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Etytree: A Graphical and Interactive Etymology Dictionary Based on Wiktionary

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ABSTRACT

We present etytree (from etymology + family tree): a new on-line multilingual tool to extract and visualize etymological relationships between words from the English Wiktionary. A first version of etytree is available at http://tools.wmflabs.org/etytree/

With etytree users can search a word and interactively explore etymologically related words (ancestors, descendants, cognates) in many languages using a graphical interface. The data is synchronised with the English Wiktionary dump at every new release, and can be queried via SPARQL from a Virtuoso endpoint.

Etytree is the first graphical etymology dictionary, which could be used to search specific etymological definitions as well as to discover new relations among words. Moreover, it can be effectively adopted by Wiktionary editors to identify inconsistencies or missing information in the data.

Keywords
etymology; Wiktionary; natural language processing; d3.js

1. INTRODUCTION

Etytree is a new tool to extract and visualize etymological relationships between lexemes (or words, for simplicity) using data coming from the English Wiktionary. The interest of this tool lies in its potential for Wiktionary users, editors and for researchers or more generally people interested in languages and etymologies.

It is built on top of DBnary[1] which extracts word Definitions, Parts of Speech, Synonyms, and other lexical information from Wiktionary pages. Etytree extends DBnary with a new method[1] that parses Etymology, Derived terms, Descendants sections, the namespace for Reconstructed Terms, and the etymtree template in Wiktionary.

With etytree, a RDF (Resource Description Framework) lexical database of etymological relationships collecting all the extracted relationships and lexical data attached to lexemes has also been released. The database consists of triples or data entities composed of subject-predicate-object where a possible statement can be (for example) a triple with a lexeme as subject, a lexeme as object, and “derivesFrom” or “etymologicallyEquivalentTo” as predicate. The RDF database has been exposed via a SPARQL endpoint and can be queried at http://etytree-virtuoso.wmflabs.org/sparql.

Etytree provides a graphical interface to the database which consists in an intuitive and multilingual graphical etymology dictionary. The graphical etymology dictionary represents the extracted etymological relationships as well as the associated lexical information using graphs and tooltips, respectively. It uses d3.js[3] a JavaScript library for manipulating documents based on data, and infers the tree structure from the RDF database on the fly through specific queries from the Virtuoso[2] SPARQL endpoint.

With etytree, users can discover new words when they search for a specific etymological definition, e.g., they can discover words that derive from the same ancestral word, both in their own language and in other languages. This happens in an intuitive way without having to read fairly long and complex sentences that describe etymological relationships between words and without the need to navigate across multiple Wiktionary pages. Moreover, with the visualization of the etymological tree, editors can easily spot inconsistencies between etymological relationships described across multiple Wiktionary pages. Finally, researchers can use the database of etymological relationships to study etymologies on a large scale. Potentially, they could extend the database of etymological relationships to include semantics or pronunciations, to study how they evolved through time across etymological trees and across languages.

[1]The extended version of DBnary is available at
https://bitbucket.org/esterpantaleo/dbnary_etymology
https://d3js.org/
https://virtuoso.openlinksw.com/
Figure 1: A screenshot of the interactive visualization produced by etytree for the English word “gorgeous”. From the graph it is possible to see that the English words “gorgeous”, “disgorge”, “gorget”, and archaic words “gorge” and “engorge” are etymologically related.
A project similar to etytree is Etymological Wordnet\footnote{WWW.ICSI.BERKELEY.EDU/~DEMELO/ETYMN/} or etymtree\footnote{See https://EN.WIKTIONARY.ORG/WIKI/TEMPLATE:ETYMN/} which is, unfortunately, neither publicly available nor maintained anymore.

2. THE MODEL

The etytree extraction tool uses regular expressions and parsing of both Wiktionary\footnote{WikiText} templates and links. It assumes a standard structure for the different sections containing etymologies, i.e., the Etymology section, the Derived terms section, the Descendants section, the namespace with Reconstructed Terms (still in the works), the etymtree template\footnote{Where FROM can be any of the following:
"[Fl]room", "[B]lack-formation (?:\?from)?", "[A]bbreviation(?:\?ion|ed)? (?:\?of|from)?", and many more, LANGUAGE corresponds to the etyl template, LEMMA corresponds to different templates in practice (e.g. m, 1, etc, generally embedding lexemes) or wiki links, COMMA corresponds to ",", DOT corresponds to ".", or ";", and OR corresponds to "or" (neither followed nor preceeded by a character).}.

2.1 Etymology sections

Figure\footnote{See https://EN.WIKTIONARY.ORG/WIKI/TEMPLATE:ETYMN/} presents a screenshot of the Etymology section of English word “gorgeous” in English Wiktionary. The same section in the xml dump (our data source) as well as in the edit tab of the online English Wiktionary is:

```markdown
===Etymology===
From Early Modern English {{m[en]gorgeous}}, {{m[en]gorgeous}} from {{etylfrm[en]}} {{m[en]gorgeias(elegant, fashionable)\}}, from {{etyl[en]}}{{m[en]gorgeias\}}, {{m[en]gorgeias\}} gorgeous, gaudy, flaunting, gallant, fine\}, of uncertain formation, but apparently connected with {{cog[en]gorgeias\}} a gorget, ruffe for the neck\)}, from {{etyl[en]}}{{m[en]gorgeia\}}{{m[en]gorgeias\}}bosom, throat}}. See {{{m[en]gorgeia\}}. Sense evolution was probably that of “swelling of the throat or bosom due to pride, bridling up” to “assume an air of importance, flaunting”.

After inspection of many different Etymology sections we inferred a set of recurrent patterns that we constructed using regular expressions. The most common pattern is:

(FROM ?\{LANGUAGE LEMMA \{LEMMA \}(COMMA \{DOT \}OR )

Using this pattern plus a set of rules we extract etymological relationships into a RDF database. In what follows we present some examples of rules that we use.

If we find a match to the pattern above with DOT or OR in the last group, we ignore all the text following the match. We ignore anything after a dot (DOT) because generally Etymology sections are phrases. For example “until the cows come home” has the following Etymology section:

```markdown
===Etymology===
Originally a [[patronymic]] from {{s[uffx]David[en]}}\{lang=da\}.
```

and clearly “patronymic” here is not etymologically related to “Davidson”. In this particular case, a standard that encourages the use of links to the glossary for words like “patronymic”, i.e. [[[Appendix:Glossary##patronymic]patronymic]], and for “ablative”, “zero-grade”, etc.) in Etymology sections would help automatic data extraction.

Other lexemes that usually have non-standard Etymology sections are phrases. For example “until the cows come home” has the following Etymology section:

```markdown
===Etymology===
Possibly from the fact that [[cattle]] let out to pasture may be only expected to return for milking the next morning; thus, for example, a party that goes on “until the cows come home” is a very long one. Alternatively, the phrase may have a Scottish origin.\<\ref>See, for example, \{{cite-web\}}\{title=Till the cows come home\}\{url=http://www.phrases.org.uk/meanings/382900.html\}\{archiveurl=https://web.archive.org/web/20160611134612/\}\} and may derive from the fact that cattle in the [[Sc[ottish Highlands|Highlands]] are put out to graze on the [[common#Noun|common]] grass is plentiful. They
```

Also we use a pattern to match compounds, i.e., sentences like

`{\{m[en]door\}+{\{m[en]bell\}}
```

or

```
Compound of \{m[en]door\} and \{m[en]bell\}
```

Whenever we find a match to a compound pattern, we ignore everything after the match, as there is no standard for the etymology of compound words.

While the selected patterns generally correctly reflect real patterns (as Etymology sections use very well defined standard\footnote{Namely “[Ss]uperceded”, v[Dd]isplaced (? native)?", “[Rr]eplaced", “[Mm]odeled on", and more.}, some etymologies are written in non-standard ways, which implies that the corresponding extraction is incorrect (or partially incorrect). We are trying to interact with the community of editors of English Wiktionary to better understand the standards they use and to encourage the use of more standards that would allow the community to have a lower amount of data loss and a lower rate of incorrectly extracted etymological relationships.

One example of non-standard Etymology sections uses links instead of templates to represent words that are etymologically related (e.g. \{[door]\} instead of \{m[en]door\}). This is a major problem because in Etymology sections words with links often correspond to descriptive words or glossary, for example the Etymology section of “Davidson” is:

```markdown
===Etymology===
```

SUPERSEDED BY or COGNATE TO

1637
gorgeous

Contents

1 English
  1.1 Etymology
  1.2 Pronunciation
  1.3 Adjective
    1.3.1 Translations
    1.3.2 Synonymes
    1.3.3 Derived terms
    1.3.4 See also

English

Etymology

From Early Modern English *gorgeous, gorgeous*, from Middle French *gorgies* ("elegant, fashionable"), from Old French *gourgius, gories* ("gorgeous, gaudy, flaunting, gallant, fine"), of uncertain formation, but apparently connected with Old French *gorgies* ("a gorget, ruffle for the neck"), from Old French *gorge* ("bosom, throat"). See *gorge*. Sense evolution was probably that of "swelling of the throat or bosom due to pride, bristling up" to "assume an air of importance, flaunting".

Figure 2: A screenshot of the English entry “gorgeous” in the English Wiktionary
stay out for months before scarcity of food causes them to find
their way home in the autumn for feeding.

we propose to add template (for example {{{detailed etym-
ology}}}) before long descriptive etymologies that don’t have
a standard chain of etymological relationships which would
signal to the extraction algorithm to ignore that section.

In the current version, etytree parses links like [[cattle]] in
the Etymology section above as an ancestor of “until the cows
come home” and therefore infers an incorrect etymological
relationship. We decided to keep those links for now, as we
hope that editors will fix those entries and set a clear
standard in the structure of Etymology sections.

2.2 Derived terms sections

Derived terms sections are pretty standard with some ex-
ceptions. Below we copy the Derived terms section of En-
lish “gorgeous”, which is representative of how Derived terms
sections are usually structured:

====Derived terms====
* {{|en|gorgeously}}
* {{|en|gorgeousness}}

2.3 Descendants sections

Descendants sections also are written in a standard way
(with some exceptions). Below we copy the (beginning of
the) Descendants section of Latin “aqua”:

====Descendants====
* Eastern:
  ** Aromanian: |rup|apă
  ** Istro-Romanian: |ruo|ape
  ** Megleno-Romanian: |ruq|apu
  ** Romanian: |ro|apă
* Franco-Provençal: |frp|aïva
* Gallo-Italian:
  ** Emilian: |leg|aqua
  ** Ligurian: |l|aqua, |l|aqua
  ** Lombard: |lmo|aqua, |lmo|aqua
  ** Piedmontese: |lpm|eacva
  ** Romagnol: |lrg|aqua, |lrg|açva
  ** Venetian: |vec|aqua

2.4 Appendix with reconstructed words

Reconstructed terms are words, roots, or phrases that are
not attested but have been reconstructed by linguists and are
conventionally identified with an initial asterisk. They are
defined in the namespace Reconstruction (see for example
entry “h₂kʷch₂” defined at https://en.wiktionary.org/
wiki/Reconstruction:Proto-Indo-European/h₂E₂/kʷE₂|
C₁šAŠ/kCW7eh/E₂E₂/k₂/82) and are structured similarly to
regular Wiktionary entries.

2.5 etytree template

The etytree template is a template used in Wiktionary
to describe etymological trees and reflects the structure of
the Descendants sections.

3. THE DATABASE

The database is installed on the Wikimedia Labs, the
Wikimedia Foundation’s cloud computing environment. It
is managed by Virtuoso version 07.20.3217 on Linux.
The extracted database consists of 6 million distinct
entries (6023380) in 3365 languages, with Latin having the
highest number of entries (around 13% or 806999 entries),
followed by English (9% or 547506), Italian (8.5% or 515059),
Spanish (7% or 419889), Russian (5.5% or 331798), French
(5% or 305973), Portuguese (4% or 244784), German (3% or
185520).

With appropriate queries to the SPARQL endpoint we can
ask interesting questions.

For example, we can ask which languages English words
derive from. The extracted English words derive mostly
from other English words (2702), Middle English words (1152),
Latin words (1116), French words (832), Old French words
(715), Italian words derive mostly from Latin words (1132),
Italian words (457), Spanish words (358), French words (147),
Greek words (118). French words derive mostly from Latin
words (2190), Middle French (1185), Old French (995), French
(982), Italian words (584).

We can also ask Virtuoso to list the most connected en-
tries. The most connected entries are affixes, namely English
“-ly” (7070 connections), “non-“ (6900 connections), “un-“
(6873), “-ness” (5312). The most connected French affix is
“-ment” (2573). Hungarian “-ok-” (2054), “-ek-“ (1809), “-k-”
(1821) and Italian “-mente” (2035), “-ti” (1670) are the
most connected affixes in their respective languages.

The most connected entries that are not affixes are English
lemmas “man” (353 connections), “back” (303), “head” (290),
followed by “work”, “house”, “wood”, “land”, “line”. These
highly connected nodes slow down queries launched by the
visualization tool. We are currently working on the design
of more efficient queries given the available data.

4. CONCLUSIONS

We have presented etytree, a tool to visualize etymological
relationships between words in the form of a connected
graph. The tool is currently under development but a first
working release is available at http://tools.wmflabs.org/
etytree/etymology/сосourse/dbc/4/index.html.

This tool can be a valuable resource for people that are
interested in the history of words or words in general as
they can discover new words in other languages that are et-
ymologically related to the searched words, as well as for
etymology enthusiasts, as they can explore etymological re-
lationships in a completely new way. Also we believe that
the database can be a valuable resource for linguists as they
can study etymologies on a much larger scale.

Because of its nature, we believe this work will attract new
users to Wiktionary and will improve as well as increase
its content. We also believe it will encourage Wiktionary
editors to use more standard rules to format etymologies.
We hope that this project will help to turn the whole Wik-
tionary into a machine readable resource with the minimum
possible loss of information.

Because of the complexity of the original data contained
in Wiktionary (especially the complexity of Etymology sections)
the extracted database contains some incorrect en-
tries. We hope that users will contribute to Wiktionary to
spot those inconsistencies. We would like to work together
with them to improve even more Wiktionary Etymology sec-
tions and to improve etytree simultaneously.
The project has the potential to grow in both content and quality as it is open source and relies on data coming from a collaborative and multilingual resource as Wiktionary.

5. FUTURE DEVELOPMENTS

As the structure of etymological trees (or graphs) is language independent, this project could be extended to use etymological relationships described in other language versions of Wiktionary, although Etymology sections seem rather incomplete/informal in other languages (Russian might be the next target language).

In addition, as the textual part of the tree (definition of words, language tags, etc.) can be exported from different language versions of Wiktionary, this tool can easily become available in different languages, thus considerably extending its scope.

Last, this tool can be integrated into Wikidata when the Wikidata-for-Wiktionary proposal turns into production.

6. ACKNOWLEDGMENTS

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7. AUTHOR CONTRIBUTIONS

Ester Pantaleo conceived the idea and developed the tool, Tommaso Di Noia contributed to the research project with monthly meetings, Gilles Sérasset helped integration with DBnary and provided some computational resources, Vito Walter Anelli helped formulating appropriate queries to the Virtuoso DBMS. Everyone participated in the writing of this paper.

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