The thought behind the symbol

About the automatic interpretation and representation of UDC numbers

Attila Piros
University of Debrecen, Hungary
The thought behind the symbol

In **classificatory subject metadata**:
- The **object** means the object of the description
- The **thought** is the resume of the object
- The **symbol** is the designation of the thought by means of a classification system

The decisions about the relevance require extracting the thought from the symbol.

Semiotic triangle from "The Meaning of Meaning" by Charles Kay Ogden and Ivor Armstrong Richards (1946).
Fundamental structures in classifications

• **Enumerative schemes** (e.g. LCC, DDC)
• **Faceted schemes** (e.g. CC, BC2)
• **Analytico-synthetic schemes** (e.g. UDC, BC1). (Broughton 2015)
  ○ Has systematic schedules with rich concept hierarchy
  ○ Has (common and special) auxiliary schedules
  ○ Has facilities for expressing complex and agglomerated subjects
UDC as an analytico-synthetic classification

• **Compound subjects**: concepts that are created by specifying basic subjects with facets. (Ranganathan 1967)
  - Special auxiliaries. Common auxiliaries. Table 1c/1h.

• **Complex subjects**: concepts that are created by joining two or more subjects on the bases of some relation. (Ranganathan 1967)
  - Relation (:) and order-fixing (::). Table 1b.

• **Agglomerated basic subjects**: concepts that are built by the "collecting together of entities into larger masses without cohesion among the components". (Neelameghan 1973)
  - Coordination and consecutive extension. Table 1a.
Compositionality

• The idea that "The meaning of a complex expression is determined by its structure and the meanings of its constituents."

• Examples of the semantic effects
  • Special and common auxiliary schedules
    • 512.54.03:531.111.5-3 – The relationship between elementary theory of various classes of groups and three-dimensional symmetry of space and time.
    • 512.54-3:531.111.5.03 – Computation technics in group theory in (investigating) the causes of phenomena in symmetry of space and time.
    • 341.232.3(519)::330.34(510) – Economic aid to China by Korea
    • 341.232.3(510)::330.34(519) – Economic aid to Korea by China
  • Auxiliary signs
    • 21+29 – Prehistoric religions and modern spiritual movements
    • 21/29 – Religious systems. Religions and faiths
    • 21:29 – The relationship between prehistoric religions and modern spiritual movements
    • 339.9(44:450) – International economical relationships between France and Italy
    • 339(44+450) – The economies of France and Italy
  • Citation order (Robinson 2003)
    • 94(410)"20"(051) – Periodicals about the history of Britain in the 21st Century
    • 94(410)(051)"20" – Periodicals from the 21st Century about the history of Britain
    • 94"20"(051)(410) – British periodicals about the history of the 21st Century
The goal of my current research

To support applications to **employ UDC**

To support the **decisions about the relevance** of UDC based subject metadata

To support the **analysis of UDC classmarks**
  • To design a **format to store UDC numbers** by retaining both their elements and their inner structure
  • To design and implement an algorithm that is able to **convert UDC numbers** into such a format by automatic means
Requirements for the format

The representation of UDC numbers
• Has to describe the whole syntactic structure of the numbers
• Has to respect all UDC rules by taking the different editions into account
• Has to be a standard, platform-independent format

The XML language was chosen as the basis of the format, because it is:
• Flexible
• Widely supported
• Easy to use
• Easy to validate
• Fits the structure of UDC numbers
The structure of composite UDC numbers

A composite UDC number can be represented as a tree. When there are multilevel relationships between its elements, their priority order is derived from the following conceptual definitions:

1. Simple numbers
2. Agglomeration of consecutive numbers. Subgrouping
3. Special and common facets
4. Phase relationships
5. Agglomeration
The structure of composite UDC numbers

[515.5+514:517]-7:528.9 Employing topological and analytic-geometrical methods in cartography

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The representation of UDC numbers

Each tree can be represented as an XML.

• The nodes of the tree are complex or single objects
• The possible object types are described by an XML Schema Definition

The XSD is available at http://piros.udc-interpreter.hu#xsd.
The representation of UDC numbers

  <ns:description xml:lang="EN">Topology and analytical geometry</ns:description>
  <ns:main_concept>
    <ns:main_table_addition>
      <ns:main_concept order="1"><ns:main_table_number number1="515.1"/></ns:main_concept>
      <ns:main_table_relation order="2">
        <ns:main_concept order="1"><ns:main_table_number number1="514"/></ns:main_concept>
        <ns:main_concept order="2"><ns:main_table_number number1="517"/></ns:main_concept>
      </ns:main_table_relation>
    </ns:main_table_addition>
  </ns:main_concept>
</ns:udc_concept>
Parsing UDC numbers by automatic means

• The automatic parsing of UDC numbers has been investigated since the 1960s (cf. Rigby 1974)
• The most comprehensive research was conducted by Gerhard Riesthuis (1998)
• A similar research has been conducted in Hungary by Gábor Mándy (2013)
Requirements for the interpreter

The next step is to implement an **interpreter** that converts UDC numbers **into the designed XML format** by

- retaining the **parts and the syntactic structure** of UDC numbers
- respecting all **UDC rules** by taking the **different editions** into account
- being fully **automatic** and **available online for** use by both humans and **programs**
  - [http://piros.udc-interpreter.hu#process](http://piros.udc-interpreter.hu#process)
- parsing the numbers in a **syntactic way**
The functioning of the program

The interpreter is an automaton that recognizes the formal language determined by the classification system.

• Input
  • The UDC number
  • The year of the UDC edition

• Output
  • The XML representation of the number or
  • An error message
Conversion to other formats

Processing XML may be too complicated for other applications, thus conversion methods to other formats have been implemented:

- HTML (display) format
- KWOC (Keyword Out of Context: list of the elements out of their context)
  - HTML
  - JavaScript Object Serialization (JSON) data-interchange format
    - Self-describing and easy to understand
    - Language-independent
    - Lightweight
Conversion to other formats

{
  "concept": "378.4.007.1", "udcEdition":"1990",
  "pref_labels":{
    "pref_label_1":{"pref_label":"University senior officials. Chancellors, principals, rectors.",
    "language":"EN"}
  },
  "udc_numbers":{
    "number_1": {"notation":"378.4", "filing":"3T7T8C", "uri":"http://udcdata.info/025169", "pref_labels":{
      "pref_label_1": {"language":"EN", "pref_label":"Higher education. Universities. Academic study" }},
    "number_2": {"notation": ".007.1", "filing":"P0T0T7T1C", "pref_labels": { "pref_label_1": { "language": "EN", "pref_label": "" }}}
  }
}
A case study

The case study was conducted based on the open data of the Digital National Library of Portugal from The European Library (TEL) Open Dataset, which contains 13,741 unique UDC notations.

• Two bugs were found
• Five unimplemented practices to build numbers
• A number of typing mistakes and number building practices that didn't respect UDC rules by the indexers
Changes in the XML

A new version (version 2.1) of the XML was released based on

• The UDC Online English (http://udc-hub.com/ )
• The case studies
• Further research of the literature

It is clearer, better documented and theoretically better established than the previous version.
Changes in the XML

The XML was completed, there is no further changes needed.

The most important changes

• The special auxiliaries were changed in order to handle even the most specific rules
• The citation order is stored for each element
• Constraints were corrected
• Handling special cases inside auxiliaries of place [place according to quadrants (161/164), measurements and dimensions (18)]
• Handling special cases inside auxiliaries of language (translations under =030.1/.9 and dialects in =...’276/’292).
• Handling the numbers of main table numbers and independent common auxiliaries on the same level
The test set

• It contains more than 700 test cases
• It can be used to test any interpreter/parser
• It will be available soon at http://interpreter-eto.rhcloud.com/#test
The evaluation of the software

• **Aligning** the software **to the XML**
• Availability through a **RESTful** interface (Representational State Transfer)
  • An architecture style for distributed hypermedia applications
  • It would help other applications to apply the interpreter easier
• **Further machine-readable output formats**
  ○ UNIMARC
  ○ RDF
Further research plans

Following the abovementioned improvements the first phase of the research will be completed.

The future research can focus on the feasible applications of the outputs of the previous phase.
Further research plans

Analyzing the experience.

- The test set can be a basis for reviewing and analyzing the current syntactic rules of UDC
- The further experience gives us a chance of examining how the revisions performed in recent years have helped in handling UDC notations
Further research plans

The outputs of the interpreter can serve as a basis for methods applying information regarding the syntactic structure of UDC numbers.

• **Quantitative studies** (cf. Smiraglia et al. 2013)
• **Similarity measurements** between composite subjects
• Developing **inference methods, searching and browsing algorithms**
• Building **permuted** and **KWIC-indexes**
• Implementing **intelligent classification interfaces**
Thank you

for your attention
References


http://ki.oszk.hu/kf/2013/04/a-posztkoordinacio-eselyei-az-eto-ban/


http://arizona.openrepository.com/arizona/handle/10150/106370


Robinson, Geoffrey. 2003. “Citation Order in UDC.” *Extensions and Corrections to the UDC* 25: 19-27.


https://arxiv.org/abs/1306.3783

9/15/2017

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Acknowledgments

• my wife, Krisztina and my daughter, Eszter
• Dr. Aida Slavic
• my PhD supervisor Dr. István Boda
• Jonathan Wild
• Daniel Benediktsson