

On the Flipside: Wikidata for Cultural Heritage Metadata through the Example of Numismatic Description

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Abstract:

This paper reports on an ongoing project at Princeton University Library to model numismatic descriptive metadata using FRBR-oo and Wikidata. Wikidata's lack of cardinality constraints makes it unsuitable as a standalone data model for cultural heritage description but leaves it unrivaled as point of convergence for data from different vocabularies and ontologies. Conversely, FRBR-oo's event-based approach positions it uniquely to model a complete set of data points relating to descriptive objects' creation, administrative life cycle, and relationships transcending custodial contexts, but faces implementation challenges owing to its complexity. Using the example of numismatic description, we argue that when deployed in conjunction with one another, the descriptive rigor of FRBR-oo mapped to Wikidata and serviced using the Wikibase technology form a production-ready platform for GLAM descriptive metadata.

Keywords:

FRBR-oo, Numismatics, Wikidata, Wikibase, GLAM

Introduction

Wikidata is a two-edged sword in the arsenal of current linked data implementations in that its greatest strength, i.e. the liberating ease it brings to metadata creation, is also its greatest weakness in the context of--traditionally highly prescriptive--GLAM descriptive metadata. In order to fully leverage the powers of Wikidata for cultural heritage resource description while maintaining a sufficient level of descriptive rigor to drive consistent discovery functionality, Wikidata needs to be deployed in conjunction with a conceptual model endorsed by the GLAM community as well as policies governing the exchange of data between local data sets and the open Wikidata environment.

This paper presents an ongoing project at Princeton University Library to explore modeling numismatic metadata in FRBR-oo and implementing the model in Wikidata.

Background

Wikidata is a collaboratively edited knowledge graph hosted by the Wikimedia Foundation under a public domain license. In the short seven years since its launch, it has partnered with a fast-growing constituency of cultural heritage and educational institutions as well as, increasingly, the entertainment sector to provide an open structured linked data infrastructure that facilitates online discovery and rich content (Merhav 2018; Simonite 2019; Snyder 2019).

The software underlying Wikidata, Wikibase, is a lightweight technology stack distinguished by an intuitive user interface and outstanding response time. Its built-in revision tracking together with Wikidata's statement-level references ensure that data can be verified and sourced, which is of particular interest in the context of cooperative cataloging environments. Wikibase is available both as community infrastructure and as stand-alone deployment, allowing for varying degrees of locally imposed control over creation/editing privileges and quality assurance.

The GLAM community has rallied around Wikidata's cross-disciplinary potential. A popular feature among GLAM professionals is the way in which Wikidata's multi-lingual descriptions can be leveraged to present information in the preferred language and/or script of the user as well as associate works with translations (Turki 2017; Smith-Yoshimura 2017; Smith-Yoshimura and Li 2019). Wikidata's potential for multi-lingual identity management and controlled vocabularies has earned Wikidata the moniker "linking hub" (ARL White Paper on Wikidata 2019; Neubert 2018). Cultural heritage projects such as Social Networks and Archival Context (SNAC) and Share-VDE, respectively, have used Wikidata to link authorities; some 1 million Wikidata links are in the NAF to date; and new projects in domains as varied as video games, pseudonyms, and local authority files are currently being explored (Chan 2019; Panigabutra-Roberts 2019; Chou 2019; Moody 2019). Additionally, the idea of a "linking hub" extends to data from entirely different subject domains. Hence the 2016 IFLA Wikipedia Opportunity Paper notes:

the potential of Wikidata to draw linked data and linked data authorities together across the world's languages and many different ontologies and taxonomies has enormous potential to support researchers around the world.

OCLC Research's "Project Passage," a local deployment of Wikibase with the objective to explore and experiment with the creation of library catalog data in a production environment, put this concept to the test in 2018 with bibliographic data (OCLC 2018; OCLC Research 2019).

Unsurprisingly, Wikidata has fast risen to strategic importance in the GLAM community. As early as 2015, Europeana's Wikimedia task force cited Wikidata's "enormous potential for linking collections, performing authority control, digital humanities research and synergy with Europeana's systems" and recommended "investigating becoming Wikimedia's first movement-partner" (Europeana 2015). More recently, Wikidata has been identified as a strategic direction by institutions including the International Federation of Library Associations and Institutions (IFLA), the Program for Cooperative Cataloging (PCC), the Association of Research Libraries (ARL), OCLC, and Linked Data for Production (LD4P) (IFLA 2016; ARL 2019; OCLC Research 2018; LD4P Wikidata Affinity Group 2019).

Despite its agile technology stack, cross-domain qualities, and community support, Wikidata has an obvious Achilles' heel: the giddy ease with which statements can be published while leaving quality control up to the editorial community's good data hygiene and the corrective powers of crowdsourcing. This low barrier to production is Wikidata's superpower, yet it also translates into a certain permissiveness and lack of descriptive rigor that puts it squarely at odds with hard-won descriptive norms in the traditions of the cultural heritage community. Items¹ of the barely-passing "D"-grade quality ("some basic statements, but lacking in references, translations, and aliases")

¹ When referring to Wikidata, "Items" and "Properties" are capitalized throughout.

literally take seconds to create and, possible issues notwithstanding, are immediately available for use pending subsequent cleanup by human or bot. Newly proposed Properties, while subject to a community review process, nevertheless require nothing more to clear the bar of approval than clearly reasoned use cases and supporting votes from the Wikidata community.

In addition, Wikidata takes a deliberately ad-hoc approach to data modeling. For example, despite the creation of “manifestation of” in 2014 as a “necessary property for modeling w:FRBR levels” (property proposal discussion page), the accompanying Property “expression of” was not established until February 2019, whereas the somewhat less pressing—in the context of a library catalog, that is—Property “possessed by spirit” has led a happy existence on Wikidata since October 2017. The spotty representation of fundamental descriptive GLAM concepts illustrates that to facilitate conceptual interoperability in Wikidata, the GLAM community must first form a consensus around appropriate data models and their intersections and map them onto Wikidata.

No overwhelming community consensus endorsing one single GLAM-compatible conceptual model seems to be emerging to date. The bibliographic community has thrown its weight behind BIBFRAME following the announcement by Beecher Wiggins at ALA Annual 2018 that Library of Congress is “committed” to replacing MARC with BIBFRAME for cataloging within 2-5 years. BIBFRAME itself is signaling a shift towards comprehensive modeling aspirations with the ongoing extensions for art and rare materials, performed music, and cartographic resources. Meanwhile, LC’s BIBFRAME editor forms the starting point for the LD4P community’s development of the Sinopia linked data editor.

Functional Requirements for Bibliographic Records—object-oriented (FRBR-oo) favors a more nuanced structure over BIBFRAME’s flattened FRBR model, which is likely the reason for what can only be described as a hesitant response from the cultural heritage community. First published in 2006, FRBR-oo was developed from the start as a generalized model for resource description based on the harmonization of the bibliographic and museum models, FRBR-ER and CIDOC-CRM:

[I]t applies empirical analysis and ontological structure to the entities and processes associated with the bibliographic universe, to their properties, and to the relationships among them. It thereby reveals a web of interrelationships, which are also applicable to information objects in non-bibliographic arenas. (*Definition of FRBR-oo 2016*)

Reminiscent of the language used by Wikidata supporters, supporters stress FRBR-oo’s cross-disciplinary qualities as “*interlingua*...between the heterogeneous metadata formats of libraries and museums” (Ya-Ning 2013; cf. Europeana 2011) and note that it “enable[es] a common view of information from memory institutions” (Riva 2008) with the “grand vision...to see all these data sets integrated so that users are effectively supported in searching for and analyzing data across all domains” (Doerr 2008). FRBR-oo is currently in a new development cycle to align it with FRBR’s successor, LRM, as LRM-oo (Riva 2018), which is currently available as draft (“Issue 360: LRMoo” 2017).

Despite early enthusiasm for the cross-domain potential of FRBR-oo, its emphasis on modeling the temporality of cultural heritage entities has earned it an undeserved reputation for being “extremely complex, and understood by few” (Coyle n.d.; cf. Alexiev 2016), and it has not been implemented in large-scale pilot projects (with the notable exception of Europeana’s formation of an application profile task force in 2013).

Nevertheless, implementers note that FRBR-oo’s event-based model allows for the full representation of complex information surrounding cultural heritage objects, including seriality (Oury 2017), performance (Doerr 2008), and archival context (Le Boef 2012). Projects in music, digital classics, and rare materials in particular leverage FRBR-oo’s power to handle complex relationships as an asset; examples include the DOREMUS project, CorpusTracer, the Humanities Citation Ontology (HuCit), and a knowledge base created by Matteo Romanello and Michele Pasins, among others

(Lisena and Troncy 2017; Kräutli 2017; Wulfman 2019; Romanello 2017). Le Boef (2012) notes that FRBR-oo's

“complexity” and “verbosity” may be perceived as an obstacle to its acceptance by the librarian community. But, precisely because it is more refined and detailed—and therefore “complex”—than the original FRBR, FRBROO makes it possible to deal in a more satisfactory way with particular materials such as rare and unique materials.

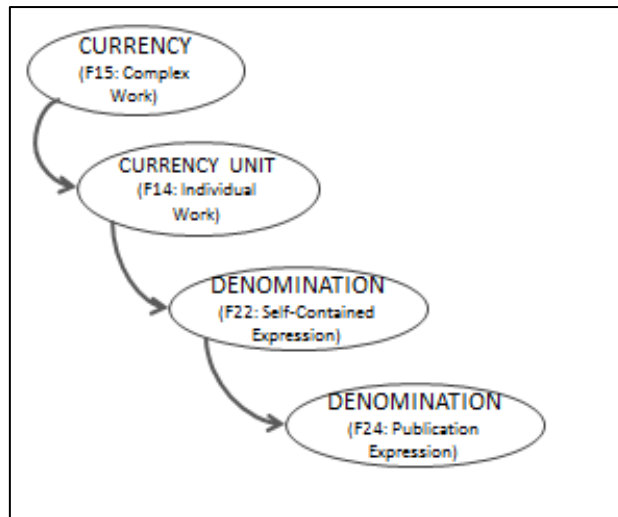
FRBR-oo is designed to be implemented as linked data, in Le Boef's words “very much with RDF in mind”. In more than one way, then, Wikidata and FRBR-oo seem to go hand in glove: Both are designed to cross disciplinary boundaries; statements in both are structured as triples; what one imposes in complexity (FRBR-oo) is offset by the agility and simplicity of the other (Wikidata). Only a handful of other projects implementing FRBR-oo as Wikidata exist, among them the Ontology of Narratives project, an ambitious drag-and-drop tool for the “triplification” of narrative text (Metilli 2016). Several Wikidata communities are working towards aligning Wikidata properties with FRBR-oo, including the WikiProject *Cultural heritage*.

The Flipside

The numismatic community has been discussing FRBR-oo since at least 2014 (cf. “Issue 268” 2014). Our decision to adopt FRBR-oo to remodel numismatic collections was based on several key points: FRBR-oo, as the only conceptual model on the horizon, supports the full entification of information relating to numismatic objects, whether as information carriers or as artifacts, in complex and nuanced configurations; FRBR-oo supports an integrated data system that holistically manages all metadata associated with an object from before the point of acquisition to its disposition and beyond; and FRBR-oo's event-based structure single-handedly sifts entities, attributes, and relationships into their respective buckets—the feature which gave our project its name as it allowed us to model the sides of a coin (or banknote, for that matter) as entities rather than properties.

At the same time, we consciously left the established numismatic descriptive standards largely behind. We felt that NUDS, an XML schema for Numismatic description adapted from Encoded Archival Description by Ethan Gruber in 2009 and based on a set of core fields defined in 2007 by Sebastian Heath and Andrew Meadows (called Numismatic Description Standard and, confusingly, also abbreviated NUDS), was unsuitable for a semantic web environment due to its document-centric nature (despite being retrofitted to accommodate URIs). The Nomisma ontology, which implements the Numismatic Description Standard as linked data in RDF/XML, does not fully manage to depart from NUDS's record-centered model. Additionally, Nomisma is burdened by a narrative descriptive legacy that in a linked data environment translates into data quality issues. One example to illustrate this problem is the conflation of places with other entities, e.g. through the use of `skos:closeMatch` and `skos:broader` properties as properties on `nmo:mint`. Positing the Strymonian and Bottiaean District as a broader concept for the mint inferred (by archaeological and other evidence) to have been located at Bottiaea, rather than for the place Bottiaea itself, is largely unproblematic in the narrative tradition that most GLAM research is rooted in, but it is equally easy to see how it might quickly lead to unreliable inferences in a cascading linked data environment.

The Flipside project conceives of two distinct Work-Expression-Manifestation-Item (WEMI) progressions. The two arms of the model are defined by the two broad characteristics of a coin: as a legal/information object on the one hand and as an artefactual object on the other. The description of a coin as an information object proceeds from the description of the monetary currency system within which the object has meaning (Ill.1).



III.1: The coin as information object

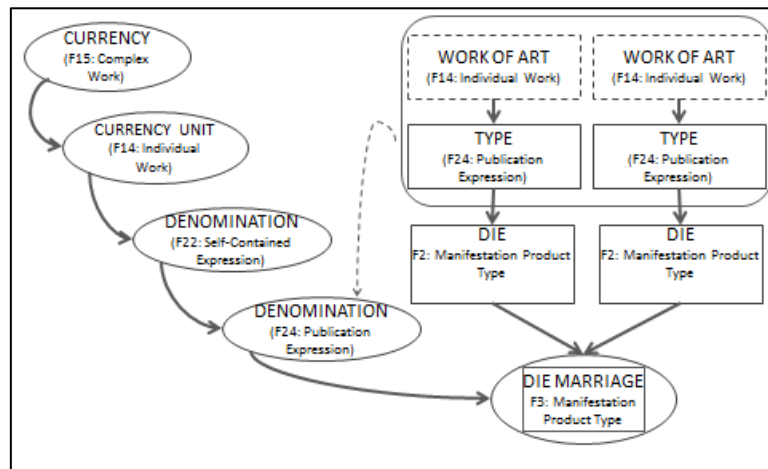
The currency is modeled as a complex work, a historically specific, authorized value structure that, within the confines of its jurisdiction, allows commodities to be exchanged for tokens of equivalent value. The act of intellectual and political creation of the currency is conceived here as equivalent to the acts of creation of creative works. The complex work of the currency consists of currency units, modeled for our purposes as single works within the complex work. Just as the currency itself, currency units are contingent on authorizing acts, and various units of the currency may arise or cease to exist over the time of existence of the currency. Currency units are distinct from denominations in that denominations express, at various points in time, units in specific amounts. We model them as self-contained expressions. For example, the U.S. Half Cent is a denomination expressing the U.S. Cent, which is a unit of the currency named U.S. Dollar.

Each denomination is further expressed in one or more design decisions over time, a subtle but necessary distinction of the expression layer for which FRBR-oo provides the concept of the publication expression. The publication expression includes the final set of signs intended to constitute the publication or (in this case) issue. For example, the change from the U.S. Half-Cent design from Lady Liberty Facing Left to Lady Liberty Facing Right between 1793 and 1797 represents two distinct publication expressions.

It is in this concept of publication expression and the following descriptive layer, the manifestation product type, that FRBR-oo truly distinguishes itself from other conceptual models. Publication expression is the first step towards modeling the design decisions for the obverse and the reverse as separate entities, in departure from NUDS and Nomisma, which consider the sides properties of the object (leading to significant redundancies in the NUDS schema). The artwork of the coin design is traced on the second (doubled) arm starting with the abstract artworks. It traces the creative work through the publication expressions for each side and on to their respective realizations as two sets of dies, or manifestation product types--one set per side (III.2).

The Flipside model is agnostic about which side is front and which is back; it simply describes two sides. In comparison, Nomisma provides the narrower properties `nmo:hasObverse` and `nmo:hasReverse` to the generic `nmo:hasFace`, the obverse being defined as “normally... carrying the representation [sic], badge or inscription of the issuing authority.” This definition seemed to us too speculative, and the added value too vanishing, to risk controvertible assertions; the Flipside model therefore deliberately chooses the cautiously descriptive over the more academic argumentative approach.

Though we chose to forego modeling the edge, this model is easily extensible for repositories wishing to model a separate, third side (cf. U.S. Mint 2017).

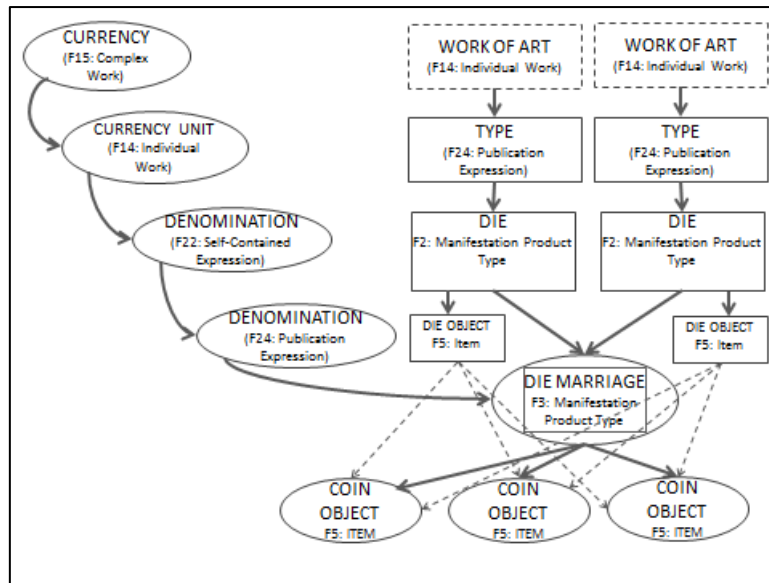


III.2. The coin as artifact

The double WEMI progression allows us to describe a run of coins produced from two runs of dies as a die marriage with a precision that accommodates the description of the coin as much as it accommodates the description of the die that made it. At the product manifestation level, the model captures the type design of each side, with properties including the (linked) identity of the artist or engraver and the date of the execution of either easily associated with the appropriate class, as well as all physical characteristics of the “ideal” coin, such as diameter, weight, etc.

It is important to note here that, tempting as it may be to use them as analogous, the concepts of a numismatic “issue” and that of a bibliographic “edition” differ in one crucial aspect: while bibliographers and rare book catalogers typically consider any printing made from a new setting of type a separate and distinct “edition,” a coin struck from a fresh die is not usually considered a separate “issue” by numismatists. It should also be noted that this model does not entify the numismatic notion of “issue” overall but considers it a compound of properties spread out over several conceptual layers.

On the item level, this model allows statements about which individual dies struck an individual coin specimen, including e.g. statements describing the die state, or describing minute differences between dies of the same issue (III.3).



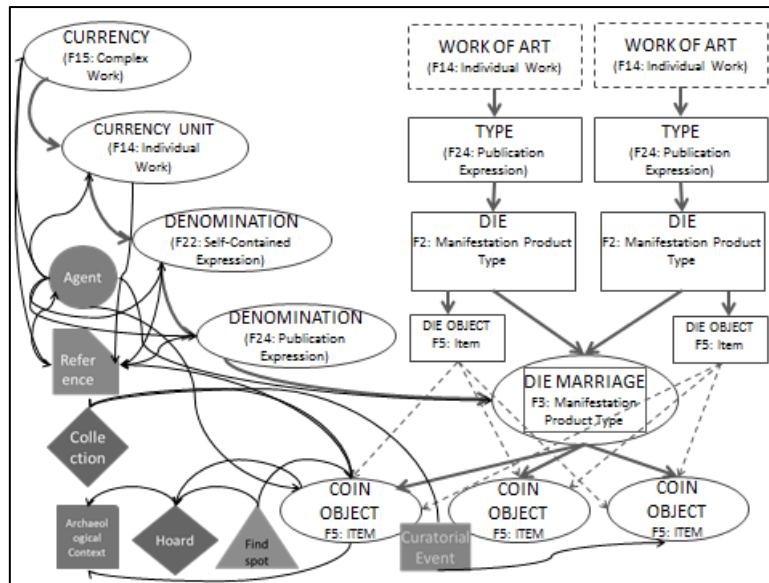
III.3. The relationship between two die specimens and a coin specimen

Relationships with Group 2 entities (i.e., associated agents), e.g. the commissioning/authorizing/issuing bodies of monetary objects or the artists, engravers, die cutters, mints etc. involved in producing them, are added in as separate statements.

Aggregate description is possible in this model both as contained-in relationships (i.e. descriptions for members of the aggregate exist) or standalone (i.e. the description for the aggregate is the lowest level of description provided). This makes it possible to describe in aggregate bodies such as collections, hoards, or acquisitions, among others, and to practice iterative description. Crucially, due to FRBR-oo's temporal emphasis, the model captures changes in these relationships over time (e.g. if material is assigned from one collection to another).

FRBR-oo's event-centric structure accommodates a flexible network of additional statements regarding pre-custodial events, including e.g. archaeological events (which in their turn relate to agents, findspots, archaeological contexts, references etc.) as well as curatorial events such as conservation treatment, loan, exhibit, accession, deaccession, and purchase.

References, an integral part of numismatic description, are built into Wikidata, and statements may hook e.g. into WikiCite or BIBFRAME URIs. By the same mechanism, relationships with other items or aggregates may be established, including those external to the describing repository such as objects from the same dig housed in another collection or at another repository, or archival records pertaining to the same archaeological expedition. (III.4)



III.4: Extended model (sample relationships)

The model can be further built out to accommodate numismatic objects other than coins, such as paper money, medals, or tokens.

Mapping this structure onto Wikidata means careful analysis of the available Wikidata Items and Properties and beginning to fill the gaps. Due to the overarching aspirations of the model and the fluid boundaries of linked data, this work proved to be somewhat of a moving target. We started by creating Items for some FRBR-oo classes in Wikidata to allow us to declare certain descriptions as instances or subclasses thereof. We were stopped in our tracks early on by the lack of a Wikidata “expression of.” Having successfully proposed the Property, we were eventually able to express the conceptual model as

item (F5) (Q60644781) :: instance of (P31) : manifestation product type (F3) (Q60644797)
 manifestation product type (F3) (Q60644797) : manifestation of (P1557) : publication expression (F24) (Q61130262)
 publication expression (F24) (Q61130262) : subclass of (P279) : self-contained expression (F22) (Q61196126)
 self-contained expression (F22) (Q61196126) : expression of (P6524) : individual work (F14) (Q61196352)
 individual work (F14) (Q61196352) : subclass of (P279) : complex work (F15) (Q61196382)

From there, we were able to create Items for the numismatic concepts where they didn’t already exist and associate them with FRBR-oo classes:

currency (Q8142) : instance of (P31) : complex work (F15) (Q61196382)
 currency unit (Q61200261) : instance of (P31) : individual work (F14) (Q61196352)
 denomination (Q918448) : instance of (P31) : self-contained expression (F22) (Q61196126)
 die marriage (Q60644899) : instance of (P31) : manifestation product type (F3) (Q60644797)
 coin (Q41207) : instance of (P31) : item (F5) (Q60644781)

creative work (Q17537576) : equivalent class (P1709) : work (F1) (Q60644751)
 type (Numismatics) (Q61130974) : instance of (P31) : publication expression (F24) (Q61130262)
 die (coinage) (Q60644990) : instance of (P31) : manifestation product type (F3) (Q60644797)
 die exemplar (Q61885863) : instance of (P31) : die (coinage) (Q60644990)

Relationships between the numismatic concepts themselves could then be established as necessary to express the following:

coin (Q41207) : instance of (P31) : die marriage (Q60644899)
 die exemplar (Q61885863) : instance of (P31) : die (coinage) (Q60644990)

die marriage (Q60644899) : manifestation of (P1557) : denomination (Q918448)

die (coinage) (Q60644990) : manifestation of (P1557) : type (Numismatics) (Q61130974)

die marriage (Q60644899) : product or material produced (P1056) : die (coinage) (Q60644990)

denomination (Q918448) : expression of (P6524) : currency unit (Q61200261)

type (Numismatics) (Q61130974) : expression of (P6524) : creative work (Q17537576)

currency unit (Q61200261) : subclass of (P279) : currency (Q8142)

The next step, ongoing as of the writing of this article, was to add relationships and properties on a conceptual level and bulk-import Items from other sources. For example, type (Numismatics) (Q61130974) was complemented with has-part relationships to the Items *exergue* (Q9251657), *attribute* (Q758238), and *adjunct (art)* (Q61132439) in keeping with the definitions of numismatic concepts by the American Numismatic Society. (For a set of properties and proposed mappings to Wikidata Properties for the core Items see appendix.)

Bulk-importing Items (with associated Properties) in Wikidata proved a surprisingly artisanal process even when repurposing data from canonical sources like Nomisma. For both local and external data, we undertook steps to ensure data quality before merging the records into Wikidata in the spirit of Wikidata's emphasis on contributors' metadata ethics and following Wikidata's Item quality guidelines. We accomplished this through various normalization routines including SPARQL and XQUERY scripts and OpenRefine's reconciliation service prior to merging the dataset into Wikidata.

Conclusions and Outlook

At this point in the project, we are side-stepping the issue of non-structured (narrative) data. While Wikidata accommodates literals, it is not intended for long, discursive text. OCLC has suggested an elegant solution to this problem that essentially envisions putting structured data on Wikidata, narrative on Wikipedia, and images on Wikimedia Commons, though the editorial gatekeeping culture of Wikipedia may pose an obstacle to this promising vision (Chapman 2018; OCLC 2018 (prototype); OCLC 2018 (webinar)).

At the time of the writing of this article, the project remains in the experimental stages. All metadata for this project is being created in the open Wikidata ecosystem, in line with Wikidata's self-perception as a public good and its philosophy of an open, democratic, consensus- and use-driven knowledge universe.

Stacy Allison-Cassin makes a strong case for contributing library metadata to the open Wikidata ecosystem:

Creating original metadata that is exclusively contained in local systems doesn't make sense in a global knowledge ecosystem... Depositing linked data in Wikidata, where it can be reused and linked to collections and knowledge all over the web, extends and expands the impact of metadata creation and strengthens our contribution to public goods. (Ruttenberg 2019)

The operative word here is “exclusively.” For cultural heritage institutions used to controlling the metadata they create through standards and stringently defined partnerships that govern who adds, changes, and removes records—diplomatically dubbed “editorial processes” by the ARL White Paper on Wikidata—this lack of oversight is highly counter-intuitive. Additionally, statements relating to the life cycle of an institution's holdings, such as, for example, acquisition information or storage location of sensitive materials, may not be appropriate to share with the world at large out of security and privacy concerns.

For the next phase of our project, we therefore anticipate a transition to a local deployment of Wikibase following examples set by other pilot projects such as the Linked Jazz Project (Miller 2018) and the Smithsonian Open Data Pilot (Snyder and Nguyen 2018). A local Wikibase installation will serve as the data store for our Wikidata-compatible statements, which may then be contributed to Wikidata judiciously, selectively, and in accordance with local and professional best practices and policies while also allowing updates to be merged into the local data store by making use of Wikidata’s source statements and references as primary filters. That phase of the project will serve as a test case not only for how a local instance may allow an institution to retain stable descriptive records while shielding them from unauthorized data vandalism and other mishaps, but also for developing the requisite cooperative policies and implementation decisions to achieve repose between locally and communally owned data.

Based on our work on the Flipside project so far, we propose that Wikidata can be leveraged for the description and discovery of cultural heritage data on the web provided the resource description community develops and uses it in conjunction with agile data models like FRBR-oo and with some technical and policy consideration given to the flow of shared data as well as permissions and contributor profiles.

Appendix

coin (Q41207)

Free-text label	Nomisma property	Wikidata Property/relationship to Item
name		name (P2561)
inventory number		inventory number (P217)
date on object	http://nomisma.org/ontology#hasBearsDate	date depicted (P2913)
condition	http://nomisma.org/ontology#hasCorrosion	rating (P4271)(?) / <i>may be necessary to propose new Property “condition”</i>
completeness	http://nomisma.org/ontology#hasWear	<i>may be necessary to propose new Property “completeness”</i>
brockage	http://nomisma.org/ontology#hasPecularity / http://nomisma.org/ontology#hasPecularityOfProduction	instance of (P31) : Brockage (Q3951988)
double strike	http://nomisma.org/ontology#hasPecularity / http://nomisma.org/ontology#hasPecularityOfProduction	instance of (P31) : double strike (coin) (Q63985139)
mint mark	http://nomisma.org/ontology#hasMintmark	has part (P527) : [instance of (P31) : mint mark (Q616732)]

counter mark	http://nomisma.org/ontology#hasCountermark	has part (P527) : [instance of (P31) : countermark (Q1411429)]
monogram	http://nomisma.org/ontology#hasMonogram	monogram (P1543) (?) : [instance of (P31) : monogram (Q168346)]
overstrike		has part (P527) : [instance of (P31) : Overstrike (Q3965672)]
test mark	http://nomisma.org/ontology#hasControlmark	has part (P527) : [instance of (P31) : identifier (Q853614)] / <i>may be necessary to propose new Property "test mark"</i>
alteration	http://nomisma.org/ontology#hasSecondaryTreatment	instance of (P31) : alteration (Q37759970) <i>with qualifier, or applicable Item</i>
description	http://nomisma.org/ontology#hasAppearance	<i>Link to Wikipedia article following model of Project Passage?</i>
is part of collection	http://nomisma.org/ontology#hasCollection	collection (P195)
is part of hoard		part of (P361) : [instance of (P31) : hoard (Q164099)] [<i>hoard (Q164099)</i> : <i>location of discovery (P189)</i> : <i>find spot (Q1291195)</i> : <i>has part (P527) : archaeological site (Q839954)</i> : <i>location (P276) : Archaeological context (Q4785459)</i>]
has image		image (P18)
product of (die instance)	http://nomisma.org/ontology#hasDie, http://nomisma.org/ontology#hasProductionObject	product or material produced (P1056)
reference	http://nomisma.org/ontology#hasReferenceWork	described at URL (P973) / described by source (P1343) : reference work (Q13136)
external reference number	http://nomisma.org/ontology#hasTypeSeriesItem	<i>May be necessary to propose specific identifier</i> ; [instance of (P31) : identifier (Q853614)]

die marriage (Q60644899)

Free-text label	Nomisma property	Wikidata Property/relationship to Item
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name		name (P2561)
production date from	http://nomisma.org/ontology - hasStartDate (in scope?)	start time (P580)
production date to	http://nomisma.org/ontology - hasEndDate (in scope?)	end time (P582)
type (e.g. coin / paper money)	http://nomisma.org/ontology#hasObjectType , http://nomisma.org/ontology#representsObjectType	instance of (P31)
weight	http://nomisma.org/ontology#hasWeight , http://nomisma.org/ontology#hasWeightStandard	mass (P2067)
shape	http://nomisma.org/ontology#hasShape	shape (P1419)
width	http://nomisma.org/ontology#hasWidth , http://nomisma.org/ontology#hasMaxWidth , http://nomisma.org/ontology#hasMinWidth	width (P2049)
height	http://nomisma.org/ontology#hasHeight , http://nomisma.org/ontology#hasMaxHeight , http://nomisma.org/ontology#hasMinHeight	height (P2048)
diameter	http://nomisma.org/ontology#hasDiameter , http://nomisma.org/ontology#hasMaxDiameter , http://nomisma.org/ontology#hasMinDiameter	diameter (P2386)
thickness	http://nomisma.org/ontology#hasDepth , http://nomisma.org/ontology#hasMaxDepth , http://nomisma.org/ontology#hasMinDepth	thickness (P2610)
manufacture method	http://nomisma.org/ontology#hasManufacture	fabrication method (P2079)
axis	http://nomisma.org/ontology#hasAxis	angle from vertical (P4183)
edge type	http://nomisma.org/ontology#hasEdge	has part (P527) : coin edge (Q308800) : instance of (P31) : <literal> or has decorative pattern (P5422)

edge legend		has part (P527) : coin edge (Q308800) : inscription (P1684) : legend (coin) (Q61132822)
material	http://nomisma.org/ontology#hasMaterial	material used (P186)
mint	http://nomisma.org/ontology#hasMint , http://nomisma.org/ontology#hasMintmark	manufacturer (P176) : mint (Q464780)
issuing body	http://nomisma.org/ontology#hasIssuer	central bank/issuer (P562)
die (manifestation)	http://nomisma.org/ontology#hasDie , http://nomisma.org/ontology#hasProductionObject	product or material produced (P1056) : <die run>
reference	http://nomisma.org/ontology#hasReferenceWork	described at URL (P973) / described by source (P1343) : reference work (Q13136)
external reference number	http://nomisma.org/ontology#hasTypeSeriesItem	identifier (Q853614)

denomination (Q918448)

Free-text label	Nomisma property	Wikidata Property/relationship to Item
name	http://nomisma.org/ontology#hasDenomination (?)	name (P2561)

count of unit (count+name=denomination, e.g. "1/2"+"U.S. cent")		quantity (P1114) : currency unit (Q61200261)
exist date from	http://nomisma.org/ontology - hasStartDate (?)	start time (P580)
exist date to	http://nomisma.org/ontology - hasEndDate (?)	end time (P582)
authorizing body	http://nomisma.org/ontology - hasAuthority	authorizing body (Q61129413)
reference	http://nomisma.org/ontology#hasReferenceWork	described at URL (P973) / described by source (P1343) : reference work (Q13136)

currency unit (Q61200261)

Free-text label	Nomisma property	Wikidata Property/relationship to Item
name		name (P2561)

exist date from	http://nomisma.org/ontology - hasStartDate (?)	start time (P580) or inception (P571)
exist date to	http://nomisma.org/ontology - hasEndDate (?)	end time (P582)
type		instance of (P31) : unit of account (Q747699) (where applicable)
authorizing body	http://nomisma.org/ontology - hasAuthority	authorizing body (Q61129413)
reference	http://nomisma.org/ontology#hasReferenceWork	described at URL (P973) / described by source (P1343) : reference work (Q13136)

currency (Q8142)

Free-text label	Nomisma property	Wikidata Property/relationship to Item
name		name (P2561)
exist date from	http://nomisma.org/ontology - hasStartDate	start time (P580) or inception (P571)
exist date to	http://nomisma.org/ontology - hasEndDate	end time (P582)
type (for use with other signifying systems, e.g. awards, tokens)	http://nomisma.org/ontology#hasObjectType, http://nomisma.org/ontology#representsObjectType	subclass of (P279) : money (Q1368) / etc.
authorizing body	http://nomisma.org/ontology - hasAuthority	authorizing body (Q61129413)
has unit of account		unit of account (Q747699)
reference	http://nomisma.org/ontology#hasReferenceWork	described at URL (P973) / described by source (P1343) : reference work (Q13136)

type (Numismatics) (Q61130974)

Free-text label	Nomisma property	Wikidata Property/relationship to Item
name		name (P2561)
use date from	http://nomisma.org/ontology - hasStartDate (?)	start time (P580)
use date to	http://nomisma.org/ontology - hasEndDate (?)	end time (P582)
main design	http://nomisma.org/ontology#hasIconography , http://nomisma.org/ontology#hasPortrait	depicts (P180)
attribute		attribute (Q758238)
adjunct		adjunct (art) (Q61132439)
legend	http://nomisma.org/ontology#hasLegend	legend (coin) (Q61132822)
exergue		exergue (Q9251657)

language		language (Q34770)
script		alphabet (Q9779)
authorizing body	http://nomisma.org/ontology - hasAuthority, http://nomisma.org/ontology#hasStatedAuthority	authorizing body (Q61129413)
reference	http://nomisma.org/ontology#hasReferenceWork	described at URL (P973) / described by source (P1343) : reference work (Q13136)

die (coinage) (Q60644990)

Free-text label	Nomisma property	Wikidata Property/relationship to Item
name		name (P2561) / identifier (Q853614)
has engraver		manufacturer (P176) : engraver (Q329439)
production date from	http://nomisma.org/ontology - hasStartDate (in scope?)	start time (P580)
production date to	http://nomisma.org/ontology - hasEndDate (in scope?)	end time (P582)
weight	http://nomisma.org/ontology#hasWeight, http://nomisma.org/ontology#hasWeightStandard	mass (P2067)
shape	http://nomisma.org/ontology#hasShape	shape (P1419)
width	http://nomisma.org/ontology#hasWidth, http://nomisma.org/ontology#hasMaxWidth,	width (P2049)

	http://nomisma.org/ontology#hasMinWidth	
height	http://nomisma.org/ontology#hasHeight , http://nomisma.org/ontology#hasMaxHeight , http://nomisma.org/ontology#hasMinHeight	height (P2048)
diameter	http://nomisma.org/ontology#hasDiameter , http://nomisma.org/ontology#hasMaxDiameter , http://nomisma.org/ontology#hasMinDiameter	diameter (P2386)
manufacture method	http://nomisma.org/ontology#hasManufacture	fabrication method (P2079)
material	http://nomisma.org/ontology#hasMaterial	material used (P186)
reference	http://nomisma.org/ontology#hasReferenceWork	described at URL (P973) / described by source (P1343) : reference work (Q13136)
external reference number	http://nomisma.org/ontology#hasTypeSeriesItem	identifier (Q853614)

die exemplar (Q61885863)

Free-text label	Nomisma property	Wikidata Property/relationship to Item
name		name (P2561)
inventory number		inventory number (P217)
description	http://nomisma.org/ontology#hasAppearance	Link to Wikipedia article following model of Project Passage?

production date	http://nomisma.org/ontology#hasDate	earliest date (P1319) / latest date (P1326)
has condition	http://nomisma.org/ontology#DieWear	rating (P4271) / may be necessary to propose a new Property “die state”
is part of collection	http://nomisma.org/ontology#hasCollection	collection (P195)
image		image (P18)
reference	http://nomisma.org/ontology#hasReferenceWork	described at URL (P973) / described by source (P1343) : reference work (Q13136)
external reference number	http://nomisma.org/ontology#hasTypeSeriesItem	identifier (Q853614)

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