Validating the OntoLex-*lemon* lexicography module with K Dictionaries' multilingual data

JULIA BOSQUE-GIL[1,2], DORIELLE LONKE[3], JORGE GRACIA[2], ILAN KERNERMAN[3]

[1] Ontology Engineering Group
Universidad Politécnica
de Madrid, Spain

[2] Distributed Information Systems Group. University
of Zaragoza, Spain
{jbosque,jogracia}@unizar.es

[3] K Dictionaries Ltd.
{dorielle,ilan}@kdictionaries.com

Outline

1. Introduction and motivation
2. K Dictionaries multilingual Global Series
3. Problems of past RDF representations
4. The *lexicog* module
5. Methodology
6. Applying *lexicog*
7. Conclusions

Introduction

- The set of best practices for **exposing, sharing and connecting data on the Web** referred to as **Linked Data** (LD; Bizer et al., 2009) are progressively being adopted in lexicography

- LD enhances the tendency to **standardise the ways of representation**, query and enrichment of lexical content

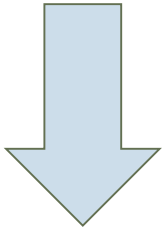
Introduction

- **Facilitating interoperability** with external resources, enhancing depth, precision and cross-linguality
- Improved features are an advantage in the emerging **multilingual digital single market**, in Europe and eventually worldwide
- Making KD data a ***golden standard*** **for LD-compliant lexicographic data** increases appeal and uniqueness in the private sector

Introduction

- **OntoLex-lemon** (McCrae et al., 2017) and its predecessor, *lemon*, have been the preferred choice by developers to convert lexicographic resources into LD

- But there are situations in which **no perfect match** is available between the elements of the model and those found in lexicographic entries



OntoLex Module for Lexicography:
lexicog

Goal

- **Validate** *lexicog* with **an actual use case** as well as to introduce some recommendations for future applications
- Examine how the **limitations** of the OntoLex-*lemon* model already **reported** in the literature with respect to KD are **successfully addressed** by the module

The data

K Dictionaries multilingual Global series

- Detailed and multi-layered lexicographic datasets
- Compiled with advanced **corpus-based** analysis tools
- Developed within a single, systematic framework
- Elaborate and robust **XML Schema** (DTD)
- Underlying **monolingual** layer can either be used on its own, or serve as a base for producing **multilingual** versions
- Complemented by idiomatic translation equivalents, individual sets can be **cross-linked** to other sets
- **25** language cores and nearly **100** language pairs

K Dictionaries multilingual Global series

Junge[1] ['jʊŋə] *nm* (*gensg* **-n**, *Nordd. umg. nompl* **Jungs**, [jʊŋs]) **1** *Nordd.*≠Mädchen; männliches Kind

{ar} - غُلَامٌ [ɣu'la:mun] *m sg*, وَلَدٌ ['waladun] *m sg*

◊ *als ich noch ein kleiner Junge war*

{ar} - حينما كنت لا أزال غلامًا صغيرًا .

2 *coll*=Kerl, Bursche; (junger) Mann

{ar} - فَتًى ['fata:] *m sg*, شَابٌّ ['ʃa:bbun] *m sg*

◊ *Der neue Lehrling ist ein tüchtiger Junge.*

{ar} - المتدرّب الجديد شاب كفء .

♦ **Junge, Junge!** drückt Staunen oder Bewunderung aus

{ar} - يَا لَلْعَجَبِ [ja: la-l-'ʕadʒabi] -

Junge[2] ['jʊŋə] *nmt* (*gensg* **-n**, *nompl* **-n**) *zool* sehr junges Tier

{ar} - صَغِيرُ الْحَيَوَانِ [sˁa'ɣi:ru l-ħaja'wa:ni] *m sg*

◊ *Unsere Katze hat Junge bekommen.*

{ar} - ولدت قطتنا قططًا صغيرةً .

Problems of past RDF representations of KD's data

- Previous conversions of KD Global series **monolingual** data with the **lemon** model (Klimek & Brümmer, 2015):
  - **Lexical relations** (e.g. compositional phrases and their relation to the elements embedding them)
  - Lack of **ontological references** for `lemon:LexicalSense` instances
  - Gaps in LexInfo, high amount of **ad-hoc** classes
- OntoLex-*lemon* (2016) providing **new classes** and **relations**

Problems of past RDF representations of KD's data

- Previous conversions of KD Global series multilingual data with the OntoLex-*lemon* model (Bosque-Gil et al. 2016a)
  - Part of **LDL4HELTA**
  - **Round-tripping** condition

Problems of past RDF representations of KD's data

1. Loss of **structural information** reflecting lexical distinctions
2. Lack of elements for the **annotations** in the microstructure
3. Lack of **guidelines** for the application of OntoLex-*lemon* for lexicographic content
4. **Mismatches** between LexInfo elements and KD's DTD tags and values

The model

Aim

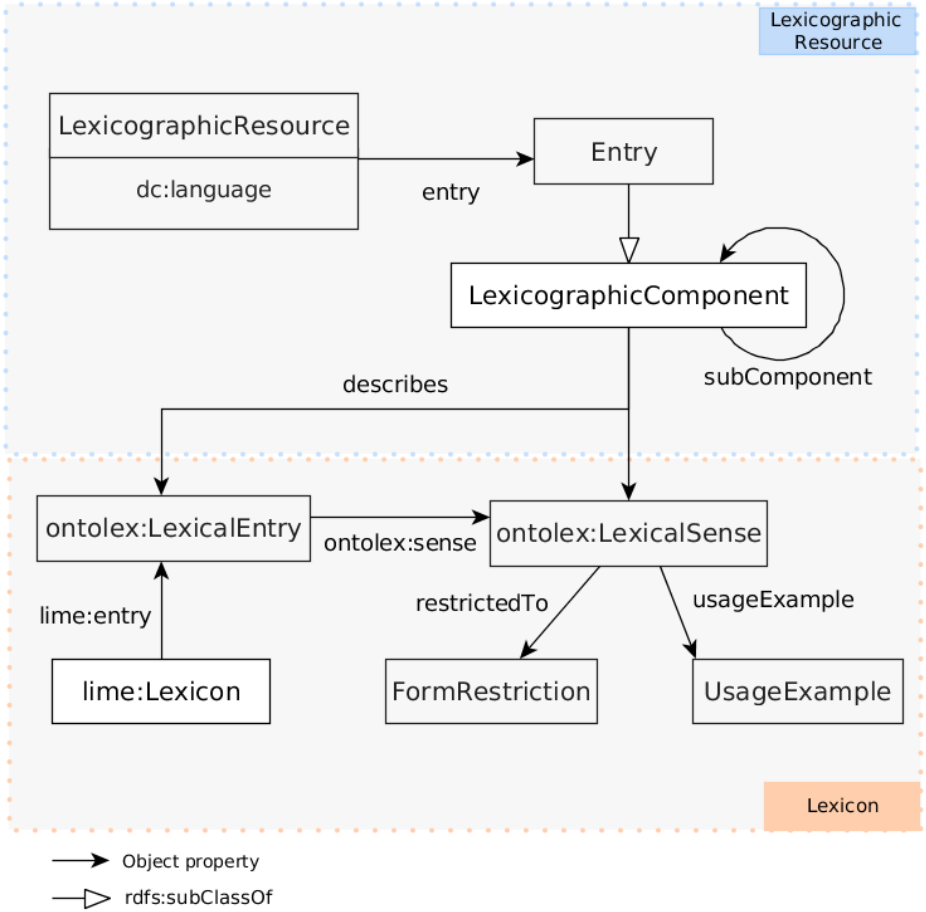
Modelling existing lexicographic resources as LD by...

overcoming the limitations of OntoLex when modelling lexicographic information as LD in a way that is **agnostic to the underlying lexicographic view** and minimises information loss

Aim

Modelling existing lexicographic resources as LD by...

providing a **model of linguistic objects in lexicography** to capture the underlying **original structure and annotations** of the lexicographic entry in a way that keeps the purely **lexical** content **separate from** the **lexicographic** one


Lexicographic Resource
LexicographicResource
dc:language
entry
Entry
LexicographicComponent
subComponent
describes
ontolex:LexicalEntry
ontolex:sense
ontolex:LexicalSense
lime:entry
restrictedTo
usageExample
lime:Lexicon
FormRestriction
UsageExample
Lexicon
Object property
rdfs:subClassOf

The methodology

Methodology

- An **incremental approach** was taken, starting with the basics of a single entry and gradually adding more complex elements
- Prior to conversion, each XML path was **mapped** to a corresponding LD element
- After the mapping stage, a **URI naming strategy** was established

Identifying entities | Automatic conversion | Validation

JSON Schema

- ✓ Checks that the predicates are in place and that **the correct relations occur**
- ✓ Checks that **all necessary information is present** and that nothing was left out during conversion
- ✓ Checks that **only relevant information is present** by limiting what could appear in the document
- ✓ Checks that the **URIs are well-defined** using Regular Expressions

JSON Schema

```
"title": "lexicog:entry instance",
"description": "a single dictionary entry belonging to a lexicographic resource",
"bsonType": "object",
"properties": {
    "@id": {
        "description": "lexicog:Entry URI",
        "bsonType": "string",
        "pattern": "^kd-base:DE[0-9]{8}$"
    },
    "@type": {
        "bsonType": "string",
        "enum": [
            "lexicog:Entry"
        ]
    },
    "lexicographicEntryIn": {
        "description": "reversed predicate - lexicog:entry",
        "bsonType": "object",
        "properties": {
            "@id": {
                "description": "lexicog:LexicographicResource URI",
                "bsonType": "string",
                "pattern": "^kd-base:mlds-[A-Z0-9]+"
            },
            "@type": {
                "bsonType": "string",
                "enum": [
                    "lexicog:LexicographicResource"
                ]
```

The instantiation

Data example

arte ['arte] *nm/f* **1** =inspiración; manifestación humana con intención estética
{nl} - kunst *de*
{no} - kunst *m*
{br} - arte *f*
{ja} - 芸術（げいじゅつ） geejutu
{dk} - kunst *common*
{sv} - konst *u* , konstart *u* , konstverk *nt*
{en} - art
◊ *La música, la danza y la pintura son formas de arte.*
{nl} - *Muziek, dans en schilderen zijn vormen van kunst.*
{no} - *Musikk, dans og maling er kunsttyper.*
{br} - *A música, a dança e a pintura são formas de arte.*
{ja} - *音楽（おんがく）、舞踊（ぶよう）、絵画（かいが）は芸術（げいじゅつ）の一端（いったん）だ。 Ongaku, buyoo, kaiga wa geejutu no it-tan da.*
{dk} - *Musikken, dansen og billedkunsten er kunstarter.*
{sv} - *Musik, dans och måleri är konstarter.*
{en} - *Music, dance and painting are art forms.*
◊ *Distintas formas de arte han acompañado siempre a la humanidad.*
{dk} -
{sv} -
{en} -
{br} -
♦ <tipo de arte> **artes plásticas** artes que utilizan el dibujo o el volumen: la pintura, la escultura y la arquitectura

lexicog:Entry vs ontolex:LexicalEntry

SOURCE (Spanish Dictionary)

- Dictionary Entry: *arte* (art)
- Embedded compositional phrase: *artes plásticas* (fine arts)
- Embedded synonym: *inspiración* (inspiration)

lexicog:Entry vs ontolex:LexicalEntry

:mlds-ES3 a **lexicog:LexicographicResource**;
  dc:language "es" ;
  lexicog:entry :ES_DE00005536 .

:ES_DE00005536 a lexicog:Entry ;
  lexicog:describes :lexiconES/arte-n .

:lexiconES/arte-n a ontolex:LexicalEntry . :lexiconES/artes-plásticas-n a ontolex:LexicalEntry . :lexiconES/inspiración-n a ontolex:LexicalEntry .
:lexiconES a lime:Lexicon;
  lime:entry :lexiconES/arte-n, :lexiconES/artes-plásticas-n, :lexiconES/inspiración-n .

Nested entries

SOURCE (German Dictionary)

- Dictionary Entry: *besuchen* (visit. v), *Besuch* (visit. n), *Besucher* (visitor).
- An element <NestEntry> grouping them together

Nested entries

:lexiconDE/besuchen-v a ontolex:LexicalEntry .
:lexiconDE/Besuch-n a ontolex:LexicalEntry . :lexiconDE/Besucher-n a ontolex:LexicalEntry .
:lexiconDE a lime:Lexicon; lime:entry :lexiconDE/besuchen-v, :lexiconDE/Besuch-n, :lexiconDE/Besucher-n.

:mlds-ES3 **lexicog:entry** :DE_DE00003297, :DE_DE00003298, :DE_DE00003299 .

:DE_EN00002666 a **lexicog:LexicographicComponent** ; **rdfs:member** :DE_DE00003297, :DE_DE00003298, :DE_DE00003299 .

Usage examples and their translations

SOURCE (Spanish Dictionary)

- A sense with usage examples
- Each example in the source language has in turn a translation into the target language

Usage examples and their translations

```
:lexiconES/arte-n-SE00007455-sense a ontolex:LexicalSense ;
        lexicog:usageExample
                :lexiconES/arte-n-SE00007455-sense-TC00017355-
ex .

:lexiconES/arte-n-SE00007455-sense-TC00017355-ex a
        lexicog:UsageExample ;
    rdf:value "La música, la danza y la pintura son formas de
                        arte."@es ;
    rdf:value "Muziek, dans en schilderen zijn vormen van
                    kunst."@nl .
```

Conclusion

Conclusion

- *lexicog* addresses the loss of **structural and lexical information in the original resource**, and provides elements to capture data frequently found in lexicographic records
- An **incremental approach + a JSON schema** → a solid first output to manually validate in subsequent steps towards a flawless conversion and linking to other sources
- Future work: cross-lingual **linking** between different KD cores and to external resources

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