM Definition	Condition	Mapping
LRM-E1-A1	Res	Category	A type to which the *res* belongs		E1 CRM Entity. P2 has type: E55 Type {Res:Category}
LRM-E1-A2	Res	Note	Any kind of information about a *res* that is not recorded through the use of specific attributes and/or relationships		E1 CRM Entity. P3 has note: E62 String
LRM-E2-A1	Work	Category	A type to which the *work* belongs		F1 Work. P2 has type: E55 Type {Work:Category}
LRM-E2-A2	Work	Representative	An attribute which is deemed essential in		F1 Work. R79 has representative expression

LRM ID	LRM Entity	LRM Name	LRM Definition	Condition	Mapping
		expression attribute	characterizing the *work* and whose values are taken from a representative or canonical *expression* of the *work*		attribute: E55 Type
LRM-E3-A1	Expression	Category	A type to which the *expression* belongs		F2 Expression. P2 has type: E55 Type {Expression:Category}
LRM-E3-A2	Expression	Extent	A quantification of the extent of the *expression*		F2 Expression. P43 has dimension: E54 Dimension. P90 has value: E60 Number, a*nd* P91 has unit: E58 Measurement Unit
LRM-E3-A3	Expression	Intended audience	A class of users for which the *expression* is intended		F2 Expression. P103 was intended for: E55 Type {Personal characteristic}
LRM-E3-A4	Expression	Use rights	A class of use restrictions to which the *expression* is submitted		F2 Expression. P104 is subject to: E30 Right
LRM-E3-A5	Expression	Cartographic scale	A ratio of distances in a cartographic *expression* to the actual distances they represent		F2 Expression (instantiated as E36 Visual Item. {P2 has type: E55 Type = “cartographic image”}). P2 has type: E55 Type {Cartographic scale}
LRM-E3-A6	Expression	Language	A language used in the *expression*		F2 Expression (instantiated as E33 Linguistic Object). P72 has language: E56 Language
LRM-E3-A7	Expression	Key	A pitch structure (musical scale, ecclesiastic mode, raga, maqam, etc.), that characterizes the *expression*		F2 Expression. P2 has type: E55 Type {Key}
LRM-E3-A8	Expression	Medium of performance	A combination of performing tools (voices, instruments, ensembles, etc.) stated, intended, or actually used in the *expression*	stated or intended medium	F2 Expression. P103 was intended for: E55 Type {Medium of performance}
				actual medium	F2 Expression. R17i was created by: F28 Expression Creation. R81 recorded: F31 Performance. P125 used object of type: E55 Type {Medium of performance}
LRM-E4-A1	Manifestation	Category of carrier	A type of material to which all physical carriers of the *manifestation* are assumed to belong		F3 Manifestation. R69 has physical form: E55 Type {Category of carrier}
LRM-E4-A2	Manifestation	Extent	A quantification of the extent observed on a physical carrier of the *manifestation* and assumed to be observable on all physical carriers of the *manifestation*		F3 Manifestation. R70 has dimension: E54 Dimension. P90 has value: E60 Number, *and* P91 has unit: E58 Measurement Unit

LRM ID	LRM Entity	LRM Name	LRM Definition	Condition	Mapping
LRM-E4-A3	Manifestation	Intended audience	A class of users for which the physical carriers of the *manifestation* are intended		F3 Manifestation. P103 was intended for: E55 Type {Personal characteristic}
LRM-E4-A4	Manifestation	Manifestation statement	A statement appearing in exemplars of the *manifestation* and deemed to be significant for users to understand how the resource represents itself		F3 Manifestation. P3 has note {P3.1 has type: E55 Type = “manifestation statement”}: E62 String
LRM-E4-A5	Manifestation	Access conditions	Information as to how any of the carriers of the *manifestation* are likely to be obtained		F3 Manifestation. P3 has note {P3.1 has type: E55 Type = “access conditions”}: E62 String
LRM-E4-A6	Manifestation	Use rights	A class of use and/or access restrictions to which all carriers of the *manifestation* are assumed to be submitted		F3 Manifestation. P104 is subject to: E30 Right
LRM-E5-A1	Item	Location	The collection and/or institution in which the *item* is held, stored, or made available for access	normal shelf location	F5 Item. P54 has current permanent location: E53 Place
				current shelf location	F5 Item. P55 has current location: E53 Place
				collection	F5 Item. P46i forms part of: E78 Curated Holding. {P109 has current or former curator: E39 Actor}
				institution	F5 Item. P50 has current keeper: E39 Actor
LRM-E5-A2	Item	Use rights	A class of use and/or access restrictions to which the *item* is submitted		F5 Item. P104 is subject to: E30 Right
LRM-E6-A1	Agent	Contact information	Information useful for communicating with or getting in contact with the *agent*		E39 Actor. P76 has contact point: E41 Appellation. {P2 has type: E55 Type = “contact point”}
LRM-E6-A2	Agent	Field of activity	A field of endeavour, area of expertise, etc., in which the *agent* is engaged or was engaged		E39 Actor. P14i performed: E7 Activity**.** P2 has type: E55 Type {Sphere of activity}
LRM-E6-A3	Agent	Language	A language used by the *agent* when creating an expression		E39 Actor. P14i performed (P14.1 in the role of: E55 Type = “creator”}: F28 Expression Creation. R17 created: F2 Expression (instantiated as E33 Linguistic Object). P72 has language: E56 Language
					E39 Actor. P14i performed: E7 Activity. P2 has type: E55 Type {Creating expressions in Language [fill in the specific language]}

LRM ID	LRM Entity	LRM Name	LRM Definition	Condition	Mapping
LRM-E7-A1	Person	Profession / Occupation	A profession or occupation in which the *person* works or worked	long-term identification	E21 Person. P2 has type: E55 Type {Professional category}
				specific activity	E21 Person. P14i performed: E7 Activity. P2 has type: E55 Type {Occupational activity}
LRM-E9-A1	Nomen	Category	A type to which the *nomen* belongs a) the type of thing named b) the source in which the *nomen* is attested c) the function of the *nomen*		F12 Nomen. P2 has type: E55 Type {Nomen:Category}
LRM-E9-A2	Nomen	Nomen string	The combination of signs that forms an appellation associated with an entity through the *nomen*		F12 Nomen. R33 has string: E62 String
LRM-E9-A3	Nomen	Scheme	The scheme in which the *nomen* is established		F12 Nomen. R35 is specified by: F2 Expression. {P2 has type: E55 Type = “controlled vocabulary or knowledge organization system”}
LRM-E9-A4	Nomen	Intended audience	A class of users for which the *nomen* is considered appropriate or preferred		F12 Nomen. P103 was intended for: E55 Type {Personal characteristic}
LRM-E9-A5	Nomen	Context of use	Information as to the context(s) in which a *nomen* is used by the *agent* who is referred to through it		F12 Nomen. P16i was used for: E7 Activity {P14 carried out by: E39 Actor. P67i is referred to by: F12 Nomen}. P2 has type: E55 Type {Type of context}
LRM-E9-A6	Nomen	Reference source	A source in which there is evidence for the use of the *nomen*		F12 Nomen. R35 is specified by: F2 Expression. R4i is embodied in: F3 Manifestation
LRM-E9-A7	Nomen	Language	The language in which the *nomen* is attested		F12 Nomen. R54 has language: E56 Language
LRM-E9-A8	Nomen	Script	The script in which the *nomen string* is notated		F12 Nomen. P2 has type: E55 Type {Script}
LRM-E9-A9	Nomen	Script conversion	The rule, system, or standard that was used to create a *nomen string* of a *nomen* that is derived on the basis of a *nomen string* of another, distinct *nomen* whose *nomen string* is notated in		F12 Nomen {P2 has type: E55 Type = “transliterated”}. R36 uses script conversion: F36 Script Conversion

LRM ID	LRM Entity	LRM Name	LRM Definition	Condition	Mapping
			another, distinct script		
LRM-E10-A1	Place	Category	A type to which the *place* belongs		E53 Place. P2 has type: E55 Type {Place:Category}
LRM-E10-A2	Place	Location	A delimitation of the physical territory of the *place*		E53 Place. P168 is defined by: E94 Space Primitive
LRM-E11-A1	Time-span	Beginning	A value for the time at which the *time-span* started, expressed in a precise way in an authoritative external system to allow temporal positioning of events		E52 Time-Span. P82 at some time within: E61 Time Primitive/xsd:DateTime
LRM-E11-A2	Time-span	Ending	A value for the time at which the *time-span* ended, expressed in a precise way in an authoritative external system to allow temporal positioning of events		E52 Time-Span. P82 at some time within: E61 Time Primitive/xsd:DateTime

8.3. IFLA LRM Relationships

LRM ID	LRM Domain	Name (inverse)	LRM Range	LRM Definition	Condition	Mapping
LRM-R1	Res	is associated with (is associated with)	Res	This relationship links two *res* that have an association of any kind		no mapping (too broad), use specific properties
LRM-R2	Work	is realized through (realizes)	Expression	This relationship links a *work* with any of the *expressions* which convey the same intellectual or artistic content		F1 Work. R3 is realised in: F2 Expression
LRM-R3	Expression	is embodied in (embodies)	Manifestation	This relationship links an *expression* with a *manifestation* in which the *expression* appears		F2 Expression. R4i is embodied in: F3 Manifestation
LRM-R4	Manifestation	is exemplified by (exemplifies)	Item	This relationship connects a *manifestation* with any *item* that reflects the characteristics of that *manifestation*		F3 Manifestation. R7i is exemplified by: F5 Item
LRM-R5	Work	was created by (created)	Agent	This relationship links a *work* to an *agent* responsible for the creation of the intellectual or		F1 Work. R16i was created by: F27 Work Creation. P14 carried out by {P14.1 in the role of: E55 Type = “creator”}: E39 Actor

LRM ID	LRM Domain	Name (inverse)	LRM Range	LRM Definition	Condition	Mapping
				artistic content		
LRM-R6	Expression	was created by (created)	Agent	This relationship links an *expression* to an *agent* responsible for the realization of a *work*		F2 Expression. R17i was created by: F28 Expression Creation. P14 carried out by {P14.1 in the role of: E55 Type = “creator”}: E39 Actor
LRM-R7	Manifestation	was created by (created)	Agent	This relationship links a *manifestation* to an *agent* responsible for creating the *manifestation*		F3 Manifestation. R24i was created through: F30 Manifestation Creation. P14 carried out by: E39 Actor
LRM-R8	Manifestation	was manufactured by (manufactured)	Agent	This relationship links a *manifestation* to an *agent* responsible for the fabrication, production or manufacture of the *items* of that *manifestation*		F3 Manifestation. R27i was materialized by: F32 Item Production Event. P14 carried out by: E39 Actor
LRM-R9	Manifestation	is distributed by (distributes)	Agent	This relationship links a *manifestation* to an *agent* responsible for making i*tems* of that *manifestation* available		F3 Manifestation. P104 is subject to: E30 Right {P2 has type: E55 Type = “distribution”}. P75i is possessed by: E39 Actor
LRM-R10	Item	is owned by (owns)	Agent	This relationship links an i*tem* to an *agent* that is or was the owner or custodian of that *item*	ownership	F5 Item. P51 has former or current owner: E39 Actor
					custodianship	F5 Item. P49 has former or current keeper: E39 Actor
LRM-R11	Item	was modified by (modified)	Agent	This relationship links an *item* to an *agent* that made changes to this particular *item* without creating a new *manifestation*		F5 Item. P31i was modified by: E11 Modification. P14 carried out by: E39 Actor
LRM-R12	Work	has as subject (is subject of)	Res	This relationship links a *work* to its topic(s)		F1 Work. P129 is about: E1 CRM Entity
LRM-R13	Res	has appellation (is appellation of)	Nomen	This relationship links an entity with a sign or combination of signs or symbols through which that entity is referred to within a given scheme or context		E1 CRM Entity. P67i is referred to by: F12 Nomen
LRM-R14	Agent	assigned (was assigned by)	Nomen	This relationship links an *agen*t with a particular *nomen* that was		E39 Actor. P14i performed: E13 Attribute Assignment. P141 assigned: F12 Nomen

LRM ID	LRM Domain	Name (inverse)	LRM Range	LRM Definition	Condition	Mapping
				assigned by this *agent*		
LRM-R15	Nomen	is equivalent to (is equivalent to)	Nomen	This is the relationship between two *nomens* which are appellations of the same *res*		F12 Nomen. R56 has related form: F12 Nomen
LRM-R16	Nomen	has part (is part of)	Nomen	This relationship indicates that the *nomen string* of the domain *nomen* is constructed using the *nomen string* of another *nomen* as a component		F12 Nomen. R8 combines: F12 Nomen
LRM-R17	Nomen	is derivation of (has derivation)	Nomen	This relationship indicates that one *nomen* was used as the basis for another *nomen*, both of which are appellations of the same *res*		F12 Nomen. R56i is related form of {R56.1 has type E55 Type = “derivation”}: F12 Nomen
LRM-R18	Work	has part (is part of)	Work	This is the relationship between two *works,* where the content of one is a component of the other		F1 Work. R67 has part: F1 Work
LRM-R19	Work	precedes (succeeds)	Work	This is the relationship of two *works* where the content of the second is a logical continuation of the first		F1 Work. R1i has successor: F1 Work
LRM-R20	Work	accompanies / complements (is accompanied / complemented by)	Work	This is the relationship between two *works* which are independent, but can also be used in conjunction with each other as complements or companions		F1 Work. R77 accompanies or complements: F1 Work
LRM-R21	Work	is inspiration for (is inspired by)	Work	This is the relationship between two *works* where the content of the first served as the source of ideas for the second		F1 Work. R68i is inspiration for: F1 Work

LRM ID	LRM Domain	Name (inverse)	LRM Range	LRM Definition	Condition	Mapping
LRM-R22	Work	is a transformation of (was transformed into)	Work	This relationship indicates that a new *work* was created by changing the scope or editorial policy (as in a serial or aggregating *work*), the genre or literary form (dramatization, novelization), target audience (adaptation for children), or style (paraphrase, imitation, parody) of a previous *work*		F1 Work. R2 is derivative of: F1 Work
LRM-R23	Expression	has part (is part of)	Expression	This is a relationship between two *expressions* where one is a component of the other		F2 Expression. R5 has component: F2 Expression
LRM-R24	Expression	is derivation of (has derivation)	Expression	This relationship indicates that of two *expressions* of the same *work*, the second was used as the source for the other		F2 Expression. R76 is derivative of: F2 Expression
LRM-R25	Expression	was aggregated by (aggregated)	Expression	This relationship indicates that a specific *expression* of a *work* was chosen as part of the plan of an aggregating *expression*		F2 Expression. P165i is incorporated in: F2 Expression
LRM-R26	Manifestation	has part (is part of)	Manifestation	This is a relationship between two *manifestations* where one is a component of the other		F3 Manifestation. R71 has part: F3 Manifestation
LRM-R27	Manifestation	has reproduction (is reproduction of)	Manifestation	This is the relationship between two *manifestations* providing the end-user with exactly the same content and where an earlier *manifestation* has provided a source for the creation of a subsequent *manifestation*, such as facsimiles, reproductions, reprints, and reissues		F3 Manifestation. R30i was publication reproduced in: F33 Reproduction Event. R24 created: F3 Manifestation
LRM-R28	Item	has reproduction (is reproduction of)	Manifestation	This is the relationship between an *item* of one *manifestation* and		F5 Item. R29i was object reproduced by: F33 Reproduction Event. R24 created: F3

LRM ID	LRM Domain	Name (inverse)	LRM Range	LRM Definition	Condition	Mapping
				another *manifestation* providing the end-user with exactly the same content and where a specific *item* has provided a source for the creation of a subsequent *manifestation*		Manifestation
LRM-R29	Manifestation	has alternate (has alternate)	Manifestation	This relationship involves *manifestations* that effectively serve as alternatives for each other		F3 Manifestation. R78 has alternate: F3 Manifestation
LRM-R30	Agent	is member of (has member)	Collective Agent	This is a relationship between an *agent* and a *collective agent* that the *agent* joined as a member		E39 Actor. P107i is current or former member of: F55 Collective Agent
LRM-R31	Collective Agent	has part (is part of)	Collective Agent	This is a relationship between two *collective agents* where one is a component of the other		F55 Collective Agent. P107 has current or former member: F55 Collective Agent
LRM-R32	Collective Agent	precedes (succeeds)	Collective Agent	This is a relationship between two *collective agent*s where the first was transformed into the second		F55 Collective Agent. P151i participated in: E66 Formation. P151 was formed from: F55 Collective Agent
LRM-R33	Res	has association with (is associated with)	Place	This relationship links any entity with a given extent of space		no mapping (too broad), use specific properties
LRM-R34	Place	has part (is part of)	Place	This is a relationship between two *places* where one is a component of the other		E53 Place. P89i contains: E53 Place
LRM-R35	Res	has association with (is associated with)	Time-span	This relationship links any entity with a temporal extent		no mapping (too broad), use specific properties
LRM-R36	Time-span	has part (is part of)	Time-span	This is a relationship between two *time-spans* where one is a component of the other		E52 Time-Span. P86i contains: E52 Time-Span

8.4 Mapping from LRM$_{OO}$ to IFLA LRM

This mapping indicates the correspondence between classes and properties in LRM$_{OO}$ and the entities, attributes and relationships in IFLA LRM. The symbols in the ***Map*** column indicate whether the correspondence is equivalent ("="), or whether the LRM$_{OO}$ element is broader than the IFLA LRM element (>), or else narrower than it (<). The indication N/A applies when the LRM$_{OO}$ element does not map to IFLA LRM (other than by refining either the LRM-E1 Res entity or the top level LRM-R1 associates relationship). This is the case for five LRM$_{OO}$ properties.

Table 11. Mapping LRM$_{OO}$ Classes

LRM$_{OO}$ ID	***LRM$_{OO}$ Class***	***Map***	***LRM ID***	***IFLA LRM entity, attribute or relationship***	***Remarks***
F1	Work	"="	LRM-E2	Work	
F2	Expression	"="	LRM-E3	Expression	
F3	Manifestation	"="	LRM-E4	Manifestation	
F5	Item	"="	LRM-E5	Item	
F11	Corporate Body	<	LRM-E8	Collective Agent	Use superclass, or create subcategory
F12	Nomen	"="	LRM-E9	Nomen	
F18	Serial Work [PRESS$_{OO}$]	<	LRM-E2	Work	Use superclass
F27	Work Creation	"="	LRM-R5	Work *was created by (created)* Agent	LRM$_{OO}$ reifies the IFLA LRM relationship
F28	Expression Creation	"="	LRM-R6	Expression *was created by (created)* Agent	LRM$_{OO}$ reifies the IFLA LRM relationship
F30	Manifestation Creation	"="	LRM-R7	Manifestation *was created by (created)* Agent	LRM$_{OO}$ reifies the IFLA LRM relationship
F31	Performance	<	LRM-R6	Expression {LRM-E3-A1 Category = "performance"} *was created by (created)* Agent	Refinement of the IFLA LRM relationship for a category of Expression
F32	Item Production Event	"="	LRM-R8	Manifestation *was manufactured by (manufactured)* Agent	LRM$_{OO}$ reifies the IFLA LRM relationship

LRM$_{OO}$ ID	***LRM$_{OO}$ Class***	***Map***	***LRM ID***	***IFLA LRM entity, attribute or relationship***	***Remarks***
F33	Reproduction Event	>	LRM-R27 OR LRM-R28	Manifestation *has reproduction (is reproduction of)* Manifestation OR Item *has reproduction (is reproduction of)* Manifestation	LRM$_{OO}$ reifies the IFLA LRM relationships In LRM$_{OO}$ the properties R29 and R30 differentiate the IFLA LRM relationships
F36	Script Conversion	>	LRM-E9-A9	Script conversion (of Nomen)	In LRM$_{OO}$ the class can relate to any E33 Linguistic Object, in IFLA LRM the property is only for LRM-E9 Nomen
F39	Family	<	LRM-E8	Collective Agent	Use superclass, or create subcategory
F55	Collective Agent	"="	LRM-E8	Collective Agent	

Note: 5 IFLA LRM entities (LRM-E1 Res, LRM-E6 Agent, LRM-E7 Person, LRM-E10 Place, LRM-E11 Time-span) do not appear in the mapping as they correspond directly to CIDOC CRM classes.

Table 12. Mapping LRM_{OO} Properties

LRM_{OO} ID	***LRM_{OO} Property Name***	***LRM_{OO} Domain Class***	***LRM_{OO} Range Class***	***Map***	***IFLA LRM ID***	***IFLA LRM relationship or attribute***	***Remarks***
R1	is logical successor of (has successor)	F1 Work	F1 Work	"="	LRM-R19i	Work *succeeds* Work	Mapping is to inverse relationship
R2	is derivative of (has derivative)	F1 Work	F1 Work	"="	LRM-R22	Work *is a transformation of (was transformed into)*Work	
R3	is realised in (realises)	F1 Work	F2 Expression	"="	LRM-R2	Work *is realized through (realizes)* Expression	
R4	embodies (is embodied in)	F3 Manifestation	F2 Expression	"="	LRM-R3i	Manifestation *embodies* Expression	Mapping is to inverse relationship
R5	has component (is component of)	F2 Expression	F2 Expression	"="	LRM-R23	Expression *has part (is part of)* Expression	
R7	exemplifies (is exemplified by)	F5 Item	F3 Manifestation	"="	LRM-R4i	Item *exemplifies* Manifestation	Mapping is to inverse relationship
R8	combines (is combined to form)	F12 Nomen	F12 Nomen	"="	LRM-R16	Nomen *has part (is part of)* Nomen	
R10	is member of (has member)	F1 Work	**E28 Conceptual Object**	<	LRM-R1	Res (subclass Work) *is associated with* Res {LRM-E1-A1 Category = "conceptual object"}	Refinement is not declared in IFLA LRM
R11	has issuing rule (is issuing rule of) [$PRESS_{OO}$]	F18 Serial Work	**E29 Design or Procedure**	N/A	N/A		Out of scope for IFLA LRM
R15	has fragment (is fragment of)	F2 Expression	**E90 Symbolic Object**	N/A	N/A		Out of scope for IFLA LRM
R16	created (was created by)	F27 Work Creation	F1 Work	"="	LRM-R5i	Agent *created* Work	*Mapping is to inverse relationship using **P14i** and **F27** in a path
R17	created (was created by)	F28 Expression	F2 Expression	"="	LRM-R6i	Agent *created* Expression	*Mapping is to inverse

LRM$_{OO}$ ID	*LRM$_{OO}$ Property Name*	*LRM$_{OO}$ Domain Class*	*LRM$_{OO}$ Range Class*	*Map*	*IFLA LRM ID*	*IFLA LRM relationship or attribute*	*Remarks*
		Creation					relationship using **P14i** and **F28** in a path
R19	created a realisation of (was realised through)	F28 Expression Creation	F1 Work	"="	LRM-R6i AND LRM-R2i	Agent *created* Expression AND Expression *realizes* Work	Shortcut. *Mapping is to inverse relationships using **P14i** and **F28** in a path
R24	created (was created through)	F30 Manifestation Creation	F3 Manifestation	"="	LRM-R7i	Agent *created* Manifestation	*Mapping is to inverse relationship using **P14i** and **F30** in a path
R27	materialized (was materialized by)	F32 Item Production Event	F3 Manifestation	"="	LRM-R8i	Agent *manufactured* Manifestation	*Mapping is to inverse relationship using **P14i** and **F32** in a path
R28	produced (was produced by)	F32 Item Production Event	F5 Item	"="	LRM-R8i AND LRM-R4	Agent *manufactured* Manifestation AND Manifestation *is exemplified by (exemplifies)* Item	Shortcut. *Mapping is to inverse relationship using **P14i** and **F32** in a path
R29	reproduced object (was object reproduced by)	F33 Reproduction Event	F5 Item	"="	LRM-R28i	Manifestation *is reproduction of* Item	**Mapping is to inverse relationship using **R24i** and **F30** in a path
R30	reproduced publication (was publication reproduced by)	F33 Reproduction Event	F3 Manifestation	"="	LRM-R27i	Manifestation *is reproduction of* Manifestation	**Mapping is to inverse relationship using **R24i** and **F30** in a path
R33	has string	F12 Nomen	**E62 String**	"="	LRM-E9-A2	Nomen string	
R35	is specified by (specifies)	F12 Nomen	F2 Expression	>	LRM-E9-A3 OR LRM-E9-A6	Scheme (of Nomen) OR Reference source (of Nomen)	The scheme is a controlled vocabulary where the Nomen appears OR The Nomen appears embedded in a statement in a reference source
R36	uses script conversion (is	F12 Nomen	F36 Script	"="	LRM-E9-A9	Script conversion (of	

LRM$_{OO}$ ID	*LRM$_{OO}$ Property Name*	*LRM$_{OO}$ Domain Class*	*LRM$_{OO}$ Range Class*	*Map*	*IFLA LRM ID*	*IFLA LRM relationship or attribute*	*Remarks*
	script conversion used in)		Conversion			Nomen)	
R54	has language (is language of)	F12 Nomen	**E56 Language**	"="	LRM-E9-A7	Language (of Nomen)	
R56	has related form (is related form of)	F12 Nomen	F12 Nomen	>	LRM-R15 OR LRM-R17	Nomen *is equivalent to* Nomen OR Nomen *is derivation of (has derivation)* Nomen	General or specific type of relationship between Nomens of the same Res
R67	has part (forms part of)	F1 Work	F1 Work	"="	LRM-R18	Work *has part (is part of)* Work	
R68	is inspired by (is inspiration for)	F1 Work	F1 Work	"="	LRM-R21i	Work *is inspired by* Work	Mapping is to inverse relationship
R69	has physical form (is physical form of)	F3 Manifestation	**E55 Type**	<	LRM-E4-A1	Category of carrier	
R70	has dimension (is dimension of)	F3 Manifestation	**E54 Dimension**	"="	LRM-E4-E2	Extent (of Manifestation)	
R71	has part (is part of)	F3 Manifestation	F3 Manifestation	"="	LRM-R26	Manifestation *has part (is part of)* Manifestation	
R73	takes representative attribute from (bears representative attribute for)	F1 Work	F2 Expression	"="	LRM-E2-A2 AND LRM-R2	Representative expression attribute (of Work) AND Work *is realized through (realizes)* Expression	Shortcut. The domain of LRM-R2 bears the LRM-E2-A2 attribute and its range the desired attribute value
R74	uses expression of (has expression used in)	F1 Work	F1 Work	N/A	N/A		No IFLA LRM equivalent
R75	incorporates (is incorporated in)	F2 Expression	F2 Expression	N/A	N/A		No IFLA LRM equivalent

LRM$_{OO}$ ID	*LRM$_{OO}$ Property Name*	*LRM$_{OO}$ Domain Class*	*LRM$_{OO}$ Range Class*	*Map*	*IFLA LRM ID*	*IFLA LRM relationship or attribute*	*Remarks*
R76	is derivative of (has derivative)	F2 Expression	F2 Expression	"="	LRM-R24	Expression *is derivation of (has derivation)* Expression	
R77	accompanies or complements (is accompanied or complemented by)	F1 Work	F1 Work	"="	LRM-R20	Work *accompanies / complements (is accompanied / complemented by)* Work	
R78	has alternate	F3 Manifestation	F3 Manifestation	"="	LRM-R29	Manifestation *has alternate* Manifestation	
R79	has representative expression attribute (is representative expression attribute of)	F1 Work	**E55 Type**	"="	LRM-E2-A2	Representative expression attribute	
R80	performed (is performed in)	F31 Performance	F1 Work	"="	LRM-R6i AND LRM-R2i	Agent *created* Expression {LRM-E3-A1 Category = "performance"} AND Expression *realizes* Work	Shortcut. *Mapping is to inverse relationships using **P14i** and **F28** in a path
R81	recorded (is recorded in)	F28 Expression Creation	F31 Performance	"="	LRM-R6i AND LRM-R24 AND LRM-R6	Agent(1) *created* Expression {LRM-E3-A1 Category = "recording"} *is derivation of (has derivation)* Expression {LRM-E3-A1 Category = "performance"} *was created by* Agent(2)	Shortcut. ***Mapping is nested and includes inverse relationships using **P14i** and **F28** in a path

Notes:

* Mappings with paths involving **P14i** mean the property is mapped to a longer path that begins:

E39 Actor. P14i performed: E7 Activity (for a subclass of E7 Activity)

Fully worked out case:

E39 Actor. P14i performed: E7 Activity (of subclass F27 Work Creation). R16 created: F1 Work

= LRM-E6 Agent LRM-R5i created LRM-E2 Work

** Mappings for reproductions given in full (for a reproduction of a Manifestation, substitute *R30 reproduced publication* for *R29 reproduced object* and LRM-R27 for LRM-R28):

F3 Manifestation. R24i was created through: F30 Manifestation Creation (of subclass F33 Reproduction Event). R29 reproduced object: F5 Item

= LRM-E4 Manifestation LRM-R28i is reproduction of LRM-E5 Item

*** Mapping for recording in full:

E39 Actor(1): P14i performed: E7 Activity (of subclass F28 Expression Creation). R17 created: F2 Expression AND

F28 Expression Creation. R81 recorded: F31 Performance (a subclass of E7 Activity). P14 carried out by: E39 Actor(2)

= LRM-E6 Agent(1) LRM-R6i created LRM-E3 Expression(1) {LRM-E3-A1 Category = “recording”}LRM-R24 is derivation of LRM-E3 Expression(2) {LRM-E3-A1 Category = “performance”} LRM-R6 was created by LRM-E6 Agent(2)

Table 13. Mapping Residual FRBR$_{OO}$ Classes

FRBR$_{OO}$ ID	***FRBR$_{OO}$ Class***	***Map***	***LRM ID***	***LRM entity or attribute***	***Remarks***
F38	Character	<	LRM-E1	Res {LRM-E1-A1 Category = "conceptual object"}	Out of scope for IFLA LRM Define a subcategory of Res
F51	Pursuit	>	LRM-E6-A2 OR LRM-E7-A1	Field of activity OR Profession / Occupation	FRBR$_{OO}$ corresponds to reified IFLA LRM attributes The second mapping can only apply to Agents of category LRM-E7 Person
F52	Name Use Activity	"="	LRM-E9	Nomen	IFLA LRM reifies the Name Use Activity into LRM-E9 Nomen

NB: 1 class (F38 Character) does not map to IFLA LRM other than as a refinement of LRM-E1 Res; as a result its two properties in Table 14 below do not map.

Table 14. Mapping Residual FRBR$_{OO}$ Properties

FRBR$_{OO}$ ID	***FRBR$_{OO}$ Property Name***	***FRBR$_{OO}$ Domain Class***	***FRBR$_{OO}$ Range Class***	***Map***	***IFLA LRM ID***	***IFLA LRM relationship or attribute***	***Remarks***
R57	is based on (is basis for)	F38 Character	**E39 Actor** [=LRM-E6 Agent]	N/A	N/A		Out of scope for IFLA LRM
R58	has fictional member (is fictional member of)	F38 Character	F38 Character	N/A	N/A		Out of scope for IFLA LRM
R59	had typical subject (was typical subject of)	F51 Pursuit	**E1 CRM Entity**	"="	LRM-E6-A2	Field of activity (of Agent)	*Using **P14i** in a path
R60	used to use language (was language used by)	F51 Pursuit	**E56 Language**	"="	LRM-E6-A3	Language (of Agent)	*Using **P14i** in a path
R61	occurred in kind of context (was kind of context for)	F52 Name Use Activity	**E55 Type**	<	LRM-E9-A5	Context of use	
R62	was used for membership in (was context for)	F52 Name Use Activity	**E74 Group**	<	LRM-E9-A5	Context of use	
R63	named (was named by)	F52 Name Use	**E1 CRM Entity**	"="	LRM-R13i	Nomen *is appellation of*	**Using **R64i** in a

FRBR$_{OO}$ ID	*FRBR$_{OO}$ Property Name*	*FRBR$_{OO}$ Domain Class*	*FRBR$_{OO}$ Range Class*	*Map*	*IFLA LRM ID*	*IFLA LRM relationship or attribute*	*Remarks*
		Activity				Res	path
R64	used name (was name used by)	F52 Name Use Activity	**E41 Appellation**	"="	LRM-R14	Agent *assigned* (*was assigned by)* Nomen	*Using **P14i** in a path

* Mappings with paths involving **P14i** mean the property is mapped as the second part of a path that begins:

E39 Actor. P14i performed: E7 Activity (for a subclass of E7 Activity)

Fully worked out case:

E39 Actor. P14i performed: E7 Activity (of subclass F51 Pursuit). R59 had typical subject: E1 CRM Entity ("the field")

= LRM-E6 Agent has attribute LRM-E6-A2 Field of activity

** Mapping with **R64i**:

E41 Appellation. R64i was name used by: F52 Name Use Activity. R63 named: E1 CRM Entity

= LRM-E9-A2 Nomen string of LRM-E9 Nomen LRM-R13i is appellation of LRM-E1 Res

9. Residual FRBR$_{OO}$ Classes and Properties

The classes and properties declared in this section were declared in FRBR$_{OO}$ version 2.4 and have not been deprecated. They cover valid concepts that are out of scope for other harmonised models. However, they are not necessary for an implementation of LRM$_{OO}$. They may be implemented as a transition mechanism for implementations of the superseded model FRBR$_{OO}$ version 2.4 that require them.

Table 15. Residual FRBR$_{OO}$ Classes

Class ID	Class Name
F38	Character
F51	Pursuit
F52	Name Use Activity

Table 16. Residual FRBR$_{OO}$ Properties

Property ID	Property Name	Class – Domain	Class – Range
R57	is based on (is basis for)	F38 Character	**E39 Actor**
R58	has fictional member (is fictional member of)	F38 Character	F38 Character
R59	had typical subject (was typical subject of)	F51 Pursuit	**E1 CRM Entity**
R60	used to use language (was language used by)	F51 Pursuit	**E56 Language**
R61	occurred in kind of context (was kind of context for)	F52 Name Use Activity	**E55 Type**
R62	was used for membership in (was context for)	F52 Name Use Activity	**E74 Group**
R63	named (was named by)	F52 Name Use Activity	**E1 CRM Entity**
R64	used name (was name used by)	F52 Name Use Activity	**E41 Appellation**

Table 17. Residual FRBR$_{OO}$ .1 Properties

Property ID	Property Name	Property – Domain	Class – Range
R60.1	has type of use	F51 Pursuit. **R60 used to use language (was language used by)**: E56 Language	**E55 Type**

9.1. Class declarations of residual FRBR$_{OO}$ classes

F38 Character

Subclass of: E28 Conceptual Object

Scope note: This class comprises fictional or iconographic individuals or groups of individuals (including families) appearing in works in a way relevant as subjects. Characters may be purely fictitious or based on real persons or groups, but as characters they may exhibit properties that would be inconsistent with a real person or group. Rather than merging characters with real persons, they should be described as disjoint, but related entities.

Examples:

- Harry Potter [in J. K. Rowling's series of novels and the films based on them]
- Sinuhe the Egyptian [in Mika Waltari's novel]
- The Knights of the Round Table [in fiction]

In First Order Logic:

F38(x) ⇒E28(x)

Properties**:** R57 is based on (is basis for): E39 Actor

R58 has fictional member (is fictional member of): F38 Character

F51 Pursuit

Subclass of: E7 Activity

Scope note: This class comprises periods of continuous activity of an Actor in a specific professional or creative domain or field.

Examples:

- Natalya Goncharova working as a set and costume designer, painter, illustrator and poet in Russia and France in the first half of the 20th century
- Satyajit Ray working as a film maker, writer, composer and graphic designer in India in the second half of the 20th century
- Folger Shakespeare Library in Washington studying the works of William Shakespeare
- M. & N. Hanhart working in lithographic publishing (1839-1882)

In First Order Logic:

F51(x) ⇒E7(x)

Properties: R59 had typical subject (was typical subject of): E1 CRM Entity

R60 used to use language (was language used by): E56 Language

(R60.1 has type of use: E55 Type)

F52 Name Use Activity

Subclass of: E13 Attribute Assignment

Scope note: This class comprises periods of continuous use of a specific instance of E41 Appellation for a particular instance of E1 CRM Entity by an E39 Actor. It includes in particular the use of the name by its carrier. Characteristically, actors performing an activity may choose a particular appellation for themselves in the context of this activity. Such cases should be modelled by additionally classifying these activities as instances of F52 Name Use Activity.

It is possible to specify the type of name use, through the *P2 has type (is type of)* property, e.g.: use of a pseudonym, use of a married name, use of a birth name, use of a blended name, use of a religious name.

Examples:

- using the pseudonym 'Prince' until 1993, and again from 2000 on
- using the pseudonym 'Love Symbol' from 1993 to 2000
- using the pseudonym 'Lewis Carroll' when authoring works of fiction (*has type* Use of a pseudonym (E55))
- using the name 'Charles Dodgson' when authoring works of mathematics and logics (*has type* Use of a birth name (E55))
- using the name 'Mother Teresa' instead of 'Agnes Gonxha Bojaxhiu' when becoming head of the Missionaries of Charity (*has type* Use of a religious name (E55))
- using the name 'Elizabeth Barrett Browning' instead of 'Elizabeth Barrett Barrett' after marrying Robert Browning (*has type* Use of a married name (E55))
- using the name 'Antonio Villaraigosa' instead of 'Antonio Villar' after marrying Corina Raigosa (*has type* Use of a blended name (E55)) [When former mayor of Los Angeles Antonio Villar and Corina Raigosa married in 1987, the two spouses decided they would merge their two last names into one.]

In First Order Logic:

F52(x) ⇒E13(x)

Properties: R61 occurred in kind of context (was kind of context for): E55 Type

R62 was used for membership in (was context for): E74 Group

R63 named (was named by): E1 CRM Entity

R64 used name (was name used by): E41 Appellation

9.2. Property declarations of residual FRBR$_{oo}$ properties

R57 is based on (is basis for)

Domain: F38 Character

Range: E39 Actor

Quantification: many to many (0,n:0,n)

Scope note: This property associates an instance of F38 Character with an instance of E39 Actor that the character is motivated by or is intended to represent. An instance of F38 Character may be based on a combination of features taken from several actors.

This property is a shortcut for the path from E28 Conceptual Object, restricted to F38 Character, through the inverse of *P94 has created (was created by):* E65 Creation. *P17 was motivated by (motivated)* to E1 CRM Entity restricted to E39 Actor.

Full path: F38 Character. P94i was created by: E65 Creation. P17 was motivated by (motivated): E39 Actor

Examples:

- The character 'Sinuhe' (F38) in Mika Waltari's 'Sinuhe the Egyptian: A Novel' *is based on* Sinuhe (E21). [Documented in the autobiographic narrative in fragments carried by The Ramesside Papyrus, Pap. Berlin 10499, Pap. Berlin 3022, The Amherst fragments (m-q) and other Egyptian sources.]
- The character 'Alexander' (F38) in Mary Renault's 'Fire from Heaven' *is based on* Alexander the Great of Macedon (356-323) (E21).

In First Order Logic:

$R57(x,y) \Rightarrow F38(x)$
$R57(x,y) \Rightarrow E39(y)$
$R57(x,y) \Rightarrow (\exists z)\,[E65(z) \wedge P94i(x,z) \wedge P17(z,y)]$

R58 has fictional member (is fictional member of)

Domain: F38 Character

Range: F38 Character

Subproperty of: Out of CIDOC CRM Scope

Quantification: many to many (0,n:0,n)

Scope note: This property associates an instance of F38 Character representing a group with another instance of F38 Character that is presented in relevant fiction as a member of the fictional group. This property is not transitive. It is asymmetric and irreflexive.

Examples:

- The Argonauts (F38) *has fictional member* Jason (F38).

In First Order Logic:

$R58(x,y) \Rightarrow F38(x)$
$R58(x,y) \Rightarrow F38(y)$
$R58(x,y) \Rightarrow \neg R58(y,x)$

R59 had typical subject (was typical subject of)

Domain: F51 Pursuit

Range: E1 CRM Entity

Quantification: many to many (0,n:0,n)

Scope note: This property associates an instance of F51 Pursuit with the instance of E1 CRM Entity that is the typical subject of the associated activity, such as an area of expertise in which the actor is engaged or was engaged.

This property is a shortcut for the path from E65 Creation (a subclass of E7 Activity) through *P94 has created (was created by)* which creates an instance of E89 Propositional Object associated with any E1 CRM Entity as its subject through *P129 is about (is subject of)*. The subject is the typical subject of the instance of F51 Pursuit.

Full path: E65 Creation. P94 has created (was created by): E89 Propositional Object. P129 is about (is subject of): E1 CRM Entity

Examples:

- John Dover Wilson's activity as a Shakespeare scholar (F51) *had typical subject* William Shakespeare (E21).

In First Order Logic:

R59(x,y) ⇒F51(x)
R59(x,y) ⇒E1(y)
R59(x,y) ⇒(∃z) [E89(z) ∧P94(x,z) ∧P129(z,y)]

R60 used to use language (was language used by)

Domain: F51 Pursuit

Range: E56 Language

Quantification: many to many (0,n:0,n)

Scope note: This property associates an instance of F51 Pursuit with the instance of E56 Language that was characteristically used for the products of the associated activity.

This property is a shortcut for the path from E65 Creation (a subclass of E7 Activity) through *P94 has created (was created by)* which creates an instance of E33 Linguistic Object associated with an instance of E56 Language through *P72 has language (is language of)*. The language is the one typically used in the instance of F51 Pursuit.

Full path: E65 Creation. P94 has created (was created by): E33 Linguistic Object. P72 has language (is language of): E56 Language

Properties: R60.1 has type of use: E55 Type

This property allows for specifying a particular form of use.

Examples:

- Samuel Beckett's activity as author of English texts (F51) *used to use language* eng [English] (E56) with *has type of use* Authorship (E55).
- Samuel Beckett's activity as author of French texts (F51) *used to use language* fre [French] (E56) with *has type of use* Authorship (E55).
- Samuel Beckett's activity as translator of English texts into French (F51) *used to use language* fre [French] (E56) with *has type of use* Translation – target language (E55).
- Samuel Beckett's activity as translator of English texts (F51) *used to use language* eng [English] (E56) with *has type of use* Translation – source language (E55).

In First Order Logic:

R60(x,y) ⇒F51(x)
R60(x,y) ⇒E56(y)
R60(x,y) ⇒(∃z) [E33(z) ∧P94(x,z) ∧P72(z,y)]
R60(x,y,z) ⇒R60(x,y) ∧E55(z)

R61 occurred in kind of context (was kind of context for)

Domain: F52 Name Use Activity

Range: E55 Type

Quantification: many to many (0,n:0,n)

Scope note: This property associates an instance of F52 Name Use Activity with the instance of E55 Type that characterises the kind of role or context within which the associated name was used.

This property is a shortcut for the path from F52 Name Use Activity through the inverse of *P9 consists of (forms part of)*, and an instance of F51 Pursuit through *P2 has type (is type of)* to an E55 Type.

Full path: F52 Name Use Activity. P9i forms part of: F51 Pursuit. P2 has type (is type of): E55 Type

Examples:

- Charles Lutwidge Dodgson using the name 'Lewis Carroll' (F52) *occurred in kind of context* writing for children (E55).
- Charles Lutwidge Dodgson using the name 'Charles Dodgson' (F52) *occurred in kind of context* writing in mathematics (E55).

In First Order Logic:

R61(x,y) ⇒F52(x)
R61(x,y) ⇒E55(y)
R61(x,y) ⇒(∃z) [F51(z) ∧P9i(x,z) ∧P2(z,y)]

R62 was used for membership in (was context for)

Domain: F52 Name Use Activity

Range: E74 Group

Quantification: many to many (0,n:0,n)

Scope note: This property associates an instance of F52 Name Use Activity with the instance of E74 Group that characterises the context within which the associated name was used for membership in that group.

This property is a shortcut for the path from E7 Activity, restricted to its subclass F52 Name Use Activity, through *P17 was motivated by (motivated)*, E85 Joining, and *P144 joined with (gained member by)* to E74 Group.

Full path: F52 Name Use Activity. P17 was motivated by (motivated): E85 Joining. P144 joined with (gained member by): E74 Group

Examples:

- Using the name 'John Paul I' (F52) *was used for membership* in the corporate body identified in the Library of Congress's authority file as 'Catholic Church. Pope' (E74).

In First Order Logic:

R62(x,y) ⇒F52(x)
R62(x,y) ⇒E74(y)
R62(x,y) ⇒(∃z) [E85(z) ∧P17(x,z) ∧P144(z,y)]

R63 named (was named by)

Domain: F52 Name Use Activity

Range: E1 CRM Entity

Subproperty of: E13 Attribute Assignment. P140 assigned attribute to (was attributed by): E1 CRM Entity

Quantification: many to one, necessary (1,1:0,n)

Scope note: This property associates an instance of F52 Name Use Activity with the instance of E1 CRM Entity that the associated name was used for.

Examples:

- The recording of the MARC 21 field '110 2_ |a Canadian Academic Centre in Italy' (F52) *named* the corporate body represented by the Library of Congress authority record number n 85118480 (F11).
- The appearance of the name 'Centro accademico canadese in Italia' on the title page of the book 'Lo Scavo di S. Giovanni di Ruoti ed il periodo tardoantico in Basilicata' published in 1983 (F52) *named* the corporate body represented by the Library of Congress authority record number n 85118480 (F11).
- The statement 'IFLA is the global voice of libraries, representing the interests of the profession and working to improve services worldwide' (F52) cited from the 'About IFLA' page of the website http://www.ifla.org/ *named* the corporate body represented by the Library of Congress authority record number n 78004438 (F11).

In First Order Logic:

R63(x,y) ⇒F52(x)
R63(x,y) ⇒E1(y)
R63(x,y) ⇒P140(x,y)

R64 used name (was name used by)

Domain:	F52 Name Use Activity
Range:	E41 Appellation
Subproperty of:	E7 Activity. P16 used specific object (was used for): E70 Thing
Quantification:	many to one, necessary (1,1:0,n)
Scope note:	This property associates an instance of F52 Name Use Activity with the instance of E41 Appellation that was used for the associated entity.

Examples:

- The appearance of the name 'Lewis Carroll' on the title page of 'Le avventure d'Alice nel paese delle meraviglie', published in 1872 in London by Macmillan and Co. (F52) *used name* 'Lewis Carroll' (E41).
- The appearance of the name 'Centro accademico canadese in Italia' on the title page of the book 'Lo Scavo di S. Giovanni di Ruoti ed il periodo tardoantico in Basilicata' published in 1983 (F52) *used name* 'Centro accademico canadese in Italia' (E41).
- The appearance of the name 'Canadian Academic Centre in Italy' on page 6 of the book 'Lo Scavo di S. Giovanni di Ruoti ed il periodo tardoantico in Basilicata' published in 1983 (F52) *used name* 'Canadian Academic Centre in Italy' (E41).
- The appearance of the name 'IFLA' as an acronym for 'The International Federation of Library Associations and Institutions' in the sentence 'IFLA is the global voice of libraries, representing the interests of the profession and working to improve services worldwide' cited from the 'About IFLA' page of the website http://www.ifla.org/ (F52) *used name* 'IFLA' (E41).

In First Order Logic:

R64(x,y) ⇒F52(x)
R64(x,y) ⇒E41(y)
R64(x,y) ⇒P16(x,y)

9.3. Mapping of IFLA LRM Attributes and Relationships using Residual FRBR$_{oo}$ Classes and Properties

The mappings presented in this section can optionally supplement the mappings presented in section 8 for a small subset of IFLA LRM attributes and relationships. The mappings in section 8 use only LRM$_{oo}$ and CIDOC CRM classes and properties; in these mappings certain CIDOC CRM classes and properties are substituted by their subclasses or subproperties taken from sections 9.1 and 9.2, making the mappings more specific. Only the relevant IFLA LRM attributes and relationships are mapped in this section. These additional mappings would be of interest for those implementations which implemented these FRBR$_{oo}$ classes and properties in FRBR$_{oo}$ version 2.4 and want to retain that specificity.

Table 18. Selected IFLA LRM Attributes

LRM ID	LRM Entity	LRM Name	LRM Definition	Condition	Mapping
LRM-E6-A2	Agent	Field of activity	A field of endeavour, area of expertise, etc., in which the *agent* is engaged or was engaged	Subject specialization	E39 Actor. P14i performed: **F51 Pursuit. R59 had typical subject**: E1 CRM Entity
				Type of field	E39 Actor. P14i performed: **F51 Pursuit.** P2 has type: E55 Type {Field of activity}
LRM-E6-A3	Agent	Language	A language used by the *agent* when creating an expression	Specific expression creation (section 8.2)	E39 Actor. P14i performed (P14.1 in the role of: E55 Type = “creator”}: F28 Expression Creation. R17 created: F2 Expression (instantiated as E33 Linguistic Object). P72 has language: E56 Language
				Habitual expression creation	E39 Actor. P14i performed: **F51 Pursuit. R60 used to use language** {**R60.1 has type**: E55 Type = “creating expressions that are linguistic objects”}: E56 Language
LRM-E7-A1	Person	Profession / Occupation	A profession or occupation in which the *person* works or worked	Long-term identification (section 8.2)	E21 Person. P2 has type: E55 Type {Professional category}
				Activity in a specific period	E21 Person. P14i performed: **F51 Pursuit**. P2 has type: E55 Type {Occupational activity}
LRM-E9-A5	Nomen	Context of use	Information as to the context(s) in which a *nomen* is used by the *agent* who is referred to through it	General type of use context	F12 Nomen. **R64i was name used by: F52 Name Use Activity** {P14 carried out by: E39 Actor. **R63i was named by: F52 Name Use Activity**}. **R61 occurred in kind of context**: E55 Type {Type of context}

				Use in context of group membership	F12 Nomen. **R64i was name used by: F52 Name Use Activity** {P14 carried out by: E39 Actor. **R63i was named by: F52 Name Use Activity**}. **R62 was used for membership in**: E74 Group

Table 19. Selected IFLA LRM Relationships

LRM ID	LRM Domain	Name (inverse)	LRM Range	LRM Definition	Mapping
LRM-R13	Res	has appellation (is appellation of)	Nomen	This relationship links an entity with a sign or combination of signs or symbols through which that entity is referred to within a given scheme or context	E1 CRM Entity. **R63i was named by: F52 Name Use Activity. R64 used name**: F12 Nomen
LRM-R14	Agent	assigned (was assigned by)	Nomen	This relationship links an *agent* with a particular *nomen* that was assigned by this *agent*	E39 Actor. P14i performed: **F52 Name Use Activity. R64 used name**: F12 Nomen

10. Migration from FRBR$_{OO}$ to LRM$_{OO}$

This section consists of a comprehensive list of the classes and properties that were declared in the last approved version of FRBR$_{OO}$ (version 2.4, 2015) and provides the corresponding LRM$_{OO}$ or CIDOC CRM class or property. The last column indicates briefly whether the class or property was retained or deprecated in LRM$_{OO}$. For those classes and properties that were retained in a transformed version, the change (which might involve renaming) is briefly indicated. For the deprecated classes and properties, the corresponding class or property (or appropriate path) to substitute when implementing LRM$_{OO}$ is noted in the second column, with a brief explanation in the last column. This substitute class, property or path is in a number of cases drawn from CIDOC CRM. These recommended correspondences may need to be adjusted to maintain internal consistency when migrating specific implementations of FRBR$_{OO}$, considering usage in the implementation. Some data validation may also be required. The classes and properties listed in section 9 above are simply indicated as 'See Section 9' in the LRM$_{OO}$ column.

10.1. Migration of FRBR$_{OO}$ Classes

Table 20. Mapping of FRBR$_{OO}$ Classes to LRM$_{OO}$

FRBR$_{OO}$ version 2.4	**LRM$_{OO}$**	**Changes for LRM$_{OO}$**
F1 Work	F1 Work	Retained, editorial scope note revision
F2 Expression	F2 Expression	Retained, editorial scope note revision
F3 Manifestation Product Type	Use F3 Manifestation and multiply instantiate as E99 Product Type	Revised to be more general, renamed as Manifestation, now a subclass of E73 Information Object. Requires E99 Product Type to express the product type aspects. Merged in F24 Publication Expression, revised scope note
F4 Manifestation Singleton	Use F3 Manifestation with R7i is exemplified by: F5 Item	Deprecated. Merged with F3 Manifestation and requires a single instance of F5 Item to be instantiated
F5 Item	F5 Item	Retained, expanded scope note
F6 Concept	Use E28 Conceptual Object	Deprecated classes exactly equivalent to CRM classes
F7 Object	Use E18 Physical Thing	Deprecated classes exactly equivalent to CRM classes
F8 Event	Use E4 Period	Deprecated classes exactly equivalent to CRM classes
F9 Place	Use E52 Place	Deprecated classes exactly equivalent to CRM classes
F10 Person	Use E21 Person	Deprecated classes exactly equivalent to CRM classes
F11 Corporate Body	F11 Corporate Body	Retained, modified superclass to F55 Collective Agent
F12 Nomen	F12 Nomen	Considerably modified Merged in F35 Nomen Use Statement
F13 Identifier	Use E42 Identifier Else use F12 Nomen	Deprecated classes exactly equivalent to CRM classes

F14 Individual Work	Use superclass F1 Work Else, do not migrate	Deprecated unneeded subclasses of F1 Work If F14 Individual Work was implemented with a one-to-one correspondence to F22 Self-Contained Expression and an instance of F15 Complex Work or F1 Work existed for all instances of F14, then the instances of F14 Individual Work are redundant and should not be migrated. In this case, also do not migrate instances of property *R9 is realised in (realises)*
F15 Complex Work	Use superclass F1 Work	Deprecated unneeded subclasses of F1 Work
F16 Container Work	Use superclass F1 Work	Deprecated unneeded subclasses of F1 Work
F17 Aggregation Work	Use superclass F1 Work	Deprecated unneeded subclasses of F1 Work
F18 Serial Work	F18 Serial Work Else use superclass F1 Work	Now a direct subclass of F1 Work Implement only in conjunction with $PRESS_{OO}$
F19 Publication Work	Use superclass F1 Work	Deprecated unneeded subclasses of F1 Work
F20 Performance Work	Use superclass F1 Work	Deprecated unneeded subclasses of F1 Work
F21 Recording Work	Use superclass F1 Work	Deprecated unneeded subclasses of F1 Work
F22 Self-Contained Expression	Use superclass F2 Expression	Deprecated, merged into its superclass F2 Expression
F23 Expression Fragment	Use E90 Symbolic Object	Deprecated
F24 Publication Expression	Use F3 Manifestation	Merged with F3 Manifestation Note that any instances of the property *R4 embodies (is embodied in)* originating with domain F24 Publication Expression, should not be migrated
F25 Performance Plan	Use superclass F2 Expression and multiply instantiate as E29 Design or Procedure	Deprecated unneeded subclass of F2 Expression. Requires E29 Design or Procedure to express the plan aspects
F26 Recording	Use superclass F2 Expression	Deprecated unneeded subclass of F2 Expression
F27 Work Conception	F27 Work Creation	Retained, renamed, revised scope note to focus on creation rather than inception of the F1 Work
F28 Expression Creation	F28 Expression Creation	Retained, editorial scope note revision
F29 Recording Event	Use superclass F28 Expression Creation	Deprecated unneeded subclass of F28 Expression Creation
F30 Publication Event	F30 Manifestation Creation	Retained, renamed Manifestation Creation, revised scope note
F31 Performance	F31 Performance	Retained, scope note revised
F32 Carrier Production Event	F32 Item Production Event	Retained, renamed Item Production Event, editorial scope note revision
F33 Reproduction Event	F33 Reproduction Event	Retained, editorial scope note revision.

		Added superclass F30 Manifestation Creation
F34 KOS	Use superclass F2 Expression	Deprecated unneeded subclass of F2 Expression
F35 Nomen Use Statement	Use F12 Nomen	Merged into revised F12 Nomen
F36 Script Conversion	F36 Script Conversion	Retained
F38 Character	See Section 9	Optional supplement
F39 Family	F39 Family	Retained, modified superclass to F55 Collective Agent
F40 Identifier Assignment	Use E15 Identifier Assignment	Deprecated classes exactly equivalent to CRM classes
F41 Representative Manifestation Assignment	Use E13 Attribute Assignment to label an instance of manifestation as representative of the expression	Deprecated, use the superclass to assign the type (P2 has type: E55 Type = “representative”) to the F3 Manifestation
F42 Representative Expression Assignment	Use E13 Attribute Assignment to label an instance of expression as representative of the work	Deprecated, use the superclass to assign the type (P2 has type: E55 Type = “representative”) to the F2 Expression
F43 Identifier Rule	Use superclass E29 Design or Procedure and multiply instantiate as F2 Expression	Deprecated unneeded subclass
F44 Bibliographic Agency	Use superclass F11 Corporate Body	Deprecated unneeded subclass
F50 Controlled Access Point	Use superclass F12 Nomen	Deprecated unneeded subclass
F51 Pursuit	See Section 9	Optional supplement
F52 Name Use Activity	See Section 9	Optional supplement, revised scope note
F53 Material Copy	Use F5 Item and multiply instantiate as E25 Human-Made Feature	Deprecated overly specialized class in favour of multiple instantiation
F54 Utilised Information Carrier	Use subclass F5 Item and multiply instantiate as E22 Human-Made Object	Deprecated unneeded superclass in favour of multiple instantiation
New	F55 Collective Agent	Added as an equivalent to LRM-E8 Collective Agent New class, subclass of E74 Group, superclass of F11 Corporate Body and F39 Family

10.2. Migration of FRBR$_{OO}$ Properties

Table 21. Mapping of FRBR$_{OO}$ Properties to LRM$_{OO}$

FRBR$_{OO}$ version 2.4	**LRM$_{OO}$**	**Changes for LRM$_{OO}$**
R1 is logical successor of (has successor)	R1 is logical successor of (has successor)	Retained
R2 is derivative of (has derivative)	R2 is derivative of (has derivative)	Retained, now subproperty of new property R68
R3 is realised in (realises)	R3 is realised in (realises)	Retained, revised range to F2 Expression, superclass of deprecated F22 Self-contained Expression, quantification revised, deprecated .1 property
R4 carriers provided by (comprises carriers of)	R4 embodies (is embodied in)	Retained, renamed (and reversed direction), superproperty modified, quantification revised
R5 has component (is component of)	R5 has component (is component of)	Retained, revised range to F2 Expression, superclass of deprecated F22 Self-contained Expression
R6 carries (is carried by) D: F54; R: F24	Use R7 exemplifies (is exemplified by) D: F5; R: F3	Merged into R7, as its domain, F54 Utilised Information Carrier, is deprecated in favour of F5 Item, and its range, F24 Publication Expression, is merged with F3 Manifestation
R7 is example of (has example)	R7 exemplifies (is exemplified by)	Retained, renamed, superproperty modified, scope note revised
R8 consists of (forms part of)	R8 combines (is combined to form)	Retained, renamed, modified domain and range to F12 Nomen, replaced superproperty with a shortcut statement
R9 is realised in (realises) D: F14; R: F22	Use superproperty R3 is realised in (realises) D: F1; R: F2 Else, if F14 Individual Work is not migrated, do not migrate	Deprecated unneeded subproperty. Its domain, F14 Individual Work, is deprecated in favour of F1 Work, its range, F22 Self-contained Expression, in favour of F2 Expression If F14 Individual Work is not migrated (see note at F14 Individual Work), then the migrated instances of this property would produce instances of *R3 is realised in (realises)* redundant with those originally declared, and should not be migrated
R10 has member (is member of) D: F15; R: F1	R10 is member of (has member) D: F1; R: E28	Retained, reversed direction, revised range to E28 Conceptual Object, quantification revised, scope note revised
R11 has issuing rule (is issuing rule of)	R11 has issuing rule (is issuing rule of)	Implement only in conjunction with PRESS$_{OO}$. Shortcut statement added
R12 is realised in (realises) D: F20; R: F25	Use superproperty R3 is realised in (realises)	Deprecated unneeded subproperty. Its domain, F20 Performance Work, is deprecated in favour of F1 Work, its range, F25 Performance Plan, in favour of F2 Expression

FRBR$_{OO}$ version 2.4	**LRM$_{OO}$**	**Changes for LRM$_{OO}$**
R13 is realised in (realises) D: F21; R: F26	Use superproperty R3 is realised in (realises)	Deprecated unneeded subproperty. Its domain, F21 Recording Work, is deprecated in favour of F1 Work, its range, F26 Recording, in favour of F2 Expression
R15 has fragment (is fragment of)	R15 has fragment (is fragment of)	Retained, revised range to E90 Symbolic Object, scope note revised
R16 initiated (was initiated by)	R16 created (was created by)	Retained, renamed, scope note revised for consistency
R17 created (was created by)	R17 created (was created by)	Retained, quantification revised, scope note revised for consistency
R18 created (was created by) D: F28; R: F4	Use a path: F28 Expression Creation. R17 created (was created by): F2 Expression. R4i is embodied in: F3 Manifestation. R7i is exemplified by: F5 Item	Deprecated, its range, F4 Manifestation Singleton, is deprecated in favour of F3 Manifestation
R19 created a realisation of (was realised through)	R19 created a realisation of (was realised through)	Retained, quantification revised
R20 recorded (was recorded through) D: F29; R: E2	Use superproperty R17 created (was created by) D: F28; R: F2 with P129 is about (is subject of) D: E89; R: E1 to link the expression to the temporal entity recorded	Deprecated, its domain, F29 Recording Event, is deprecated in favour of F28 Expression Creation
R21 created (was created through) D: F29; R: F26	Use superproperty R17 created (was created by) D: F28; R: F2	Deprecated unneeded subproperty. Its domain, F29 Recording Event, is deprecated in favour of F28 Expression Creation, its range, F26 Recording, in favour of F2 Expression
R22 created a realisation of (was realised through) D: F29; R: F21	Use superproperty R19 created a realisation of (was realised through) D: F28; R: F1	Deprecated unneeded subproperty. Its domain, F29 Recording Event, is deprecated in favour of F28 Expression Creation, its range, F21 Recording Work, is deprecated in favour of F1 Work
R23 created a realisation of (was realised through) D: F30; R: F19	Use superproperty R19 created a realisation of (was realised through) D: F28; R: F1	Deprecated unneeded subproperty. Its domain, F30 Publication Event, was formerly a subclass of F28 Expression Creation. Its range, F19 Publication Work, is deprecated in favour of F1 Work
R24 created (was created through)	R24 created (was created through)	Retained, modified range to F3 Manifestation, modified superproperty to P94 has created, quantification revised
R25 performed (was performed in) D: F31; R: F25	Use superproperty P33 used specific technique (was used by): E29 Design or Procedure	Deprecated unneeded property. Its range, F25 Performance Plan, is deprecated in favour of E29 Design or Procedure, which may be multiply instantiated as F2 Expression

FRBR$_{OO}$ version 2.4	**LRM$_{OO}$**	**Changes for LRM$_{OO}$**
R26 produced things of type (was produced by) D: F32; R: F3	Use R27 materialized (was materialized by): F3 Manifestation and multiply instantiate as E99 Product Type	Merged with R27
R27 used as source material (was used by)	R27 materialized (was materialized by)	Renamed, modified range to F3 Manifestation
R28 produced (was produced by)	R28 produced (was produced by)	Retained, revised range to F5 Item, quantification revised
R29 reproduced (was reproduced by)	R29 reproduced object (was object reproduced by)	Retained, renamed, revised range to F5 Item
R30 produced (was produced by)	R30 reproduced publication (was publication reproduced by)	Retained, renamed, revised range to F3 Manifestation, superproperty modified, quantification revised
R31 is reproduction of (has reproduction) D: E84; R: E84	Use a path: F5 Item(1). R29i was object reproduced by: F33 Reproduction Event. R24 created (was created through): F3 Manifestation. R7i is exemplified by: F5 Item(2)	Deprecated in favour of the long path. An Item cannot be reproduced directly from another Item. It requires the creation of an intermediate Manifestation
R32 is warranted by (warrants) D: F35; R: F52	Use R35 is specified by (specifies)	Deprecated, its domain F35 Nomen Use Statement, is merged into F12 Nomen. Its range, F52 Name Use Activity, is a residual class in section 9
R33 has content	R33 has string	Retained, renamed, quantification revised, .1 property deprecated
R34 has validity period (is validity period of)	To be generalized in a CRM family model	Deprecated, its domain, F34 KOS, is deprecated. Semantics require a more general construct which is out of LRM$_{OO}$ scope
R35 is specified by (specifies)	R35 is specified by (specifies)	Retained, revised domain to F12 Nomen, revised range to F2 Expression, superclass of deprecated F34 KOS, modified superproperty, deprecated .1 property
R36 uses script conversion (is script conversion used in)	R36 uses script conversion (is script conversion used in)	Retained, revised domain to F12 Nomen, quantification revised, shortcut statement added, scope note revised
R37 states as nomen (is stated as nomen in) D: F35; R: F12	No equivalent	Deprecated, domain F35 Nomen Use Statement merged with F12 Nomen
R38 refers to thema (is thema of) D: F35; R: E1	No equivalent	Deprecated, domain F35 Nomen Use Statement merged with F12 Nomen
R39 is intended for (is target audience in) D: F35; R: E74	Use property P103 was intended for (was intention of): E55 Type. The type describes the type of users intended	Deprecated, domain F35 Nomen Use Statement merged with F12 Nomen. The target audience of the nomen is not an instance of E74 Group, rather the intended users

FRBR$_{OO}$ version 2.4	**LRM$_{OO}$**	**Changes for LRM$_{OO}$**
		share a type which describes their shared characteristics
R40 has representative expression (is representative expression for) D: F1; R: F22	Use superproperty R3 is realised in (realises): F2 Expression with R73 takes representative attribute from (bears representative attribute for): F2 Expression where the same instance of F2 is the range of both properties and the same instance of F1 is the domain of both properties	Deprecated unneeded property. Its range, F22 Self-contained Expression, is deprecated in favour of F2 Expression
R41 has representative manifestation product type (is representative manifestation product type for) D: F2; R: F3	Use superproperty F2 Expression. R4i is embodied in: F3 Manifestation and multiply instantiate as E99 Product Type with R73 takes representative attribute from (bears representative attribute for): F2 Expression where the same instance of F2 is the domain of R4i and the range of R73	Deprecated unneeded property
R42 is representative manifestation singleton for (has representative manifestation singleton) D: F4; R: F2	Use the path F5 Item. R7 exemplifies: F3 Manifestation (not multiply instantiated as E99 Product Type). R4 embodies (is embodied in): F2 Expression with R73 takes representative attribute from (bears representative attribute for): F2 Expression where the same instance of F2 is the range of both properties	Deprecated unneeded property. Its domain, F4 Manifestation Singleton, is deprecated in favour of F3 Manifestation. In this case F3 cannot also be an E99 Product Type and is exemplified by a single instance of F5 Item
R43 carried out by (performed) D: F41; R: F44	Use superproperty P14 carried out by (performed)	Deprecated unneeded subproperty. Its domain, F41 Representative Manifestation Assignment, is deprecated in favour of E13 Attribute Assignment, its range, F44 Bibliographic Agency, in favour of F11 Corporate Body
R44 carried out by (performed) D: F42; R: F44	Use superproperty P14 carried out by (performed)	Deprecated unneeded subproperty. Its domain, F42 Representative Expression Assignment, is deprecated in favour of E13 Attribute Assignment, its range, F44 Bibliographic Agency, in favour of F11 Corporate Body
R45 assigned to (was assigned by) D: F40; R: E1	Use superproperty P140 assigned attribute to (was attributed by)	Deprecated unneeded subproperty. Its domain, F40 Identifier Assignment, is equal to E15 Identifier Assignment
R46 assigned (was assigned by) D: F40; R: E1	Use the equivalent property P37 assigned (was assigned by)	Deprecated properties exactly equivalent to CRM properties. Its domain, F40 Identifier Assignment, is equal to E15 Identifier Assignment; its range, F13 Identifier, to E42 Identifier

FRBR$_{OO}$ version 2.4	**LRM$_{OO}$**	**Changes for LRM$_{OO}$**
R48 assigned to (was assigned by) D: F41; R: F2	Use superproperty P140 assigned attribute to (was attributed by)	Deprecated unneeded subproperty. Its domain, F41 Representative Manifestation Assignment, is deprecated in favour of E13 Attribute Assignment
R49 assigned (was assigned by) D: F41; R: F3	Use superproperty P141 assigned (was assigned by)	Deprecated unneeded subproperty. Its domain, F41 Representative Manifestation Assignment, is deprecated in favour of E13 Attribute Assignment
R50 assigned to (was assigned by) D: F42; R: F15	Use superproperty P140 assigned attribute to (was attributed by)	Deprecated unneeded subproperty. Its domain, F42 Representative Expression Assignment, is deprecated in favour of E13 Attribute Assignment
R51 assigned (was assigned by) D: F42; R: F2	Use superproperty P141 assigned (was assigned by)	Deprecated unneeded subproperty. Its domain, F42 Representative Expression Assignment, is deprecated in favour of E13 Attribute Assignment
R52 used rule (was the rule used in) D: F40; R: F43	Use superproperty P33 used specific technique: (was used by): E29 Design or Procedure	Deprecated unneeded subproperty. Its domain, F40 Identifier Assignment, is equal to E15 Identifier Assignment; its range, F43 Identifier Rule, is a subclass of E29 Design or Procedure
R53 assigned (was assigned by) D: F41; R: F4	Use superproperty P141 assigned (was assigned by)	Deprecated unneeded subproperty. Its domain, F41 Representative Manifestation Assignment, is deprecated in favour of E13 Attribute Assignment
R54 has nomen language (is language of nomen in)	R54 has language (is language of)	Retained, renamed, domain modified to F12 Nomen, superproperty modified
R55 has nomen form (is nomen form in) D: F35; R: E55	Use P2 has type (is type of)	Deprecated, prefer a general property to assign a type to a nomen
R56 has related use (is related use for)	R56 has related form (is related form of)	Retained, renamed, domain and range modified to F12 Nomen, replaced superproperty with a shortcut statement
R57 is based on (is basis for)	See Section 9	Optional supplement
R58 has fictional member (is fictional member of)	See Section 9	Optional supplement
R59 had typical subject (was typical subject of)	See Section 9	Optional supplement
R60 used to use language (was language used by)	See Section 9	Optional supplement
R61 occurred in kind of context (was kind of context for)	See Section 9	Optional supplement
R62 was used for membership in (was context for)	See Section 9	Optional supplement
R63 named (was named by)	See Section 9	Optional supplement

FRBR$_{OO}$ version 2.4	**LRM$_{OO}$**	**Changes for LRM$_{OO}$**
R64 used name (was name used by)	See Section 9	Optional supplement
R65 recorded aspects of (had aspects recorded through) D: F29; R: E18	Use property R17 created (was created by) D: F28; R: F2 with P62 depicts (is depicted by) D: E24; R: E1 to link the items of the expression to the physical thing captured in the recording	Deprecated, its domain, F29 Recording Event, is deprecated in favour of F28 Expression Creation
R66 included performed version of (had a performed version through) D: F31: R:E89	Use R80 performed (is performed in) D: F31; R: F1	Deprecated in favour of a more specific property with range F1 Work instead of E89 Propositional Object
CLP2 should have type (should be type of) D: F3; R: E55	Use R69 has physical form (is physical form of) D: F3; R: E55	Class property redefined as a standard property since domain, F3 Manifestation, is no longer a subclass of E55 Type, superproperty added
CLP43 should have dimension (should be dimension of) D: F3; R: E54	Use R70 has dimension (is dimension of) D: F3; R: E54	Class property redefined as a standard property since domain F3 Manifestation is no longer a subclass of E55 Type, superproperty added
CLP45 should consist of (should be incorporated in) D: F3; R: E57	Use R69 has physical form (is physical form of) D: F3; R: E55	Merged into R69. Its range, E57 Material, is a subclass of E55 Type
CLP46 should be composed of (may form part of) D: F3; R: F3	Use R71 has part (is part of) D: F3; R: F3	Class property redefined as a standard property since domain F3 Manifestation is no longer a subclass of E55 Type, superproperty added
CLP57 should have number of parts D: F3; R: E60	Use R70 has dimension (is dimension of) D: F3; R: E54	Merged into R70. Number of parts is a type of dimension
CLP104 subject to (applies to) D: F3; R: E30	Use P104 is subject to (applies to) D: E72; R: E30	Deprecated unneeded class property in favour of equivalent property
CLP105 right held by (right on) D: F3; R: E39	Use P105 right held by (has right on) D: E72; R: E39	Deprecated unneeded class property in favour of equivalent property
CLR6 should carry (should be carried by) D: F3; R: F24	Use R4 embodies (is embodied in) D: F3; R: F2	Deprecated unneeded property since domain F3 Manifestation is no longer a subclass of E55 Type, and its range, F24 Publication Expression, was a subclass of F2
New	R67 has part (forms part of) D: F1; R: F1	Added as an equivalent for the work relationship LRM-R18 has part (is part of)

FRBR$_{OO}$ version 2.4	**LRM$_{OO}$**	**Changes for LRM$_{OO}$**
New	R68 is inspired by (is inspiration for) D: F1; R: F1	Added as an equivalent for the work relationship LRM-R21 is inspiration for (is inspired by) Superproperty of R2
New	R73 takes representative attribute from (bears representative attribute for) D: F1; R: F2	Added as part of the simplification of the modelling of representative expressions
New	R74 uses expression of (has expression used in) D: F1; R: F1	Added to model works using expressions of pre-existing works
New	R75 incorporates (is incorporated in) D: F2; R: F2	Added to model expressions using expressions of pre-existing works
New	R76 is derivative of (has derivative) D: F2; R: F2 R76.1 has type	Added as an equivalent for the expression relationship LRM-R24 is derivation of (has derivation)
New	R77 accompanies or complements (is accompanied or complemented by) D: F1; R: F1	Added as an equivalent for the work relationship LRM-R20 accompanies / complements (is accompanied /complemented by)
New	R78 has alternate D: F3; R: F3	Added as an equivalent for the manifestation relationship LRM-R29 has alternate
New	R79 has representative expression attribute (is representative expression attribute of) D: F1; R: E55	Added as an equivalent for the work attribute LRM-E2-A2 Representative expression attribute
New	R80 performed (is performed in) D: F31; R: F1	Added to explicitly link a performance to the work performed
New	R81 recorded (is recorded in) D: F28; R:F31	Added to model the use of the recording of a performance as a means of expressions creation

11. Bibliography

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12. Amendments

12.1 Changes between version 1.0 and version 1.1.1

First-order logic expressions were added to all class and property declarations throughout. New section 4.6 was added with the explanation of the conventions and symbols found in the first-order logic expressions.

All properties that are shortcuts can be expressed in a developed path. The full path is formally given in a section of the property declaration labelled “Full path:” placed at the end of the scope note. Formerly, this path was given with the label “Shortcut of:” or “Inverse shortcut of:” and placed immediately before the scope note.

A textual description of the path was added as a final paragraph of the scope note when it was not already present. This affected properties:

- R11 has issuing rule (is issuing rule of)
- R36 uses script conversion (is script conversion used in)
- R56 has related form (is related form of)
- R68 is inspired by (is inspiration for)
- R73 takes representative attribute from (bears representative attribute for)
- R77 accompanies or complements (is accompanied or complemented by)
- R78 has alternate

And properties in section 9:

- R59 had typical subject (was typical subject of)
- R60 used to use language (was language used by)
- R61 occurred in kind of context (was kind of context for)
- R62 was used for membership in (was context for)

A new section 8.4 was added to provide the mapping from LRM_{OO} to IFLA LRM. The title of section 8 was changed from “IFLA LRM to LRM_{OO} Mapping” to “Mappings between IFLA LRM and LRM_{OO}”. The text at the beginning of section 8 was edited for consistency. Text in section 1 describing section 8 was adjusted.

Section 9 was reframed as recording optional residual $FRBR_{OO}$ classes and properties, rather than classes and properties to be eventually moved to the CRMsoc model, since there is no longer an intention to create a fully harmonised model for social phenomena. Text in section 1, section 3, section 8 and in the migration recommendations in section 10, was edited to reflect this change in policy.

Section 11, Bibliography. The reference to IFLA LRM was updated to reflect the 2024 amendment.

Section 12, Amendments was added.

Specific modifications

R2 is derivative of (has derivative):

Modified the full path and textual explanation in the scope note to present the path in the forwards direction rather than in the inverse direction.

R8 combines (is combined to form):

Declared as a subproperty of *P148 has component (is component of)*.

This is also added to the aligned property hierarchy in Table 8.

Full path removed as not validly formulated.

R36 uses script conversion (is script conversion used in):

> Full path modified to use *P94i was created by*, instead of *R17i was created by*, as F12 Nomen is not a valid domain for R17i.

Section 9:

R58 has fictional member (is fictional member of):

> Added to the scope note: “This property is not transitive. It is asymmetric and irreflexive.”