

Mapping between linked data vocabularies in ARIADNE

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ARIADNE Project

- “**A**dvanced **R**esearch **I**nfrastructure for **A**rchaeological **D**ataset **N**etworking in **E**urope”
 - <http://www.ariadne-infrastructure.eu/>
 - 4 year project, February 2013 → January 2017
 - 24 European partner organisations
 - Multiple languages, multiple controlled vocabularies
 - Thousands of metadata records
- Consolidating metadata does not make it more interoperable – adoption of common schema plus use of controlled vocabularies are the real key to interoperability

5 Star deployment scheme for Linked Open Data

- ★ Data made available on the web - in any format (with an open licence)
- ★★ As above, but using a machine readable structured data format (e.g. Excel)
- ★★★ As above, but using non-proprietary structured data formats (e.g. XML)
- ★★★★ As above, but using W3C open standards (e.g. URIs, RDF & SPARQL)
- ★★★★★ As above, and also **linking to other data**

[\[http://www.w3.org/DesignIssues/LinkedData.html\]](http://www.w3.org/DesignIssues/LinkedData.html)

- The “5 Star” scheme therefore refers to data *format*, not data *quality*
- Much LOD emphasis to date has been on the *quantity* of data; seems to be less focus on the *quality*
- Difficult to locate information on exactly how links have been created
- The quality of links may vary – e.g. automatic links vs. manual links, the quality of the underlying data itself may also vary
- ISO 25964-2:2013 notes the need for caution in mapping (between thesauri), stating “...it is better to have no mapping at all than to establish a misleading one”

We should compare concepts, not just terms

SENESCHAL project (www.heritagedata.org)

- Automated matching requires human checking and intervention
- Taking term matches at face value is an inadequate approach
- An exact match on a term is syntactic not semantic; does not mean an exact match on a concept
- Need to consider scope notes, synonyms and full hierarchical context

Heritage Data: Linked Data: x

heritagedata.org/live/schemes/1/concepts/467.html

Heritage Data

Linked Data Vocabularies for Cultural Heritage

Scheme List | Concept Search | SPARQL Query | About The Project

<http://purl.org/heritagedata/schemes/1/concepts/467> (QR Code)

Property	Value
rdf:type	skos:Concept
cc:license	http://reference.data.gov.uk/id/open-government-licence
cc:attributionURL	http://www.rcahms.gov.uk
cc:attributionName	RCAHMS
skos:inScheme	Monument Type Thesaurus (Scotland)
skos:prefLabel	TENEMENT
skos:prefLabel	TEANAMANT [gd]
skos:broader	MULTIPLE DWELLING
skos:scopeNote	A large building containing a number of rooms or flats, access to which is usually gained via a common stairway.
skos:scopeNote	Togalach mòr sa bheil grunn sheòmarichean no fhlàtaichean a ruigear air staidhir choitcheann mar is trice. [gd]
skos:altLabel	theanamantaibh [gd]

Heritage Data: Linked Data: x

heritagedata.org/live/schemes/eh_tmt2/concepts/68997.html

Heritage Data

Linked Data Vocabularies for Cultural Heritage





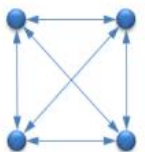



Scheme List | Concept Search | SPARQL Query | About The Project

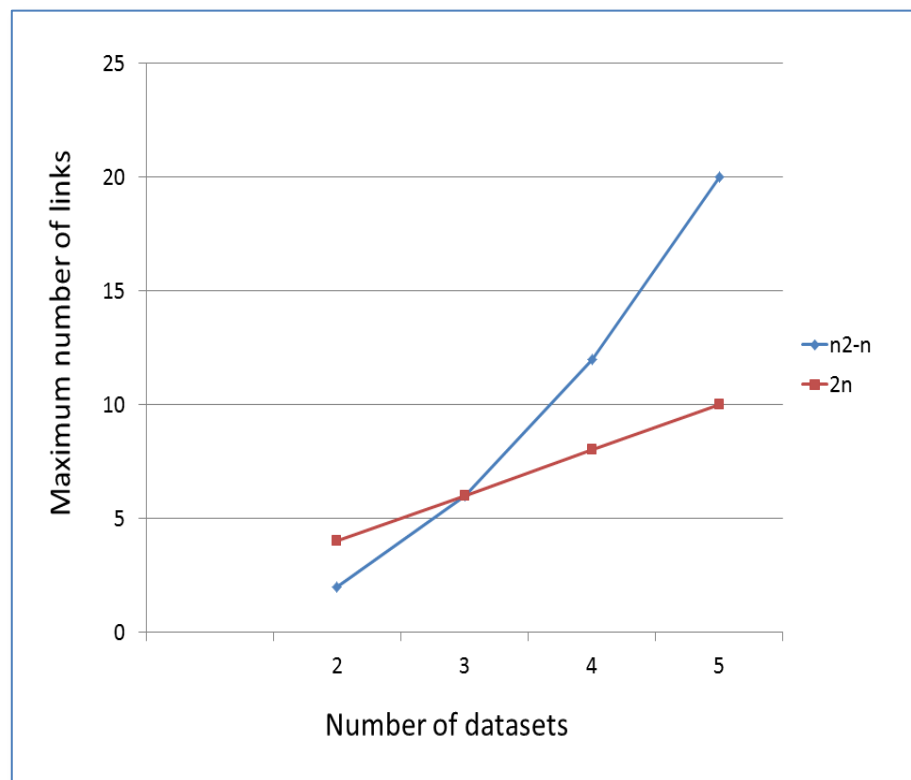
http://purl.org/heritagedata/schemes/eh_tmt2/concepts/68997 (QR Code)

Property	Value
rdf:type	skos:Concept
cc:license	http://creativecommons.org/licenses/by/3.0
cc:attributionURL	http://www.english-heritage.org.uk
cc:attributionName	English Heritage
skos:inScheme	MONUMENT TYPE (EH)
skos:prefLabel	TENEMENT
skos:broader	SETTLEMENT
skos:scopeNote	A parcel of land.
skos:related	DWELLING
dct:publisher	http://www.english-heritage.org.uk
dct:identifier	http://purl.org/heritagedata/schemes/eh_tmt2/concepts/68997
dct:issued	2013-07-17T08:43:50

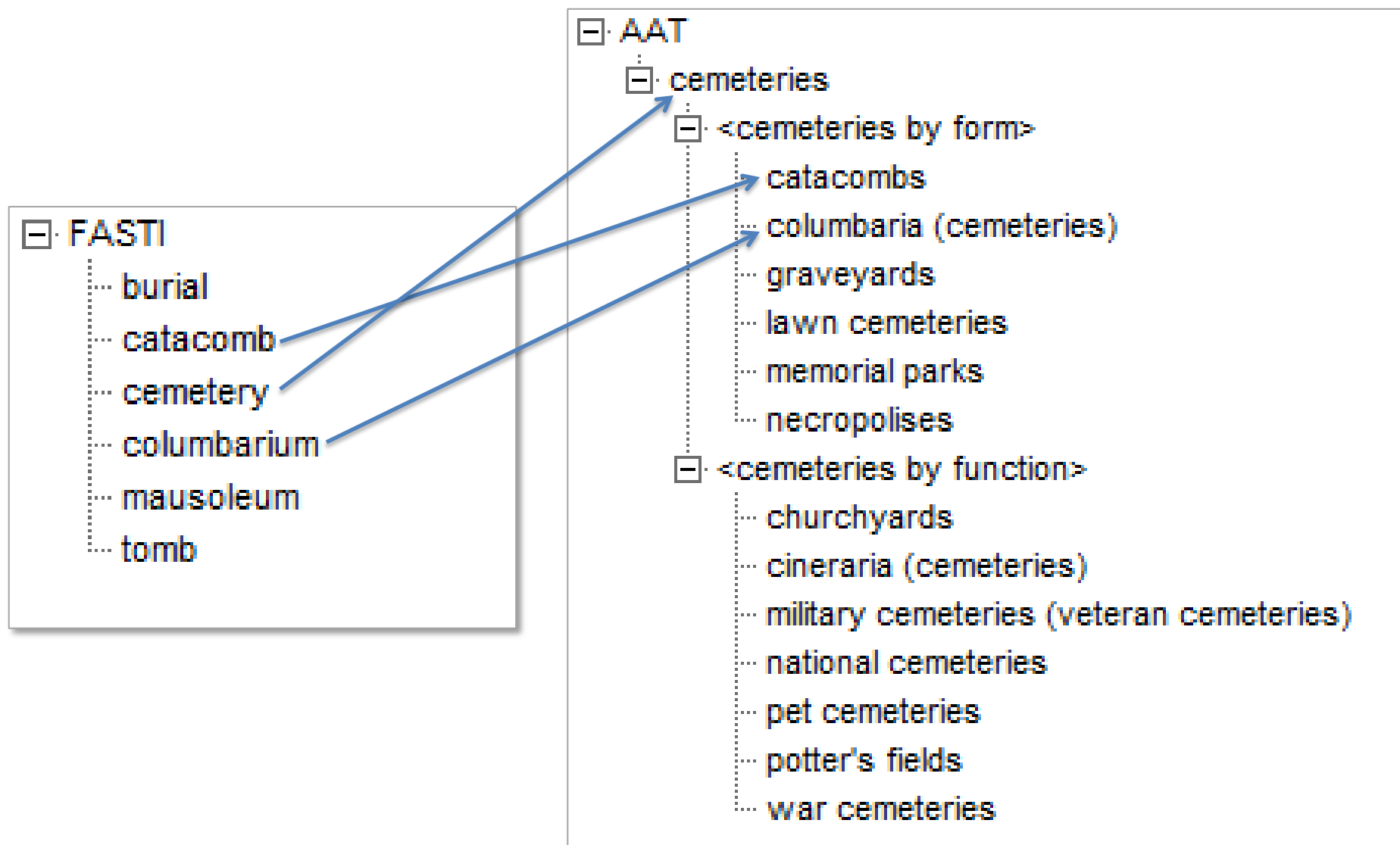
Rationale for a mapping hub (Getty AAT)

- Number of bidirectional links produced when linking equivalent concepts between multiple thesauri

Datasets	M2M	Links (n^2-n)	HUB	Links ($2n$)
2		2		4
3		6		6
4		12		8
5		20		10



Mapping from source vocabulary to AAT



Mapping issues

- Mapping tools (semi-automatic)
- [Mapping guidelines](#) for content providers (may be new to mapping work)
 - Eg describing context / purpose of mappings
 - Eg choosing SKOS mapping relationships
- Mapping metadata
 - Eg mapping template

Mapping tools

- Mapping Tool for LD vocabularies
<http://heritagedata.org/vocabularyMatchingTool/>
<https://github.com/cbinding/VocabularyMatchingTool>
- AAT indexing browser based tool (if wanted at manual import)
where no Partner subject indexing exists for a dataset
<http://heritagedata.org/vocabularyMatchingTool/indexingtool.html>
- Spreadsheet [mapping template](#) if vocabulary not in LD
plus XSL transform to RDF
- Future: multilingual archaeological dictionary as service ?

Mapping Data from partners (ongoing)

Source	Scheme mapped to AAT	No match	skos:exactMatch	skos:closeMatch	skos:broadMatch	skos:narrowMatch	skos:relatedMatch	Total
ADS	FISH Building Materials Thesaurus (subset)	0	4	8	0	0	0	12
ADS	Historic England Components Thesaurus (subset)	0	7	1	1	0	0	9
ADS	FISH Archaeological Objects Thesaurus (subset)	0	197	96	118	0	0	411
ADS	Historic England Maritime Craft Thesaurus (subset)	0	13	8	3	0	0	24
ADS	FISH Thesaurus of Monument Types (subset)	0	139	107	141	0	1	388
Sub total		0	360	220	263	0	1	844
		0%	43%	26%	31%	0%	0%	100%
DANS	Archaeologische Artefacttypen	0	0	0	0	0	0	0
DANS	Archaeologische Complextypen	25	0	56	19	0	2	102
DANS	Archaeologische Perioden	54	0	10	1	0	0	65
Sub total		79	0	66	20	0	2	167
		47%	0%	40%	12%	0%	1%	100%
FASTI	FASTI Monument Types	7	23	79	20	0	0	129
Sub total		7	23	79	20	0	0	129
		5%	18%	61%	16%	0%	0%	100%
OEAU	UK Material Pool	0	3	0	0	0	0	3
OEAU	UK Thunau DB	0	3	1	0	0	0	4
OEAU	Franzhausen Kokoern DB	0	5	2	2	1	0	10
OEAU	DFMROE DB	0	2	0	0	1	0	3
Sub total		0	13	3	2	2	0	20
		0%	65%	15%	10%	10%	0%	100%
SND	Arkeologisk undersökningstyp	9	0	1	0	0	0	10
SND	FMIS	41	17	48	48	3	0	157
SND	SND Keywords - Archaeology & History	14	36	63	27	0	0	140
SND	SND Keywords - Time Periods	22	17	6	20	0	0	65
Sub total		86	70	118	95	3	0	372
		23%	19%	32%	26%	1%	0%	100%

Vocabulary matching tool – requirements

- Creating concept→concept links, not just term→term – so utilise more contextual data when matching – labels, scope notes, relationships to other concepts
- Work interactively and allow manual matching. Matching concepts requires human judgement
- Facilitate simple side by side comparison of concepts, with useful accompanying contextual information
- Provide list of possible link types to choose from
- Generate associated metadata, export matches in a suitable serialisation format

Vocabulary matching tool - implementation

See <http://heritagedata.org/vocabularyMatchingTool/>

The screenshot displays the Vocabulary Matching Tool interface. It features two main sections: 'Source Vocabulary' and 'Target Vocabulary'. The 'Source Vocabulary' is set to 'FISH Archaeological Objects Thesaurus' and contains the term 'quill' with its definition: 'The barrel of a feather, usually goose, used as a pen.' The 'Target Vocabulary' is set to 'Getty Art & Architecture Thesaurus' and contains the term 'quill pens' with its definition: 'Pens made from the shafts of wing feathers or quills of geese, swans, ravens, eagles, owls, hawks, turkeys, and other birds. The tubular quill holds a reservoir of ink and the end may be cut into a pen point with various types of tips. Until the perfection of...'

Below these sections is the 'Concept Matching' area, which shows a 'close match' between 'QUILL' and 'quill pens'. There are buttons for 'CLEAR', 'LOAD', 'SAVE', 'EXPORT (TRIG)', and 'EXPORT (CSV)'. A search bar is also present.

The results table shows the following entries:

Source Concept	Match	Target Concept	Created
PARCHMENT	close match	parchment (animal material)	2015-03-27T14:56:34.565Z
QUILL	close match	quill pens	2015-03-27T14:57:10.804Z

Showing 1 to 2 of 2 entries

Creative Commons zero (CC0) open source code, available from <https://github.com/cbinding/VocabularyMatchingTool/>

Vocabulary matching tool - features

- Manually matching vocabulary concepts to Getty Art & Architecture Thesaurus (AAT) concepts
- Usage of linked data – Javascript components using external SPARQL endpoints (no back-end server or DB)
- Side by side comparison of concepts, with contextual details (labels, scope notes, linked concepts)
- Multilingual - French, German, Spanish, English, Dutch AAT concept details (fall back to English if chosen language not available)
- Export created mappings to JSON, CSV, RDF
- Creative Commons (CC0) open source (warts and all!). see <https://github.com/cbinding/VocabularyMatchingTool/>

Data received from partners (ongoing)

Source	Scheme mapped to AAT	Match type						Total
		No match	skos:exactMatch	skos:closeMatch	skos:broadMatch	skos:narrowMatch	skos:relatedMatch	
ADS	FISH Building Materials Thesaurus (subset)	0	4	8	0	0	0	12
ADS	Historic England Components Thesaurus (subset)	0	7	1	1	0	0	9
ADS	FISH Archaeological Objects Thesaurus (subset)	0	197	96	118	0	0	411
ADS	Historic England Maritime Craft Thesaurus (subset)	0	13	8	3	0	0	24
ADS	FISH Thesaurus of Monument Types (subset)	0	139	107	141	0	1	388
Sub total		0	360	220	263	0	1	844
		0%	43%	26%	31%	0%	0%	100%
DANS	Archaeologische Artefacttypen	0	0	0	0	0	0	0
DANS	Archaeologische Complextypen	25	0	56	19	0	2	102
DANS	Archaeologische Perioden	54	0	10	1	0	0	65
Sub total		79	0	66	20	0	2	167
		47%	0%	40%	12%	0%	1%	100%
FASTI	FASTI Monument Types	7	23	79	20	0	0	129
Sub total		7	23	79	20	0	0	129
		5%	18%	61%	16%	0%	0%	100%
OEAW	UK Material Pool	0	3	0	0	0	0	3
OEAW	UK Thunau DB	0	3	1	0	0	0	4
OEAW	Franzhausen Kokoern DB	0	5	2	2	1	0	10
OEAW	DFMROE DB	0	2	0	0	1	0	3
Sub total		0	13	3	2	2	0	20
		0%	65%	15%	10%	10%	0%	100%

Data received from partners (ongoing)

	A	B	C	D	E	F
1	sourceLabel	matchURI	targetLabel	targetURI	Source-Hierarchy	Source-ScopeNote
14	begravningsplats	skos:closeMatch	burial sites	http://vocab.getty.edu/aat/300387004	FMIS	historisk tid
15	begravningsplats, enst	skos:closeMatch	burials	http://vocab.getty.edu/aat/300263485	FMIS	historisk tid avsedd för en
16	bengömma	skos:closeMatch	remains	http://vocab.getty.edu/aat/300265420	FMIS	märghuvna ben i skyddat
17	bergshistorisk lämning	skos:closeMatch	mine structures	http://vocab.getty.edu/aat/300006423	FMIS	bergshantering som inte
18	bildristning	skos:broadMatch	rock carvings	http://vocab.getty.edu/aat/300080131	FMIS	eller slipade bilder av
19	björngrav	skos:broadMatch	graves	http://vocab.getty.edu/aat/300005907	FMIS	björnbän
20	blästbrukslämning	skos:closeMatch	bloomeries	http://vocab.getty.edu/aat/300379639	FMIS	(lågteknisk
21	blästplats (sammansat	skos:closeMatch	bloomeries	http://vocab.getty.edu/aat/300379639	FMIS	lämningar efter
22	boplat	skos:closeMatch	buried settlements	http://vocab.getty.edu/aat/300387241	FMIS	förrhistorisk tid vistats och
23	boplatsgrop	skos:broadMatch	pits (earthworks)	http://vocab.getty.edu/aat/300008027	FMIS	uppgrävda materialet
24	boplatlämning övrig	skos:broadMatch	buried settlements	http://vocab.getty.edu/aat/300387243	FMIS	boplatlämningar som inte
25	boplatvall	skos:closeMatch	sunken huts	http://vocab.getty.edu/aat/300137527	FMIS	omger eller avgränsar en
26	borg	skos:broadMatch	fortifications	http://vocab.getty.edu/aat/300006888	FMIS	kombinationer av murar,
27	bro	skos:exactMatch	bridges (built works)	http://vocab.getty.edu/aat/300007836	FMIS	väg, järnväg, kanal eller
28	brott/täkt	skos:broadMatch	extracting complexes/	http://vocab.getty.edu/aat/300000388	FMIS	utnyttjats för utvinning eller
29	brunn	skos:broadMatch	wells (structures)	http://vocab.getty.edu/aat/300006207	FMIS	åtkomst till färskvatten
30	brytningsyta	skos:closeMatch	quarries (extracting complex	http://vocab.getty.edu/aat/300000402	FMIS	bergart eller mineral för
31	byggnad annan	skos:closeMatch	buildings (structures)	http://vocab.getty.edu/aat/300004792	FMIS	kulturarhistoriskt värde. (OBS
32	byggnadsminne	skos:closeMatch	listed buildings	http://vocab.getty.edu/aat/300343491	FMIS	byggnad i privat ägo
33	bytomt	skos:closeMatch	greens (open spaces)	http://vocab.getty.edu/aat/300008164	FMIS	eller mantalssatt
34			landings (marine structures)	http://vocab.getty.edu/aat/300007928	FMIS	Stenröjd uppdragningsplats
35	dammvall	skos:broadMatch	dikes	http://vocab.getty.edu/aat/300170882	FMIS	kunna ansamla eller
36	depåfynd	skos:closeMatch	hoards (groupings)	http://vocab.getty.edu/aat/300195474	FMIS	föremål som kan antas ha

Spreadsheets containing local vocabulary → AAT mappings

Transformation of vocabulary mappings

Spreadsheet data saved to tab-delimited text:

stenkammargrav	skos:broadMatch	chamber tombs	http://vocab.getty.edu/aat/300005935
stenkistgrav	skos:exactMatch	cist graves	http://vocab.getty.edu/aat/300005941
stenkrets	skos:broadMatch	burial sites	http://vocab.getty.edu/aat/300387004

XSL Transformation

RDF (NTriples):

```
<http://tempuri/SND/stenkammargrav> <http://www.w3.org/2004/02/skos/core#broadMatch> <http://vocab.getty.edu/aat/300005935> .  
<http://tempuri/SND/stenkistgrav> <http://www.w3.org/2004/02/skos/core#exactMatch> <http://vocab.getty.edu/aat/300005941> .  
<http://tempuri/SND/stenkrets> <http://www.w3.org/2004/02/skos/core#broadMatch> <http://vocab.getty.edu/aat/300387004> .  
  
<http://tempuri/SND/stenkammargrav> <http://www.w3.org/2004/02/skos/core#prefLabel> "stenkammargrav"@sv .  
<http://tempuri/SND/stenkistgrav> <http://www.w3.org/2004/02/skos/core#prefLabel> "stenkistgrav"@sv .  
<http://tempuri/SND/stenkrets> <http://www.w3.org/2004/02/skos/core#prefLabel> "stenkrets"@sv .
```

Obtaining the Getty AAT structure

Using the SPARQL endpoint at <http://vocab.getty.edu/sparql> extract the poly-hierarchical structure of the Getty AAT:

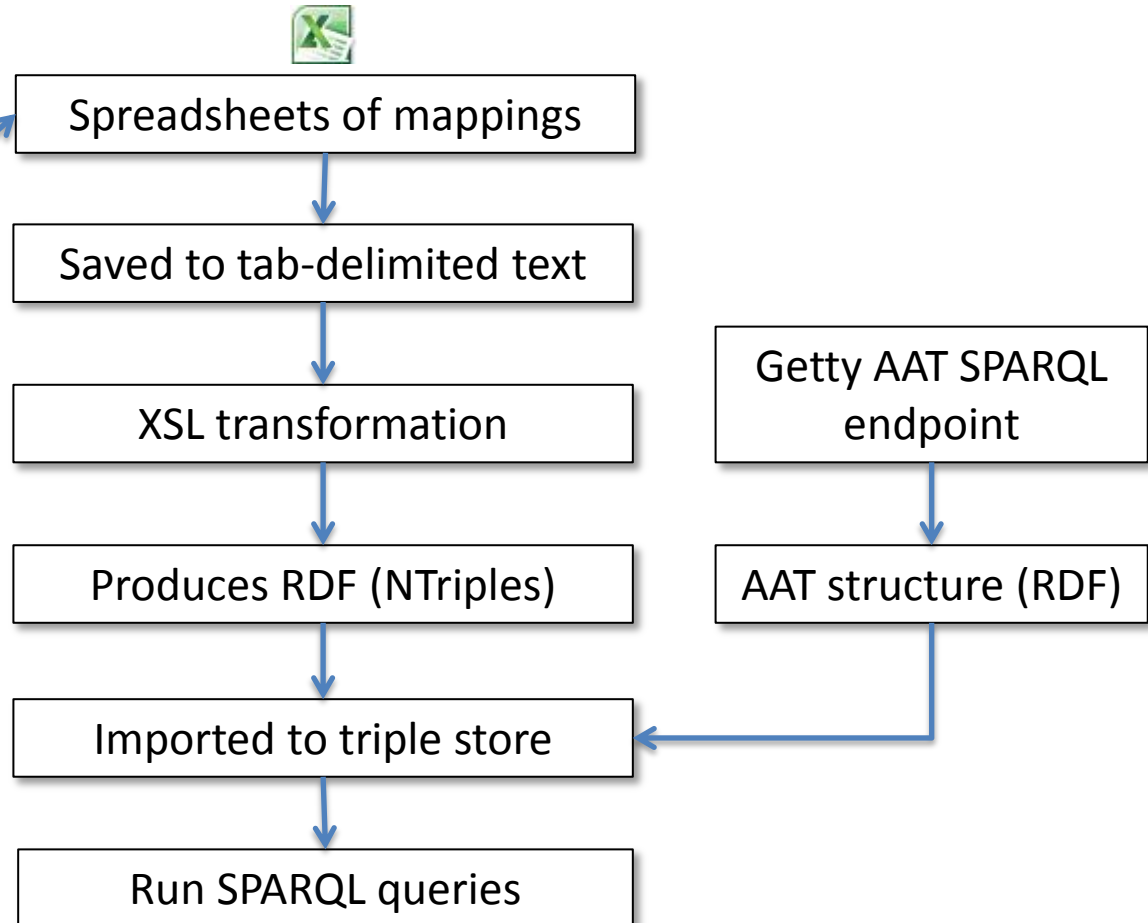
```
PREFIX skos: <http://www.w3.org/2004/02/skos/core#>
PREFIX xl: <http://www.w3.org/2008/05/skos-xl#>
PREFIX gvp: <http://vocab.getty.edu/ontology#>
PREFIX aat: <http://vocab.getty.edu/aat/>
```

```
CONSTRUCT { ?s gvp:broader ?o; skos:prefLabel ?prefLabel }
WHERE {
    ?s skos:inScheme aat: ;
    (gvp:broaderGeneric | gvp:broaderPartitive) ?o .
    MINUS { ?s a gvp:ObsoleteSubject } # don't need these
    MINUS { ?o a gvp:ObsoleteSubject } # don't need these
    OPTIONAL { ?s skos:prefLabel ?prefLabel }
    OPTIONAL { ?s xl:prefLabel [xl:literalForm ?prefLabel] }
    FILTER(langMatches(lang(?prefLabel),"EN")) .
}
```


Converting the vocabulary mappings

Sources

- ADS
- DANS
- FASTI
- OEAW
- SND
- (ICCD)
- (PICO)



Consolidating the mappings

- Import the extracted AAT structure to a triple store
- (For the examples we used SPARQL GUI; a simple standalone tool for importing RDF and testing of SPARQL queries)
 - <https://bitbucket.org/dotnetrdf/dotnetrdf/wiki/UserGuide/Tools>
- Import all the converted mappings to the triple store

```
fasti:burial skos:closeMatch aat:300387004 .  
fasti:catacomb skos:closeMatch aat:300000367 .  
fasti:cemetery skos:closeMatch aat:300266755 .  
fasti:columbarium skos:closeMatch aat:300000370 .  
[etc.]
```

Utilizing the vocabulary mappings (1)

The screenshot shows the SPARQL GUI interface. The 'Dataset Creation' section on the left has fields for 'Import RDF from File' (set to C:\Users\cbinding\OneDrive\Projects\ARIADNE\data\CSV) and 'Import RDF from URI'. The 'Query' section contains a SPARQL 1.1 query to find concepts related to 'kyrkbyggnad'. The 'Syntax Options' section on the right has 'SPARQL 1.1' selected. The 'SPARQL Results Format' is set to 'HTML' and 'Graph Format' is 'RDF/XML'. The 'Query Options' section includes a 'Timeout' of 10000 and several checkboxes for query behavior. The results table at the bottom shows a list of concepts and their labels.

Dataset Creation
Use this section of the GUI to import RDF data from Files/URIs. You can reset the Dataset to the empty dataset by clicking the Clear button

Import RDF from File: C:\Users\cbinding\OneDrive\Projects\ARIADNE\data\CSV
Import RDF from URI:

Query

```
# SPARQL 1.1 to locate concepts related (via AAT structure) to SND "kyrkbyggnad"
PREFIX gvp: <http://vocab.getty.edu/ontology#>
PREFIX skos: <http://www.w3.org/2004/02/skos/core#>

SELECT DISTINCT ?concept ?label WHERE {
  <http://tempuri/SND/kyrkbyggnad> (skos:exactMatch | skos:broadMatch | skos:closeMatch) ?
  aatconcept .
  ?aatdescendant gvp:broader+ ?aatconcept .
  {
    {?concept (skos:exactMatch | skos:broadMatch | skos:closeMatch) ?aatdescendant}
    UNION
    {?concept (skos:exactMatch | skos:broadMatch | skos:closeMatch) ?aatconcept}
  }
  OPTIONAL {?concept skos:prefLabel ?label}
}
```

Syntax Options
☐ SPARQL 1.0
☒ SPARQL 1.1
☐ SPARQL 1.1 Extended

SPARQL Results Format
HTML

Graph Format
RDF/XML

Query Options
Timeout: 10000
☐ Partial Results on Timeout
☐ Allow Graphs to be loaded 'on demand' from the Web?
☒ Permit Unknown Function URIs
☒ Optimise Queries
☒ Default Graph is union of all graphs
☒ View Results and Graphs in Application
☐ Log Query Explanations
☐ Enable Full Text Indexing

concept	label
http://purl.org/heritagedata/schemes/eh_tmt2/concepts/69975	"CATHEDRAL"@en
fasti:cathedral	"Cathedral"@en
http://www.maproject.org/data/2904916e-704c-415d-8724fd1b97a8f7e7	"Kerk"@nl
http://purl.org/heritagedata/schemes/eh_tmt2/concepts/69980	"Abbey Church"@en
http://purl.org/heritagedata/schemes/eh_tmt2/concepts/91036	"ANGLICAN CATHEDRAL"@en
http://purl.org/heritagedata/schemes/eh_tmt2/concepts/69980	"CHURCH"@en
fasti:church	"Church"@en
http://tempuri/SND/kyrkbyggnad	"kyrkbyggnad"@sv

14 Graphs 44354 Triples Last Query took 00:00:00.00

Utilizing the vocabulary mappings (2)

The screenshot shows the SPARQL GUI interface. The 'Dataset Creation' section at the top left has fields for 'Import RDF from File' (set to 'C:\Users\cbinding\OneDrive\Projects\ARIADNE\data\CSV') and 'Import RDF from URI'. The 'Query' section contains a SPARQL query to find concepts related to FASTI 'cemetery'. The 'Syntax Options' section on the right has 'SPARQL 1.1' selected. The 'SPARQL Results Format' is set to 'HTML' and 'Graph Format' is 'RDF/XML'. The 'Query Options' section includes a 'Timeout' of 10000 and several checkboxes for query execution options. At the bottom, a status bar shows '14 Graphs 44354 Triples Last Query took 00:00:00.0053548'. A table of results is displayed at the bottom right, showing concept URIs and their labels.

Dataset Creation
Use this section of the GUI to import RDF data from Files/URLs. You can reset the Dataset to the empty dataset by clicking the Clear button

Import RDF from File:
Import RDF from URI:

Query

```
# SPARQL 1.1 to locate concepts related (via AAT structure) to FASTI "cemetery"
PREFIX gvp: <http://vocab.getty.edu/ontology#>
PREFIX skos: <http://www.w3.org/2004/02/skos/core#>

SELECT DISTINCT ?concept ?label WHERE {
  <http://www.fastionline.org/concept/attribute/cemetery> (skos:exactMatch |
  skos:broadMatch | skos:closeMatch) ?aatconcept .
  ?aatdescendant gvp:broader+ ?aatconcept .
  {
    {?concept (skos:exactMatch | skos:broadMatch | skos:closeMatch) ?aatdescendant}
  UNION
    {?concept (skos:exactMatch | skos:broadMatch | skos:closeMatch
  }
  OPTIONAL {?concept skos:prefLabel ?label}
}
```

Syntax Options
☐ SPARQL 1.0
☒ SPARQL 1.1
☐ SPARQL 1.1 Extended

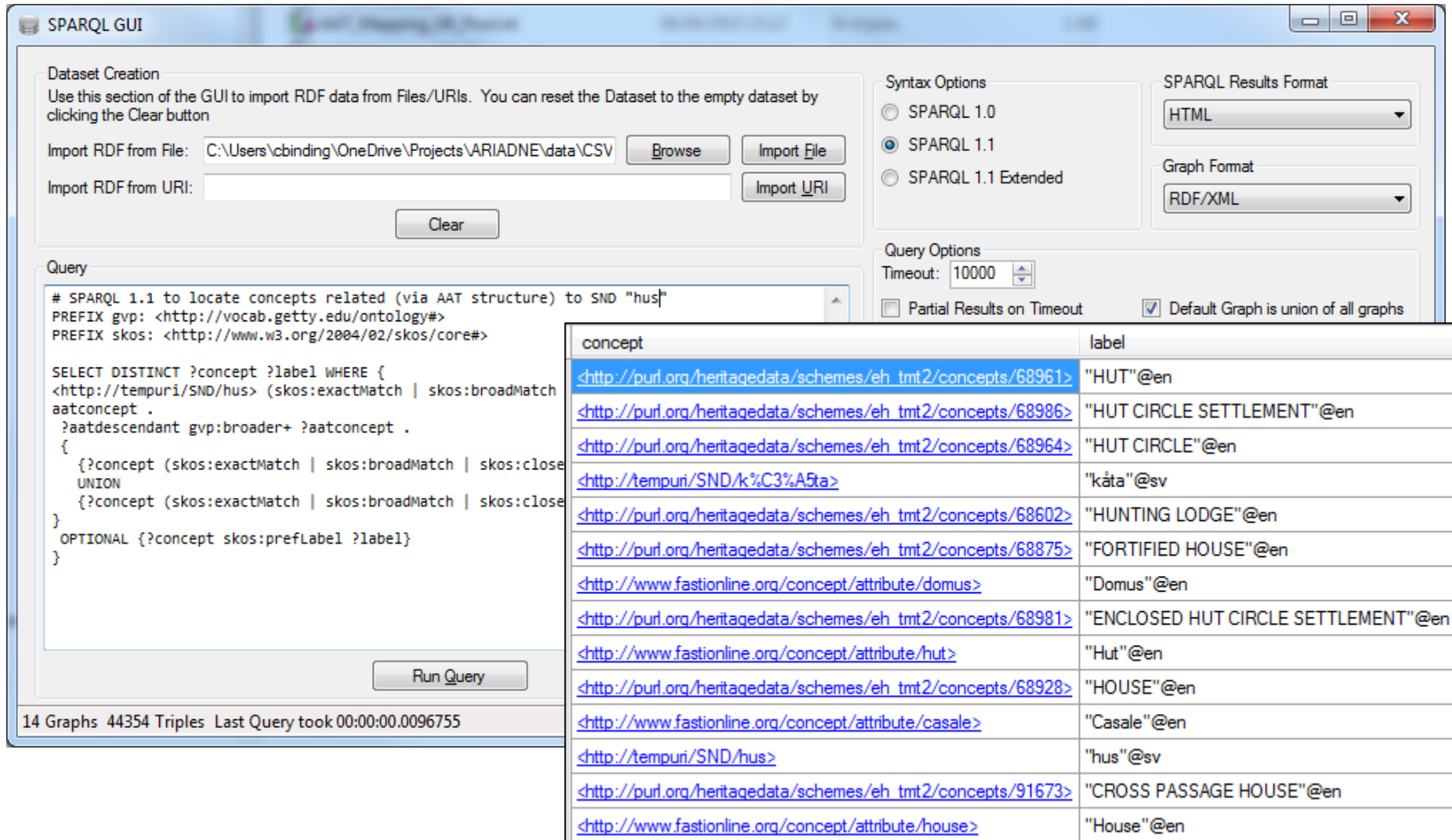
SPARQL Results Format
HTML
Graph Format: RDF/XML

Query Options
Timeout: 10000
☐ Partial Results on Timeout ☒ Default Graph is union of all graphs
☐ Allow Graphs to be loaded 'on demand' from the Web? ☒ View Results and Graphs in Application
☒ Permit Unknown Function URIs ☐ Log Query Explanations
☒ Optimise Queries ☐ Enable Full Text Indexing
☒ Optimise Query Algebra ☐ Allow Unsafe Optimisations

14 Graphs 44354 Triples Last Query took 00:00:00.0053548

concept	label
http://purl.org/heritagedata/schemes/eh_tmt2/concepts/70061	"CHURCHYARD"@en
http://www.maproject.org/data/8dec6ef7-dfad-45a3-8d79-b038b6029371	"Kerkhof"@nl
http://tempuri/SND/gravf%C3%A4lt	"gravfält"@sv
fasti:columbarium	"Columbarium"@en
fasti:catacomb	"Catacomb"@en
http://tempuri/OEAW/cemetery	"cemetery"@en
http://tempuri/SND/kyrkog%C3%A5rd	"kyrkogård"@sv
http://purl.org/heritagedata/schemes/eh_tmt2/concepts/70053	"CEMETERY"@en
http://purl.org/heritagedata/schemes/eh_tmt2/concepts/70060	"INHUMATION CEMETERY"@en
fasti:cemetery	"Cemetery"@en

Utilizing the vocabulary mappings (3)



The screenshot displays the SPARQL GUI interface. The 'Dataset Creation' section includes fields for 'Import RDF from File' and 'Import RDF from URI', along with 'Browse' and 'Import' buttons. The 'Syntax Options' section has radio buttons for 'SPARQL 1.0', 'SPARQL 1.1' (selected), and 'SPARQL 1.1 Extended'. The 'SPARQL Results Format' is set to 'HTML', and the 'Graph Format' is 'RDF/XML'. The 'Query Options' section shows a 'Timeout' of 10000 and checkboxes for 'Partial Results on Timeout' and 'Default Graph is union of all graphs'.

The 'Query' section contains the following SPARQL query:

```
# SPARQL 1.1 to locate concepts related (via AAT structure) to SND "hus"
PREFIX gvp: <http://vocab.getty.edu/ontology#>
PREFIX skos: <http://www.w3.org/2004/02/skos/core#>

SELECT DISTINCT ?concept ?label WHERE {
  <http://tempuri/SND/hus> (skos:exactMatch | skos:broadMatch
    | skos:narrowMatch | skos:closeMatch) ?aatconcept .
  ?aatconcept gvp:broaden+ ?aatconcept .
  {
    ?concept (skos:exactMatch | skos:broadMatch | skos:closeMatch) ?aatconcept .
    UNION
    ?concept (skos:exactMatch | skos:broadMatch | skos:closeMatch) ?aatconcept .
  }
  OPTIONAL {?concept skos:prefLabel ?label}
}
```

The 'Run Query' button is visible at the bottom of the query section. The status bar at the bottom left indicates '14 Graphs 44354 Triples Last Query took 00:00:00.0096755'.

The results are displayed in a table with two columns: 'concept' and 'label'.

concept	label
http://purl.org/heritagedata/schemes/eh_tmt2/concepts/68961	"HUT"@en
http://purl.org/heritagedata/schemes/eh_tmt2/concepts/68986	"HUT CIRCLE SETTLEMENT"@en
http://purl.org/heritagedata/schemes/eh_tmt2/concepts/68964	"HUT CIRCLE"@en
http://tempuri/SND/k%C3%A5ta	"kåta"@sv
http://purl.org/heritagedata/schemes/eh_tmt2/concepts/68602	"HUNTING LODGE"@en
http://purl.org/heritagedata/schemes/eh_tmt2/concepts/68875	"FORTIFIED HOUSE"@en
http://www.fastionline.org/concept/attribute/domus	"Domus"@en
http://purl.org/heritagedata/schemes/eh_tmt2/concepts/68981	"ENCLOSED HUT CIRCLE SETTLEMENT"@en
http://www.fastionline.org/concept/attribute/hut	"Hut"@en
http://purl.org/heritagedata/schemes/eh_tmt2/concepts/68928	"HOUSE"@en
http://www.fastionline.org/concept/attribute/casale	"Casale"@en
http://tempuri/SND/hus	"hus"@sv
http://purl.org/heritagedata/schemes/eh_tmt2/concepts/91673	"CROSS PASSAGE HOUSE"@en
http://www.fastionline.org/concept/attribute/house	"House"@en

Conclusions

- Compare concept not just terms
- The vocabulary mappings facilitate multilingual cross search over multiple datasets
- Integration of semantic structure can improve recall AND precision of search
- The spine structure supports hierarchical semantic expansion
- Supports semantic browsing (more like this)
- Can be used in addition to free text searching
- Quality mappings require 'expert' review of results. Manual involvement is more time consuming, but can be supported by semi-automated tools. Only needs to be done once and can support various applications.

Mapping issues

- Mapping tools (semi-automatic)
- [Mapping guidelines](#) for content providers (may be new to mapping work)
 - Eg describing context / purpose of mappings
 - Eg choosing SKOS mapping relationships
 - implications for retrieval?
- Mapping metadata
 - Eg mapping template
 - Typology of mapping methods?

Thank you

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