Uncertainty ... ?

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Archaeologists of the ancient world try to reconstruct what happened over 1500 or more years ago. Therefore, uncertainty plays an important role. Many artefacts may not be well preserved but still be highly relevant for the overall puzzle. However, uncertain information must be identified as such in order to prevent conclusions that are based on uncertain information, and then taken as certain. Uncertain information is of great importance for building hypotheses. But to prove a hypothesis you need to ensure that the data is certain.

In our presentation we show how we enter and store uncertain information within our system AFE (Antike Fundmünzen Europa). We concentrate on the attribute “Issuer” for a coin, where we allow different uncertainty levels. This includes the front-end view as well as the relational representation we use for these levels.

The more important, second part of the presentation deals with the representation of uncertainty within ontologies or other structures for exchanging data (which in the end is the overall goal of ECFN – to be able to exchange the numismatic data of different systems without losing important information, such as how certain it is). Surprisingly, many existing approaches in our domain do not handle uncertainty at all. The presentation provides and discusses different approaches as to how uncertainty could be modelled for our needs.
Real World
Entering „Real World“ into AFE Front-End Form by Expert (Numismatist)

Important to agree on!

Model (for exchange)

System

AFE Front-End Form

map into Backend-System

AFE-DB

Backend-System (in our case a relational DB)
<table>
<thead>
<tr>
<th>Material</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Issuer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Titus (Titus)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Issuer alternative 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ner</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nervii (Nervii)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nero (Nero)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nerva (Nerva)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Issuer alternative 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Uncertainty Cases in AFE

<table>
<thead>
<tr>
<th>Case Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Certain</td>
<td>The portrayed person on the coin is clearly identifiable.</td>
</tr>
<tr>
<td>One Uncertain</td>
<td>The portrayed person on the coin is NOT clearly identifiable. The expert has one candidate he favors.</td>
</tr>
<tr>
<td>Alternative</td>
<td>The portrayed person on the coin is NOT clearly identifiable. The expert can name more than one candidate for the portrayed person (and nobody else).</td>
</tr>
<tr>
<td>Alternative Uncertain</td>
<td>The portrayed person on the coin is NOT clearly identifiable. The expert can name more than one candidate for the portrayed person, but it could also be somebody else.</td>
</tr>
<tr>
<td>Uncertain</td>
<td>The portrayed person on the coin is NOT clearly identifiable and the expert is not capable to reduce the possibilities in a solid way.</td>
</tr>
</tbody>
</table>
```sql
SELECT ci.id_coin,
       ci.idIssuer,
       u.Name as "Uncertainty Case"
FROM afe.coinissuers ci, afe.uncertainty u
WHERE ci.id_uncertainty = u.id;
```
## Existing Ontologies/Models ...

<table>
<thead>
<tr>
<th>Ontology</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIDOC-CRM</td>
<td>Does not deal with uncertainty!</td>
</tr>
<tr>
<td>EDM and ESE</td>
<td>Do not deal with uncertainty!</td>
</tr>
<tr>
<td>Nomisma.org</td>
<td><img src="image" alt="Nomisma.org" /> Common currency for digital numismatics.</td>
</tr>
<tr>
<td>SKOS</td>
<td>For mapping – has some uncertain levels included!</td>
</tr>
<tr>
<td></td>
<td>skos:broadMatch, skos:closeMatch, skos:exactMatch</td>
</tr>
</tbody>
</table>
Existing Ontologies/Models ...
In a graph: The issuer of a coin is Titus!
Tasks:

• We need to define:
  – Which level of uncertainty should be supported in the exchange model?
  – How should this be modelled?
  – ... Note: Some attributes have additional characteristics: geo positioning has precision!
In a graph: The issuer of a coin is Titus! ... but I am uncertain!
Version 1: reified statement

A statement about a statement could be used. The drawback here would be the explosion of triples. In fact it would look like in the following figure!
How I would model: The issuer of a coin is Titus! ... but I am uncertain!
Version 1:

```
foaf:Person
  rdf:type nm:titus

nm:coin
  rdf:type genID_1

nm:issuer
  rdf:object genID_2
  rdf:subject

un:certainty
  rdf:object
  rdf:predicate

rdf:Statement
  rdf:type
  genID_2

nm:uncertain_value
```

**Triple Explosion!**
How I would model: The issuer of a coin is Titus! ... but I am uncertain!
Version 2: ... in order to avoid triple explosion special properties could be used!

Defining un:issuer_uncertain as subproperty of nm:issuer!

Properties Explosion!
How I would model: The issuer of a coin is Titus! ... but I am uncertain!
Version 3: ... to avoid additional properties!

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How I would model: The issuer of a coin is either Titus or Nero!

Version 1:

```xml
<nm:coin rdf:type nm:issuer>
  <foaf:Person rdf:type nm:issuer />
  <nm:nero rdf:type />
  <nm:titus rdf:type />
</nm:coin>
```
How I would model: The issuer of a coin is either Titus or Nero!

Version 2:

Could also be done with a List, Bag or Alternative that are defined in RDF!
Thank you for listening!