

RDF* to represent multivocality in the Sloane Collections

What is RDF*

RDF* (RDF-star) is an extension of the Resource Description Framework (RDF) designed to enhance the expressiveness and flexibility of representing knowledge in semantic web applications. While traditional RDF represents information using subject-predicate-object triples, RDF* introduces the concept of "named graphs" or "quads" and supports nested triples within them.

In RDF*, triples can be grouped together within double angle brackets ("`<< >>`") to form a named graph, allowing for the representation of more complex relationships and additional metadata. This enables the modelling of statements about statements, attaching metadata to individual triples, and capturing contextual information.

The use of RDF* has several benefits. First, it enables the representation of higher-order knowledge, allowing for statements about statements and the interpretation of metadata associated with those statements. Second, RDF* facilitates more nuanced representations of relationships, enabling the attachment of metadata, such as dates, attribution, or confidence values, to triples. This enhances the richness and contextuality of the represented knowledge. Third, RDF* supports the integration and interoperability of data across different datasets, as it aligns with the principles of Linked Data and can be combined with existing RDF-based technologies and tools.

Use cases in the Sloane Collections

RDF* finds applications in the Cultural Heritage domain, including the Sloane collections, to enhance the representation of the collected items, their relationships, and associated metadata. Below, we explore several ways in which RDF* can be used in this domain.

1. Representing Item Relationships

Hans Sloane collections consist of various items, such as artefacts, specimens, books, and artworks. RDF* can be used to represent the relationships between these items. For example, it is possible to use RDF* triples to indicate that a certain specimen was part of a particular collection.

Example: content of books and catalogue records

We can take the example of the *Erythrina corallodendron* L., which was collected in Jamaica and recorded in "[Voy. Isl. Madera, Barbados, Nieves, S. Christophers and Jamaica](#)" by H. Sloane. It is also recorded in the [NHM collections](#).

```
<< crm:book-3683232 :P94_wasCreatedBy crm:creationEvent1 >>
:relationshipType "creation" .

<< crm:catalogue-number-BM000593775 crm:P129_isAbout
crm:specimen-8799501f-6d8f-4925-93b9-abf981ef45e7 >> :relationshipType
"inclusion" .

<< crm:specimen-8799501f-6d8f-4925-93b9-abf981ef45e7 :collectedFrom
crm:Location456 >> :relationshipType "origin" .

<< crm:transferofcustody1 :P30_transferredCustodyOf
crm:specimen-8799501f-6d8f-4925-93b9-abf981ef45e7 >> crm:P7_tookPlaceAt
"Jamaica" .
```

Example: provenance, acquisition date, specific details

This example illustrates the book "[Voy. Isl. Madera, Barbados, Nieves, S. Christophers and Jamaica](#)" by H. Sloane and when it was acquired by a library.

```
<< :crm:creationEvent1 crm:P14_carriedOutBy crm:HansSloane >> :date
"1707"^^xsd:Year .

<< crm:book-3683232 crm:P24_changedOwnershipThrough
crm:AcquisitionEvent1 >> :provenance "Acquired between 1769 and 1802.
Recorded in RAA Library, Catalogue, 1802."^^rdfs:literal .

<< crm:book-3683232 crm:P102_hasTitle crm>Title1 >> :description "The
imprint of the second volume reads, 'London: Printed for the Author.
1725.' This account of the natural history of Jamaica is based on the
collections which Sir Hans Sloane made there in 1687-1689, while
physician to the Governor, the Duke of Albemarle. These collections
afterwards became the nucleus of the holdings of the British Museum (and
later of the Natural History and Geological Museums). Most plates in
Volume I show plants; those of Volume II show plants and
animals."^^xsd:literal .
```

2. Capturing Historical Context

Hans Sloane collections have historical significance. RDF* can be used to capture and represent the historical context of the items. For instance, it is possible to use RDF* to link an item to relevant historical events, people, or places. This allows for a more nuanced understanding of the items within their historical context.

Example : spatio-temporal contextualisation

[This artefact](#) is taken as an example. It is from the period of Ottoman Dynasty, therefore pertaining to the Middle East department, and has origin in Turkey.

```
<< crm:artifact-1928-0323-0-46-22 crm:P8_witnessed crm:OttomanDynasty >>
:department "MiddleEast" .

<< crm:artifact-1928-0323-0-46-22 crm:P8_witnessed crm:OttomanDynasty >>
:location "Turkey" .

<< crm:artifact-1928-0323-0-46-22 crm:P8_witnessed
crm:HistoricalPlace123 >> :relationshipType "origin".
```

Example: connection to events and to people

[This artefact](#) has been transferred to the British Museum in 1974 and is explicitly associated with Engelbert Kämpfer, who made some of the drawings.

```
<< crm:artifact-1974-0617-0-1-38 crm:P30_custodyTransferredThrough
crm:TransferringEvent2 >> :eventDate "1974"^^xsd:date .

<< crm:artifact-1974-0617-0-1-38 :hasContributor crm:BIOG11220 >>
:associationType "contributor".
```

3. Managing Attribution

Attribution is crucial in collections, particularly when it comes to acknowledging the contributors, researchers, and curators involved. RDF* can be employed to attribute statements, annotations, or other metadata to individuals or organisations, documenting their contributions or expertise in the context of the collection.

Example: attribution

[This artefact](#) is now attributed to Aurelio Luini by the British Museum collections, but in the past it had another attribution (Palma il Vecchio).

```
attribute-assignment-author-aurelio-luini :P141_assigned :aurelio-luini
<< attribute-assignment-author-aurelio-luini :P140_wasAttributedBy
:TheBritishMuseum >> :P177_assignedPropertyOfType :AuthorshipAttribution
```

4. Representing statements and interpretation

With RDF*, statements can be associated with their interpretations, providing valuable context and insights into the meaning and implications of the statements. Experts, scholars, and analysts can contribute their interpretations, expanding the understanding and depth of knowledge. In this way, a more comprehensive and nuanced representation of knowledge is achieved. This opens up possibilities for capturing multiple perspectives, facilitating collaborative research, and enabling more sophisticated data analysis and reasoning.

Example: types of statements, interpretations and sources

According to the Multivocality ontology, it is possible to model in RDF* notes and comments about observations, beliefs and statements, along with their validity according to different perspectives.

```
<< crminf:Observation1 crminf:J2_wasConcludedBy crminf:Belief1 >> :note
"This statement suggests a correlation between X and Y." .

<< crminf:Belief1 crminf:that :ObjectIdentityStatement1 >>
crminf:holdsToBe "Unknown" .

<< :False :accordingTo :Observation2 >> :perspectiveType "Disagreement"
.
```

5. Supporting Linked Data Integration

RDF* provides a standardised representation that aligns well with the principles of Linked Data. By using RDF* to model the Hans Sloane collections, you can facilitate integration with other linked datasets, enabling connections and knowledge discovery across diverse collections and domains.

Example: Linked Data integration

This example shows how two objects from two different digital records are believed to be the same.

```
<< :SloaneLabDataAtlasObject1 :linkedTo :BritishMuseumObject2 >>
:integrationType ":believedToBeTheSameAs" .
```

6. Facilitating Querying and Analysis

RDF* allows for flexible querying and analysis of the collection data. By representing the collections and associated metadata using RDF*, you can leverage SPARQL queries and other RDF-based tools and frameworks to explore, analyse, and gain insights from the collection data.

Example: SPARQL queries

In this section, it is possible to find sample SPARQL queries for the model.

1. Retrieve the creation event details of a specific book:

```
PREFIX crm: <http://www.cidoc-crm.org/cidoc-crm/>

SELECT ?creationEvent
WHERE {
  << crm:book-3683232 :P94_wasCreatedBy ?creationEvent >>
  :relationshipType "creation" .
}
```

2. Retrieve a specimen and its inclusion details:

```
PREFIX crm: <http://www.cidoc-crm.org/cidoc-crm/>

SELECT ?specimen ?inclusion
WHERE {
  << crm:catalogue-number-BM000593775 crm:P129_isAbout ?specimen >>
  :relationshipType "inclusion" .
  ?inclusion crm:P129_isAbout ?specimen .
}
```

3. Retrieve the origin location of a specific specimen:

```
PREFIX crm: <http://www.cidoc-crm.org/cidoc-crm/>

SELECT ?originLocation
WHERE {
  << crm:specimen-8799501f-6d8f-4925-93b9-abf981ef45e7 :collectedFrom
  ?originLocation >> :relationshipType "origin" .
}
```

4. Retrieve the transfer of custody details for a specific specimen in a specific location:

```
PREFIX crm: <http://www.cidoc-crm.org/cidoc-crm/>

SELECT ?transfer ?location
WHERE {
  << crm:transferofcustody1 :P30_transferredCustodyOf
  crm:specimen-8799501f-6d8f-4925-93b9-abf981ef45e7 >> crm:P7_tookPlaceAt
  ?location .
  ?transfer :P30_transferredCustodyOf
  crm:specimen-8799501f-6d8f-4925-93b9-abf981ef45e7 .
  ?transfer crm:P7_tookPlaceAt "Jamaica" .
}
```

Conclusion

By leveraging RDF* in Hans Sloane collections, it is possible to create a more comprehensive and interconnected representation of the items, their relationships, and associated metadata. This facilitates better data management, knowledge discovery, and contextual understanding of the collections.