



MusicKG: Representations of sound and music in the Middle Ages as Linked Open Data

Victoria Eyharabide, Vincent Lully and Florentin Morel

1 2 5 7 1 6 2 2 1 6 4



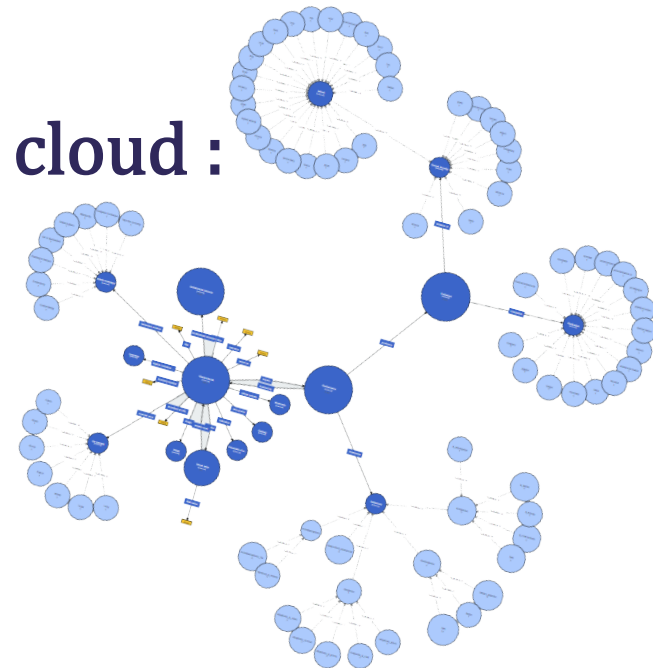
SORBONNE UNIVERSITÉ

STIH Laboratory - Paris, France



MusicKG

- MusicKG is a cultural heritage knowledge graph containing representations of sound and music in the Middle Ages
- An ontology has been designed to integrate data from several iconographic and musicology databases
- MusicKG is connected to the LOD cloud :
 - Wikidata
 - Getty Vocabularies
 - MIMO
 - Iconclass
 - GeoNames





Source data : Musiconis database





The Musiconis Search Engine



BLOG

VOCABULARY

BIBLIOGRAPHY

LOGIN



Representations of sound and music in the Middle Ages

The Musiconis database presents and analyzes musical performances (featuring instrumental musicians, singers, and dancers) depicted on medieval objects from the 8th to the 16th century.

SEARCH

<http://musiconis.huma-num.fr/en/>



<http://musiconis.huma-num.fr/en/fiche/39/x.html>



David tuning his harp

Location (current) : Charleville-Mézières, Grand Est, France

Location type : Bibliothèque

Location (original) : Belval, Grand Est, France

Century : 12

Dates : 1101 -1200

Technique : Illumination

Material : Paper / Parchment

Support : manuscrit 246 D, tome 1, folio 1

Partner database : Initiale

Original title : David jouant de la harpe

Iconclass reference :

11I62(DAVID)33 David as psalmist, as author of the psalms

48C7322 harp

⊕ Hover to zoom



<http://musiconis.huma-num.fr/en/fiche/178/x.html>

Musician playing a flute or a reed instrument, acrobat playing the vielle, acrobat holding a sword and knife juggler



Summary

English title : Musician playing a flute or a reed instrument, acrobat playing the vielle, acrobat holding a sword and knife juggler

Location (current) : Larrey, Bourgogne-Franche-Comté, France
Location type : Bibliothèque

Location (original) : Saint-Nicolas-lès-Cîteaux, Bourgogne-Franche-Comté, France

Century : 12

Dates : 1111 -1111

Technique : Illumination

Material : Paper / Parchment

Support : manuscrit 169, folio 5

Partner database : Initiale

Original title : Jongleurs

Iconclass reference :

PERFORMANCE

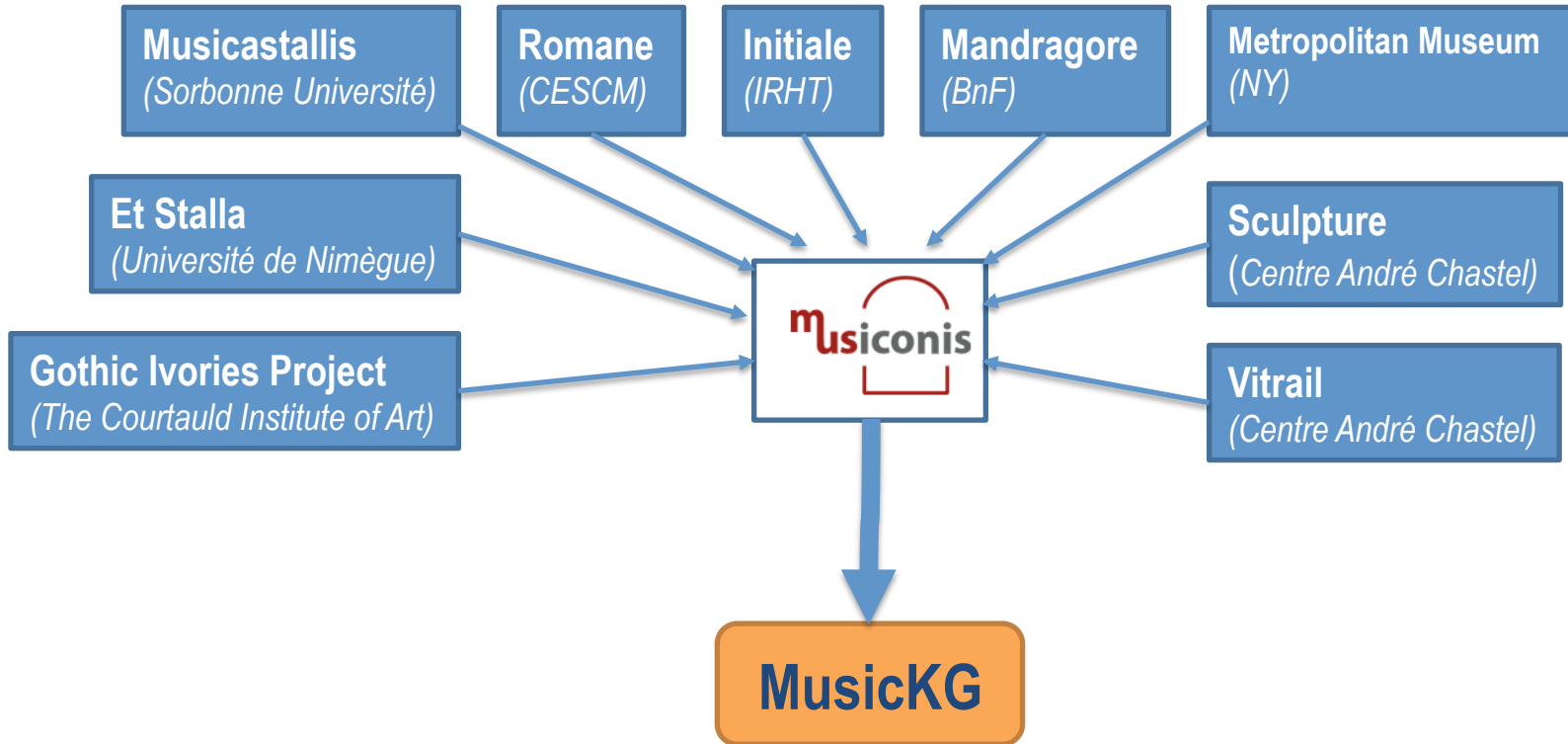
RELATION BETWEEN
PERFORMERS

SOUND

ANALOGIES

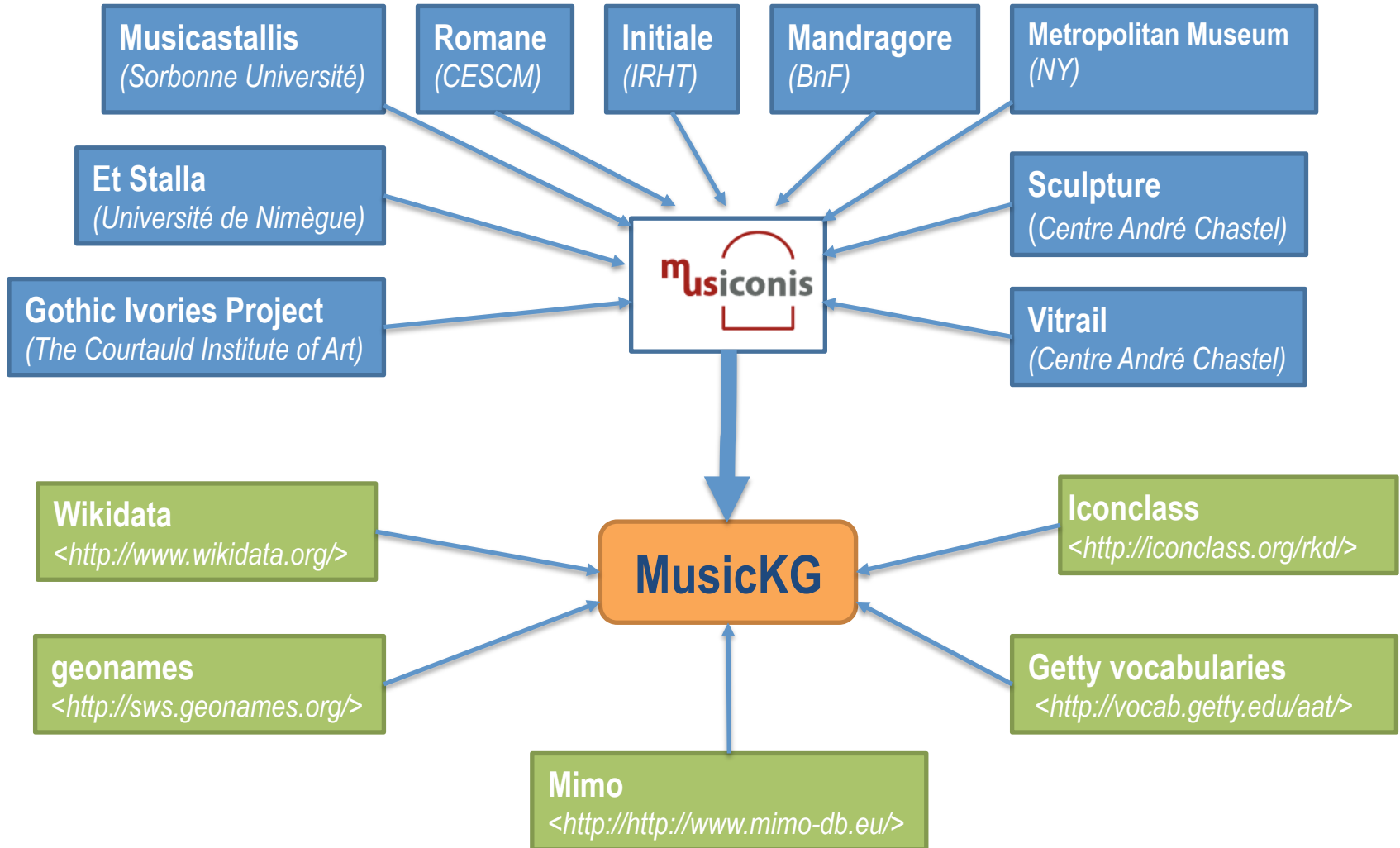


Linking MusicKG to the Linked Open Data cloud





Linking MusicKG to the Linked Open Data cloud





LOD cloud : Wikidata



- [Main page](#)
- [Community portal](#)
- [Project chat](#)
- [Create a new Item](#)
- [Create a new Lexeme](#)
- [Recent changes](#)
- [Random item](#)
- [Query Service](#)
- [Nearby](#)
- [Help](#)
- [Donate](#)

[Print/export](#)

[Download as PDF](#)

Tools

- [What links here](#)
- [Related changes](#)
- [Special pages](#)
- [Permanent link](#)
- [Page information](#)
- [Concept URI](#)

material used (P186)

[In more languages](#) [Configure](#)

Language	Label	Description	Also known as
English	material used	material the subject is made of or derived from	medium made from constructed from constructed out of construction material media built from built out of manufactured from manufactured out of crafted from crafted out of formed from formed out of made of ore source material raw material feedstock reactant ingredient ingredients
Spanish	material empleado	material del que está hecho o deriva el elemento	material material usado
French	matériau	matériau dont est constitué le sujet	composé de fait de matériau de construction matériaux construit à partir de



LOD cloud : Geonames

Chartres, France

Non sécurisé | www.geonames.org/3026467/chartres.html

GeoNames About Browse Download API Help Paris, Mount Everest, New York

Chartres ca. 158 m
P PPLA2 seat of a second-order administrative division
France FR » Centre-Val de Loire 24 » Eure-et-Loir 28 » Chartres 281 » Chartres 28065
population : 43838
48.44685, 1.48925
N 48°26'49" E 1°29'21"

geotree .kml .rdf



[instrument de musique](#) > [idiophone](#) > [idiophone à émission par percussion directe](#) > [carillon](#)

CARILLON

Descripteur

- (fr-FR) carillon
- (en-US) carillons
- (it) concerto di campane

Définition

- (fr-FR) **Ensemble de cloches montées dans un châssis, convenablement accordées pour permettre de jouer des airs de musique. Souvent placé dans un clocher d'église ou dans un beffroi, le carillon est généralement actionné par un clavier ou un autre mécanisme qui met en jeu des marteaux.**

Terme(s) générique(s)

- [idiophone à émission par percussion directe](#)

Concept(s) équivalent(s) dans d'autres vocabulaires

- <http://data.bnf.fr/ark:/12148/cb11976117r>
- <http://vocab.getty.edu/aat/300195449>
- <http://fr.dbpedia.org/resource/Carillon>

Vocabulaire source

[Thésaurus de la désignation des objets mobiliers](#)

Terme(s) de premier niveau

- [instrument de musique](#)

Illustration(s)



Statut

- Validé

Date de création

16 mai 2012



<https://github.com/victoriaeyharabide/MusicKG>

victoriaeyharabide / MusicKG

Watch 0 Star 0 Fork 0

Code Issues 0 Pull requests 0 Projects 0 Wiki Security Insights Settings

Branch: master New pull request

Create new file Upload files Find File Clone or download

victoriaeyharabide Update README.md	Latest commit de1ea4b 20 days ago
MusicKG.ttl	Add files via upload 20 days ago
README.md	Update README.md 20 days ago

README.md

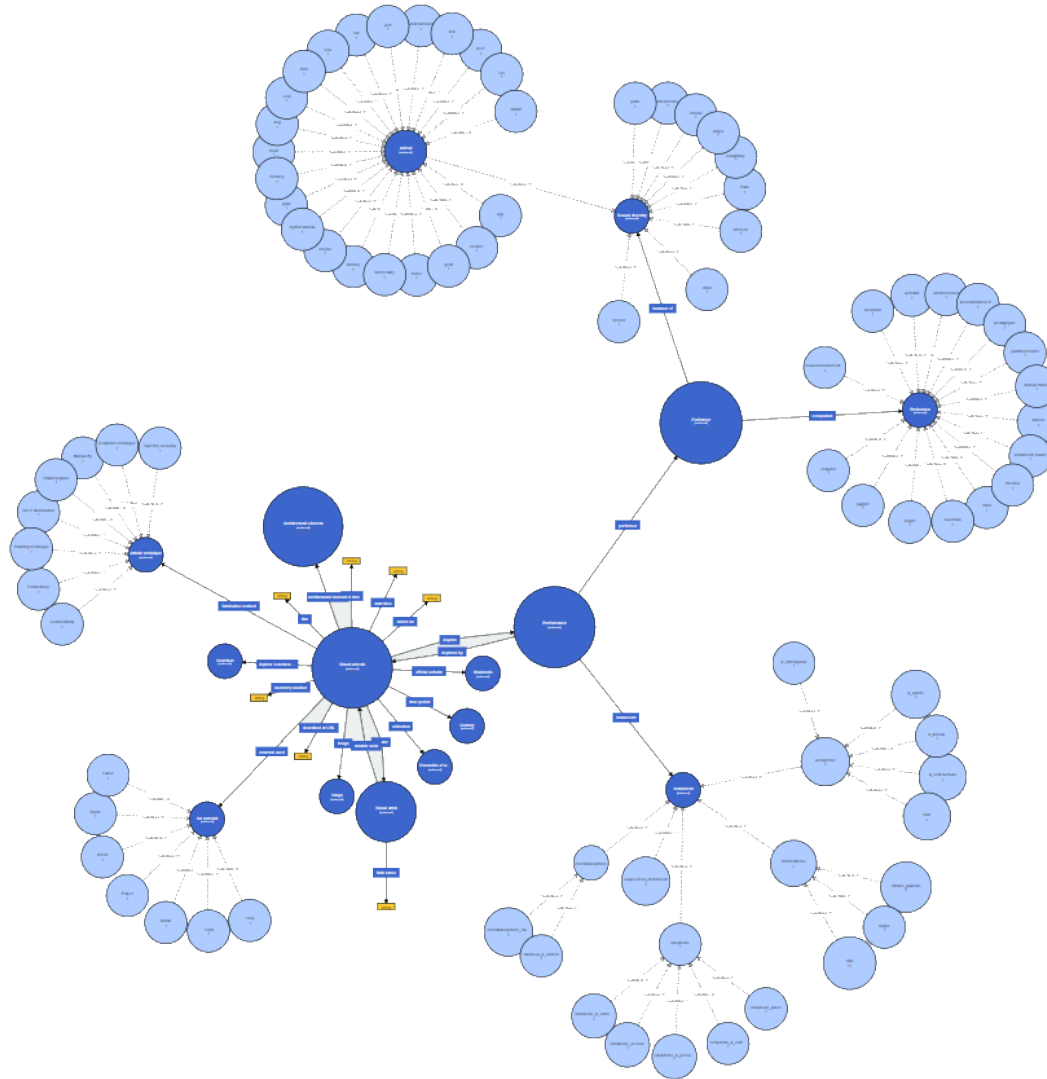
MusicKG

MusicKG is a multilingual knowledge graph about medieval musicology and musical iconography. A specific ontology has been designed to integrate data from several iconographic and musicology databases. In addition, MusicKG is connected to the Linked Open Data cloud with a significant part of its classes, properties and instances being linked to Wikidata, Getty Vocabularies, MIMO, Iconclass and GeoNames. MusicKG is accessible and reusable by three means:

- a downloadable RDF dump : <https://raw.githubusercontent.com/victoriaeyharabide/MusicKG/master/MusicKG.ttl>
- a Virtuoso faceted browser : <http://35.180.138.244:8890/fct>
- a public SPARQL endpoint : <http://35.180.138.244:8890/sparql>



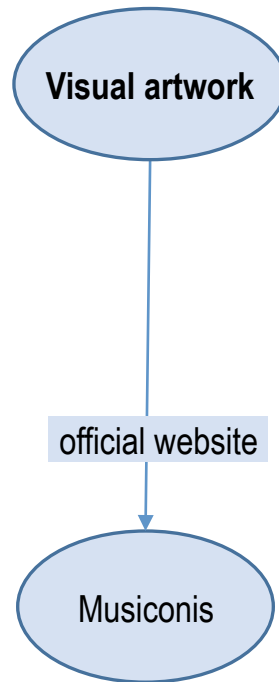
MusicKG visualisation



<http://www.visualdataweb.de/webvowl/#iri=https://raw.githubusercontent.com/victoriaeyharabide/MusicKG/master/MusicKG.ttl>₃

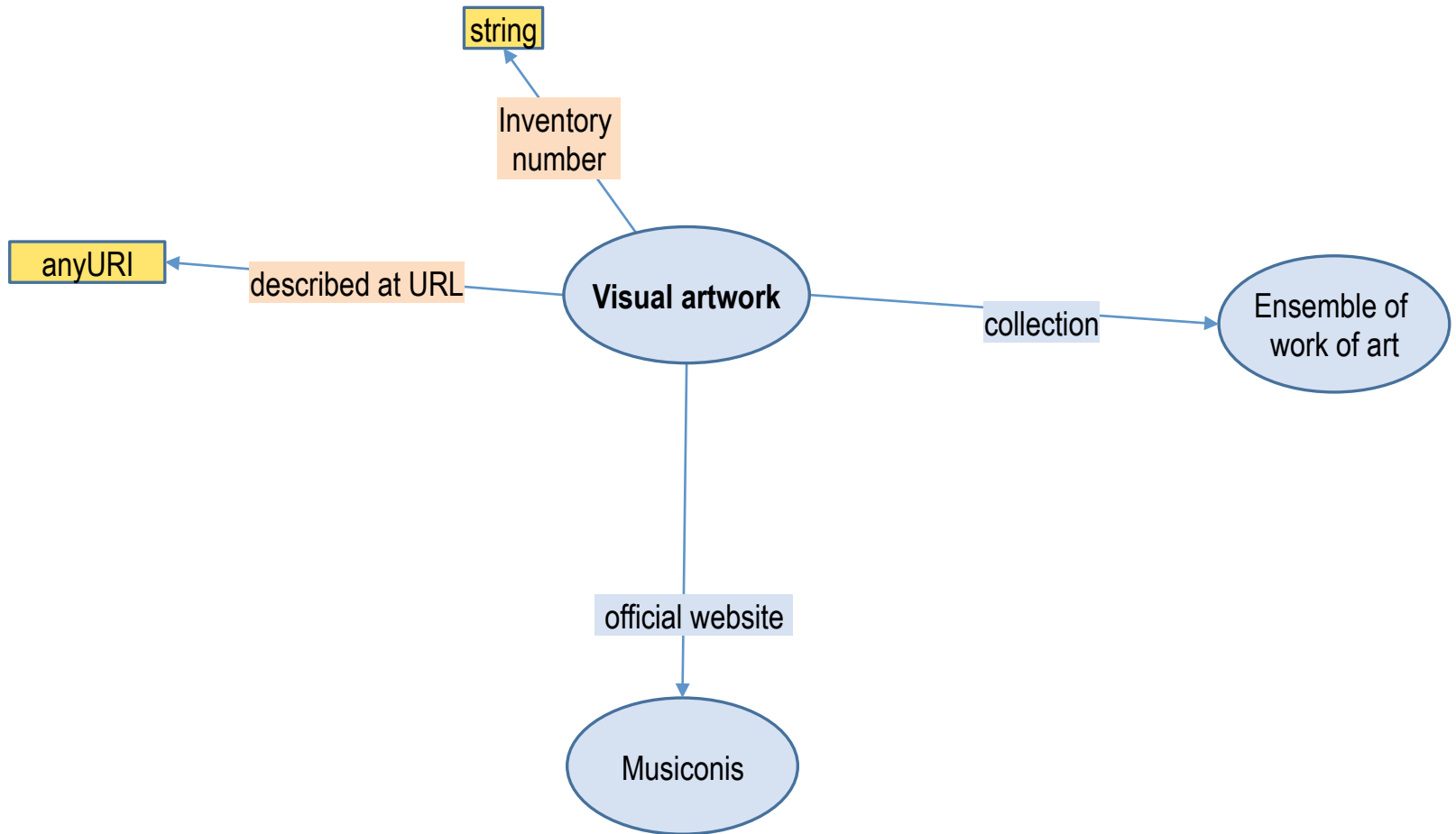


MusicKG data model : Visual artwork



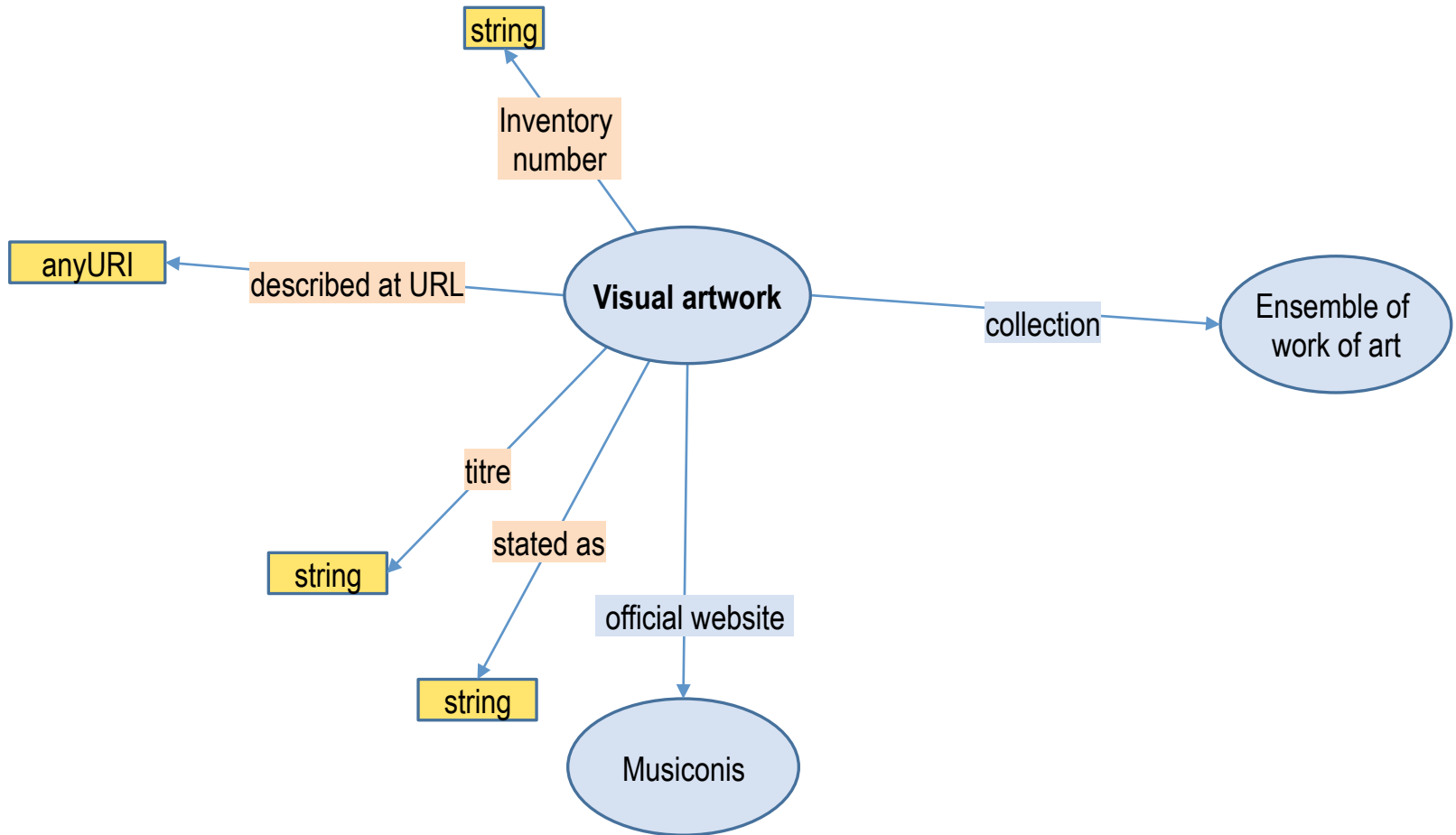


MusicKG data model : Visual artwork



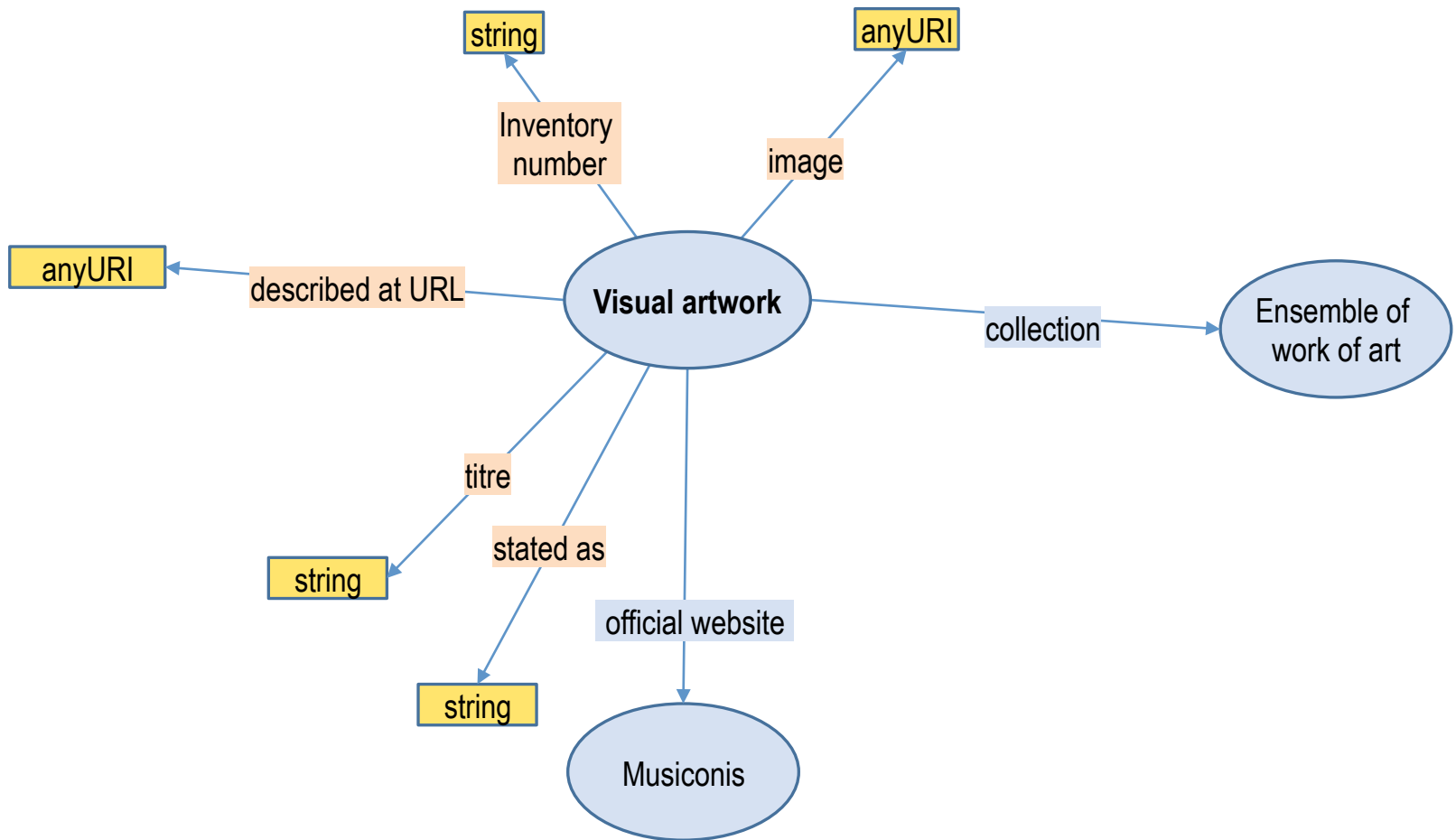


MusicKG data model : Visual artwork



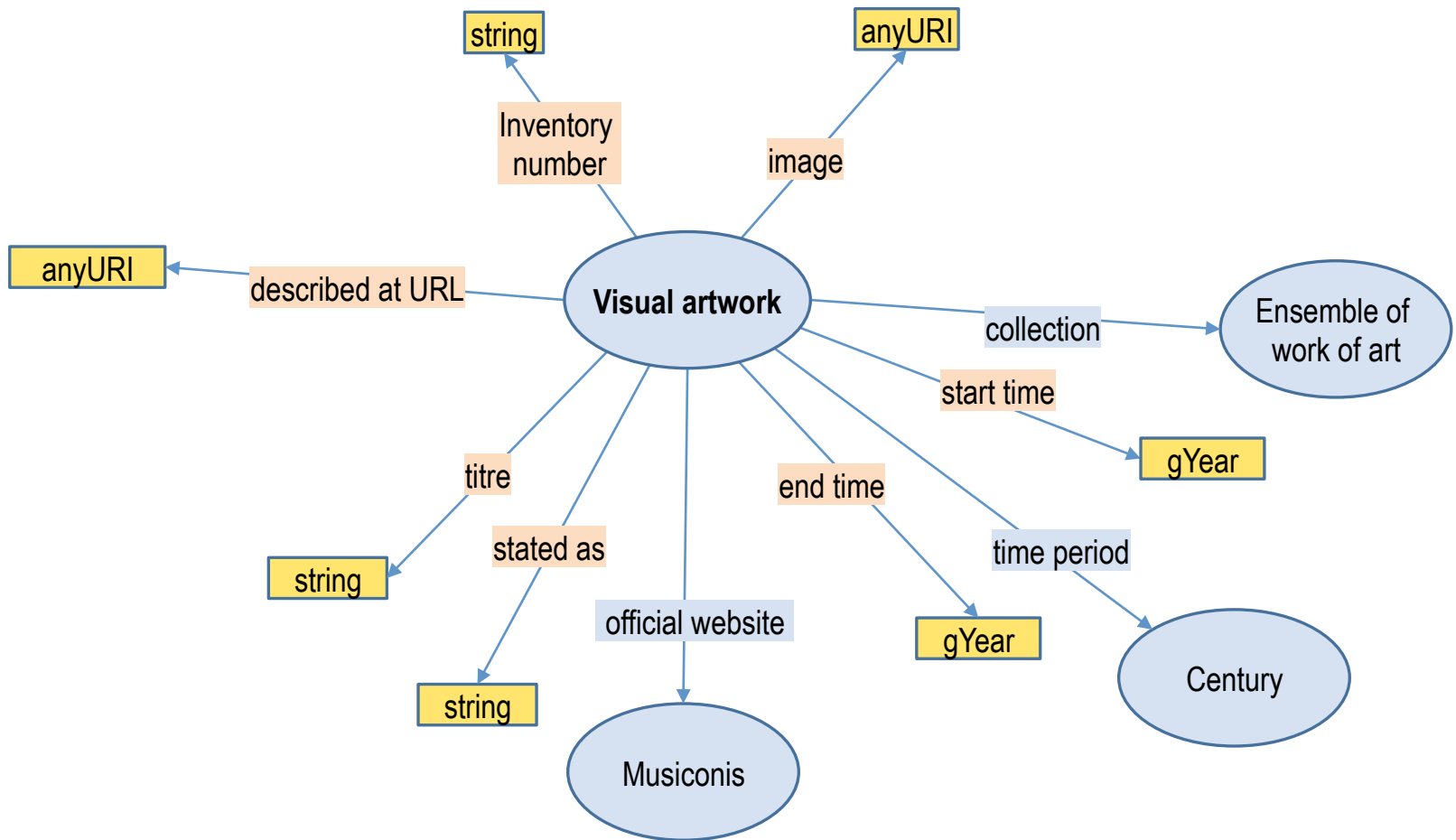


MusicKG data model : Visual artwork



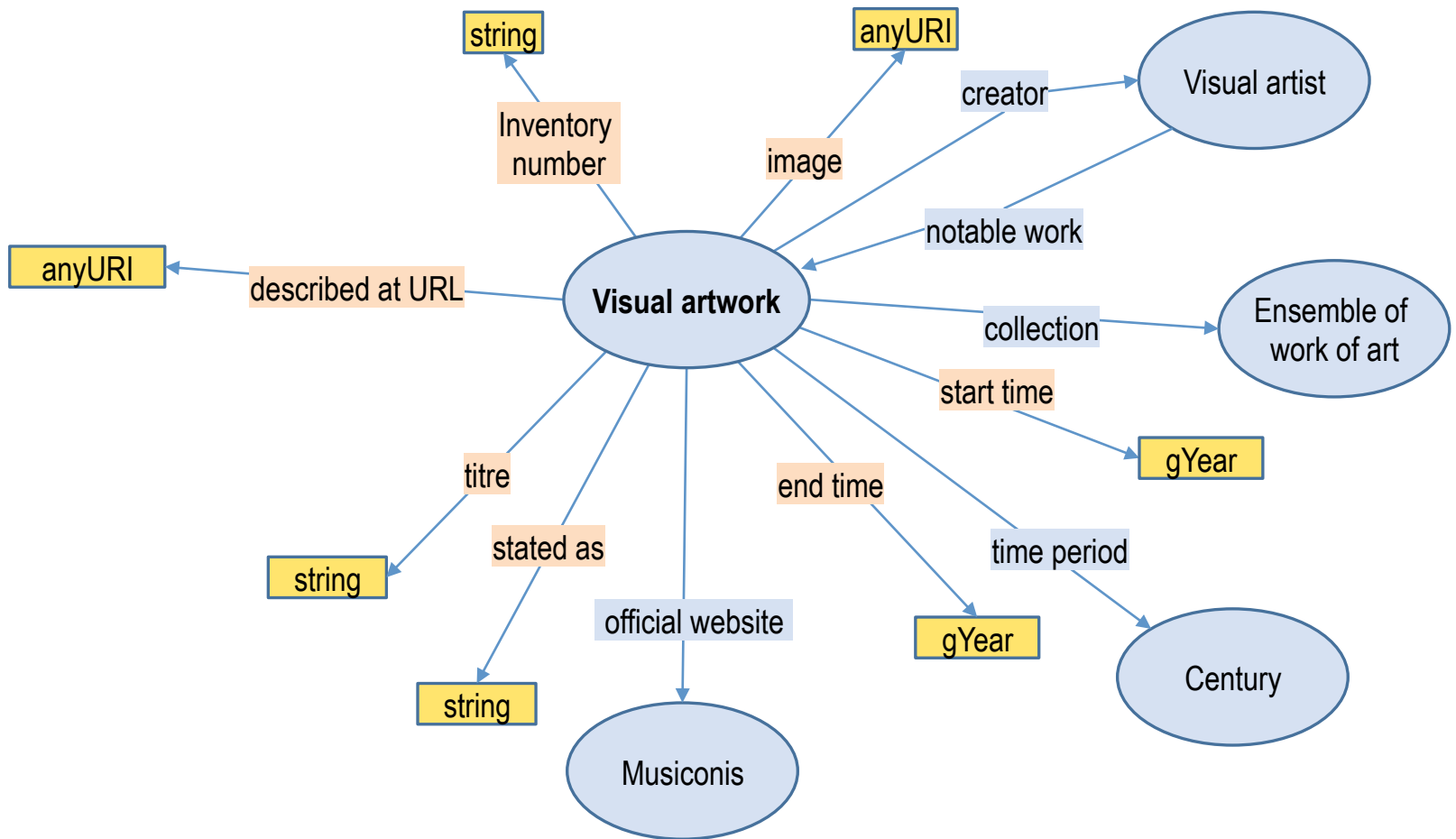


MusicKG data model : Visual artwork



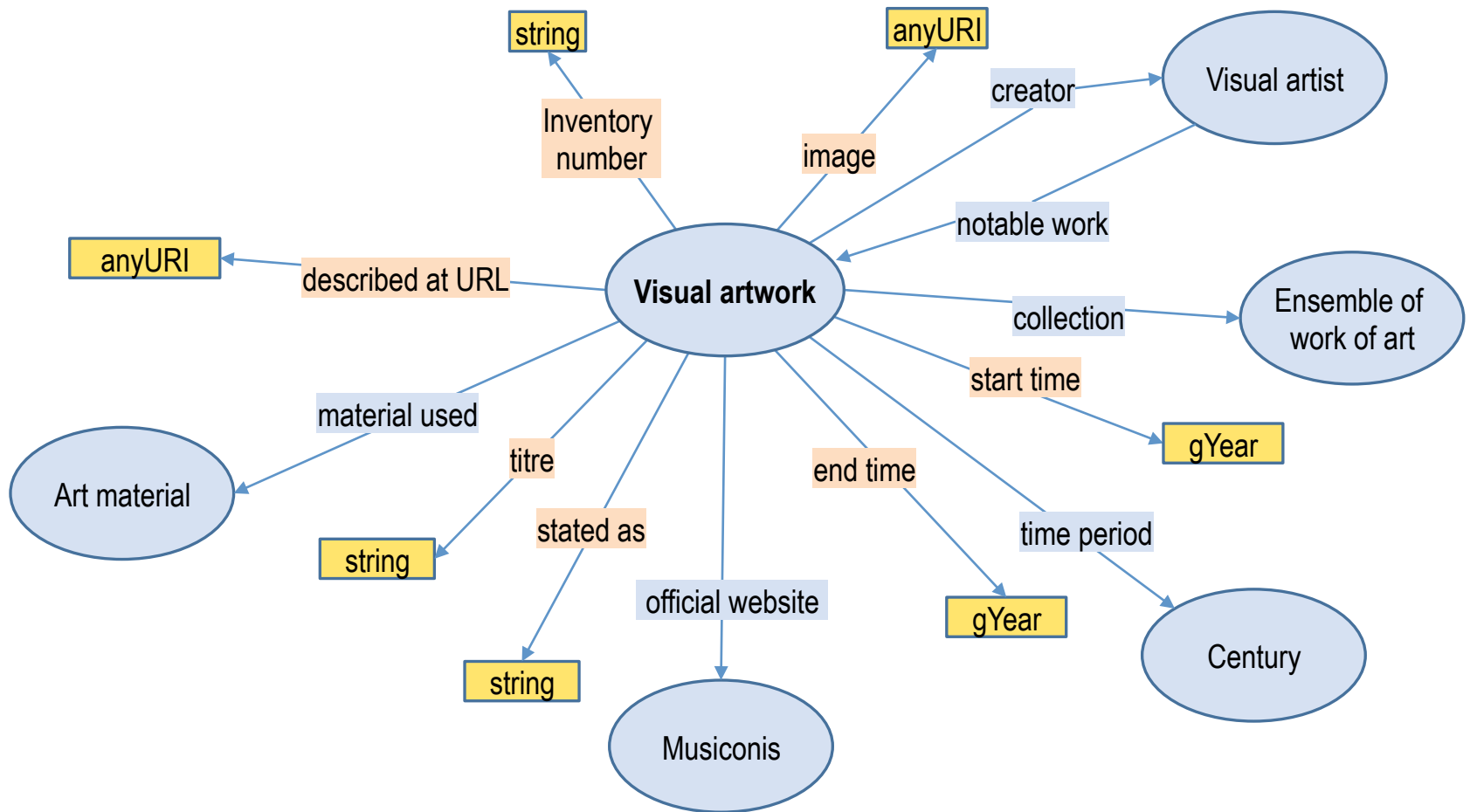


MusicKG data model : Visual artwork



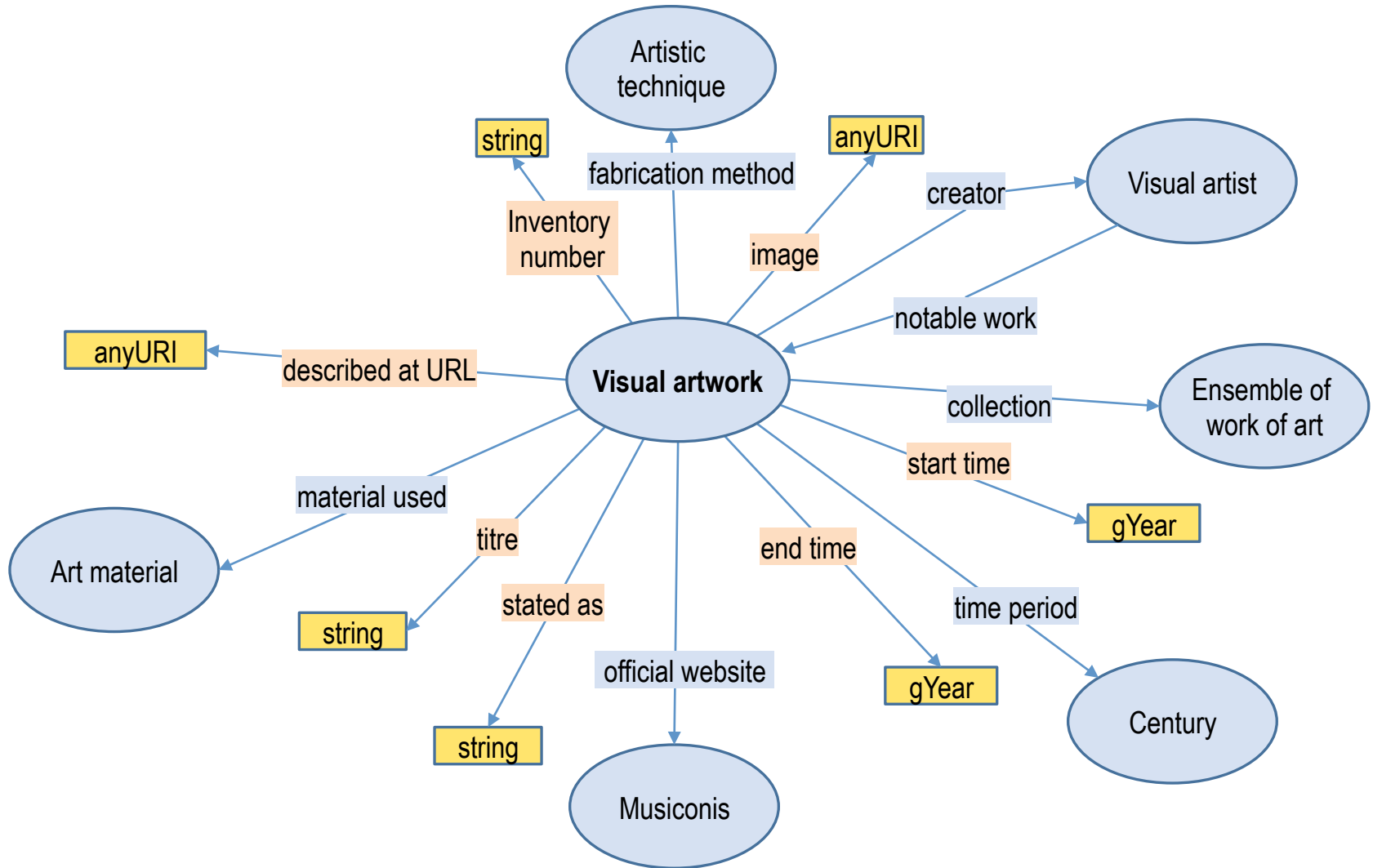


MusicKG data model : Visual artwork



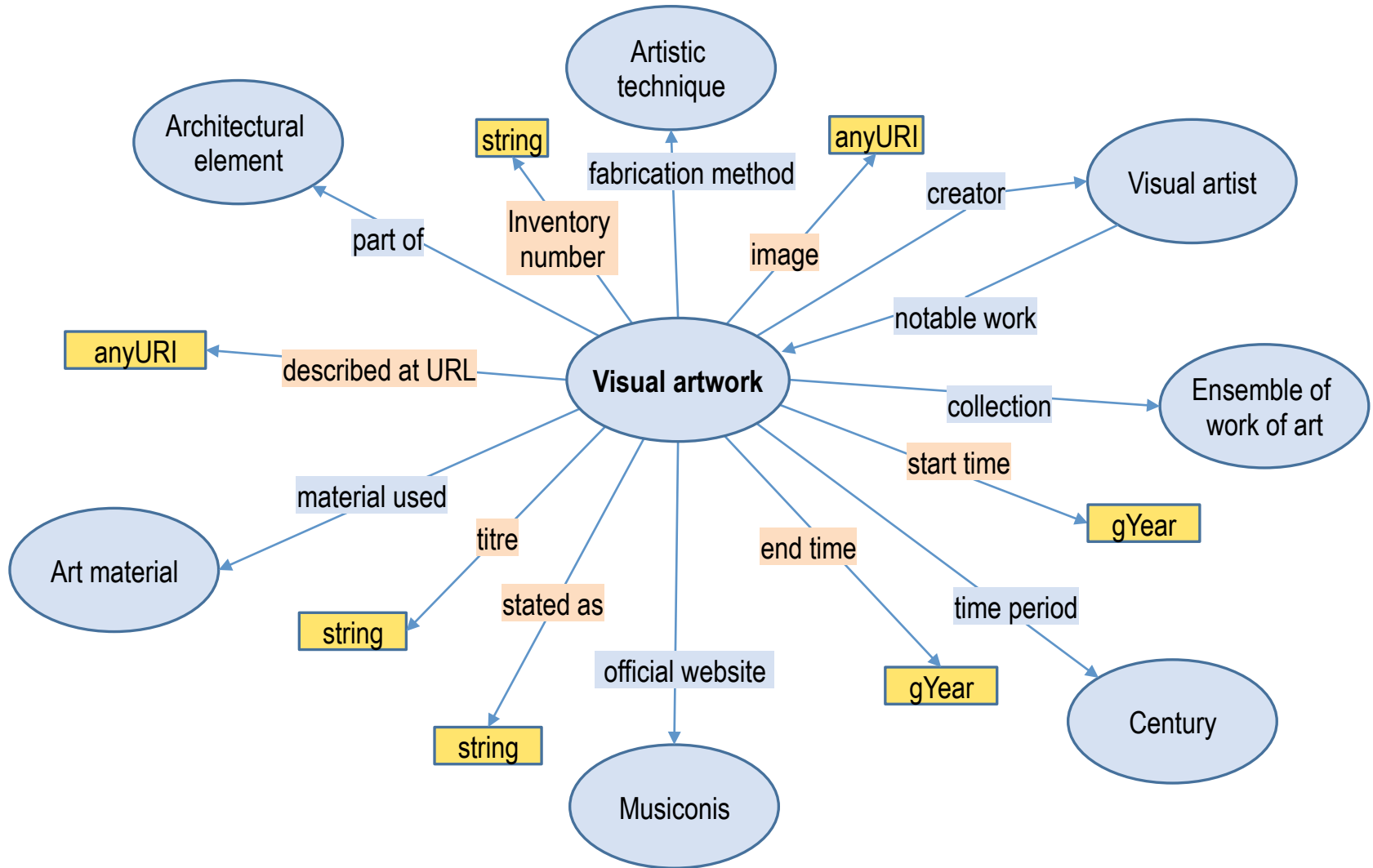


MusicKG data model : Visual artwork



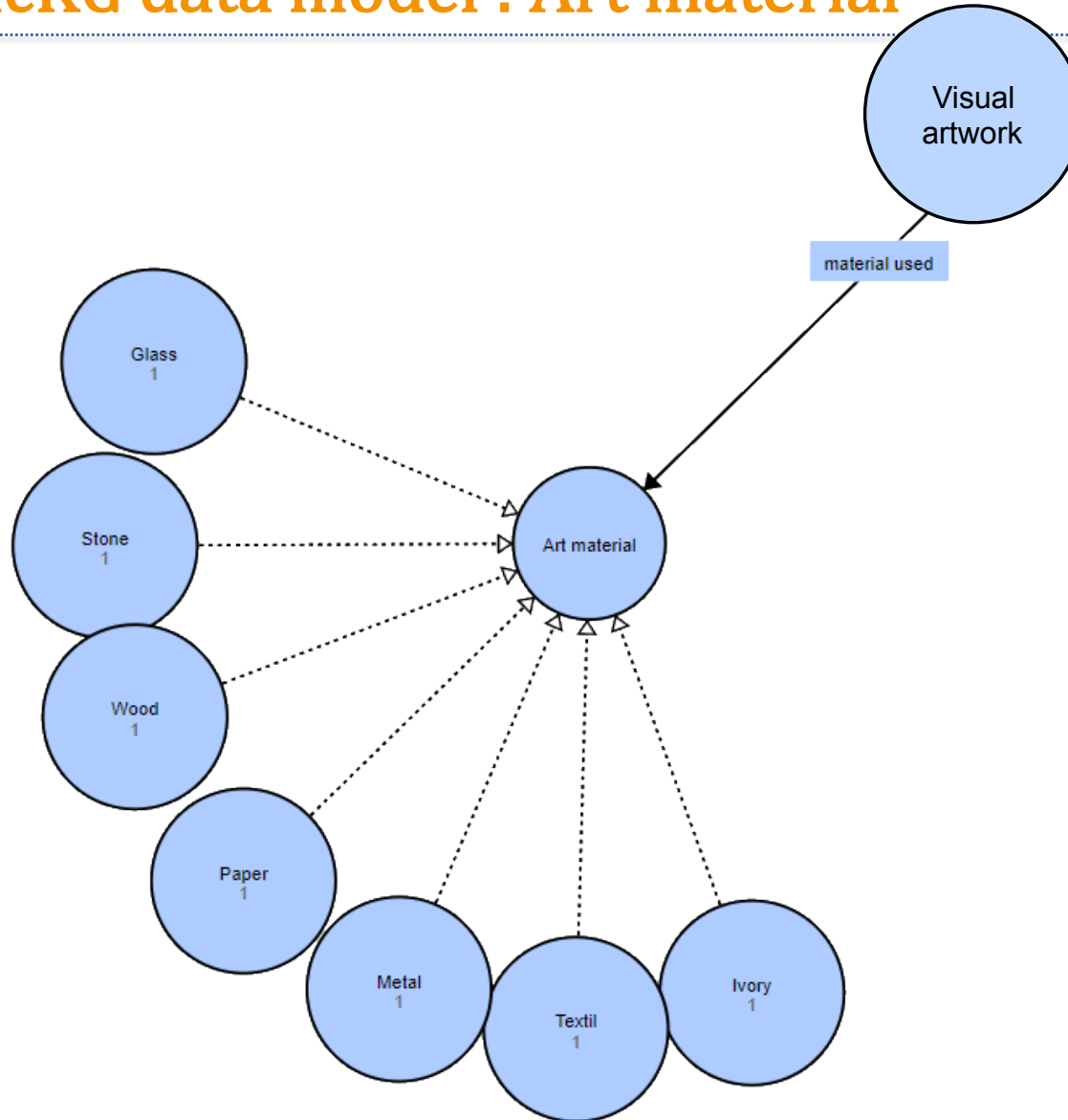


MusicKG data model : Visual artwork



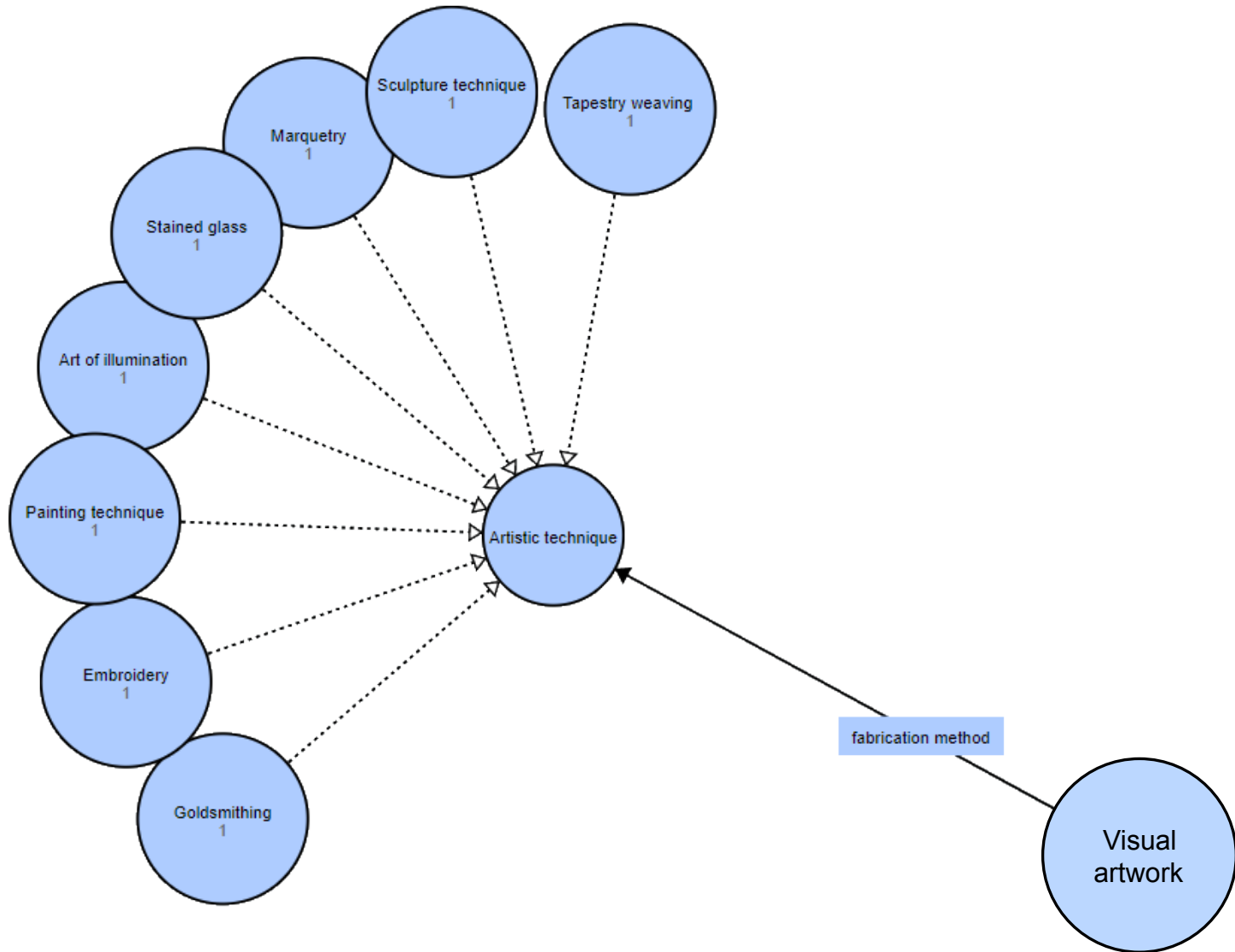


MusicKG data model : Art material



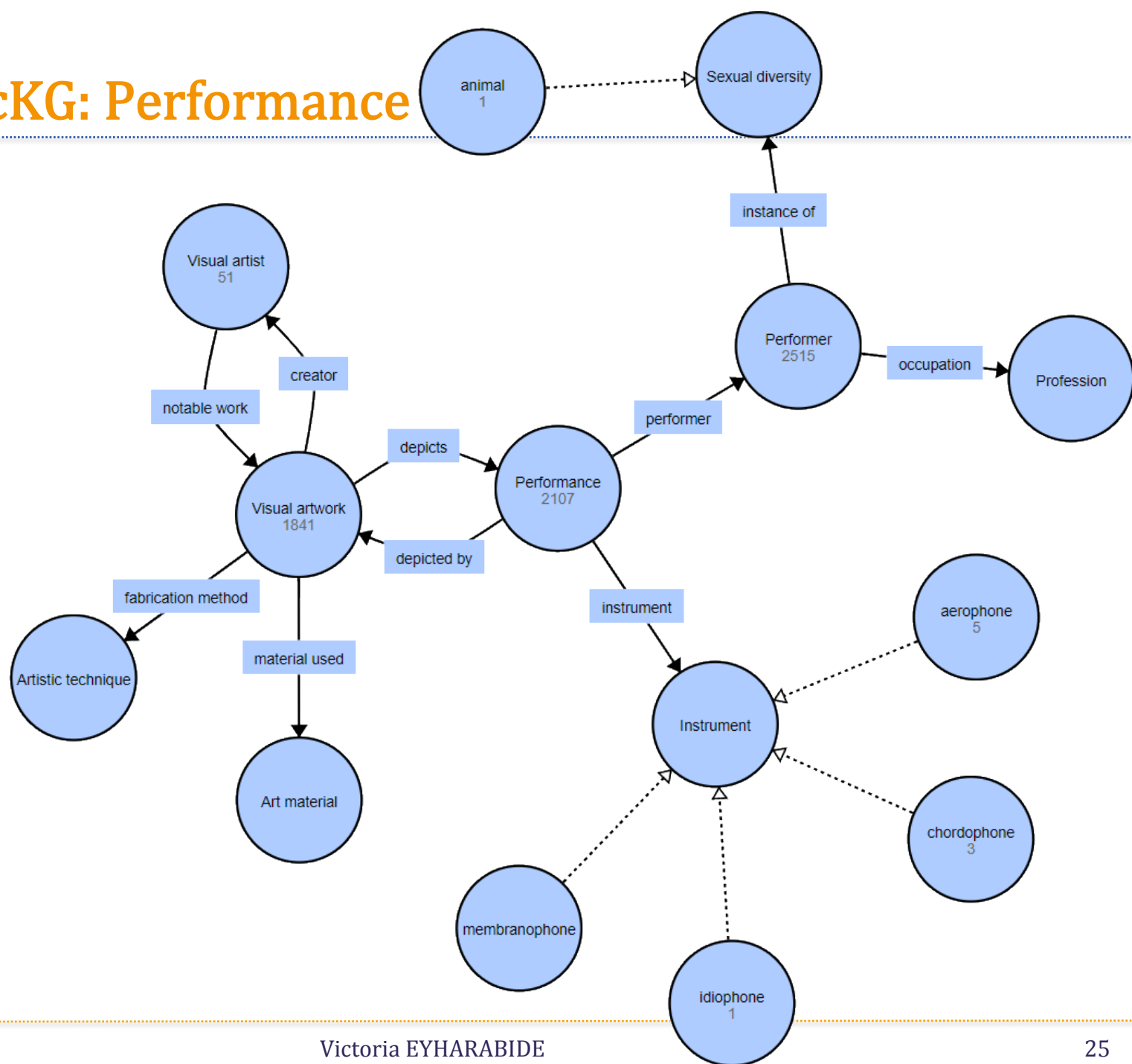


MusicKG data model : Artistic technique



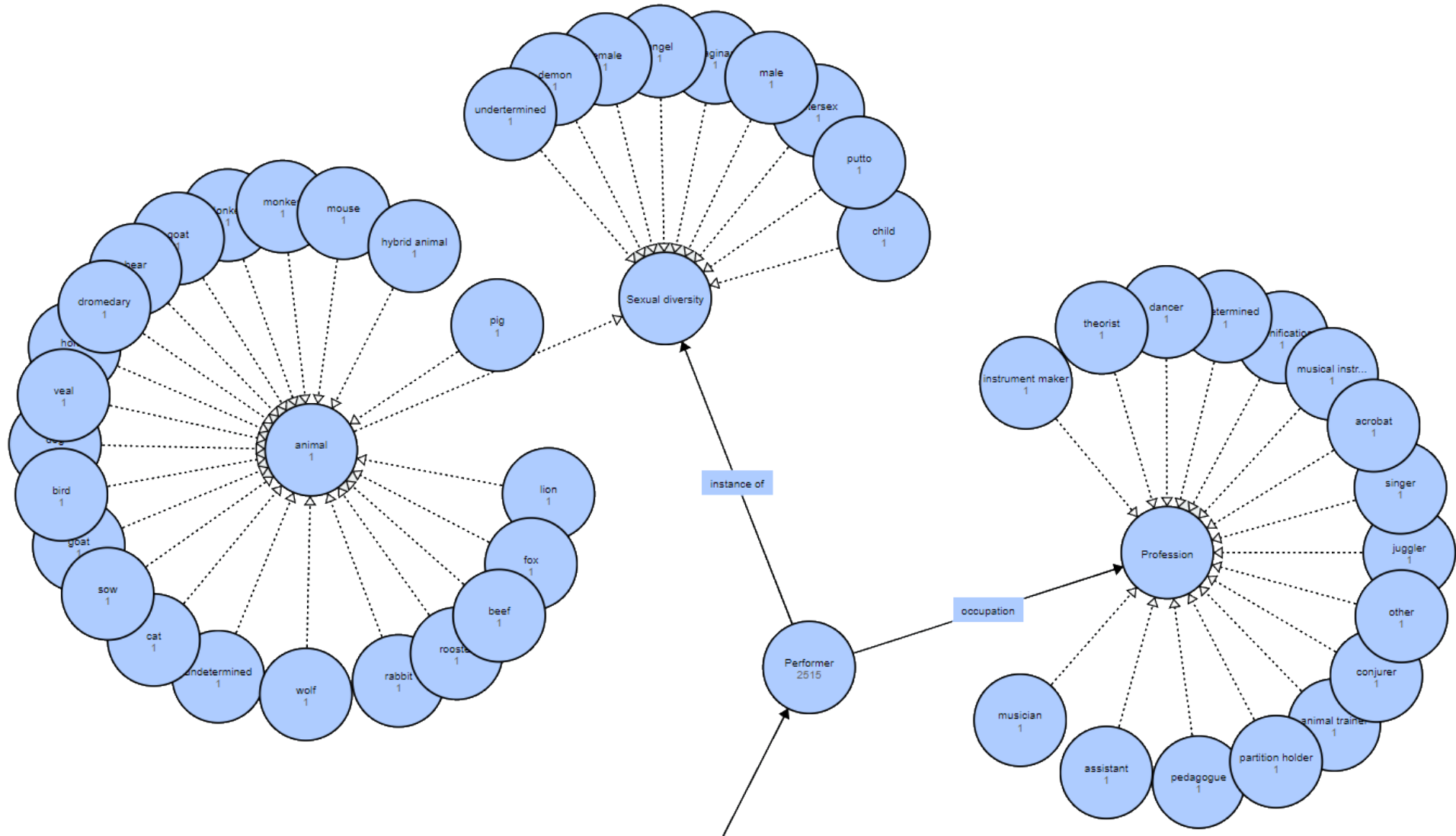


MusicKG: Performance



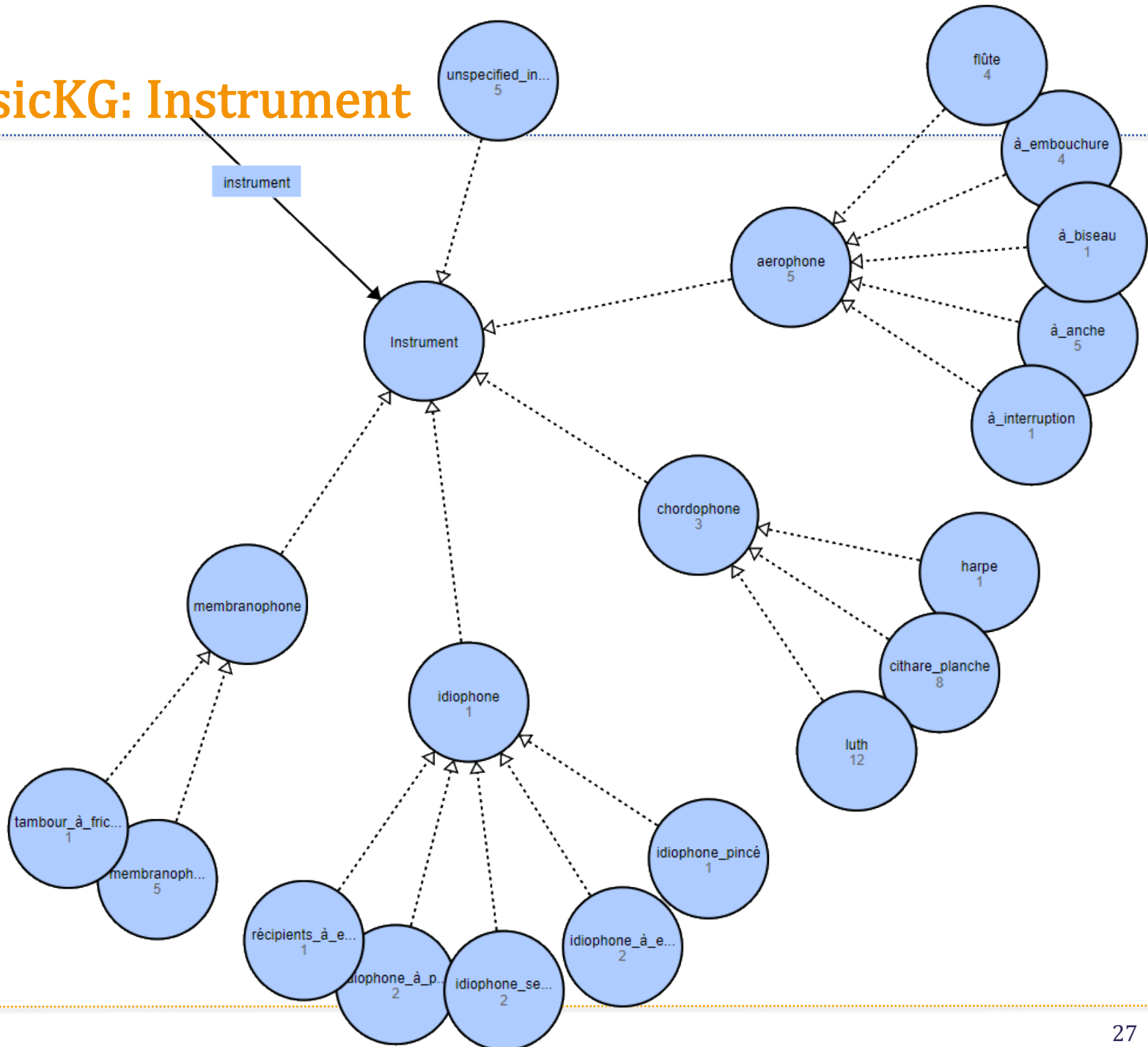


MusicKG: Performer





MusicKG: Instrument





Musiconis example: King David tuning his harp



David tuning his harp

Location (current) : Charleville-Mézières, Grand Est, France

Location type : Bibliothèque

Location (original) : Belval, Grand Est, France

Century : 12

Dates : 1101 -1200

Technique : Illumination

Material : Paper / Parchment

Support : manuscrit 246 D, tome 1, folio 1

Partner database : Initiale

Original title : David jouant de la harpe

Iconclass reference :

11I62(DAVID)33 David as psalmist, as author of the psalms, usually playing the harp

48C7322 harp

<http://musiconis.huma-num.fr/en/fiche/39/x.html>



Musiconis example: King David tuning his harp

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  <column name="nom_base_distante">Initiale</column>
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  <column name="date_debut">1101</column>
  <column name="date_fin">1200</column>
  <column name="siecle">12</column>
  <column name="emplacement">manuscrit 246 D, tome 1, folio 1</column>
  <column name="type_image">A. Augustinus Hipponensis, Enarrationes in
  Psalmos, lettrine B du Psaume 1, Beatus vir</column>
  <column name="iconclass">11I62 (DAVID) 33, 48C7322</column>
  <column name="slug">roi-david-accordant-une-harpe</column>
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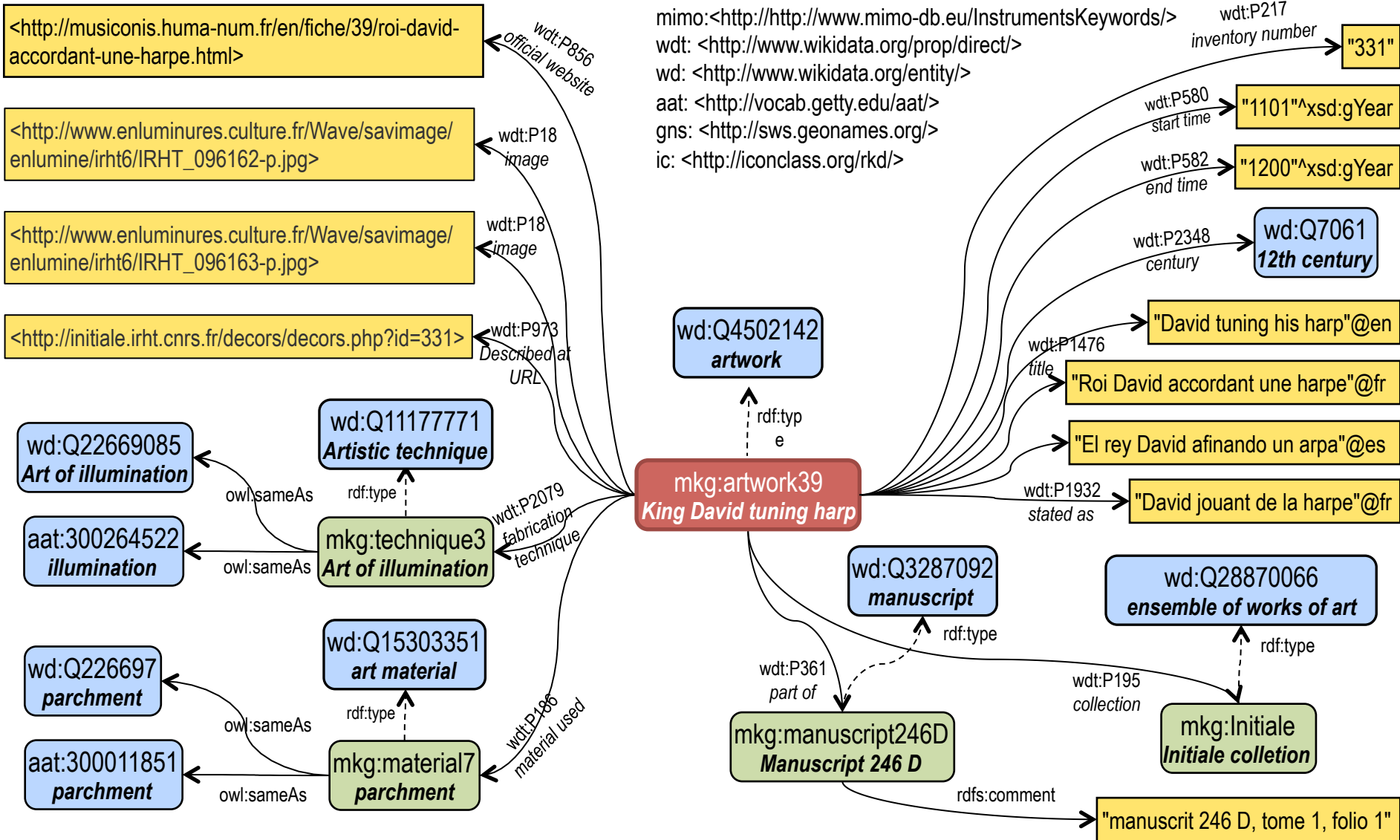


Musiconis example: King David tuning his harp

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  wdt:P217 "331" ;  
  wdt:P195 "Initiale" ;  
  wdt:P1932 "David jouant de la harpe"@fr ;  
  wdt:P580 "1101"^^xsd:gYear ;  
  wdt:P582 "1200"^^xsd:gYear ;  
  wdt:P2348 wd:Q7061 ;  
  wdt:P361 :emplacement39 ;  
  wdt:P1257 <http://iconclass.org/rkd/11I62\(DAVID\)33/> ;  
  wdt:P1257 <http://iconclass.org/rkd/48C7322/> ;  
  wdt:P856 <  
  http://musiconis.huma-num.fr/en/fiche/39/roi-david-accordant-une-harpe.html> ;  
  wdt:P186 :material7 ;  
  wdt:P2079 :technique3 ;  
  wdt:P1476 "David tuning his harp"@en ;  
  wdt:P1476 "Roi David accordant une harpe"@fr .
```



Linking MusicKG to the LOD cloud: an example





Getty Vocabularies : <http://vocab.getty.edu/aat/300011851>


Getty Vocabularies: LOD
[SPARQL](#)
[Queries](#)

parchment (animal material)

Source:<http://vocab.getty.edu/aat/300011851>

Predicate	Object
rdf:type	gvp:Concept
rdfs:seeAlso	http://www.getty.edu/vow/AATFullDisplay?find=&logic=AND&note=&subjectid=300011851
dcterms:created	1988-01-01T00:00:00
dcterms:modified	1992-02-03T00:00:00, 1992-03-04T00:00:00, 1993-01-12T00:00:00, 1995-04-12T00:00:00, 2001-07-26T22:00:44, 2001-07-26T22:15:03, 2007-01-31T16:16:50, 2007-03-20T10:36:23, 2007-03-20T11:14:38, 2007-03-20T17:34:33, 2007-05-07T14:35:31, 2010-02-11T13:38:57, 2010-03-08T08:08:09, 2010-03-08T08:08:10, 2010-03-08T09:01:05, 2010-04-23T00:17:25, 2010-05-24T21:49:15, 2011-01-08T01:37:43, 2011-03-07T15:33:37, 2012-03-16T14:05:02, 2014-08-01T08:28:29
skos:changeNote	aat_rev:5000025616, aat_rev:5000025617, aat_rev:5000025618, aat_rev:5000025619, aat_rev:5000025620, aat_rev:5001083690, aat_rev:5001083691, aat_rev:5001170746, aat_rev:5001602374, aat_rev:5001616195, aat_rev:5001616250, aat_rev:5001616426, aat_rev:5001654804, aat_rev:5002059696, aat_rev:5002073339, aat_rev:5002073340, aat_rev:5002073341, aat_rev:5002073342, aat_rev:5002073343, aat_rev:5002073344, aat_rev:5002073353, aat_rev:5002073361, aat_rev:5002073976, aat_rev:5002073977, aat_rev:5002226841, aat_rev:5002538711, aat_rev:5002935869, aat_rev:5002985788, aat_rev:5002985789, aat_rev:5003175791, aat_rev:5003662848, aat_rev:5003662849, aat_rev:5003662850, aat_rev:5003662851, aat_rev:5003662852, aat_rev:5003662871
gvp:parentString	processed animal material, animal material, biological material, <materials by origin>, materials (substances), Materials (hierarchy name), Materials Facet
gvp:parentStringAbbrev	processed animal material, animal material, ... Materials Facet
gvp:displayOrder	4
xl:prefLabel	aat_term:1000011851-en, aat_term:1000405639-de, aat_term:1000407634-nl, aat_term:1000407635-fr, aat_term:1000407636-sv, aat_term:1000407637-it, aat_term:1000407638-es, aat_term:1000589570-zh-Hant, aat_term:1000589572-zh-Latn-pinyin-x-notone, aat_term:1000589573-zh-Latn-pinyin-x-hanyu, aat_term:1000589574-zh-Latn-wadegile
xl:altLabel	aat_term:1000285076-en, aat_term:1000589571-zh-Hant
gvp:broaderGeneric	aat:300193287
gvp:broaderPreferred	aat:300193287



parchment (Q226697)

animal skin processed for writing or painting on
vellum | membrane | animal membrane

▼ In more languages [Configure](#)

Language	Label	Description	Also known as
English	parchment	animal skin processed for writing or painting on	vellum membrane animal membrane
Spanish	pergamino	piel animal procesada para convertirse en un soporte escrito	pergamino y vitela
French	parchemin	peau d'animal travaillée pour devenir un support écrit	
Portuguese	pergaminho	No description defined	pergaminação

Statements

subclass of	<ul style="list-style-type: none"> writing implement ▼ 0 references
	<ul style="list-style-type: none"> painting material

Wikipedia (66 entries)

- ar [برشمان](#)
- ast [Pergamín](#)
- az [Perqament](#)
- be_x_old [Пэргамін](#)
- be [Пэргамент](#)
- bg [Пэргамент](#)
- bs [Pergament](#)
- ca [Pergamí](#)
- cs [Pergamen](#)
- da [Pergament](#)
- de [Pergament](#)
- el [Περγαμηνή](#)
- en [Parchment](#)
- eo [Pergameno](#)
- es [Pergamino](#)
- et [Pärgament](#)
- eu [Pergamino](#)
- fa [پوست \(نوشت‌افزار\)](#)
- fi [Pergamenti](#)

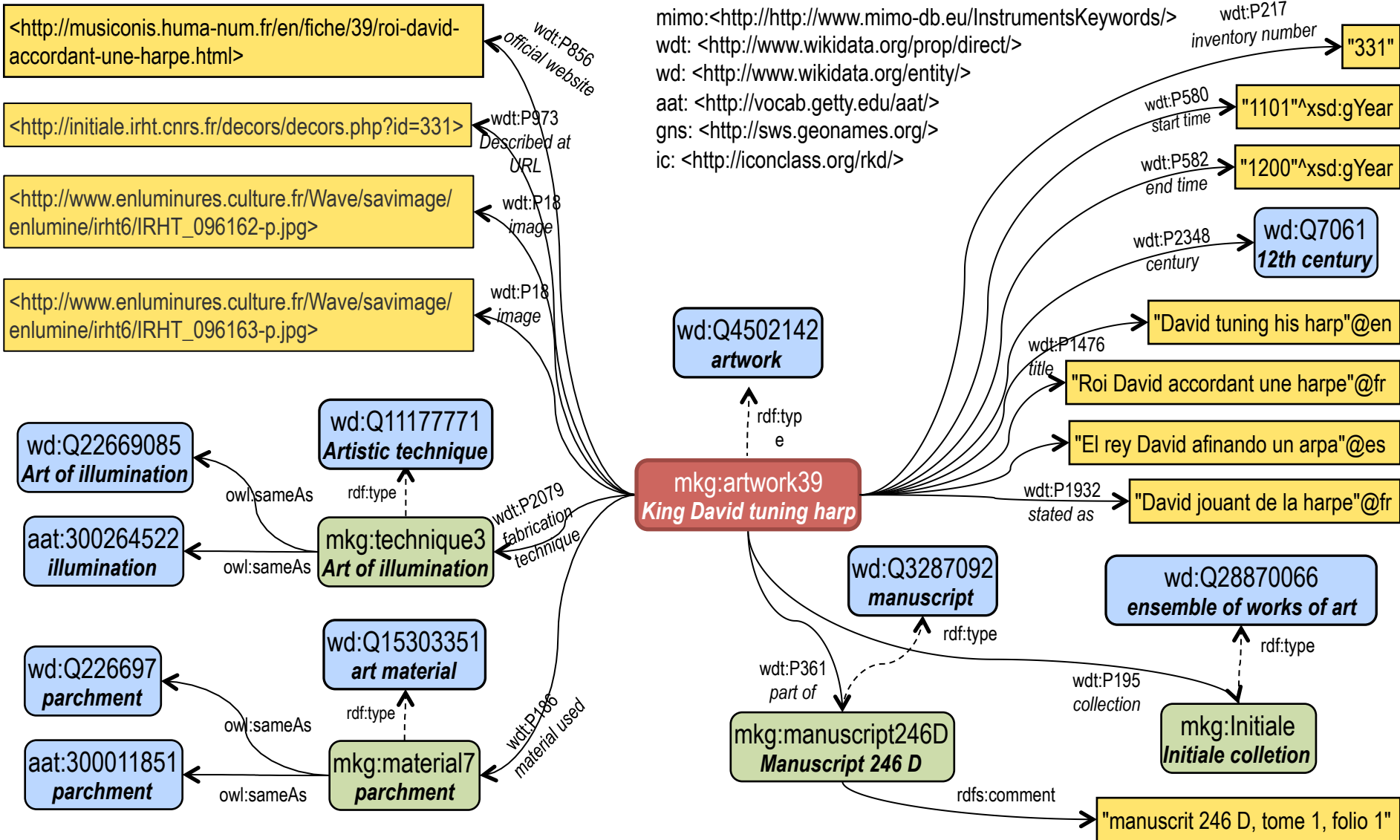
- Main page
- Community portal
- Project chat
- Create a new Item
- Create a new Lexeme
- Recent changes
- Random item
- Query Service
- Nearby
- Help
- Donate

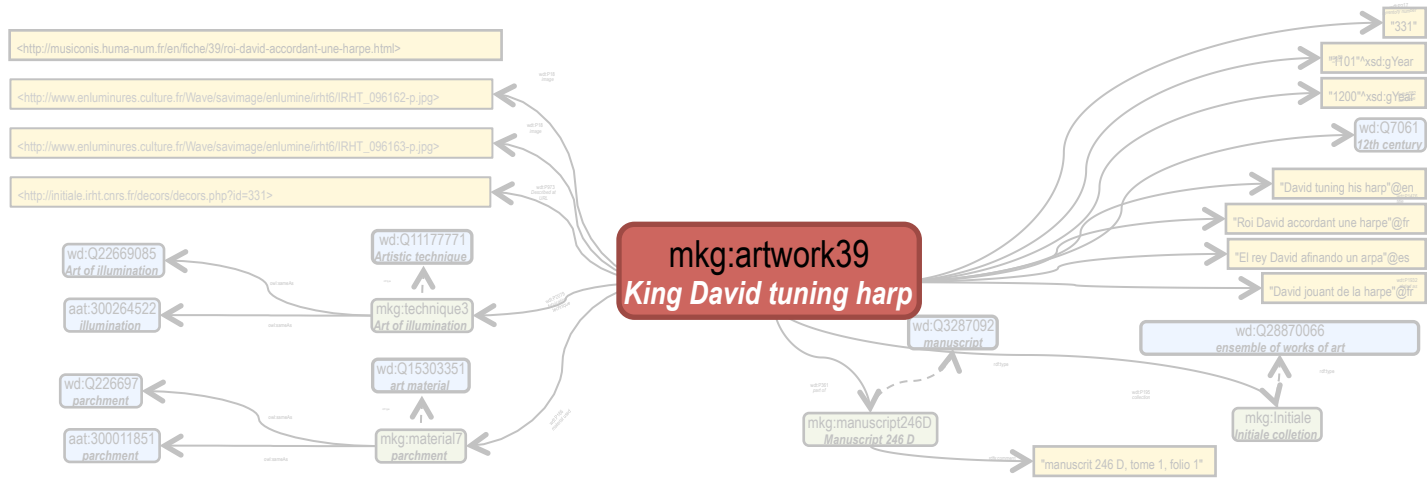
- Print/export
- Create a book
- Download as PDF
- Printable version

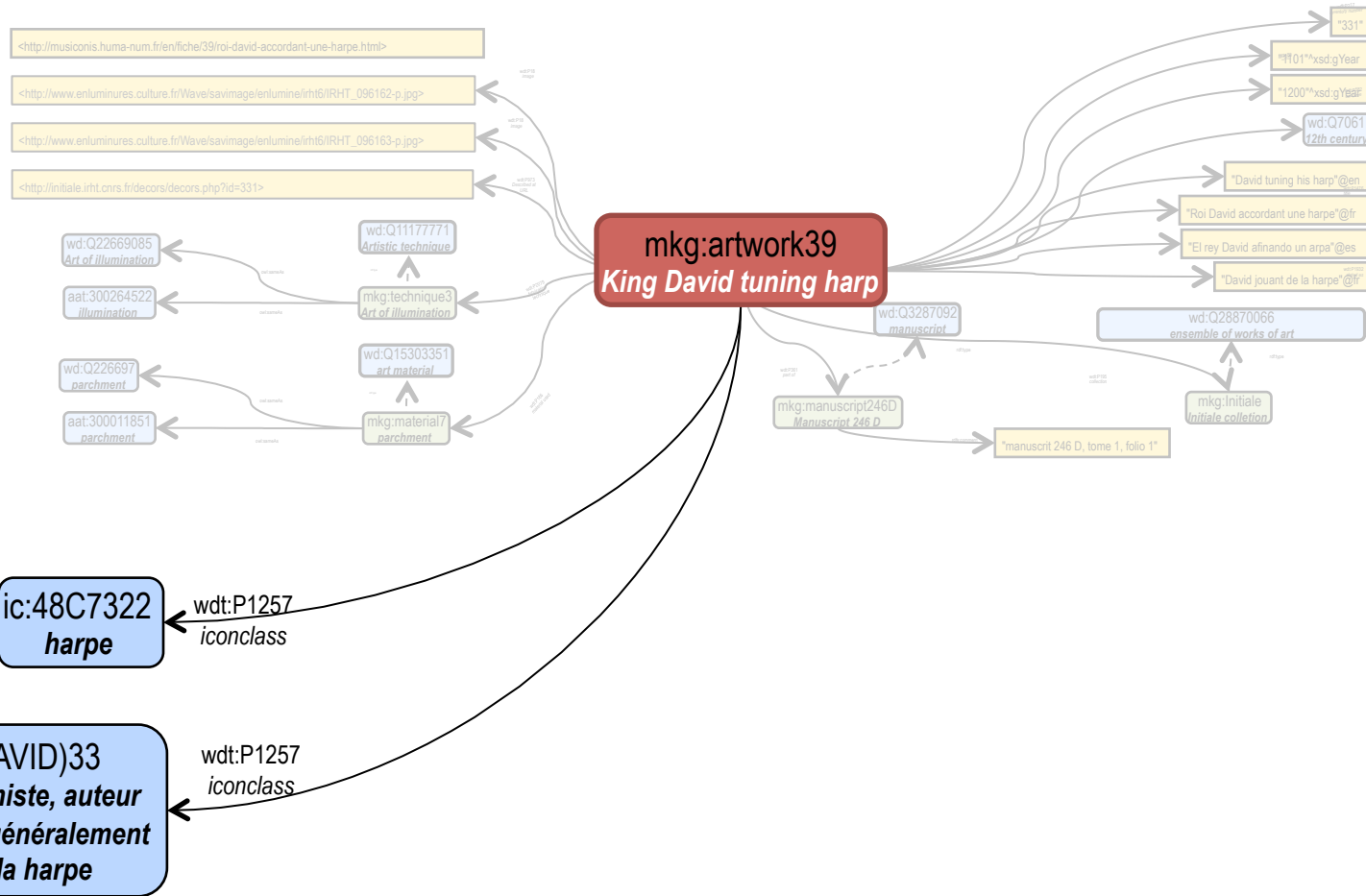
- Tools
- What links here
- Related changes
- Special pages
- Permanent link



Linking MusicKG to the LOD cloud: an example









LOD cloud : iconclass

ICONCLASS 11I62(DAVID)33

Non sécurisé | www.iconclass.org/rkd/11I62%28DAVID%2933/

Iconclass

Options · Help · About · Login ·

Outline · Edits · **Clipboard**

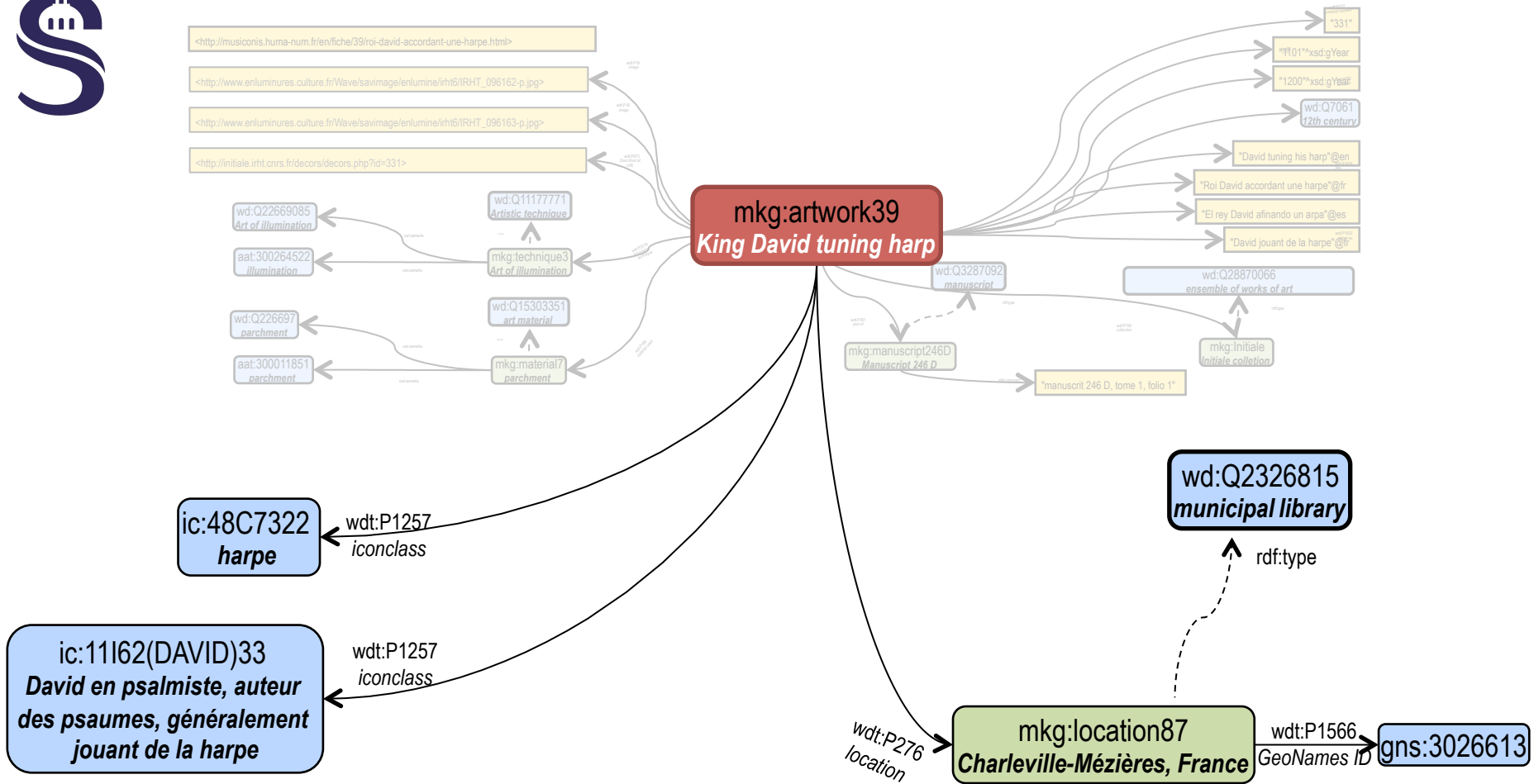
Search

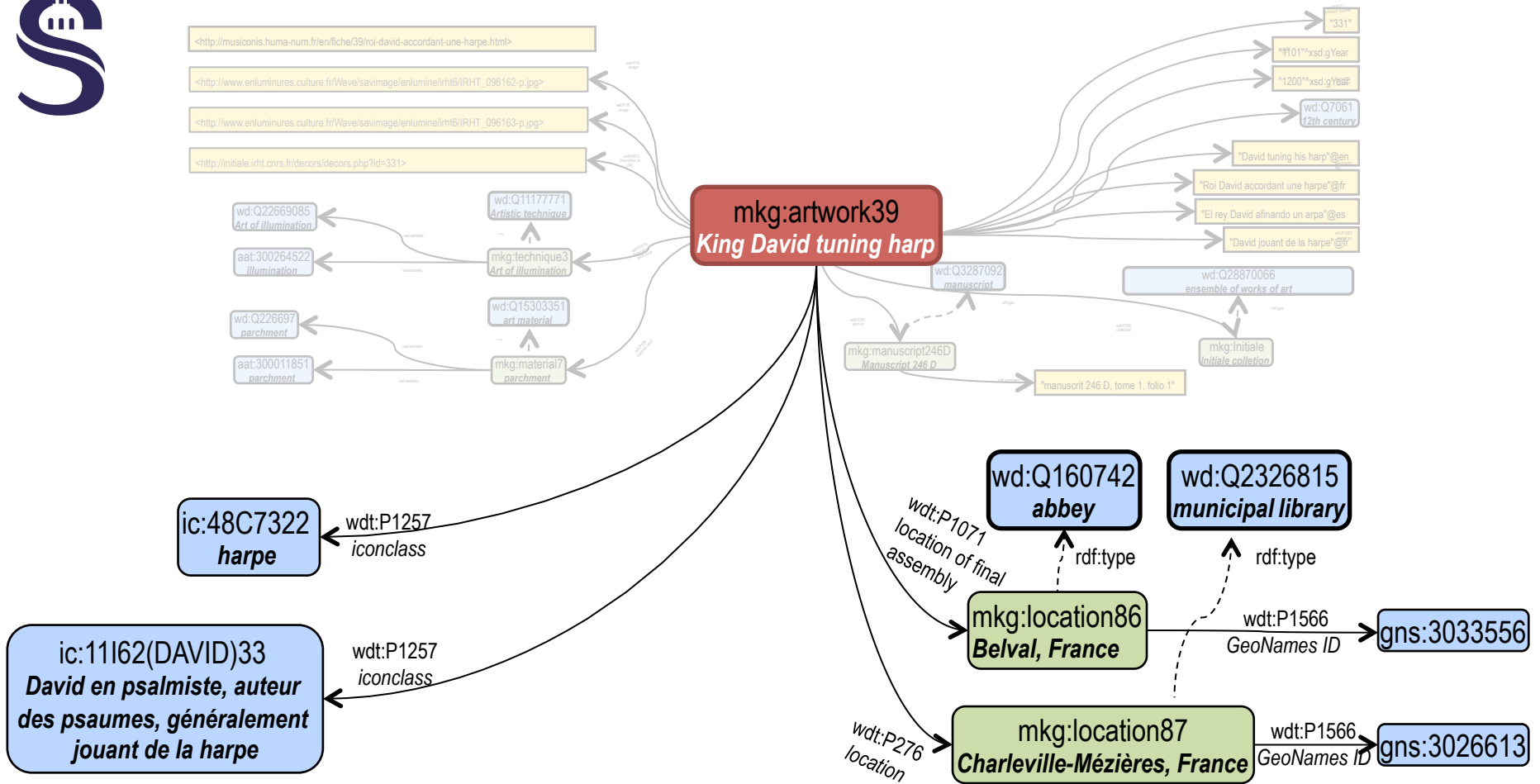
- 0 Abstract, Non-representational Art
- 1 Religion and Magic
- 11 Christian religion
- 111 prophets, sibyls, evangelists, Doctors of the Church; persons ~ the Bible (not in biblical context)
- 1116 persons from the Old Testament (not in biblical context, nor occurring in legendary/historical extensions included in Division 71)
- 11I62 male persons from the Old Testament (not in biblical context)
- 11I62(...) male persons from the Old Testament (with NAME) (not in biblical context)
- 11I62(DAVID) David (not in biblical context); possible attributes: crown, harp
- 11I62(DAVID)3 (other) specific aspects ~ David

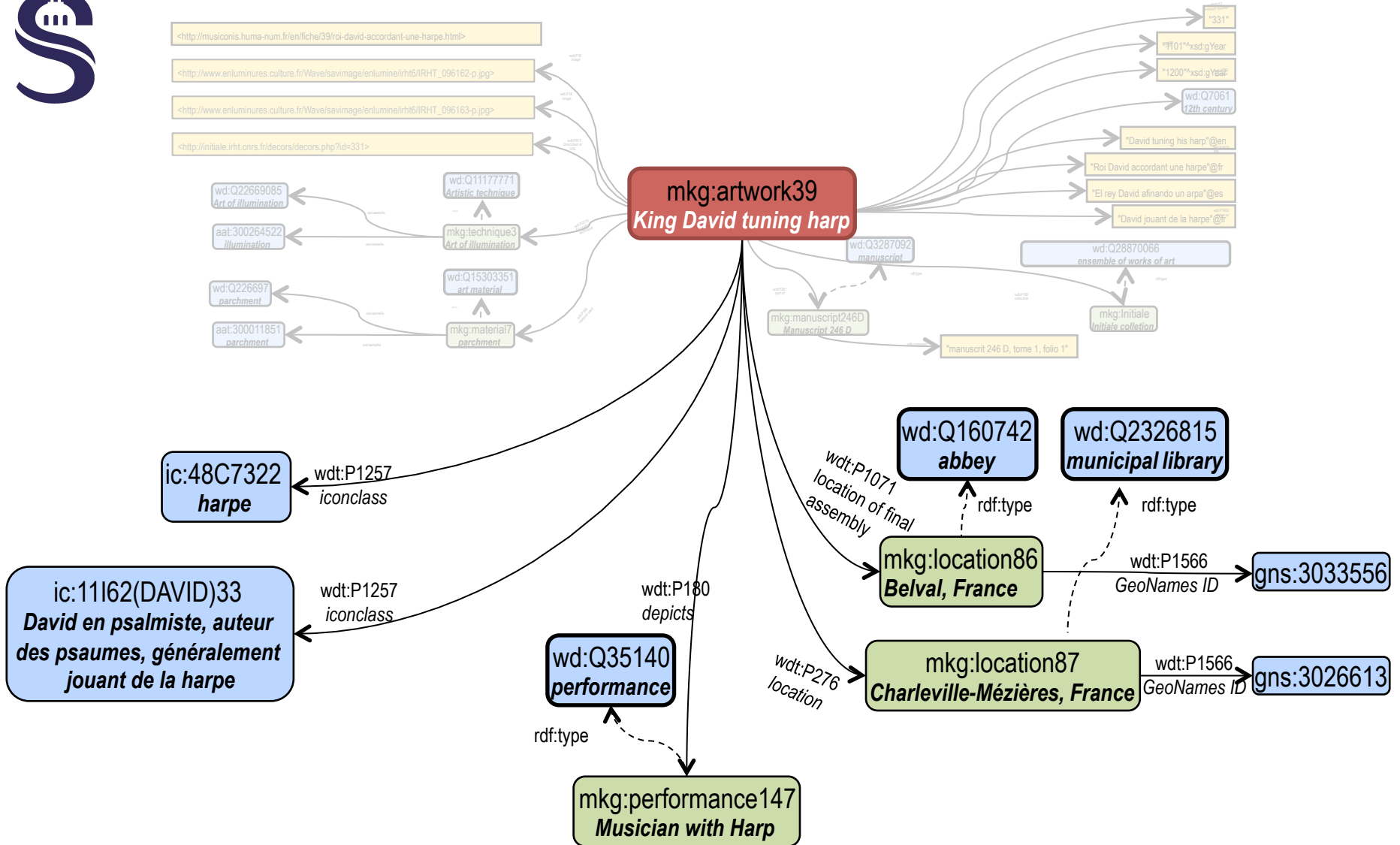
11I62(DAVID)33 David as psalmist, as author of the psalms, usually playing the harp

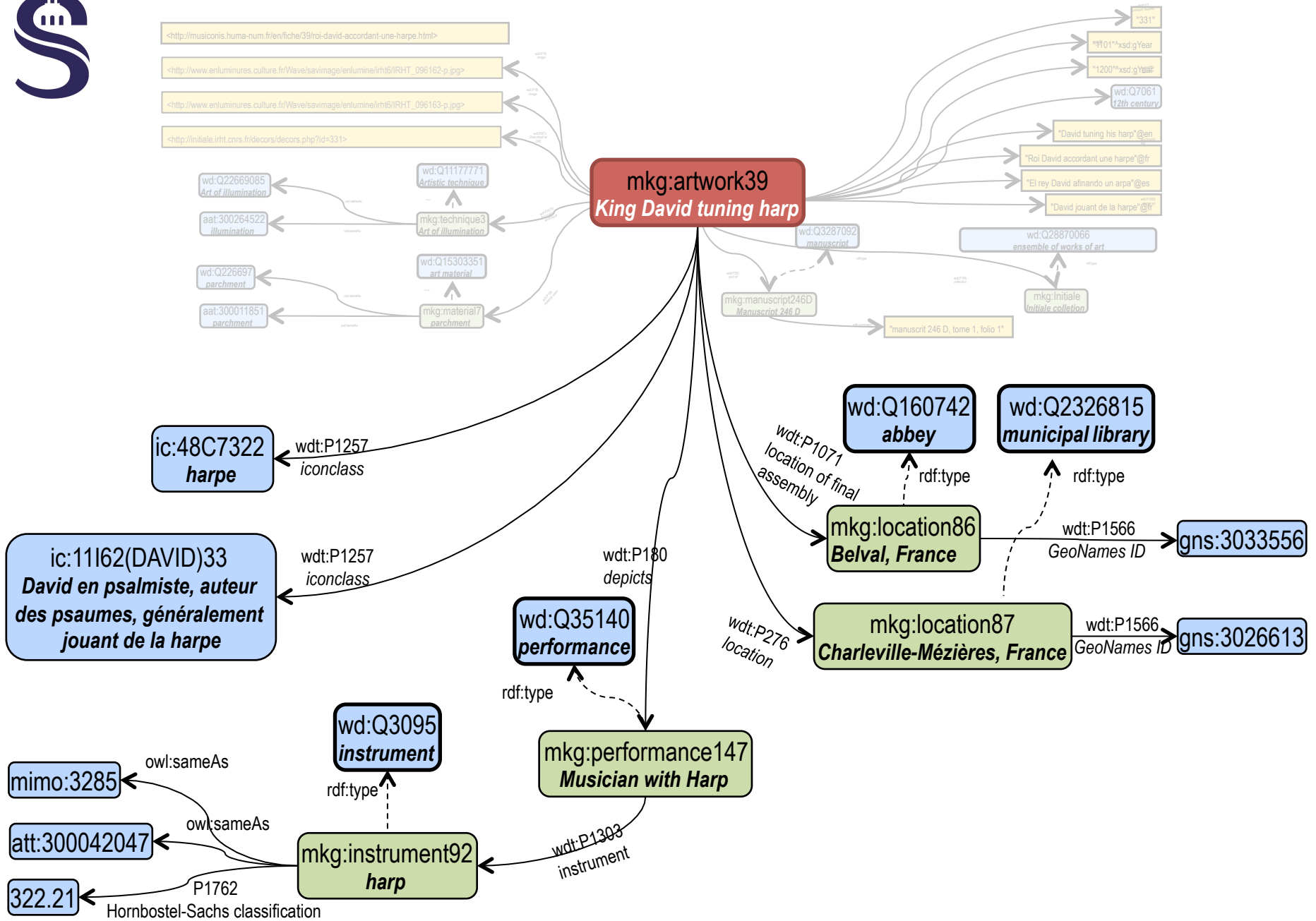
Christian religion · David · Old Testament · crown · harp · hero · judge · man · music making · patriarch · poet · prophet · psalm · religion · supernatural

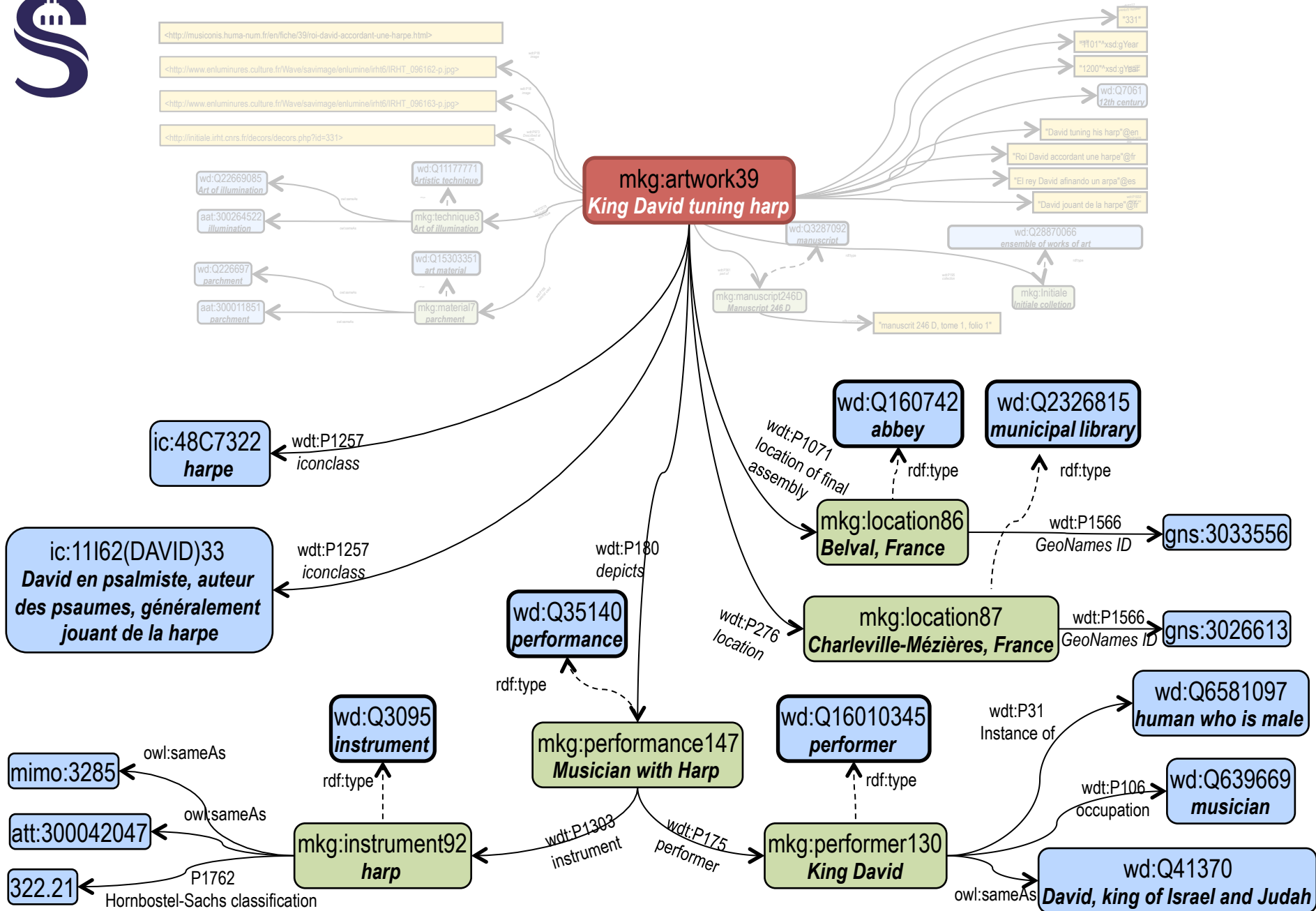
- 11I62(DAVID)33(+0) (+ variant)
- 11I62(DAVID)33(+1) (+ Holy Trinity)
- 11I62(DAVID)33(+2) (+ Mary)
- 11I62(DAVID)33(+3) (+ angel(s))
- 11I62(DAVID)33(+4) (+ devil(s))
- 11I62(DAVID)33(+5) (+ donor(s), supplicant(s))











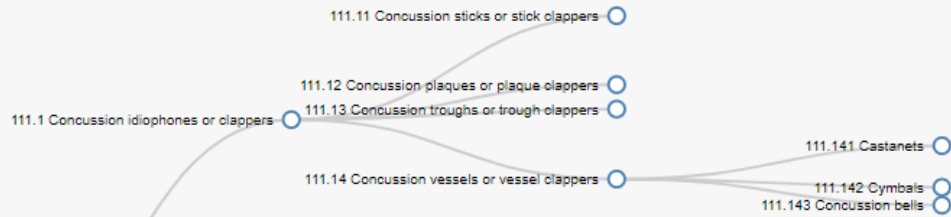


LOD cloud : MIMO



Sachs & Hornbostel classific

tree



ConceptScheme : <http://www.mimo-db.eu/HornbostelAndSachs#>

skos:Concept

<http://www.mimo-db.eu/HornbostelAndSachs/5681>

skos:definition

One or more strings are stretched between fixed points. The string bearer and the resonator are organically united and cannot be separated without destroying the instrument. The plane of the strings lies at right angles to the soundtable. The strings pass over a tall notched bridge at successive levels, their sounding lengths increasing with their distance from the soundtable. The body, like a spike lute, has a string bearer that passes diametrically through the resonator. A line joining the lower ends of the strings would be perpendicular to the neck. Gambia, kora.

skos:prefLabel

- 323.2 Spike harps with pressure bridges, bridge harps or harp-lutes (en)

skos:broader

- ▶ 1 Idiophones
- ▶▶ 11 Struck idiophones
- ▶▶▶ 111 Idiophones struck directly
- ▶▶▶▶ 111.1 Concussion idiophones or clappers
- ▶▶▶▶▶ 323 Spike harps with tall stringholders

skos:narrower

- 323.2-5 Spike harps with pressure bridges, bridge harps or harp-lutes sounded by the bare fingers

skos:exactMatch

- <http://www.mimo-db.eu/InstrumentsKeywords/3300>
- <http://www.mimo-db.eu/InstrumentsKeywords/3258>
- <http://www.mimo-db.eu/InstrumentsKeywords/3257>



Ontology Consistency and Instance Checking

- **Some errors found in artworks:**
 - Century : 0
 - Century : 1379
 - Start date : 1452,
 - Iconclass: 34A; 29A; 25F24(GOAT); 48C7353
 - *Material_used* Stone & *fabrication_technique* Illumination
- **Some common errors found in performers:**
 - *instance_of* man & *instance_of* monkey
 - *plays instrument* & NOT *instance_of* musician















SPARQL queries vs. Musiconis queries

Example 1: Animal playing the trumpet

animal playing the trumpet

6 Result(s)

  Hybrid playing a trumpet Dates: 1320 - 1330	  Hybrids playing vielle, bagpipes, trumpets, and tabor	  Hybrid playing the trumpet Dates: 1300 - 1325
  Man sounding the trumpet Dates: 1201 - 1400	  Rabbit playing the trumpet astride a naked man	  Hybrid playing the trumpet Dates: 1375 - 1375



SPARQL queries

Ex 1: Artworks depicting an animal playing the trumpet

```
SELECT ?visualArtwork
WHERE {
  ?visualArtwork rdf:type wd:Q4502142 .
  ?performance wdt:P1299 ?visualArtwork .
  ?performance wdt:P1303 ?instrument .
  ?instrument skos:exactMatch wd:Q8338 .
  ?performance wdt:P175 ?performer .
  ?performer wdt:P31 ?animal .
  ?animal skos:exactMatch wd:Q9394 . }
```

artwork type **visualArtwork**
performance depicted_by **artwork**
performance instrument_played **instrument**
instrument equivalent **trumpet**
performance equivalent **performer**
performer instance_of **animal**
animal equivalent **rabbit**



Musiconis299: “Rabbit playing the trumpet astride a naked man”



SPARQL queries

Ex 2: Artworks made with hygroscopy and renewable resources

```
SELECT ?visualArtwork ?material

WHERE {
  ?visualArtwork wdt:P186 ?typeMaterial .
  ?typeMaterial skos:exactMatch ?material .

  SERVICE <https://query.wikidata.org/sparql>
    ?material wdt:P1552 wd:Q216678 .
    ?material wdt:P279 wd:Q1138571 .
}
```

artwork material_used typeMaterial
typeMaterial equivalent material
ask Wikidata for information
#material hasQuality hygroscopy
#material subclassOf renewable_resource

hygroscopy (Q216678)

phenomenon of attracting and holding water molecules

renewable resource (Q1138571)

natural resource which can replenish with the passage of time, either through biological reproduction or other naturally recurring processes

wd:Q287 # wood





SPARQL queries

Ex 3: Artworks containing biblical figures from the Book of Genesis (Torah)

```
SELECT ?visualArtwork ?performance ?performer
WHERE {
  ?visualArtwork rdf:type wd:Q4502142 .           # artwork type visualArtwork
  ?performance wdt:P1299 ?visualArtwork .        # performance depicted_by artwork
  ?performance wdt:P175 ?performer .             # performance performed_by performer
  SERVICE <https://query.wikidata.org/sparql> {
    ?performer wdt:P31 wd:Q20643955 .             #performer instance_of human_biblical_figure
    ?performer wdt:P1441 ?chapter .               #performer present_in_work chapter
    ?chapter wdt:P361 wd:Q9184 .                  #chapter part_of Book_of_Genesis
    wd:Q9184 wdt:P361 wd:Q34990 .                 #Book_of_Genesis part_of Torah
  }
}
```

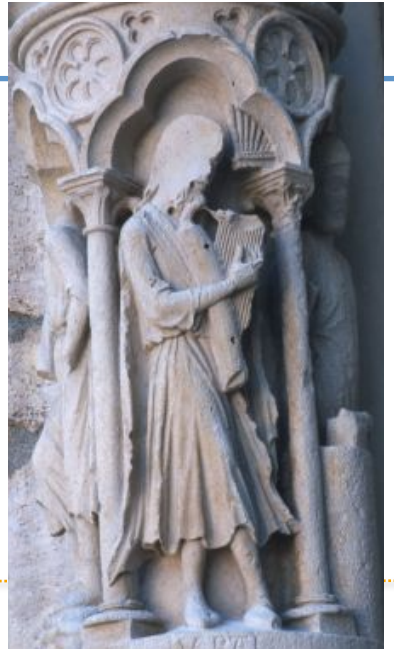


Jubal (Q1432204)

Biblical figure
Yuval | Yubal

[wd:Q1432204](#) # Jubal

Musiconis83: “Jubal playing the harp”
<http://musiconis.huma-num.fr/en/fiche/85/x.html>





Conclusions

- **We presented MusicKG: a multilingual cultural heritage knowledge graph containing representations of sound and music in the Middle Ages.**
- **We described :**
 - the source data,
 - the ontology data model,
 - how it is connected to external sources on the Linked Data Cloud
 - SPARQL query examples
- **Benefits:**
 - **Ontology Consistency and Instance Checking**
 - **The SPARQL endpoint allows to :**
 - make more precise queries
 - retrieve more accurate results



Future works

- **The connection with the LOD cloud may bring several benefits :**
 - Make MusicKG searchable in multiple languages
 - Wikidata items already have multilingual labels and aliases
 - Retrieve this data to enable the multilingual display of the knowledge graph
 - Ingest MusicKG in Wikidata
 - Wikidata is becoming the central hub for cultural heritage with lots of institutions publishing their catalogue data
 - Still a lot to be done on “their” (our?) side regarding consistency

Questions?

