

Bulgarian Icons in Wikidata and EDM

Vladimir Alexiev¹[0000-0001-7508-7428], Plamen Tarkalanov¹, Nikola Georgiev¹,
Lilia Pavlova²

¹ Ontotext Corp, Sofia, Bulgaria

² Laboratory of Telematics, Bulgarian Academy of Sciences, Sofia, Bulgaria
first.last@ontotext.com, pavlova.lilia@gmail.com

Abstract. We briefly describe Wikidata, its importance for GLAM institutions, iconographic authorities in Mix-n-Match. Then we propose an Icon Knowledge Graph Model comprising the entities: iconographer, iconographic school, herminia, icon, measurements, material, technique, iconographic subject (saint or a title of the Virgin Mary), location (city, monastery, church, museum), scientific article, academic journal, issue, links to LOD datasets (e.g. VIAF, Getty AAT, ISBN, ISSN, academia.edu). Then we introduce the Virtual Encyclopedia of Bulgarian Icons (BIDL) and describe how we exported it to Wikidata, while coreferencing to iconographers, saints, locations; and the extra info we added for such entities. Finally, we describe a conversion to the Europeana Data Model, including details such as links to Wikidata, bilingual descriptions, language tags, providers. The online version of the paper includes live links; the [accompanying presentation](#) includes more images and queries.

Keywords: Knowledge Graphs, Semantic Integration, GLAM, Wikidata, Open-Refine, Icons, Religious Icons, Iconography, Iconographic Subject, GLAM, CLADA, BIDL, Virtual Encyclopedia of Bulgarian Icons.

1 Introduction

Eastern Orthodox icons hold such importance for Eastern European art history as paintings and sculptures hold for Western European culture. While there are hundreds of thousands of Linked Open Data (LOD) records about paintings and sculptures, the situation about icons is bleak. Thanks to efforts such as Wikidata Project Visual Arts there are [466k paintings in Wikidata](#) as of July 2020. But there are only 922 icons, the icon metadata is rather poor, and we are not aware of any other large icon collections.

This paper describes an effort to contribute Bulgarian icon data to world-wide LOD. We first outline the importance of Wikidata for GLAM institutions, then describe the Virtual Encyclopedia of Bulgarian Icons (BIDL), and how we converted and exported it to Wikidata and EDM, while interlinking it to LOD authorities.

Related Work

L. Pavova proposes a comprehensive ontology for representing icons that covers details on iconography, production materials and techniques, conservation information, *etc.* (Pavlova, 2013). D. Paneva-Marinova et al, describe the implementation of BIDL, which follows this information model (Paneva-Marinova et al, 2012 & 2017). L. Carboni proposes a semantic representation of icons based on extensions of CIDOC CRM (Carboni, 2019).

2 BIDL

[BIDL \(Bulgarian Iconographic Digital Library\)](#) is a virtual encyclopedia of Balkan icons developed by the Institute for Mathematics and Informatics of the Bulgarian Academy of Sciences (IMI BAS) that presents a rich collection, data model and search capabilities. It includes bilingual (Bulgarian and English) information about the following entities (as of July 2020):

- 307 icons and other iconographic objects (frescos, miniatures, stained glass, mosaics, iconostases, thrones and royal doors)
- 30 iconographers: the author of many icons is unknown
- 8 iconographic schools, several iconographer families
- 93 saints or other personages
- 44 iconographic scenes
- Numerous structured locations (country, province, town, gallery/museum, church, monastery, chapel, *etc.*).



Fig. 1. BIDL [Search by Iconographic Scene](#)

BIDL keeps detailed icon information (e.g. [see this object](#)): title, curatorial description, conservation state/notes, dimensions, locations: source (creation/provenance) vs current, period (with approximate expressions), author, iconographic school, technique and material (both nomenclature and a detailed description), personages and scenes. It provides excellent search functionality:

- View objects: by title, author, school, technique, base material
- View authors, schools, scenes, canonical characters, characters, provinces, towns

- Search objects: by title, author, school, period, location, source; standard and advanced
- Search & Group
- Search by map
- Virtual Collections.

One shortcoming is that BIDL doesn't have open licenses for the images it displays. This is unfortunate because Wikidata images use Wikimedia Commons for centralized management, and only open license images can be added.

Images are very important in most visual applications. The project [Structured Data on Commons](#) makes it easy for GLAM to describe images, using a Wikidata approach and linking to Wikidata for creator, location, depicted elements, etc. Commons also supports DeepZoom (incl. GigaPixel), eg see [Montserrat Casas de Nieto, in Evening Dress](#).

3 Wikidata and GLAM

Wikidata is one of the most important LOD datasets for GLAM (Alexiev, 2018) as it includes encyclopedic data that can be used as references. It is also a Knowledge Graph platform for integrating and leveraging GLAM data. The [Wikidata Strategy 2019](#) includes 3 parts, of which "Wikidata as a platform" is strongly GLAM-oriented. The WikiMedia foundation has strong [GLAM Wiki](#) outreach activities including:

- Case studies on [sharing Digital Collections](#) including Documenting 3D objects, Documenting living traditions, Digitization workflows, Enriching digitized content, Sharing and integrating digitized content
- Advice on [Sharing Knowledge](#): Editathons, Workshops, Backstage Events, GLAM professionals contributing, Embedded Wikimedians, Online editing campaigns, Wikidata and institutional metadata, Embedding Wikimedia Content, GLAM + Education
- Numerous realized GLAM projects, including [Bulgarian State Archives case study](#)
- Wikipedian in Residence programs with institutions like British Library, Wales National Library, Europeana, etc.

The [Wikidata WikiProject Visual arts](#) (formerly Sum of All Paintings) has done significant work to collect artworks and defined rich metadata for various object types ([Item structure](#)). For example, see the painting [Bathsheba in Reasonator](#) and notice the field "depicts Iconclass notation: 71H712". This leads to a detailed classification using [Iconclass](#) (in this case a typical Biblical situation):

- 71H71 David, from the roof (or balcony) of his palace, sees Bathsheba bathing
- 71H712 Bathsheba attended by servant(s)
- Keywords: Bathsheba · David · Old Testament · Samuel-2 11-12 · balcony · bathing · bible · love at first sight · maidservant · palace · roof · spying.

Wikidata Iconographic Resources

As of Feb 2020 there were Only 623 icons on Wikidata ([tweet](#)). 268 (43%) had image, 355 (47%) didn't ([query](#)). 33% had no author, 46% had "anonymous", 20% had "noname" Masters. Various authors needed merging ([query](#)), e.g. [Nikolaos Tsafouris and Nikolaos Zafouris should be merged](#) on Commons. Nevertheless, we could already see the possibility if rich description and interesting queries. E.g. see wikidata [class Icon and its properties on SQID](#), Icons with Images on Wikidata ([query](#)).

One key activity for semantic data integration is coreferencing (matching/reconciliation) of entities:

- Match data instances across multiple datasets that refer to the same real-world entity
- Fuzzy name matching (various algorithms), extra features, use machine learning for tuning weights
- Reconciliation: matching tabular data ("strings") to a KG ("things")

Wikidata [Mix-n-Match](#) is a global authority control database that helps with such tasks. As of July 2020 it had:

- 5181 external-id props that link to authority control databases ([query](#))
- 1627 with Mix-n-Match catalog ([query](#))
- 3554 without Mix-n-Match catalog (but easy to import/web-scrape)

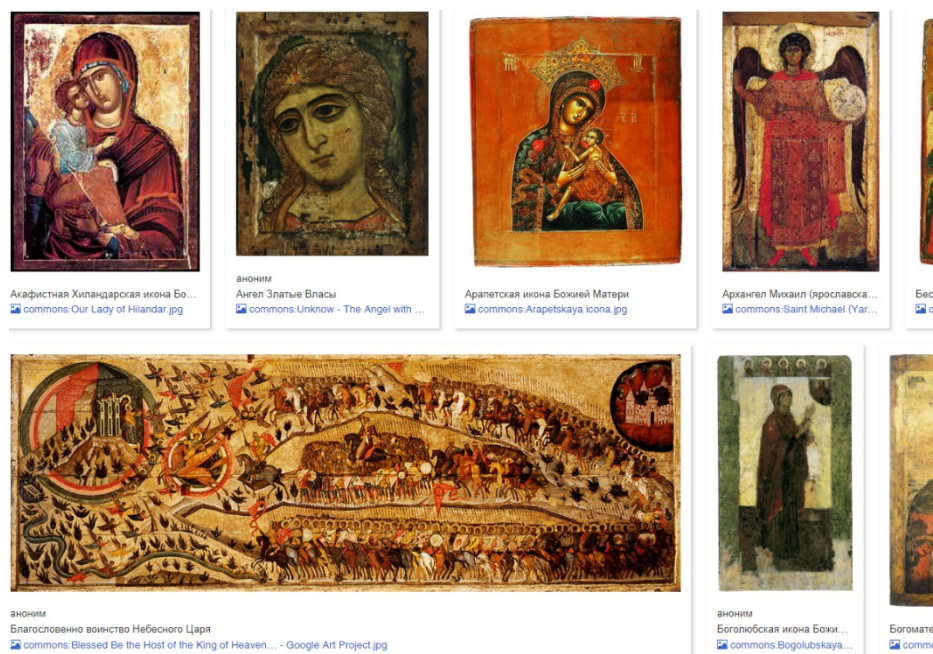


Fig. 2. Icons with Images on Wikidata ([query](#))

Icon-related Mix-n-Match catalogs:

- [Iconclass](#), a multilingual classification system for cultural content (39.5k, 3.7k matched) and [Getty Iconography Authority](#) by Getty Research Institute (1.2k, 915 matched)
- [Iconografía Hispana](#) by Biblioteca Digital Hispánica, [Brasiliana Iconográfica ID](#), [Trinidad and Tobago Icons](#).

Getty Iconography Authority Action ▾

identifier from the [Getty Iconography Authority](#)

1 2 3 4 5 ... 19

# Shiva (Hindu deity)	One of the main deities of Hinduism, whom Shaivites worship as the supreme god. Shiva is represented in a variety of forms: in a pacific mood with his consort Parvati and son Skanda, as the cosmic dancer (Nataraja), as a naked ascetic, as a mendicant begg	Auto-matched via auxiliary data
Shiva [Q11378]	Could not load description for 11378	Remove
# First Battle of Bull Run (American Civil War, 1861)	First of two battles fought a few miles north of the crucial railroad junction of Manassas, Virginia. The First Battle of Bull Run (called First Manassas by the South) was fought on July 21, 1861, at a very early stage of the war. Both armies were ill-pre	By Marsupium
First Battle of Bull Run [Q221469]	Battle in United States of America, part of American Civil War in point in time and point in time	Remove

Fig. 3. Mix-n-Match Catalog for Getty Iconography Authority

OpenRefine Reconciliation

OpenRefine is a popular tool for cleaning and transforming data. It has a Reconciliation function that allows you to "map strings to things", i.e. match labels to objects in a structured database. Reconciliation can target important databases such as Wikidata and Virtual International Authority File (VIAF).

- OpenRefine has a powerful Wikidata extension to export to Wikidata.
- It is also integrated in Ontotext GraphDB Workbench as [OntoRefine](#), so you can convert data to semantic form (RDF).

4 Icon Knowledge Graph

We defined a simple Knowledge Graph (KG) model for representing icon-related data on Wikidata: see [icon-KG](#) on Github, which includes RDF Turtle and full-size diagram generated with [rdfpuml](#) (Alexiev, 2016).

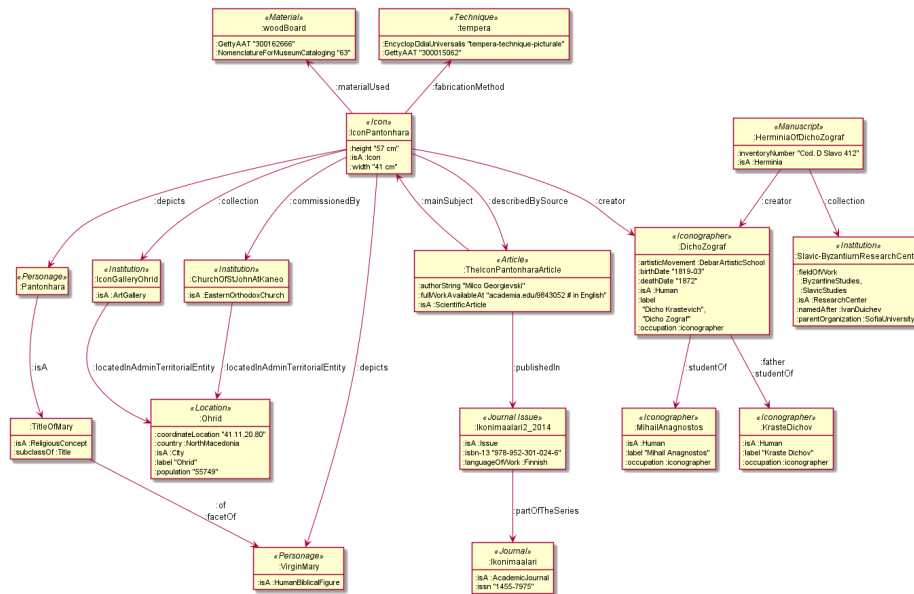


Fig. 4. Icon Knowledge Graph Model

It comprises the following entities (illustrated below): iconographer, iconographic school, herminia, icon, measurements, material, technique, iconographic subject (saint or a title of the Virgin Mary), location (city, monastery, church, museum), scientific article, academic journal, issue, links to LOD datasets (e.g. VIAF, Getty AAT, ISBN, ISSN, academia.edu).

Icon Concepts

Icons involve many specific concepts for techniques, materials, subjects, and iconography (religious subjects). [Herminias](#) were "how to guides" for iconographers painters and define some of these specific concepts. As we add icons, we need to deepen Getty AAT and Wikidata with Bulgarian/Balkan-specific icon and ethnographic concepts.

E.g. regarding "пафти" (Bulgarian ceremonial female belt buckle), Getty AAT has only [belt buckle](#). Wikidata has more detail and is easier to add to than Getty: it already had [pafiti](#), and we linked it into the class hierarchy (added "subclass of: belt buckle"), added Commons image [Belogradchik-hitorical-museum-19century-belt-buckle-14.jpg](#), added Structured metadata to image: "depicts: pafita; location: Belogradchik History Museum".

Iconographers, Families and Iconographic Schools (Movements)

Iconographers were the Old Masters of Eastern Europe, but unfortunately their lives are not well-known and their works not comprehensively described. We'll give the example of Dicho Zograf, a prolific iconographer: he's worked in tens of places, his icons

are in hundreds of churches, and he made 2-10 thousand works. He also left 2 hand-written herminias, so he was a real authority in icon creation. His family tree is known (which is unusual) and is [shown in bgwiki](#). His work and legacy spanned 3 Balkan countries and each claims him for its own:

- Bulgaria: [Дичо Зограф](#) on bgwiki: "Български иконописец, виден представител на Дебърската художествена школа".
- Macedonia: [Дичо Зограф](#) on mkwiki; "Годишно работел по околу педесет големи дела. Во нашите краишта го донел барокот кој доаѓал преку Света Гора и Солун, преку македонските мијачки зографи и резбари кои го учеле занаетот во манастирот "Зограф" на Атос".
- Serbia: [Димитар Крстевић](#) on srwiki. "Био је иконописац и представник дебарске уметничке школе".

Despite his immense importance, we have little information about Dicho Zograf's icons. The [bgwiki article](#) shows maybe 30 of his icons, Commons has 56 of his [icons/paintings](#) with CC Zero license. This is less than 2% of his total works, but it's still significant: if we guesstimate 100 iconographers on WD and assume the average is *twice less*, that makes 2800 icons with cleared license across Commons.

However, the [info about an icon on Commons](#) is poor: author, date; title and place are embedded in the filename and cannot be extracted easily. The Structured Info (see second tab, e.g. Depicted) is empty. None of these icons have a Wikidata record. (See next section for the data we'd like to capture).

Dicho Zograf's [Wikidata item](#) and [Commons Creator](#) page are also poor: Birth/death date/place, a number of identifiers to external authority databases, and links to Wikipedia pages, that was all. We enriched the [Wikidata item](#) with info [from bgwiki](#) by adding the items marked "!":

- Movement: Debar art school! (listed as "Macedonian carving", a subclass of carving; we added class "painting movement")
- Father: zograf Kraste Dichov Perkov!
- Student of: zograf Kraste Dichov Perkov!, then zograf Mihail Anagnost! of Samarina! and his son Dimitar! (Mihailov)

A curious case from BIDL is the name "Г. Стергюв от Неврокоп" (G. Stergyuv of Nevrokop). Some research leads to the bgwiki page [Серги Георгиев](#): "подписана Рука Стергюва Георгиев" ... С. п. А. ѿ рука Стергюва въ лѣто 1881". So "Stergyu" is an old transcription of the name "Sergi" and the inscription means "the hand of Sergi" but the researcher was misled that Stergyuv is a surname. We added to the respective [Wikidata item](#) all these aliases, occupation, and info from BIDL: work period start/end, movement "Bansko art school".

It would be great if we can train some icon researchers to add such in-depth information. Due to time limitations, we reconciled against Wikidata and entered basic info about 33 iconographers, such as movement, birth/death year/place and references.

WDid	name_bg	name_en	studentOf	movement	birthPlace	deathPlace	birthYear	deathYear	descr at URL (split on space)
	<small>Choose new match</small>	Usta Velyan		художествена школа <small>Choose new match</small>					
Q3657670	Dimitar Zograf <small>Choose new match</small>	Dimiter Zograph from Sozopol <small>Choose new match</small>		Самоковска художествена школа <small>Choose new match</small>					
	Dimiter Zograph from Sozopol <small>Choose new match</small>	Dimiter Zograph from Sozopol		Странджанска художествена школа <small>Choose new match</small>					
	Dimiter Kunchov (Krustev) <small>Choose new match</small>	Priest Dimiter Kunchov (Krustev)		Тревненска иконописна школа <small>Choose new match</small>					
Q19706407	Димитър Неделчев <small>Choose new match</small>			Банска художествена школа <small>Choose new match</small>					
Q19205123	Димитър Сирещов <small>Choose new match</small>	Dimiter Sirlieshtov	Михалко Голев; Симеон Молеров; Белян Огнев	Банска художествена школа <small>Choose new match</small>	Банско	Банско	1838	1913	
Q86214997	Досю Кокоа <small>Choose new match</small>			Тревненска иконописна школа <small>Choose new match</small>					https://www.facebook.com/2604148 https://m.opoznai.bg/view/muzeina-darvorezba-drianovo http://destinati.church-in-dryanovo/ https://dobrotoli.restaviraha-starinen-ram-str-tarnovo.bg/bg/administraciya/na-sie https://www.kmeta.bg/restaviraha-s-kolyu-ficheto http://www.djokodesigr
Q2989196	Zahari Zograf <small>Choose new match</small>	Zahari Hristovich Zograph		Самоковска художествена школа <small>Choose new match</small>					

Fig. 5. Reconciling Iconographers and Adding Data with OpenRefine

Icons

We described in detail the first work of Dicho Zograf: [Virgin Mary Pantonhara, 1844](#):

- physical description: creator Dicho Zograf, inception 1844, tempera. wood board, 57 x 41 x 4 cm
- commissioned by (location of creation): Church of St. John at Kaneo (Ohrid)
- collection (and current location): Icon Gallery (Ohrid)
- depicts Virgin Mary and Pantonhara (a name of Virgin Mary) as main character, and 7 saints at her feet (in order from left to right): St. George, Demetrius of Thessaloniki, etc.
- described in [The icon of the Mother of God Pantonhara in the Icon Gallery](#), an article by Milco Georgievski.

Herminias, Institutes, Articles, Journals, Researchers

- Created [Slavic-Byzantium Research Center "Prof. Ivan Duichev"](#)! with basic metadata including location and website
- Created [Herminia of Dicho Zograf](#)! with basic metadata; in the Duichev collection, inventory number "Cod. D. Slavo 412"
- Described article [The icon of the Mother of God Pantonhara in the Icon Gallery](#) by Milco Georgievski
- Published on 26 October 2014 in journal issue [Ikonimaalari 2/2014 \(ISBN 978-952-301-024-6\)](#)
- Which is part of the Finnish journal on icons [Ikonimaalari \(ISSN 1455-7975\)](#)
- The article has English edition: [academia.edu paper 9843052](#)

- Proposed the creation of Wikidata property [academia.edu work id](#) so we can link to academia.edu, which is the only source for that rare article.
- Ideally, we should create items for icon researchers or better yet incentivize them to register at [ORCID](#), which is then easy to import to Wikidata. (At present "Milco Georgievski" is only an author name string of the article, but not a person record.)

Iconographic Subjects

We did significant work to coreference and describe iconographic subjects, including 83 saints and 10 titles of Mary (we did not describe iconographic scenes).

[Titles of Mary](#) are 282 designations of the mother of Jesus Christ. We added Bulgarian names and references to those 10, including interesting cases such as:

- [Pantonhara](#) (joy to all, радост за всички)
- [Source of Life](#) (животворен източник)
- [Platitera](#) (More Spacious than Heavens, Ширшая небес, По-широка от небесата): how could otherwise a woman bear a God
- [Virgin Mary Sliced](#) (Св. Богородица Заклана), after a legend about an icon sliced by a monk who lost his mind

We added some Saints, e.g. the assumed mother and father of [St. George: Polychronia](#) (Polifrona) and [Gerontius](#), with references.

Added the Membership of the Seven Slavic Saints (Св. Седмочисленици).

751 records Schema Issues 1117 Preview						
Show as: rows records Show: 5 10 25 50 records						
All	id_persona	wd_persona	id_tip	wd_type	index_wd_id	index_wvd
1.	John the Evangelist Choose new match	Q328804	apostle Choose new match	Q43412	The Virgin Cataphyge (Refuge) and St. John the Evangelist Choose new match	Q84545297
2.	Virgin Mary Choose new match	Q345	Virgin Mary Choose new match	Q345	The Virgin Cataphyge (Refuge) and St. John the Evangelist Choose new match	Q84545297
3.	Katafygio Choose new match	Q84544887	Virgin Mary Choose new match	Q345	The Virgin Cataphyge (Refuge) and St. John the Evangelist Choose new match	Q84545297
4.	John the Baptist Choose new match	Q40662	John the Baptist Choose new match	Q40662	St. John the Baptist Choose new match	Q86592254
5.	John the Baptist Choose new match	Q40662	John the Baptist Choose new match	Q40662	St. John the Baptist Choose new match	Q86592264
6.	Virgin Mary Choose new match	Q345	Virgin Mary Choose new match	Q345	The Virgin Choose new match	Q86592271
7.	Jesus Christ Choose new match	Q302	Jesus Christ Choose new match	Q19076584	Deisis with Apostles (Unknown) (Arbanasi) (Veliko Turnovo) (Bulgaria) (English) Choose new match	Q87067320
8.	Virgin Mary Choose new match	Q345	Virgin Mary Choose new match	Q345	Deisis with Apostles (Unknown) (Arbanasi) (Veliko Turnovo) (Bulgaria) (English) Choose new match	Q87067320
9.	John the Baptist Choose new match	Q40662	John the Baptist Choose new match	Q40662	Deisis with Apostles (Unknown) (Arbanasi) (Veliko Turnovo) (Bulgaria) (English) Choose new match	Q87067320
			Christian martyr Choose new match	Q107013	St Athanasius Choose new match	Q86592276
10.	John the Baptist Choose new match	Q40662	John the Baptist Choose new match	Q40662	St. John the Baptist Choose new match	Q86592279
11.	Saint Nicholas Choose new match	Q44289	cleric Choose new match	Q2259532	St. Nicholas Choose new match	Q86592283
12.	Elisha Choose new match	Q206238	prophet Choose new match	Q42857	The prophet Elisha Choose new match	Q86592285
13.	Jesus Christ Choose new match	Q302	Jesus Christ Choose new match	Q19076584	The Virgin Hodegetria Choose new match	Q86592286
14.	Child Jesus Choose new match	Q942467	Jesus Christ Choose new match	Q19076584	The Virgin Hodegetria Choose new match	Q86592286
15.	Virgin Mary Choose new match	Q345	Virgin Mary Choose new match	Q345	The Virgin Hodegetria Choose new match	Q86592286
16.	Hodegetria Choose new match	Q132413	Virgin Mary Choose new match	Q345	The Virgin Hodegetria Choose new match	Q86592286

Fig. 6. Reconciling Personages with OpenRefine

Locations

We reconciled over 300 hierarchical locations that appear in BIDL: country, province, town, museum/gallery, church, monastery, paraclete, etc. These are used for location of creation (commissioned by) and current location (collection). More work is needed to create some missing minor churches and paracletes. E.g. below you see that we've matched Rila Monastery, but not the paracletes "St. Nikola" and "St. Simeon and Sava" within.

област	град	тип1	място1	тип2	място2	тип3	място3
Blagoevgrad Province Choose new match				Манастир	Rila Monastery Choose new match	Параклис	Св. Никола
Blagoevgrad Province Choose new match				Манастир	Rila Monastery Choose new match	Параклис	Св. Симеон и св. Сава
Blagoevgrad Province Choose new match			Diocese of Nevrokop Choose new match				
Blagoevgrad Province Choose new match		Музей	Rila Monastery Choose new match	Манастир	Rila Monastery Choose new match		
Blagoevgrad Province Choose new match		Църква	Assumption of Mary Church, Pchelino Choose new match	Манастир	Rila Monastery Choose new match		
Blagoevgrad Province Choose new match		Църква	Рождество Богородично (Рилски манастир) <small>new</small> Choose new match	Манастир	Rila Monastery Choose new match		
Blagoevgrad Province Choose new match		църква Choose new match	Църква-кустница при гробището на Рилски манастир Create new item Search for match	Манастир	Rila Monastery Choose new match		
Blagoevgrad Province Choose new match	Bansko Choose new match						
Blagoevgrad Province Choose new match	Bansko Choose new match	Музей	Bansko Art School Icon Gallery Choose new match				

Fig. 7. Reconciling Locations with OpenRefine

Once locations are reconciled, you get rich data, such as administrative location, geo-coordinates, picture, etc.

Church of St. John at Kaneo (Q164664)

Свети Йоан Канео | Йоан Канео | Sankt Johannes kyrka | Sankt Johannes vid Kaneos kyrka | Свети Јован Канео
Macedonian Orthodox church building in Ohrid, North Macedonia

Location properties

instance Eastern Orthodox church of

Maps

Other Wikidata items within 15km | Geohack | TagInfo | Overpass | 41.11108611 / 20.78865833

Location

Name	Description
Europe	continent on Earth, mainly on the northeastern quadrant, i.e. north-western Eurasia
North Macedonia	republic in Southeast Europe
Southwestern Statistical Region	geographic region
Ohrid Municipality	local administrative unit (opština) in North Macedonia
Ohrid	city in North Macedonia

External sources

Freebase /m/02r390y

External identifiers

Wikimedia projects

Current language Wikipedia

en Church of St. John at Kaneo

Big Wikipedia

az Müqəddəs İohann kilsəsi (Kaneo)

eo Igreja de San Juan Kaneo

fr Église Saint-Jean de Kaneo

pl Cerkiew św. Jana Teologa w Kaneo

ru Церковь Святого Иоанна Канео (Охрид)

sv Sankt Johannes kyrka i Kaneo

tr Aziz Yuhanna Kilisesi (Kaneo)

zh 神學家聖約翰教堂

Wikimedia Commons

commons:Category:St. John Kaneo Church

Other Wikipedia

be Царква Святога Іаана Канэа (Охрид)

bg Свети Йоан Богослов Канео

hr Sveti Jovan Kaneo

hsb Swj. Jowan Kaneo

hy Միստրոնի Սուրբ Գիորգիոսի Առաքելի Կաթողիկոսական Սուրբ Երեմիայի Եկեղեցի

Fig. 8. Church of St. John at Kaneo in Reasonator

5 BIDL Mapping

BIDL exports data to custom XML. We deduced a schema that has about 60 elements (shown in Bulgarian):

```

<object id="(\\d+)">
  <characteristics>
    Идентификация
    Заглавие: bg: en
    Тип на иконографския обект
    (Икона | Мозайка)
    друг: bg: en
    Пластичен обект
    друг: bg: en
    Автор: bg: en
    Биография на автора: bg: en
    Иконографски род: bg: en
    Иконописна школа: bg: en
    Период
    От
    (Година | Век)
    (начало | среда | край | първа половина | втора
половина)
  
```

```

До
  (Година|Век)
  (Месец|Ден)
  (начало|среда|край|първа половина|втора
половина)
Размери \ (см\)
  височина
  ширина
  дебелина
Местонахождение
  Държава:bg:en
  Област:bg:en
  (Град|Село):bg:en
  (Галерия|Музей|Частна колекция):bg:en
  Частна колекция
  Друго местонахождение:bg:en
Място на създаване
  Държава:bg:en
  Област:bg:en
  (Град|Село):bg:en
  (Манастир|Църква|Параклис):bg:en
  Църква
  Друго място на създаване:bg:en
Бележки към идентификацията на обекта:bg:en
Описание
  Персонажи
  (
  Име на персонаж:bg:en
  (
  Каноничен тип на персонаж:bg:en\n)?)*
  Иконографски сцени
  Иконографска сцена:bg:en
  Присъстващ персонаж в сцена (:bg:en)+
  Описание на обекта:bg (:en)?
Технология
  Иконографска техника:bg:en
  Описание на техниката:bg:en
  Основа:bg:en
  Описание на основата:bg (:en)?
  Състояние, реставрационни намеси и
коментари (:bg)? :en)?
  Файлове
<files>
  <file @id="(\\d+)" @original_name @savedas>

```

Once we had the schema, we imported the data to OpenRefine and implemented a mapping to the Icon KG model described above using the OpenRefine Wikidata exporter.

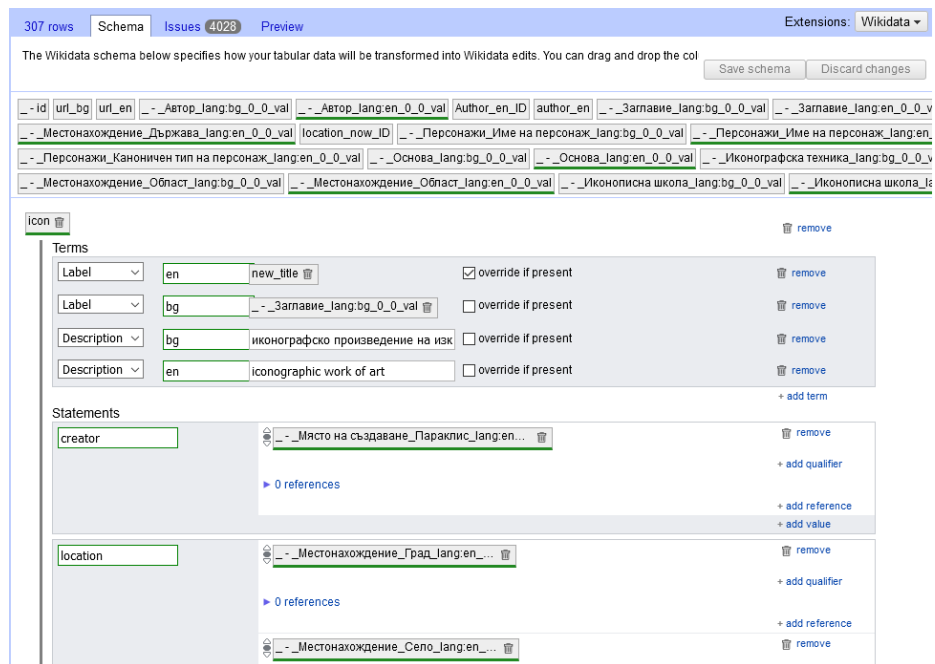


Fig. 9. Mapping BIDL Icons to Wikidata with OpenRefine

As described above, we mapped the following BIDL Authorities:

- Object Type


```
Тип на иконографския обект
(Икона|Мозайка)
друг: bg: en
Пластичен обект # this node is sort of parasitic
друг: bg: en
```
- Technique


```
Иконографска техника: bg: en
Описание на техниката: bg: en
```
- Medium


```
Основа: bg: en
Описание на основата: bg:(en)?
```
- Geography


```
(Местонахождение|Място на създаване)
Държава: bg: en
Област: bg: en
(Град|Село): bg: en
```
- GLAMs and Churches


```
Местонахождение
Държава>Област(Град|Село) # just to relate the GLAM
(Галерия|Музей|Частна колекция): bg: en
Място на създаване
Държава>Област(Град|Село) # just to relate the church
(Манастир|Църква|Параklис): bg: en
```
- Authors


```
Автор: bg: en
Биография на автора: bg: en
Иконографски род: bg: en # he belongs to it
Иконописна школа: bg: en # he is related but not part of it
```
- Saints


```
Персонажи
(
  Име на персонаж: bg: en
  Каноничен тип на персонаж: bg: en\n?)*
Иконографски сцени
Присъстващ персонаж в сцена(: bg: en)+
```

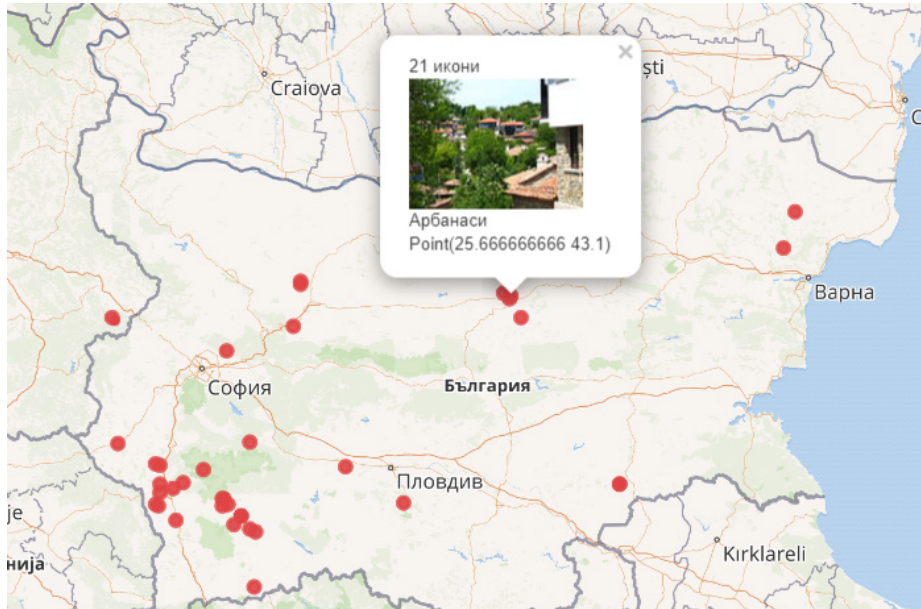



Fig. 11. Count by Location of Creation ([Query](#))

7 EDM Mapping

We implemented a Detailed and precise mapping to EDM for submission to Europeana, as a Python script that uses rdflib and ElementTree, and takes as input the BIDL XML plus Wikidata references from a CSV file. It and includes:

- Proper structuring into CHO, Aggregation, WebResource
- Bilingual data with language tags
- Links to Wikidata for all coreferenced items
- Type, Title, Creator, Size, Date, Locations, Description, Subject, Medium, Part Of (collection), Language, Webpage, Image, License, Agent (iconographer)
- 3 levels of Providers (IMI, CLADA and Bulgariana)

Below is the EDM semantic description of [Transfiguration of Jesus Christ by Toma Vishanov-Molera](#), presented as Turtle.

```

<http://bidl.cc.bas.bg/viewobject.php?id=264&lang=bg> a edm:ProvidedCHO;
  owl:sameAs wd:Q87103221;
  edm:hasType wd:Q132137;
  edm:type "IMAGE";
  dc:identifier "264";
  dc:title "Преображение Господне"@bg, "The Transfiguration of Jesus Christ"@en;
  dc:type "Икона"@bg, wd:Q132137;
  dc:creator
    "Тома Вишанов-Молера"@bg, "Тома Vishanov-Molera"@en, wd:Q12296667 ,
    "Банска иконописна школа"@bg, "Bansko Iconographic School"@en, wd:Q12272944;
  dct:created "От край на 18 Век До начало на 19 Век"@bg;
  dct:extent "30.5 x 22.5 x 2.3 cm";
  edm:currentLocation
    "Успение Богородично, Бобошево, Благоевград, България"@bg,
    "The Assumption of the Virgin, Boboshevo, Blagoevgrad, Bulgaria"@en,
    wd:Q12297283;
  dct:provenance
    "Успение Богородично, Бобошево, Благоевград, България"@bg,
    "The Assumption of the Virgin, Boboshevo, Blagoevgrad, Bulgaria"@en,
    wd:Q12297283;
  dct:spatial
    "Успение Богородично, Бобошево, Благоевград, България"@bg,
    "The Assumption of the Virgin, Boboshevo, Blagoevgrad, Bulgaria"@en,
    wd:Q12297283;
  dc:description
    """"В горната половина на композицията са изобразени : в центъра Христос в цял ръст
    ... старозаветните пророци Мойсей и Илия, седнали.
    ... вляво св. ап. Яков, клекнал и опрял ръце в земята; св. ап. Петър..""""@bg,
    """"Pictured in the upper half of the composition are: ...""""@en;
  dc:subject
    "Апостол"@bg, "Apostle"@en, wd:Q43412,
    "Иисус Христос"@bg, "Jesus Christ"@en, wd:Q302,
    "Преображение Господне"@bg, "The Transfiguration of Jesus Christ"@en,
    "Пророк"@bg, "Prophet"@en, wd:Q42857,
    "Св. Илия"@bg, "St. Elijah"@en, wd:Q133507,
    "Св. Йоан Богослов"@bg, "St. John the Evangelist"@en, wd:Q328804,
    "Св. Моисей"@bg, "St. Moses"@en, wd:Q9077,
    "Св. Петър"@bg, "St. Peter"@en, wd:Q33923,
    "Св. Яков"@bg, "St. James"@en, wd:Q43999;
  dct:medium
    """"Маслена/Дърво. Приложена е маслена живопис...""""@bg,
    """"Oil/Wood. Oil painting, laid thinly on the ground coat...""""@en,
    wd:Q56676227, wd:Q287;
  dct:isPartOf
    "Virtual encyclopaedia of Bulgarian iconography"@en,
    "Виртуална енциклопедия на Българската иконография"@bg,
    <http://bidl.cc.bas.bg/index.php?lang=bg>;
  edm:rights <https://creativecommons.org/publicdomain/mark/1.0/>;
  dc:language "bg", "en".

```

Fig. 12. EDM Mapping 1: ProvidedCHO


```

<http://bidl.cc.bas.bg/viewobject.php?id=264&lang=bg#aggr> a ore:Aggregation;
  edm:aggregatedCHO <http://bidl.cc.bas.bg/viewobject.php?id=264&lang=bg>;
  edm:isShownAt <http://bidl.cc.bas.bg/viewobject.php?id=264&lang=bg>,
    <http://bidl.cc.bas.bg/viewobject.php?id=264&lang=en>;
  edm:isShownBy <http://bidl.cc.bas.bg/view/300-view.jpg>;
  edm:dataProvider "Институт по математика и информатика, БАН";
  edm:intermediateProvider "CLADA BG";
  edm:provider "Bulgariana".

<http://bidl.cc.bas.bg/view/300-view.jpg> a edm:WebResource;
  edm:rights <http://rightsstatements.org/vocab/InC/1.0/>.

wd:Q12296667 a edm:Agent;
  skos:prefLabel "Тома Вишанов-Молера"@bg, "Тома Vishanov-Molera"@en;
  dct:isPartOf
    "Молеров"@bg, "MoleroV"@en,
    "Банска иконописна школа"@bg, "Bansko Iconographic School"@en, wd:Q12272944;
  skos:note
    """"Тома Вишанов-Молера – роден около 1750г., иконописец и стенописец,
    основоположник на банската художествена школа. Израства в семейството на...""""@bg,
    """"Тома Vishanov-Molera, born around 1750, painter of icons and murals,
    founder of the Bansko school of art. He grew up in the family of...""""@en.

```

Fig. 13. EDM Mapping 2: Aggregation, WebResource, Agent

8 Conclusion

We described the process of contributing Bulgarian icons to LOD, including Wikidata and Europeana. We hinted at the opportunities that inclusion in the world-wide LOD offers GLAM institutions and demonstrated some queries. We described the importance of adding Bulgaria-specific concepts and authorities (iconographers, places, churches, saints).

Future Work

We will continue to motivate GLAMs to release their images with open license. Other ideas for overcoming this shortcoming:

- There are many images of Balkan icons already in Commons (we estimate 2.8k). We could describe those icons in detail, so they can be used in queries and applications.
- We are adding links to external images as "URL: of Image". While Wikidata requires a Commons image for image displays like Fig.2, we can make similar displays with our own query frameworks.

We will try to motivate icon researchers to enter data about their publications, which should be used as sourcing statements for justifying important icon facts (e.g. creator, inception date, etc).

Rich icon descriptions offer a great opportunity for semantic text enrichment, i.e. using NLP to match the *highlighted* texts in the examples below to Wikidata entities, or even extracting events. CLaDA uses the INCEPTION semantic annotation software

- Donated about 1395 to the *Poganovo monastery* by *Empress Elena Paleologus*, daughter of the monastery's sponsor *Despot Deyan* and granddaughter of *Tsar Ivan Alexander*.
- *Dimiter T. Molerov*, born in 1780 in *Bansko*, son of *Toma Vishanov the Moler*. One of the best-known painters, a representative of the *Bansko* school of art, a disciple of his father, influenced by the art of *Athos*. Author of the murals of the naos in the *St Archangels' paraclete* in the *Rila monastery*, the murals in the *Church of the Assumption of the Virgin* in the *Pchelino dependance* (метох)

The [Cyrillo-Methodian Research Center](#) of BAS, a member of CLaDA BG, is working on field expeditions to describe icons depicting the Seven Slavic Saints (including the saint brothers) and taking open license photos. Currently the description is not structured (using Word) but we hope to help them use BIDL or enter in Wikidata directly. In this way the collection of Bulgarian icons can grow significantly.

Acknowledgements

This work is funded in part by [CLaDA BG](#), the Bulgarian National Interdisciplinary Research e-Infrastructure for Resources and Technologies in favor of the Bulgarian Language and Cultural Heritage, part of the EU infrastructures CLARIN and DARIAH, Grant number DO01-164/28.08.2018. We are grateful to IMI BAS for allowing us to use the BIDL data and their continuing collaboration.

References

- Alexiev, V. (2016, November). RDF by Example: rdfpuml for true RDF Diagrams, rdf2rml for R2RML Generation. *In Semantic Web in Libraries (SWIB 2016)*. Bonn: Germany. Retrieved from <http://rawgit2.com/VladimirAlexiev/my/master/pres/20161128-rdfpuml-rdf2rml/index-full.html>
- Alexiev, V. (2018). Museum Linked Open Data: Ontologies, Datasets, Projects. *Digital Presentation and Preservation of Cultural and Scientific Heritage*, 8, pp. 19-50. Retrieved from http://dipp.math.bas.bg/images/2018/019-050_32_11-iDiPP2018-34.pdf
- Carboni, L. (2019). An Ontological Approach to the Description of Visual and Iconographical Representations. *Heritage*, 2(2), pp. 1191-1210. doi:<https://doi.org/10.3390/heritage2020078>
- Paneva-Marinoва, D., Pavlov, R., & Goynov, M. (2012). Two Integrated Digital Libraries for Knowledge and Iconography of Orthodox Saints. *4th International Conference "Progress in Cultural Heritage Preservation" (EuroMed 2012)*, (pp. 684-691). Lemessos.
- Paneva-Marinoва, D., Pavlov, R., & Goynov, M. (2017). *Multimedia Digital Library: Constructive Block in Ecosystems for Digital Cultural Assets. Basic Functionality and Services*. Bonn, Germany: LAP LAMBERT Academic Publishing.

Pavlova, D. (2013). *Semantic technologies and tools in digital libraries for artistic heritage*. PhD thesis.

Received: June 30, 2020
Reviewed: July 15, 2020
Finally Accepted: July 23, 2020

