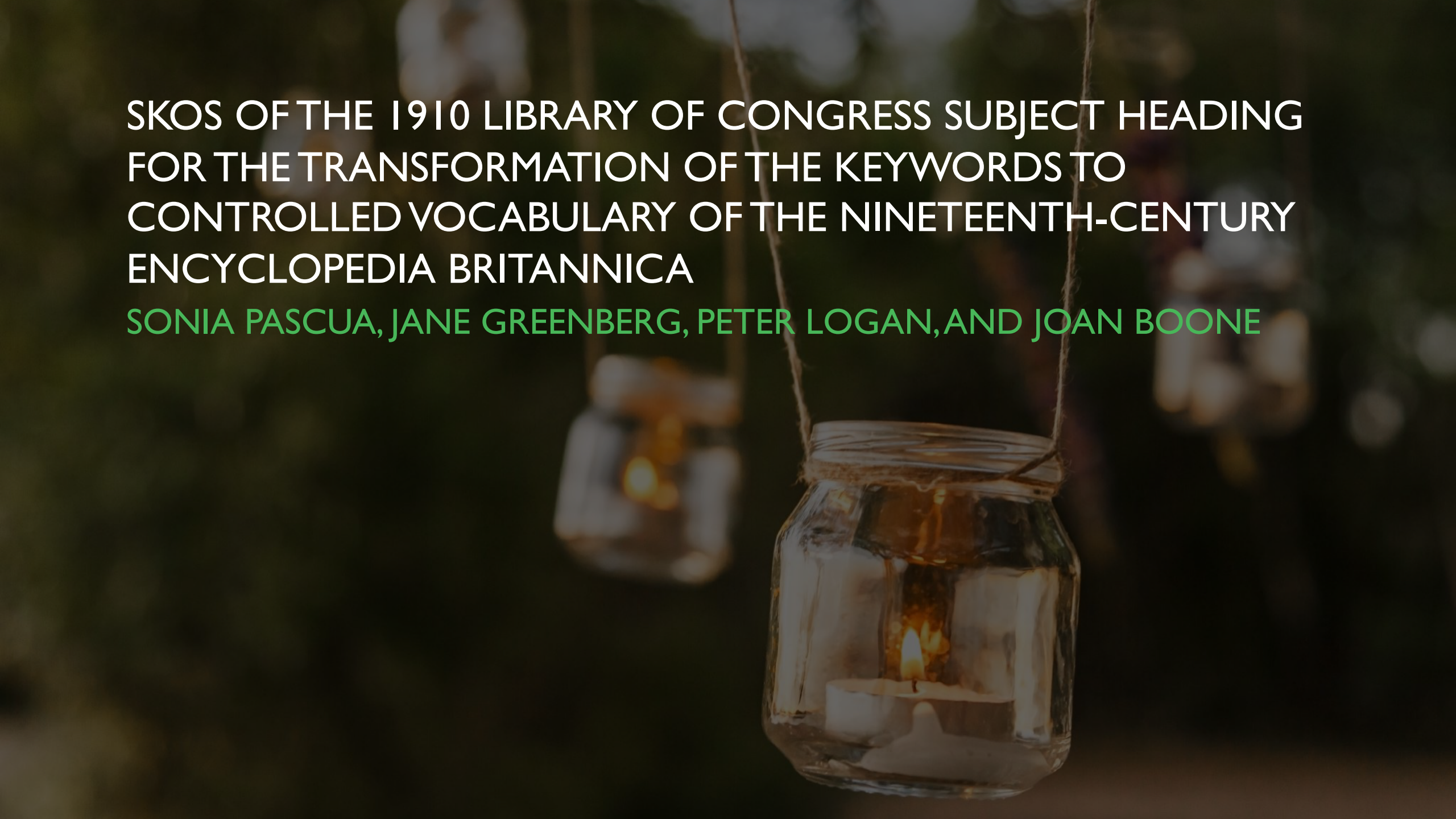


# SKOS OF THE 1910 LIBRARY OF CONGRESS SUBJECT HEADING FOR THE TRANSFORMATION OF THE KEYWORDS TO CONTROLLED VOCABULARY OF THE NINETEENTH-CENTURY ENCYCLOPEDIA BRITANNICA

SONIA PASCUA, JANE GREENBERG, PETER LOGAN, AND JOAN BOONE

# OUTLINE

Introduction

Background and Motivation

Statement of the Problem

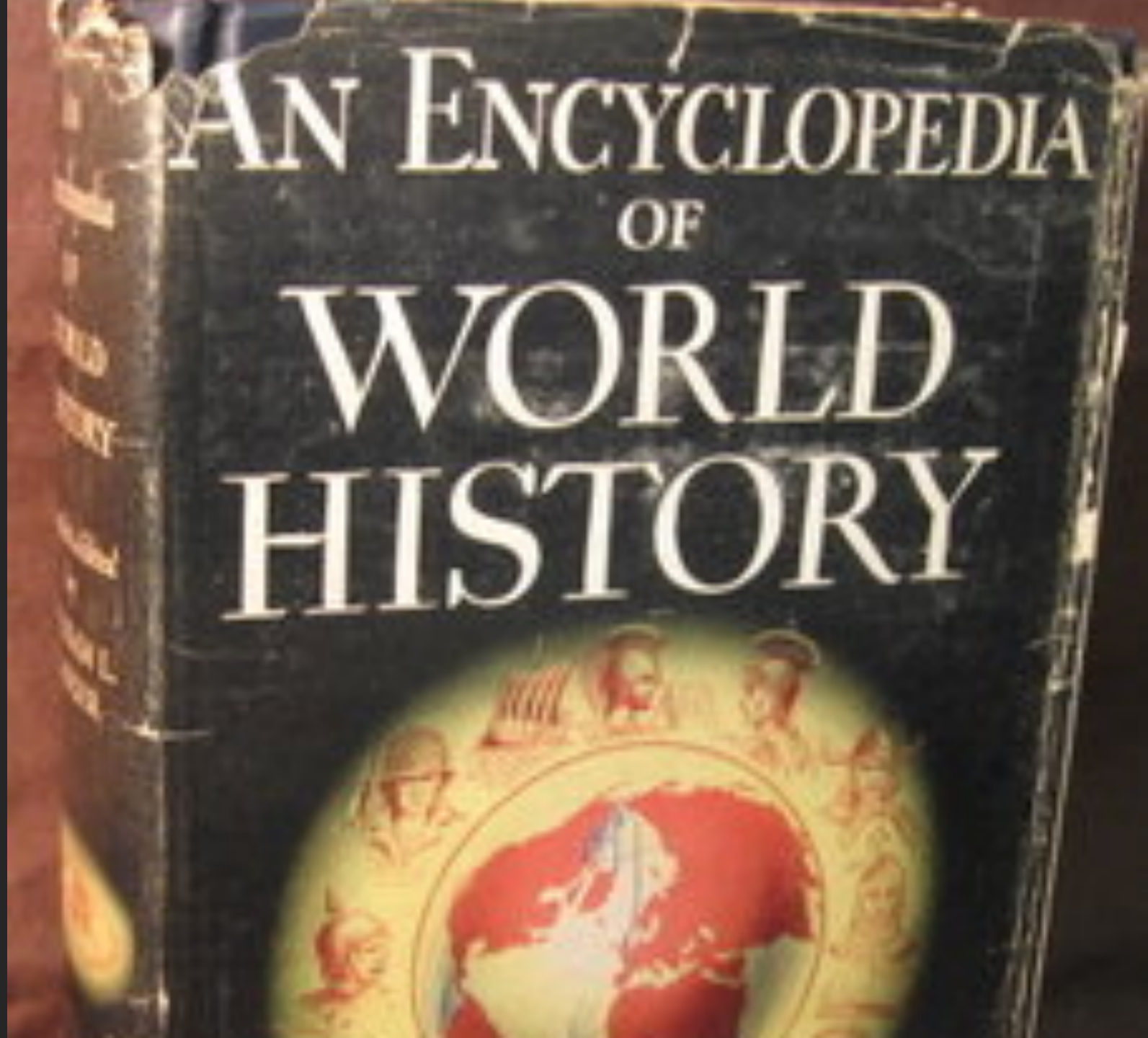
Methodology

Results and Findings

Conclusion

# INTRODUCTION

"ENCYCLOPEDIA," AS A GENRE, IS A SIGNIFICANT RESOURCE FOR RESEARCHERS ACROSS THE HUMANITIES, ARTS, AND SCIENCES.






# INTRODUCTION

RESEARCHERS CAN USE ENCYCLOPEDIAS PRODUCED DURING EARLIER TIME-PERIODS FOR STUDY BECAUSE THEY PROVIDE ACCOUNTS NOT ONLY OF HISTORY BUT ALSO EVIDENCE OF HOW KNOWLEDGE WAS PERCEIVED AND ORGANIZED.



# INTRODUCTION - ENCYCLOPEDIA

Reference work → Summaries of knowledge → Contains lexicon and vocabulary

Supplies scholars with rich info → Enables researchers to mine historical knowledge

# BACKGROUND OF THE STUDY


Digital Scholarship Center (DSC) of Temple University Libraries

The 19th Century Knowledge Project is digitizing historical editions of the Encyclopedia Britannica (1797-1911)

This initiative will offer one of the most extensive, open, digital collections available today for studying the structure of 19th-century knowledge and its transformation

DREXEL UNIVERSITY
Metadata Research Center
College of Computing & Informatics

NATIONAL ENDOWMENT FOR THE Humanities

The metadata activities are being pursued through a collaboration with the Metadata Research Center (MRC) at Drexel University, supported by the U.S. National Endowment for the Humanities (NEH).

MRC researchers are pursuing automatic methods of providing subject access for the Encyclopedia Britannica entries

# WHY SKOS?

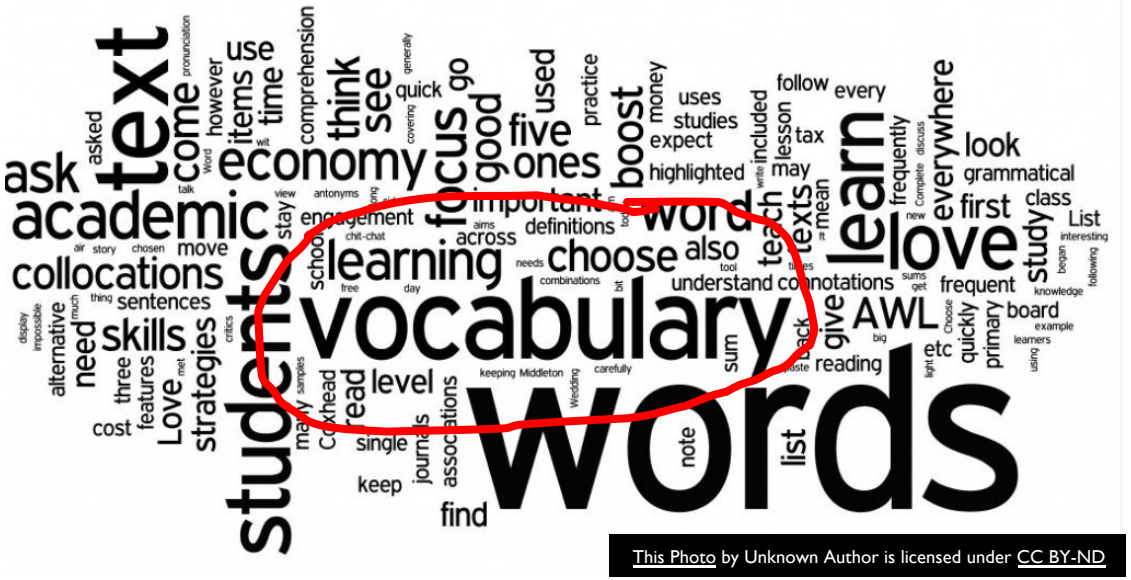
- Simple Knowledge Organization System is an area of work developing specifications and standards to support the use of knowledge organization systems (KOS) such as thesauri, classification schemes, subject heading systems and taxonomies within the framework of the Semantic Web.

# WHY SKOS?

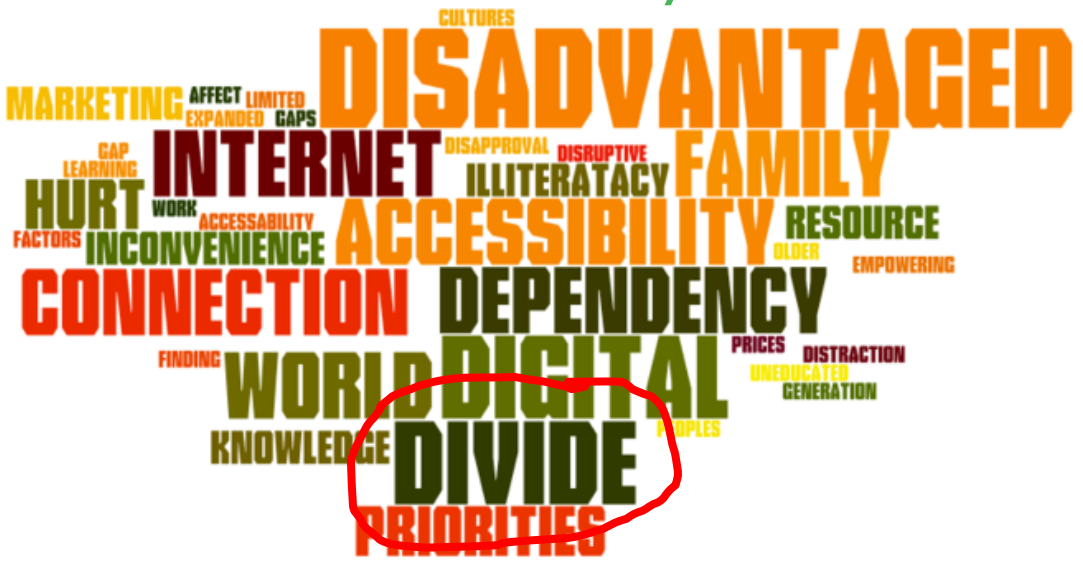
- SKOS & RDF
- SKOS provides a standard way to represent knowledge organization systems using the Resource Description Framework (RDF). Encoding this information in RDF allows it to be passed between computer applications in an interoperable way.

- Using RDF also allows knowledge organization systems to be used in distributed, decentralised metadata applications. Decentralised metadata is becoming a typical scenario, where service providers want to add value to metadata harvested from multiple sources.

# Exploration using the 1910 version of LCSH in transforming the keywords of the 19th Century Encyclopedia Britannica to a controlled vocabulary








## STATEMENT OF THE PROBLEM

- Vocabulary divide –some terms found in the 19th Century Knowledge Project are not represented in the current version of the LCSH (2016) due to deprecation
- LCSH updates represent new technical, scientific, and sociological ideas that are not recorded in the historical versions of the Encyclopedia.

# Conceptual Model for the Encyclopedia Britannica Controlled Vocabulary

Simple Knowledge Organization System

HIVE

| Digitization | SKOS | Hive Integration |
|---|---|---|
| OCR | XML | Python |
| DocX | RDF | Rake |

METHODOLOGY

SKOS of 1910 Library of Congress Subject Heading

Automatic Indexing

Subject Cataloging

Articles of 19th Century Encyclopedia Britannica

=

Encyclopedia Britannica Controlled Vocabulary

SKOS of the 1910 LCHS for the Transformation of Keywords to Controlled Vocabulary of the 19th Century Encyclopedia Britannica

# APPROACH

Exploration – the current data set (in Docx) is explored and converted to different format – RDF/XML, relational tables, TEI for testing and evaluation

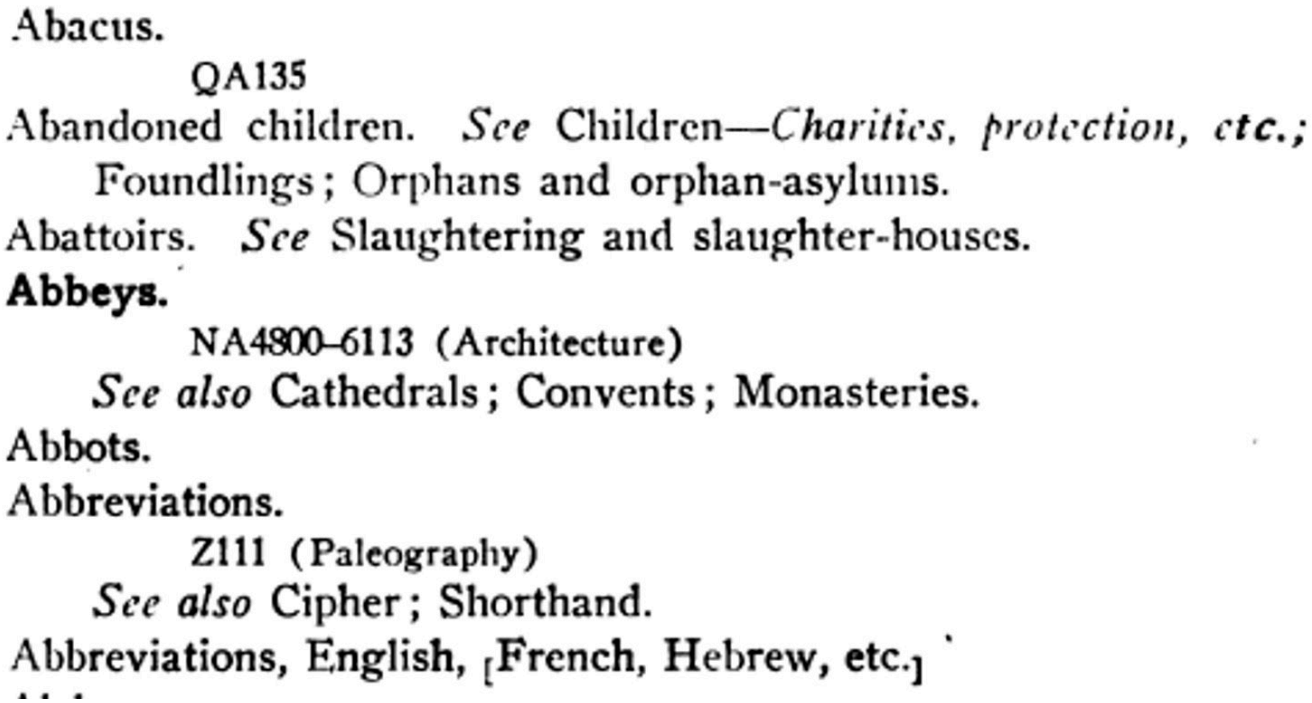
Testing – different platform is tried for evaluation of alternative solution

Evaluation – based from the results of different implementations, best solution is chosen

Documentation – Technical manual, paper and codes are prepared as deliverables

# METHODS

- Digitization – The 1910 LCSH provided in the project was in Docx and TEI version
- Encoding – Codes in Python were written including parsers to convert the TEI to RDF/XML format and def function to connect and create the 1910 LCSH database and insert records that built the 1910 LCSH schema.
- Programming
  - Characterizing the states and nature of the entries to define the objects
  - Enumerating the patterns for composition of the conditional statement
  - Data set was generated raw from the OCR process, thus the pattern was hardly identified for logic formulation.
- Digitalization – (Application Profiles) MultiTes and Python Program
  - MultiTes usage which was manual in process but yields 98% accuracy in terms of representation
  - Building of a program (Python) to automate the SKOS creation from TEI format to RDF/XML format. This yielded higher percentage of error which were identified from the inconsistencies found in the evaluation conducted when the control structures of the program were constructed. Further investigation could verify the percent error yield once compared to MultiTes version of SKOS RDF/XML.
- Metadata – Representation of SKOS elements to respective fields of the HIVE database. Tables are confined to BROADERS, RELATED and CONCEPT which has the following fields: ConceptURI, PrefLabel, AltLabel and ScopeNotes. USE, USE FOR, BT and NT are not represented because HIVE database has no provision for them.



Abacus.
QA135
Abandoned children. *See* Children—*Charities, protection, etc.;* Foundlings; Orphans and orphan-asylums.
Abattoirs. *See* Slaughtering and slaughter-houses.
**Abbeys.**
NA4800–6113 (Architecture)
*See also* Cathedrals; Convents; Monasteries.
Abbots.
Abbreviations.
Z111 (Paleography)
*See also* Cipher; Shorthand.
Abbreviations, English, [French, Hebrew, etc.]

# RESULTS AND FINDINGS

DOCX AND TEI FORMAT OF THE 1910 LIBRARY OF CONGRESS SUBJECT HEADINGS

```
<?xml version="1.0" encoding="utf-8"?>
<rdf:RDF
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:skos="http://www.w3.org/2004/02/skos/core#"
>

<skos:Concept rdf:about=http://mysite.com/#Abacus><prefLabel>Abacus</prefLabel>
<skos:notes>     QA135
</skos:notes>
</skos:Concept>
<skos:Concept rdf:about=http://mysite.com/#Abandoned children><prefLabel>Abandoned children</prefLabel>
<USE>Abandoned children.</USE>
</skos:Concept>
<skos:Concept rdf:about=http://mysite.com/#Abattoirs><prefLabel>Abattoirs</prefLabel>
<USE>Abattoirs.</USE>
</skos:Concept>
<skos:Concept rdf:about=http://mysite.com/#Abbeys><prefLabel>Abbeys</prefLabel>
<skos:notes>     NA4800-6113 (Architecture)
</skos:notes>
<RT>Cathedrals ; Convents ; Monasteries.</RT>
</skos:Concept>
<skos:Concept rdf:about=http://mysite.com/#Abbots><prefLabel>Abbots</prefLabel>
</skos:Concept>
<skos:Concept rdf:about=http://mysite.com/#Abbreviations><prefLabel>Abbreviations</prefLabel>
<skos:notes>     Z111 (Paleography)
</skos:notes>
<RT>Cipher ; Shorthand.</RT>
</skos:Concept>
<skos:Concept rdf:about=http://mysite.com/#Abbreviations, English, [French, Hebrew, etc><prefLabel>
Abbreviations, English, [French, Hebrew, etc</prefLabel>
</skos:Concept>
<skos:Concept rdf:about=http://mysite.com/#Abdomen><prefLabel>Abdomen</prefLabel>
<skos:notes>     QM543 (Regional anatomy)
</skos:notes>
<RT>Groin; Intestines; Kidneys; Liver; Peritoneum; Stomach.</RT>
</skos:Concept>
<skos:Concept rdf:about=http://mysite.com/#Abdomen—Diseases><prefLabel>Abdomen—Diseases</prefLabel>
<skos:notes>     RC941
</skos:notes>
</skos:Concept>
```

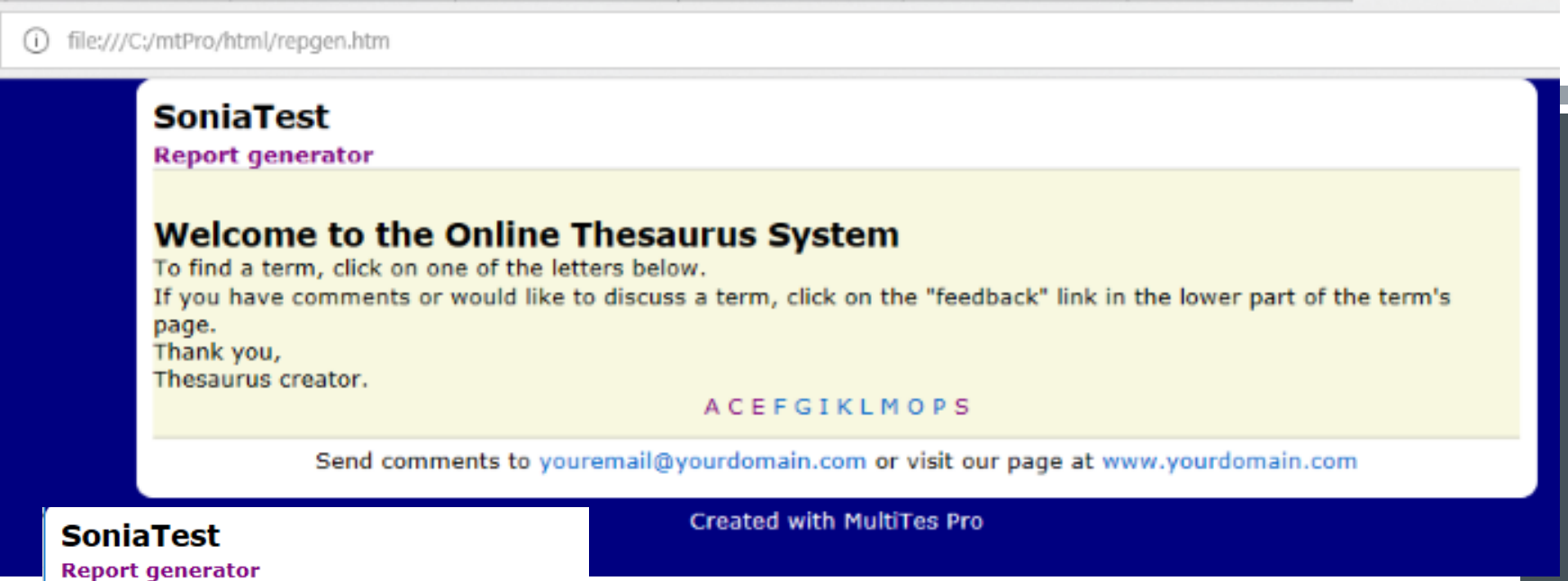
# SKOS OF THE 1910 LIBRARY OF CONGRESS SUBJECT HEADINGS

RDF / XML

MACHINE-READABLE FORMAT

# SKOS OF THE 1910 LIBRARY OF CONGRESS SUBJECT HEADINGS

## HTML VERSION


file:///C:/mtPro/html/repgen.htm

**SoniaTest**

Report generator

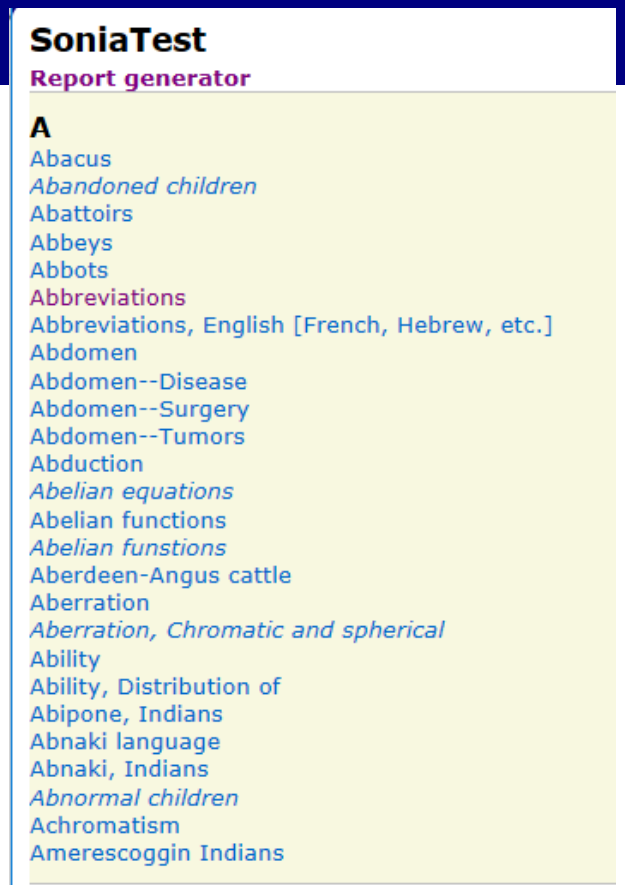
**Welcome to the Online Thesaurus System**

To find a term, click on one of the letters below.
If you have comments or would like to discuss a term, click on the "feedback" link in the lower part of the term's page.
Thank you,
Thesaurus creator.

A C E F G I K L M O P S

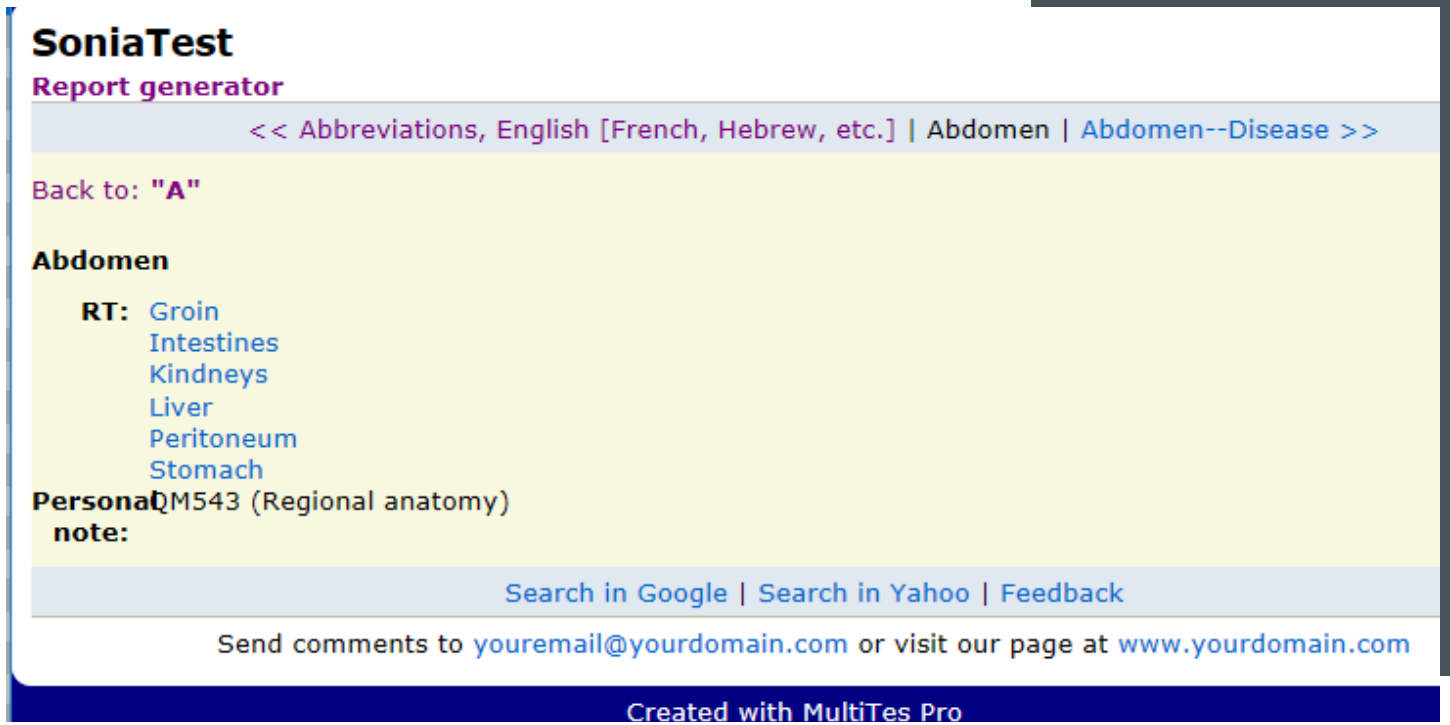
Send comments to youremail@yourdomain.com or visit our page at www.yourdomain.com

Created with MultiTes Pro


**SoniaTest**

Report generator

**A**
Abacus
*Abandoned children*
Abattoirs
Abbeys
Abbots
Abbreviations
Abbreviations, English [French, Hebrew, etc.]
Abdomen
Abdomen--Disease
Abdomen--Surgery
Abdomen--Tumors
Abduction
*Abelian equations*
Abelian functions
*Abelian funstions*
Aberdeen-Angus cattle
Aberration
*Aberration, Chromatic and spherical*
Ability
Ability, Distribution of
Abipone, Indians
Abnaki language
Abnaki, Indians
*Abnormal children*
Achromatism
Amerescoggin Indians


**SoniaTest**

Report generator

<< Abbreviations, English [French, Hebrew, etc.] | Abdomen | Abdomen--Disease >>

Back to: **"A"**

**Abdomen**

**RT:** Groin
Intestines
Kindneys
Liver
Peritoneum
Stomach

**Personal note:** QM543 (Regional anatomy)

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Send comments to youremail@yourdomain.com or visit our page at www.yourdomain.com

Created with MultiTes Pro

# EVALUATION

## Impeding question and looking at the solution for the project.

- How will the Docx format of 1910 LCHS be converted to RDF automatically?
- How will the Docx format of 1910 LCHS be loaded to HIVE DB automatically?

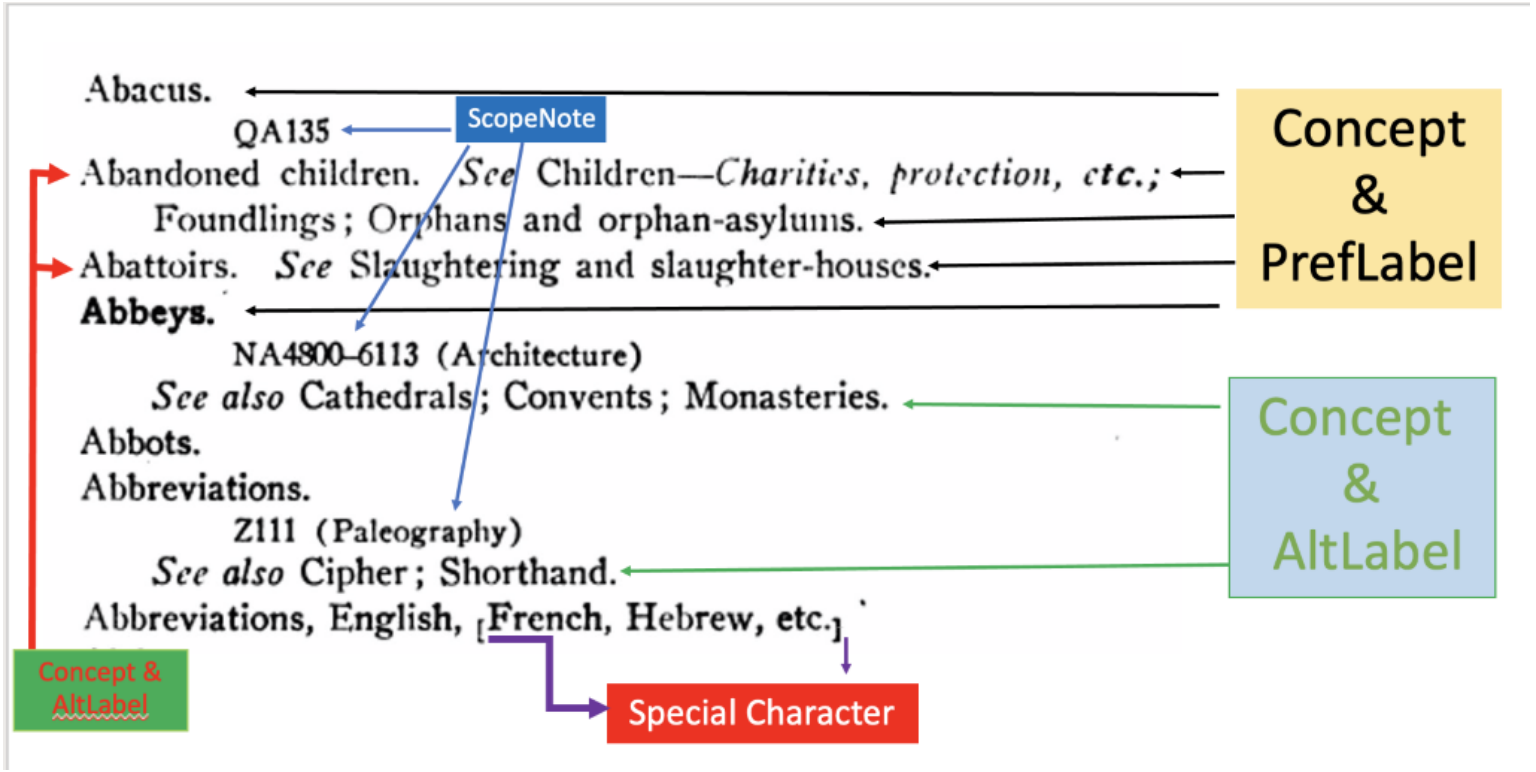
## Concerns / Issues / Risks

- Which solution to take given the limited time
- SKOS in HIVE have limited elements of the standard SKOS

## Pending action item

- To explore MultiTes in the automation of converting 1910 LCSH Doc to RDF
- To explore other tools in the automation of converting 1910 LCHS Doc to RDF
- To explore the HIVE code in the automation of loading 1910 LCSH DOC to HIVE db

# MAPPING


Abacus.
QA135
ScopeNote
Abandoned children. See Children—Charities, protection, etc.;
Foundlings; Orphans and orphan-asylums.
Abattoirs. See Slaughtering and slaughter-houses.
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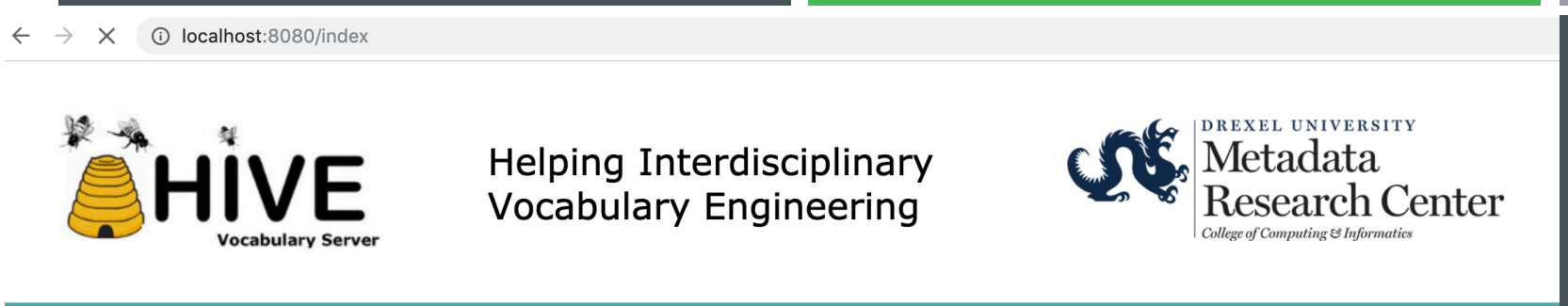
See also Cathedrals; Convents; Monasteries.
Abbots.
Abbreviations.
Z111 (Paleography)
See also Cipher; Shorthand.
Abbreviations, English, [French, Hebrew, etc.]
Concept & PrefLabel
Concept & AltLabel
Concept & AltLabel
Special Character

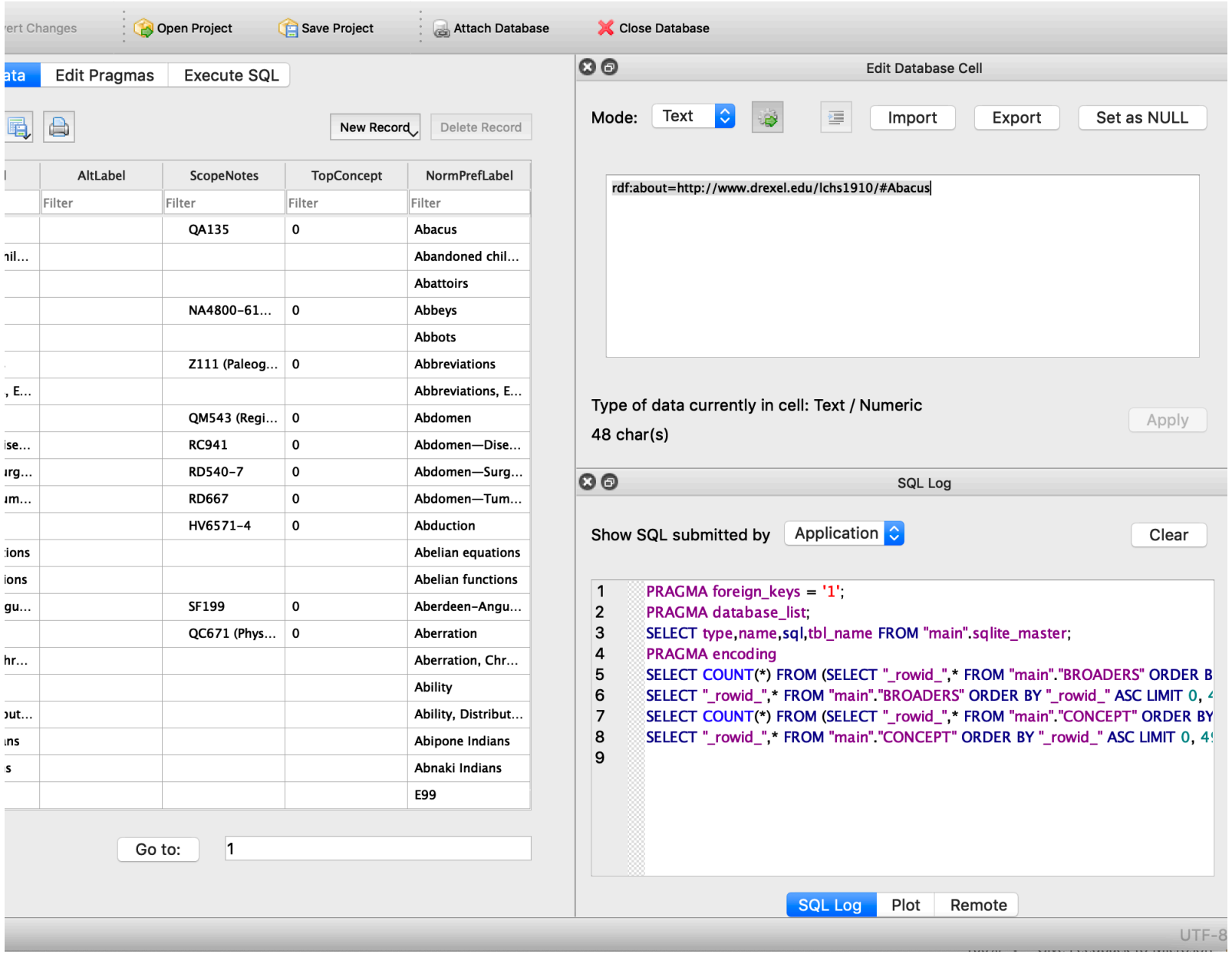
# MAPPING

- LCSH ruling and mapping to SKOS - RDF/XML and HIVE DB

| LCSH Entries | SKOS - RDF/XML | HIVE DB |
|---|---|---|
| Subject entry | <skos:Concept> rdf:http://drexel.edu/lcsh1910/ #[Subject entry]> | ConceptURI |
| Subject entry | <PrefLabel> | PrefLabel |
| SEE entry | <skos:Concept> rdf:http://drexel.edu/lcsh1910/ #[See entry]> | ConceptURI |
| SEE entry | <PrefLabel> | PrefLabel |
| See also entry | <skos:Concept> rdf:http://drexel.edu/lcsh1910/ #[See also entry]> | ConceptURI |
| See also entry | <PrefLabel> | PrefLabel |
| See also entry | <Altlabel> | AltLabel |
| Call numbers | <skos:Notes> | ScopeNotes |
| USE | | |
| RT | | |
| | | TopConcept |
| | | NormPrefLabel |
| | Other elements of SKOS | |

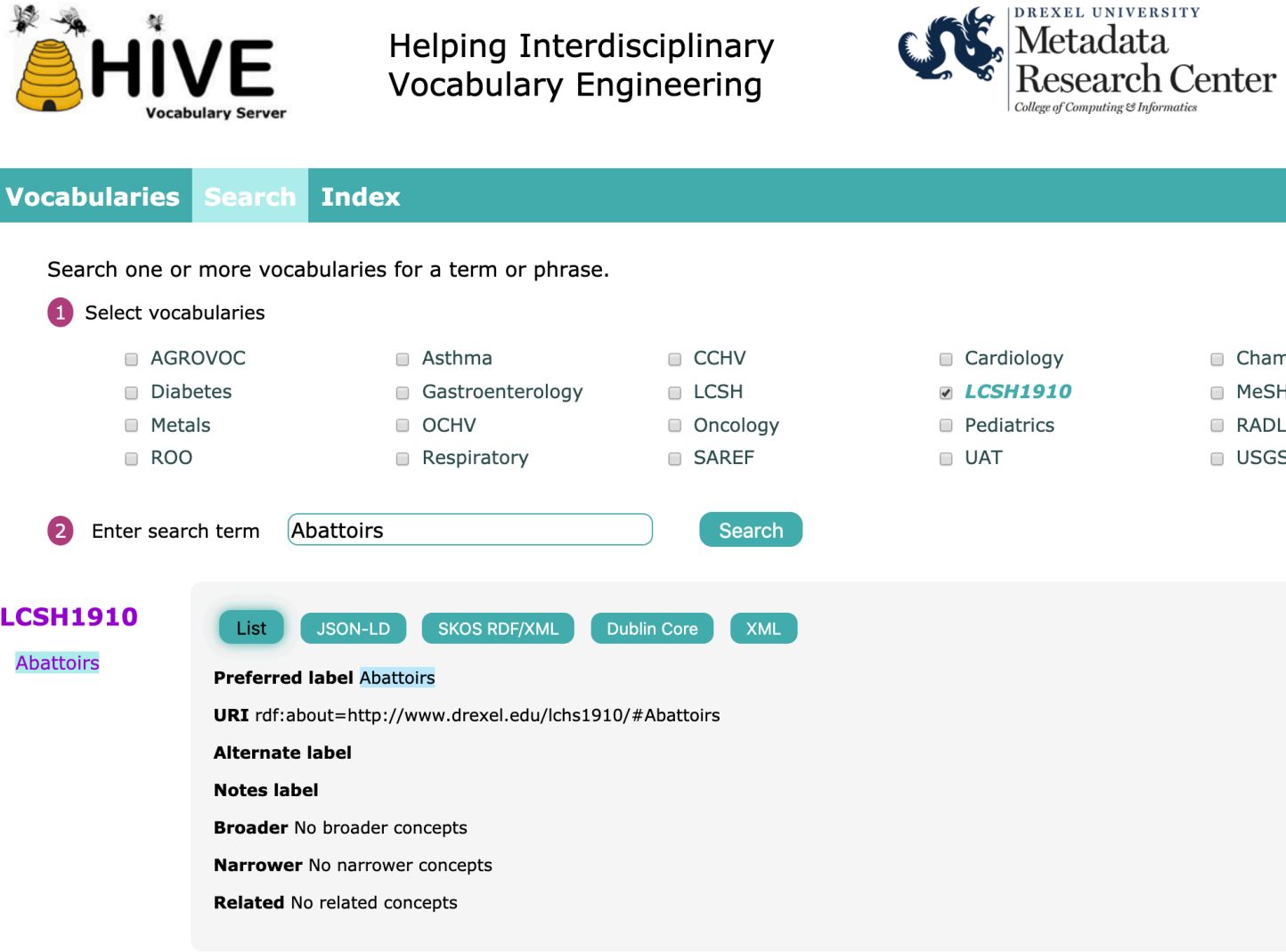



# 1910 LIBRARY OF CONGRESS SUBJECT HEADING IN HIVE




# 1910 LIBRARY OF CONGRESS SUBJECT HEADING IN HIVE

DATABASE

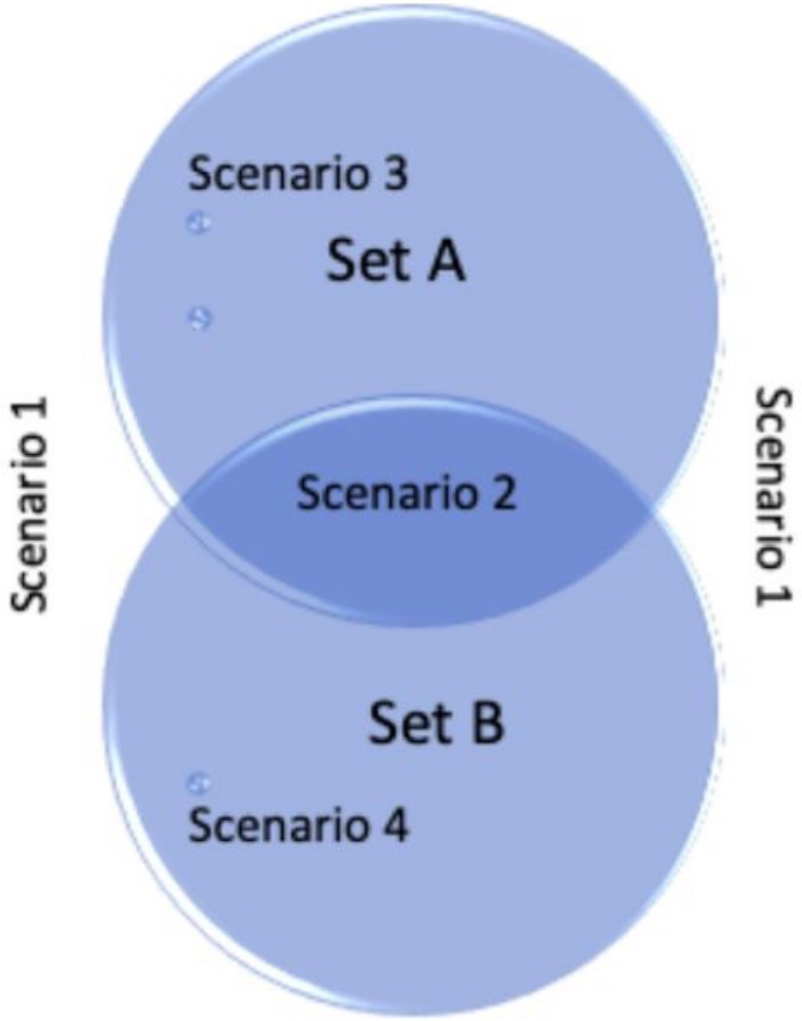



# 1910 LIBRARY OF CONGRESS SUBJECT HEADING IN HIVE

DATA SETS SPECIFICATIONS:

SET A: THE 19TH CENTURY ENCYCLOPEDIA BRITANNICA ARTICLES ARE INDEXED USING THE 1910 LCHS

SET B: THE 19TH CENTURY ENCYCLOPEDIA BRITANNICA ARTICLES ARE INDEXED USING 2016 LCHS




## USE CASES

Scenario 1: Union of Set A and Set B (A U B) gives all the keywords found in the NCEB using both versions of LCHS. These keywords are all used in the transformation of the keywords to the controlled vocabulary of NCEB.

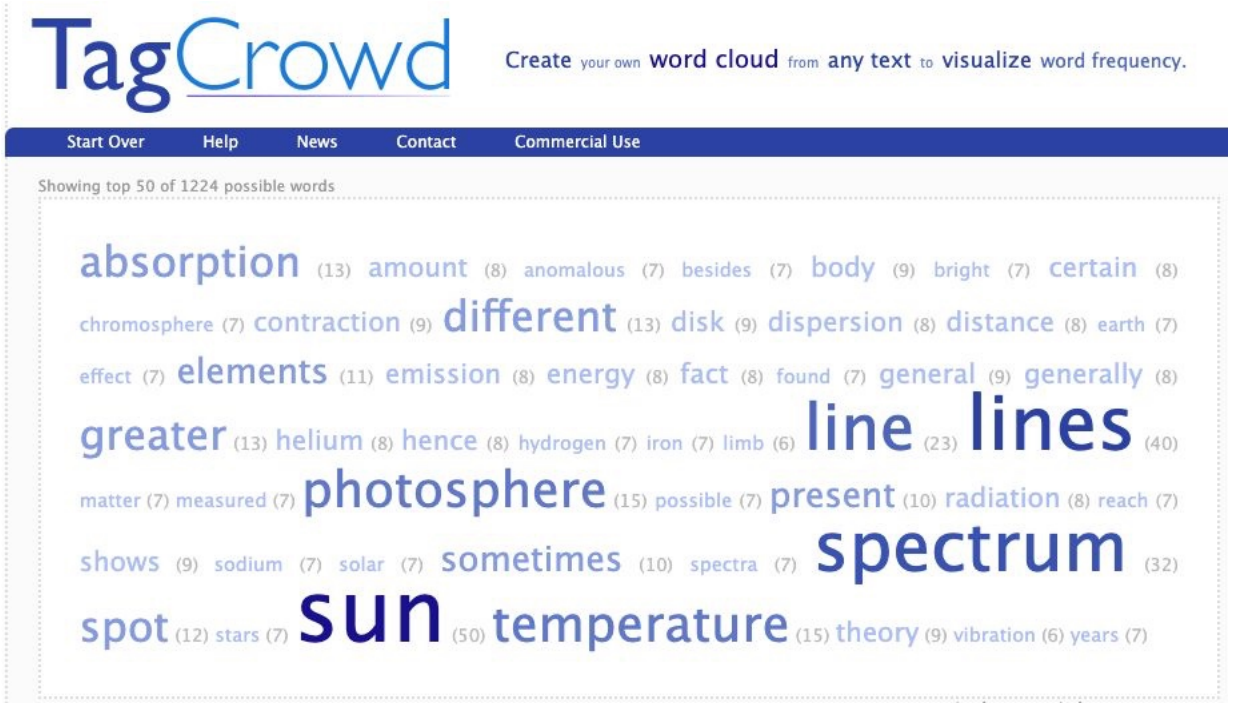
Scenario 2: Intersection of Set A and Set B (A ∩ B) gives the keywords found which are common only to both versions of LCHS. This data represents the keywords that are still being used from the 19th century until 2016.

Scenario 3: Difference of Set A and Set B (A - B) gives the keywords found in the 1910 LCHS and could be deprecated already in the 2016 LCHS version or changed through time and has new terminology that replaces it.

Scenario 4: Difference of Set A and Set B (B - A) gives the keywords found in the 2016 LCHS and but could be non-existent yet in the 1910 LCHS version. This could also be the new keywords used in the later century.

# SUBJECT ANALYSIS

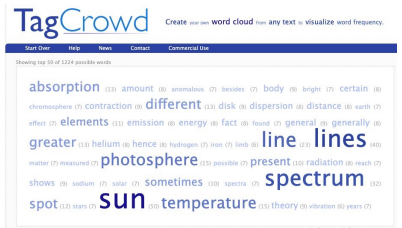
1. The text format of the article sun from the 19th Century Encyclopedia Britannica was subjected to text analysis using TagCrowd.



# SUBJECT ANALYSIS

1. The text format of the article sun from the 19th Century Encyclopedia Britannica was subjected to text analysis using TagCrowd.

2. To apply the "Aboutness" approach to subject analysis, the following words were determined as the keywords. 16 out of 51 descriptors were selected as the keywords. They were spotted to reflect both the richness of the topic being discussed in the article and the expressiveness they contain in relation to the word "SUN".




| Article (19th Century Encyclopedia Britannica | Tag Crowd | Word Frequency | Aboutness |
|---|---|---|---|
| Sun | Sun | 50 | Sun |
| | Lines | 40 | Lines |
| | Spectrum | 32 | Spectrum |
| | Line | 23 | |
| | Photosphere | 15 | Photosphere |
| | Temperature | 15 | Temperature |
| | Absorption | 13 | Absorption |
| | Different | 13 | |
| | Greater | 13 | |
| | Spot | 12 | Spot |
| | Elements | 11 | Elements |
| | Present | 10 | |
| | Sometimes | 10 | |
| | Body | 9 | Body |
| | Contraction | 9 | Contraction |
| | Disk | 9 | Disk |
| | General | 9 | |
| | Shows | 9 | |
| | Theory | 9 | |
| | Amount | 8 | |
| | Certain | 8 | |
| | Dispersion | 8 | Dispersion |
| | Distance | 8 | Distance |
| | Emission | 8 | Emission |
| | Energy | 8 | Energy |

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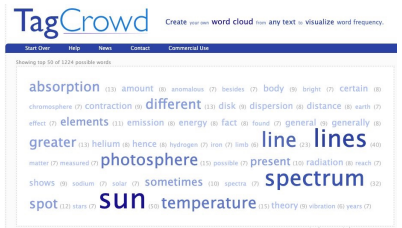
3. For the purpose of simulation, manual indexing using 1910 LCSH (OCR version) was performed capturing the structure, subdivisions and subject headings for the index of the article "SUN"

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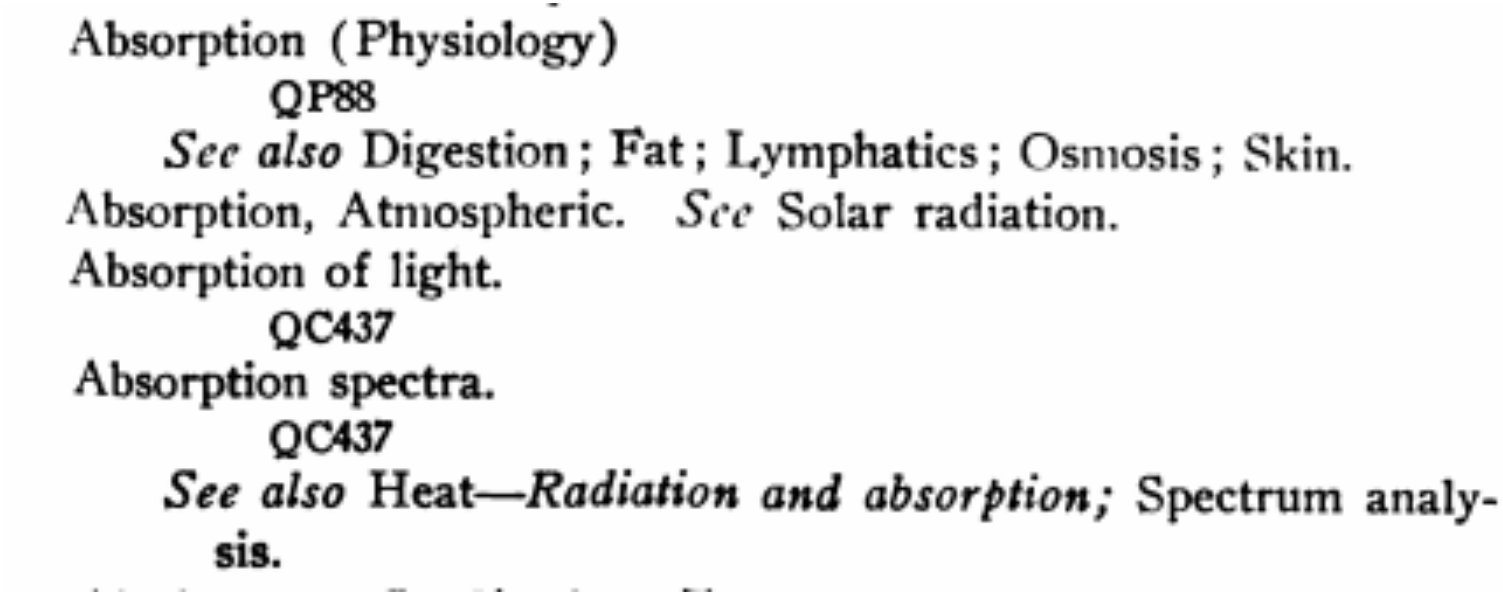
| | Different | 13 | |
| | Greater | 13 | |
| | Spot | 12 | Spot |
| | Elements | 11 | Elements |
| | Present | 10 | |
| | Sometimes | 10 | |
| | Body | 9 | Body |
| | Contraction | 9 | Contraction |
| | Disk | 9 | Disk |
| | General | 9 | |
| | Shows | 9 | |
| | Theory | 9 | |
| | Amount | 8 | |
| | Certain | 8 | |
| | Dispersion | 8 | Dispersion |
| | Distance | 8 | Distance |
| | Emission | 8 | Emission |
| | Energy | 8 | Energy |



Absorption (Physiology)
QP88
*See also* Digestion; Fat; Lymphatics; Osmosis; Skin.
Absorption, Atmospheric. *See* Solar radiation.
Absorption of light.
QC437
Absorption spectra.
QC437
*See also* Heat—*Radiation and absorption;* Spectrum analysis.

# SUBJECT ANALYSIS

1. The text format of the article sun from the NCEB was subjected to text analysis using TagCrowd.

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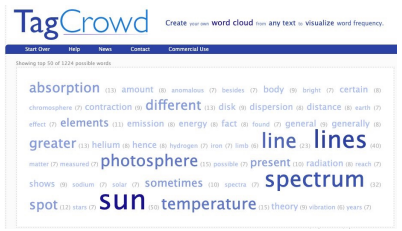
3. For the purpose of simulation, manual indexing using 1910 LCSH (OCR version) was performed capturing the structure, subdivisions and subject headings for the index of the article "SUN"

4. The same article was uploaded to HIVE for automatic indexing, generating the 2016 LCSH version of the keyword "Absorption"

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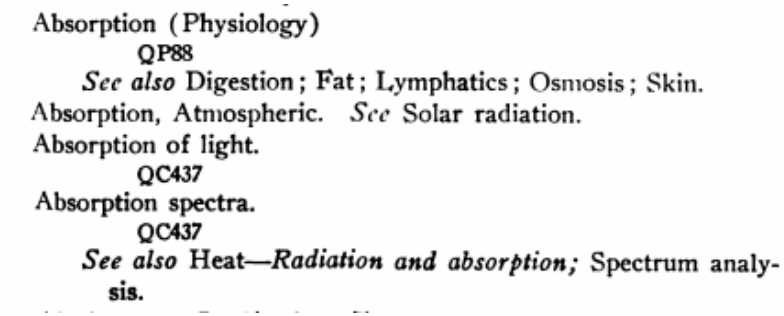
| | Different | 13 | |
| | Greater | 13 | |
| | Spot | 12 | Spot |
| | Elements | 11 | Elements |
| | Present | 10 | |
| | Sometimes | 10 | |
| | Body | 9 | Body |
| | Contraction | 9 | Contraction |
| | Disk | 9 | Disk |
| | General | 9 | |
| | Shows | 9 | |
| | Theory | 9 | |
| | Amount | 8 | |
| | Certain | 8 | |
| | Dispersion | 8 | Dispersion |
| | Distance | 8 | Distance |
| | Emission | 8 | Emission |
| | Energy | 8 | Energy |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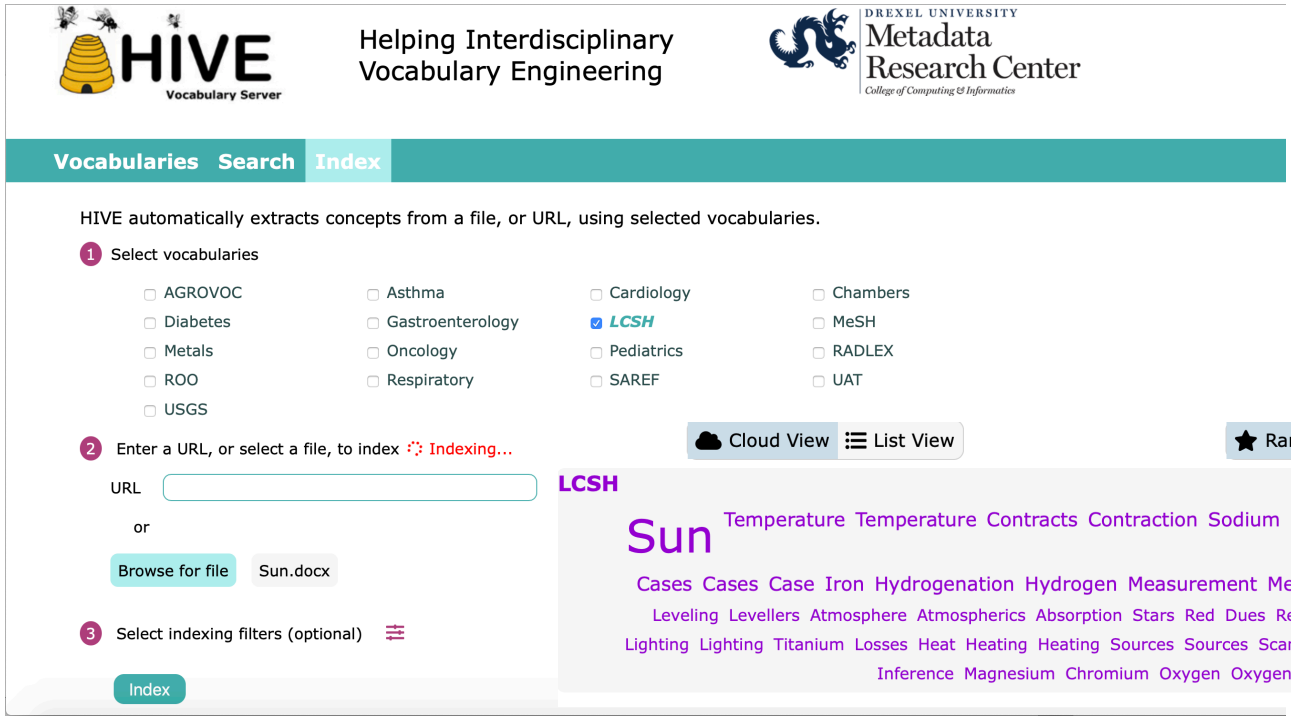
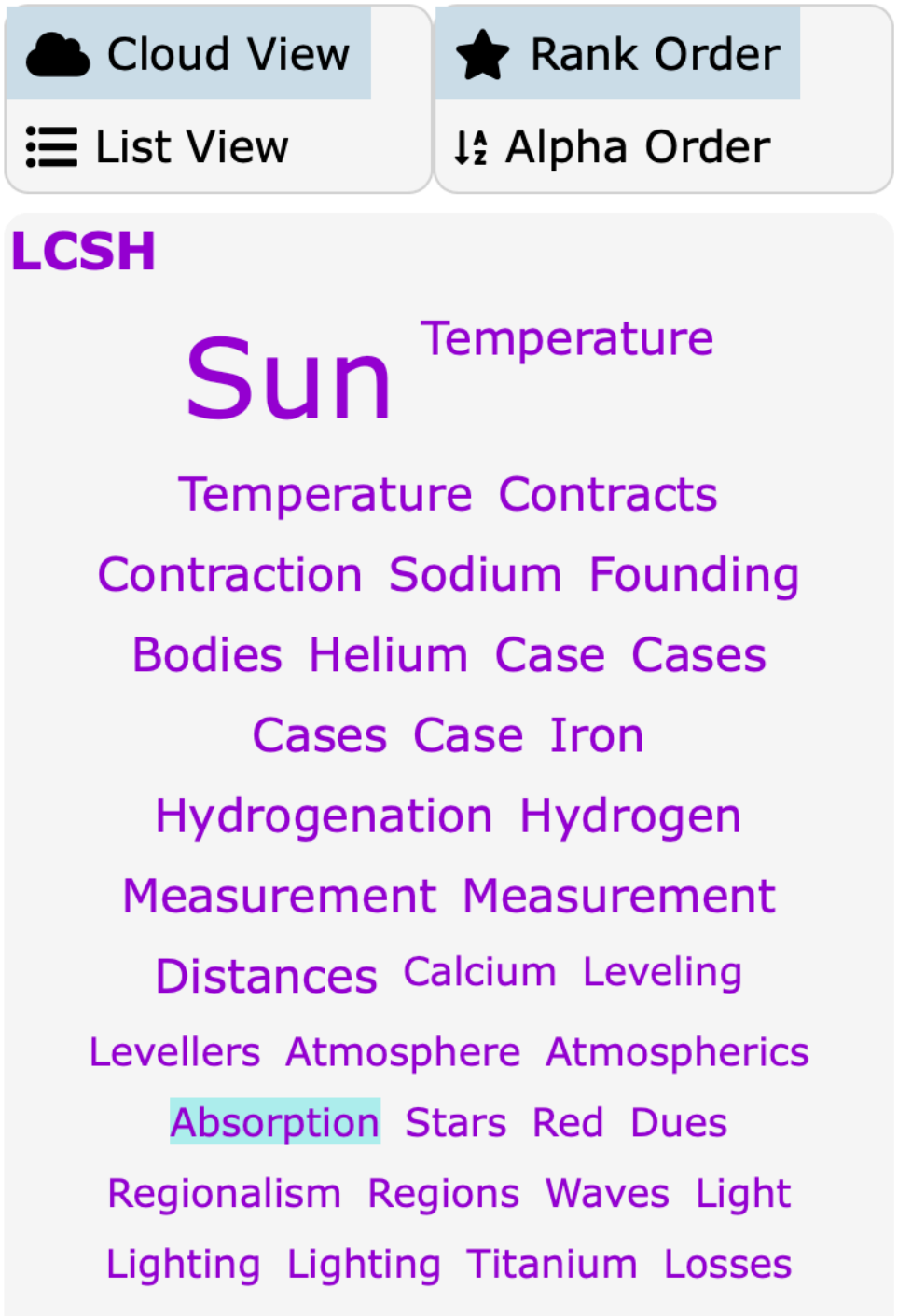





List | JSON-LD | SKOS RDF/XML | Dublin Core | XML

**Preferred label** Absorption

**URI** http://id.loc.gov/authorities/subjects/sh85000245

**Alternate label** Sorption;

**Notes label** Not provided

**Broader**

Chemistry, Physical and theoretical
Packed towers

**Narrower**

Gases--Absorption and adsorption
Light absorption
Photoabsorption
Sorbents

**Related** No related concepts

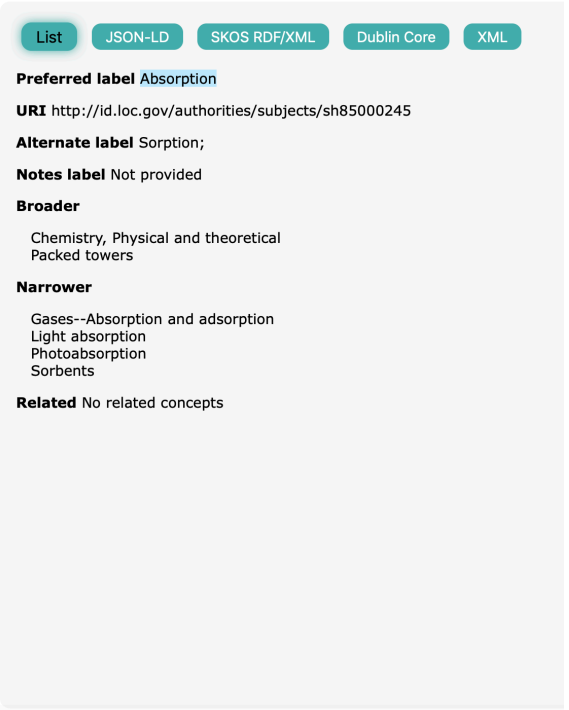
# RESULTS FROM THE 2016 LIBRARY OF CONGRESS SUBJECT HEADING IN HIVE

| Article (19th Century Encyclopedia Britannica | Tag Crowd | Word Frequency | Aboutness | 1910 LCHS Manual Subject Indexing | Output Controlled Vocabulary | LCHS in Hive | Scenario |
|---|---|---|---|---|---|---|---|
| Sun | Sun | 50 | Sun | | | | |
| | Absorption | 13 | Absorption | *Absorption (Physiology)<br>*Absorption, Atmospheric<br>See Solar -- Radiation<br>Absorption of light<br>*Absorption spectra<br>See also Heat -- Radiation a | Absorption of light | Preferred label: Absorption<br><br>URI http://id.loc.gov/authorities/subjects/sh85000245<br><br>Alternate label Sorption<br><br>Notes label Not provided<br><br>Broader<br>Chemistry, Physical and theoretical<br>Packed towers<br><br>Narrower<br>Gases--Absorption and adsorption<br>Light absorption<br>Photoabsorption<br>Sorbents<br><br>Related No related concepts | Scenario 2 |

# WORD ANALYSIS MATRIX

Table above is a word analysis matrix for the descriptor "Absorption" that shows the result of the subject analysis conducted in the article "SUN". The simulation of the word – Absorption fell in scenario 2 of the use cases. This means that the word "Absorption" intersects both data sets, thus it exists from 1910 till 2016.

| Article (19th Century Encyclopedia Britannica | Tag Crowd | Word Frequency | Aboutness | 1910 LCHS Manual Subject Indexing | Output Controlled Vocabulary | LCHS in Hive | Scenario |
|---|---|---|---|---|---|---|---|
| Sun | Sun | 50 | Sun | | | | |
| | Absorption | 13 | Absorption | *Absorption (Physiology)<br>*Absorption, Atmospheric<br>See Solar -- Radiation<br>Absorption of light<br>*Absorption spectra<br>See also Heat -- Radiation a | Absorption of light | Preferred label: Absorption<br>URI http://id.loc.gov/authorities/subjects/sh85000245<br>Alternate label Sorption<br>Notes label Not provided<br>Broader<br>Chemistry, Physical and theoretical<br>Packed towers<br>Narrower<br>Gases--Absorption and adsorption<br>Light absorption<br>Photoabsorption<br>Sorbents<br>Related No related concepts | Scenario 2 |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# CONCLUSIONS

The use of both versions of the LCHS, 1910 and 2016, as a controlled vocabulary to extract keywords from the articles of 19TH Century Encyclopedia Britannica purposively rendered a wider consideration in the establishment of the 19TH Century Encyclopedia Britannica controlled vocabulary. Use cases showed the inclusive generation of keywords producing substantial vocabularies.

Scenarios put forward the impositions of different inferences of the data.

- Scenario 1 was the integration of all descriptors that matched to the vocabulary of the 2 versions of LCHS.
- Scenario 2 captured all the descriptors that commonly matched with both versions of LCSH. This meant that these words were used in the 19th century until 2016.
- Scenario 3 represented the words that were not existent anymore in the present day since it's only found as a vocabulary in the 1910 LCSH.
- On the other hand, scenario 4 is telling us that there were new terms formulated by men in the next centuries that came. Thus using the old LCSH or the appropriate version of LCHS would yield higher percent of accuracy in terms of completeness of 19th Century Encyclopedia Britannica keywords to be transformed to a controlled vocabulary. The goal is to take simulations of all scenarios to be able to justify the hypothesis and to conduct manual indexing using the current LCSH (2016) which serve another use case.

# FUTURE WORKS

GRAPH DATABASE OF HIVE

DREXEL UNIVERSITY
Metadata Research Center
College of Computing & Informatics

DREXEL UNIVERSITY College of Computing & Informatics

LEADS 4 NDP
Library Education & Data Science for the National Digital Platform

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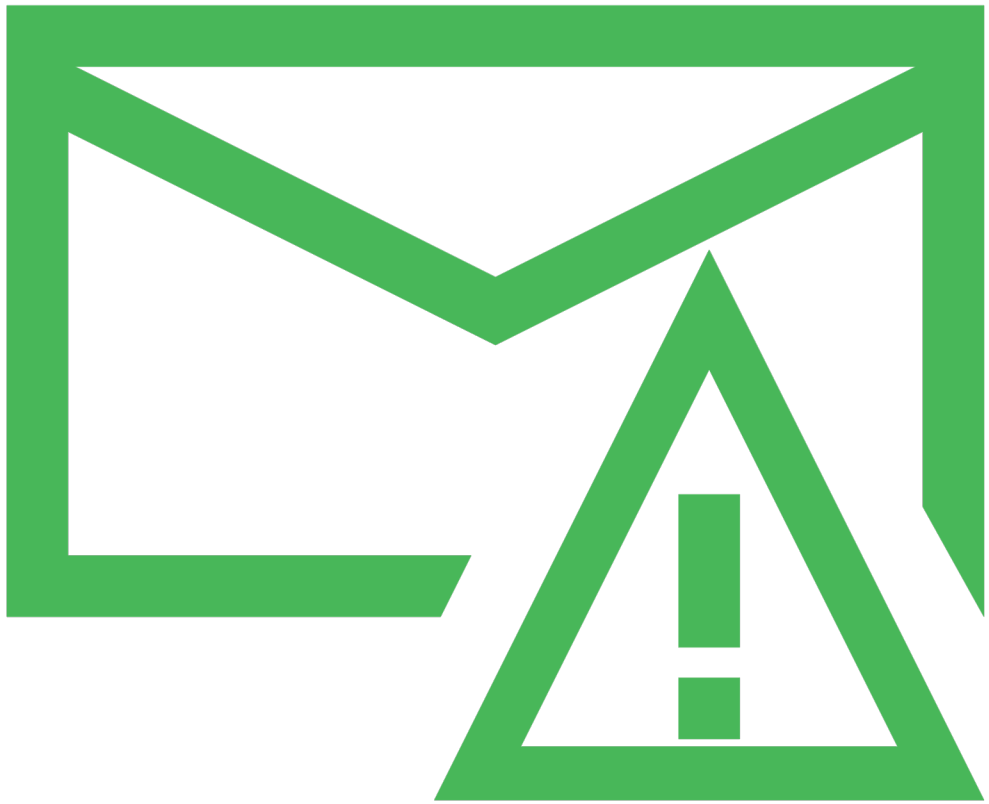
# MARAMING SALAMAT PO!



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