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A Step Forward: Adding Linked Data Vocabularies to Digital Repositories

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2018 FLA Annual Conference

A Step Forward: Adding Linked Data Vocabularies to Digital Repositories

Sai Deng, University of Central Florida Libraries

Linked Data Basics

- **Linked data:**
  - "A term used to describe a recommended best practice for exposing, sharing, and connecting pieces of data, information, and knowledge on the Semantic Web using URIs and RDF."

    -Wikipedia

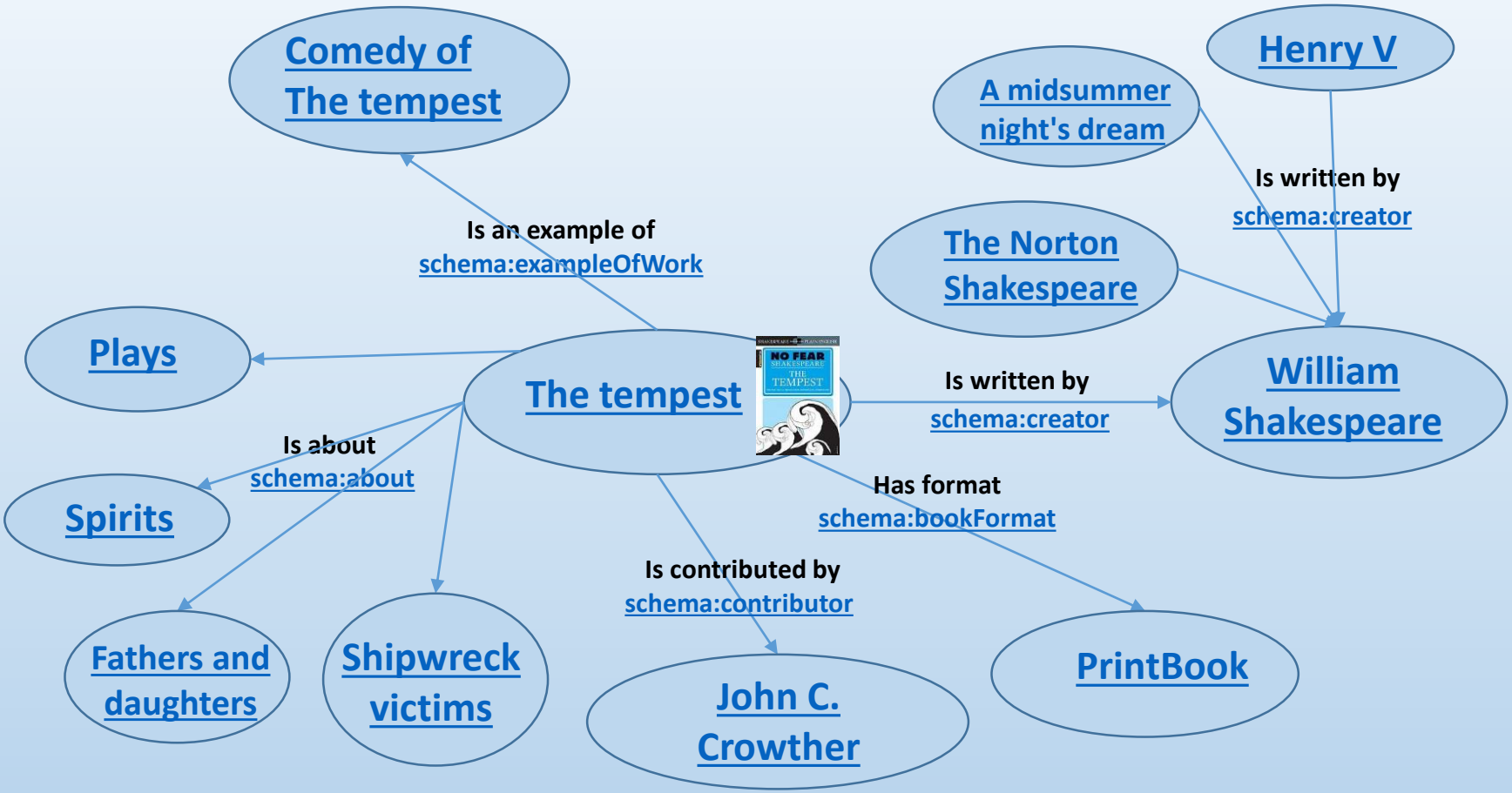
- **Resource Description Framework (RDF): Represent information in triples**
  - **Subject:** a resource, identified with a URI
  - **Predicate:** specification of the relationship
  - **Object:** a resource the subject is related to

Linked Data Basics

- **The Four Design Principles of Linked Data**
  - Use Uniform Resource Identifiers **(URIs) as names for things**.
  - Use **HTTP URIs** so that people can look up those names.
  - When someone looks up a URI, **provide** useful **information**, using the standards (**RDF**, **SPARQL**).
  - Include **links to other URIs** so that they can discover more things.
  - Tim Berners-Lee. 2006. https://www.w3.org/DesignIssues/LinkedData.html

- URIs for naming things, RDF for describing things, SPARQL for querying data; link to other URIs to find more things.

Linked Data: An Example



*Based on information from worldcat.org

Linked Open Data Building Blocks

- **The LOD Data Model:** RDF triples
- **Content Rules:** relies on external vocabularies and ontologies
- **Metadata schema**
  - RDF Schema
  - Vocabulary Building Blocks: SKOS, OWL
  - Open Archives Initiative Object Reuse and Exchange (OAI-ORE)
- **Serializations of LOD**
  - RDF Notation-3/Ns, Turtle, N-Triples; RDFa; JSON-LD
- **Exchanging LOD**
  - SPARQL
- Mitchell, Erik T. Building Blocks of Linked Open Data in Libraries. *Library Technology Reports* (vol. 49, no. 5)

Five Star-schema of Linked Open Data (LOD)

- **Five star-schema of Linked Open Data** (Tim Berners-Lee)

★ Available on the web (whatever format) but with an open licence, to be Open Data

★★ Available as machine-readable structured data (e.g. excel instead of image scan of a table)

★★★ as (2) plus non-proprietary format (e.g. CSV instead of excel)

★★★★ All the above plus, Use open standards from W3C (RDF and SPARQL) to identify things, so that people can point at your stuff

★★★★★ All the above, plus: Link your data to other people's data to provide context

Source: https://www.w3.org/DesignIssues/LinkedData.html

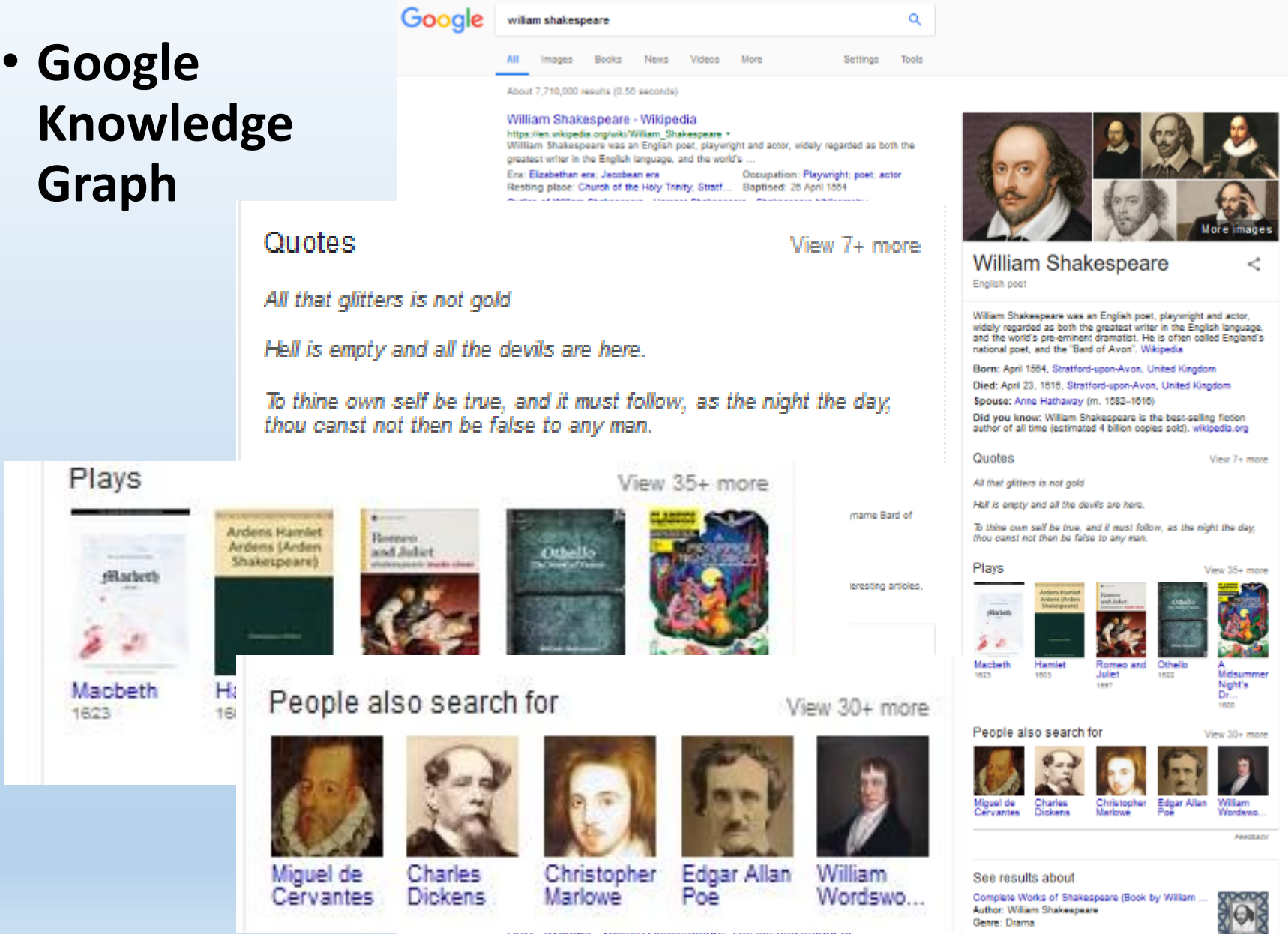
Source: http://5stardata.info/en/

Linked Data Examples and Datasets

- **LC Linked Data Service: Authorities and Vocabularies** https://id.loc.gov/
- **FAST: Faceted Application of Subject Terminology** http://id.worldcat.org/fast
- **Virtual International Authority File (VIAF)** https://viaf.org/
- **Worldcat Identities** www.worldcat.org/identities
- **Open Researcher and Contributor ID (ORCID)** https://orcid.org/
- **International Standard Name Identifier (ISNI)** http://www.isni.org/
- **GeoNames** http://www.geonames.org/ontology/documentation.html
- **DBpedia** http://wiki.dbpedia.org/
- **Schema.org Vocabulary** http://schema.org/docs/gs.html#schemaorg
- **The Linked Open Data Cloud** https://lod-cloud.net/

Linked Data Implementations

- Google Knowledge Graph



Linked Data Implementations

- **Libraries, Archives and Museums Community**
  - **Europeana** http://europeana.eu
  - **DPLA** http://dp.la
  - **LIBRIS** https://libris.kb.se/
  - **British National Bibliography** http://bnb.bl.uk/
  - **BIBFRAME** http://BIBFRAME.org/

- **The Web and the Library Community**
  - **Schema.org**
    - **Bibliographic Extension**

      http://bib.schema.org/, e.g., Audiobook, Thesis
    - **Extend Schema.org to represent archives**

      https://archival.github.io/schema-org/

- **More Library Experiments/Cases**
  - **OCLC Linked Data** https://www.oclc.org/developer/develop/linked-data.en.html
  - **WorldCat Works** (schema:exampleOfWork) http://experiment.worldcat.org/entity/work/data/1080130963
  - **Transforming Library Metadata into Linked Library Data**: Introduction and Review of Linked Data for the Library Community, 2003–2011 http://www.ala.org/alcts/resources/org/cat/research/linked-data
  - Check out ALA conference programs on LOD in the past few years, e.g., Linked Library Data IG

Current Digital Repositories and Linked Data

- **Islandora**
  - Effort in mapping MODS to RDF;
  - Fedora 4, LDP implementation; Islandora CLAW

- **Experiments and Cases:**
  - Islandora CLAW
  - TU Delft repository example: Colonial Architecture (Delftdora module, Fedora 3)
  - A Lightweight Structured Data Implementation Using JSON-LD and Schema.org for Digital Repository (Mak et al.)

Current Digital Repositories and Linked Data

- **CONTENTdm**
- **Not inside the system, but work on exported data;**
- **UIUC.** Challenges of Mapping Digital Collections Metadata to Schema.org (Lampron et. al. 2016)
- **OCLC& CONTENTdm** Metadata Refinery, transforms CONTENTdm metadata to Linked Data, 2016. Not yet scalable. (Washburn et al. 2016)

A UIUC Experiment http://imagesearch-test1.library.illinois.edu/cdm/ref/collection/motley-new/id/599
Project Site http://publish.illinois.edu/linkedspcollections/

Current Digital Repositories and Linked Data

- **Omeka**
  - Open source web publishing platform. Supports Dublin Core. Can export METS, dc-rdf, JSON etc.
  - Ozmeka (plug-ins)/ Omeka linked data

- **DSpace**
  - **DSpace Linked Data support** spans all three Layers: “the storage layer with **a triple store**, the business logic with classes to **convert** stored contents into RDF, and the application layer with a module to **publish** RDF serializations.”

    - Donohue. Linked (Open) Data.
    (https://wiki.duraspace.org/display/DSDOC6x/Linked+%28Open%29+Data)

Current Digital Repositories and Linked Data

- **Digital Commons**
  - Allow to add extra fields for links (not RDF)

- **Preparing for Linked Data**
  - Include links (e.g., id.loc.gov, viaf.org) in added additional fields for author, advisor, department names etc.;

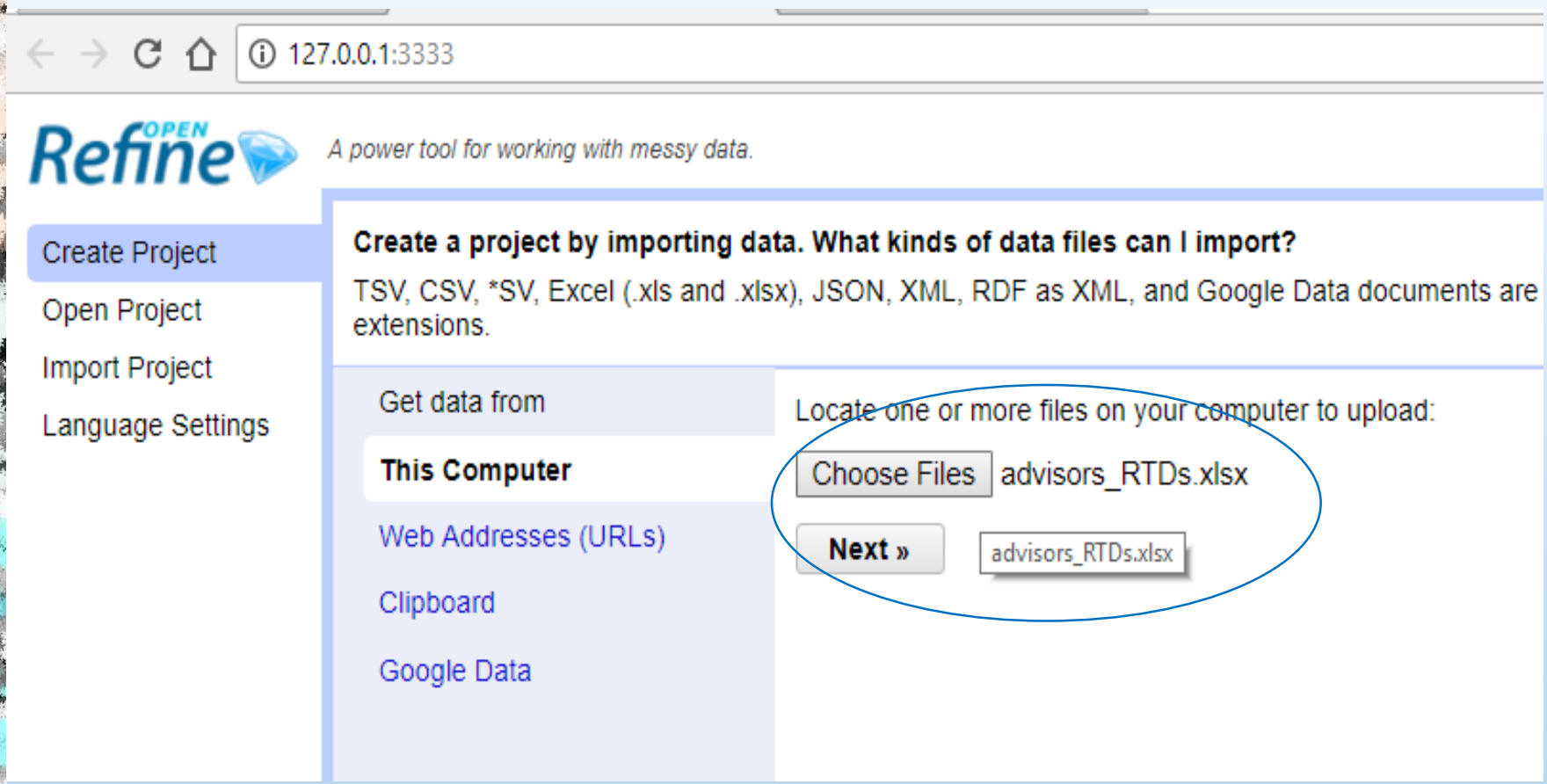
  - Data (in spreadsheet) cleanup and reconciliation using OpenRefine
    - Name review can be tricky and time-consuming: Google, Wikipedia, obituary, university and departmental websites, publications, CVs…

Adding Linked Data Vocabularies to UCF Digital Repositories

- **Adding LOD Links to Fields in Digital Repositories**
  - Authors/Creators
  - Contributors, e.g., thesis advisors
  - Corporate names, e.g., university, college and departmental names
  - Subjects
  - Person identifiers

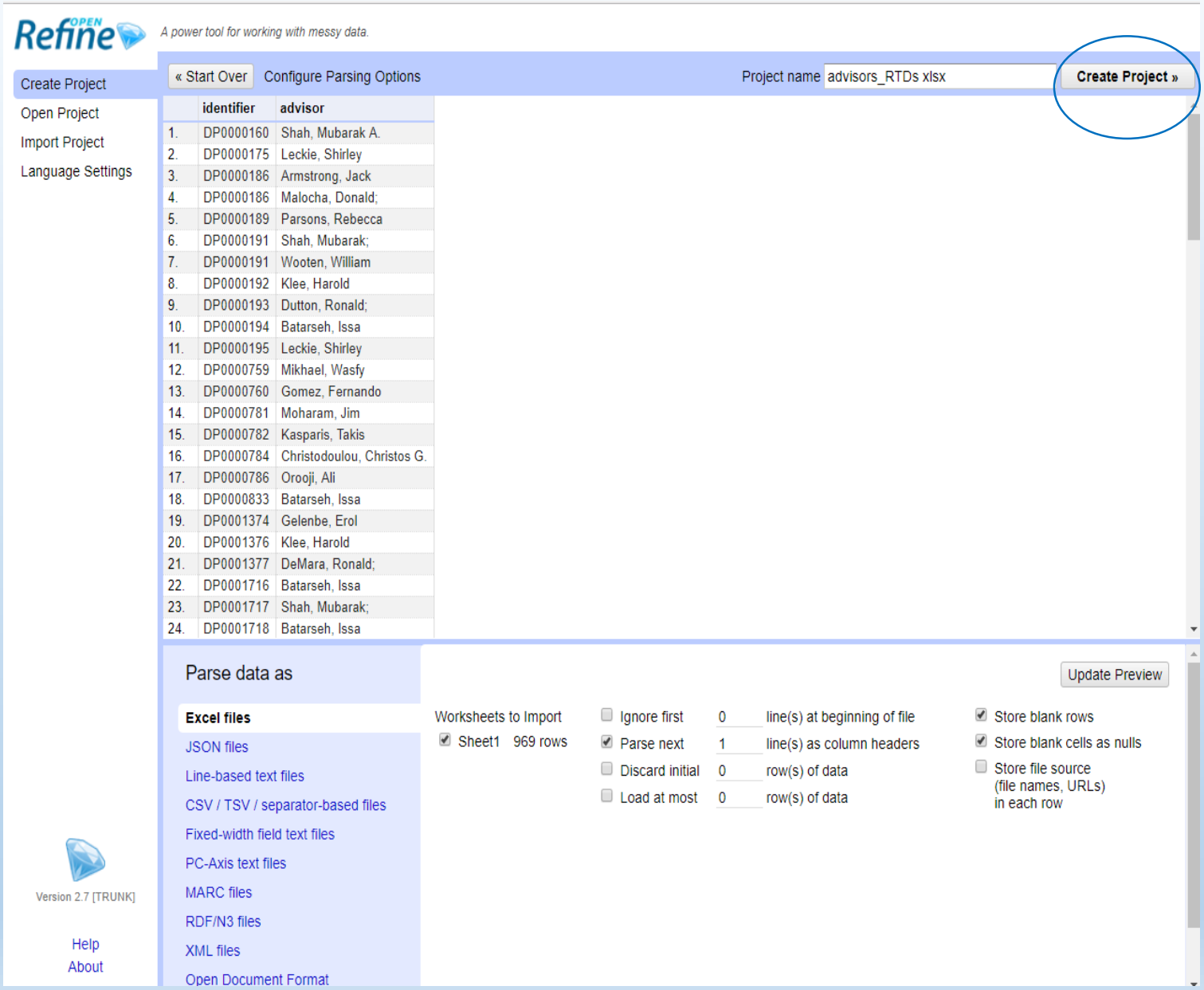
- **OpenRefine**
  - **Download and installation**
    http://openrefine.org/download.html
  - **Documentation**
    https://github.com/OpenRefine/OpenRefine/wiki/Documentation-For-Users
  - **Features**
    - Import
    - Facet
    - Edit cells: Clustering…
    - Edit columns: Add Column based on this column; Fetching URLs from Web Services (*Enrich existing data columns)…
    - Expressions
    - Export
    - History…

Adding LC and VIAF Links to Advisor Names



Open OpenRefine — Choose Files — Select advisors-RTDs.xlsx — Click “Next”

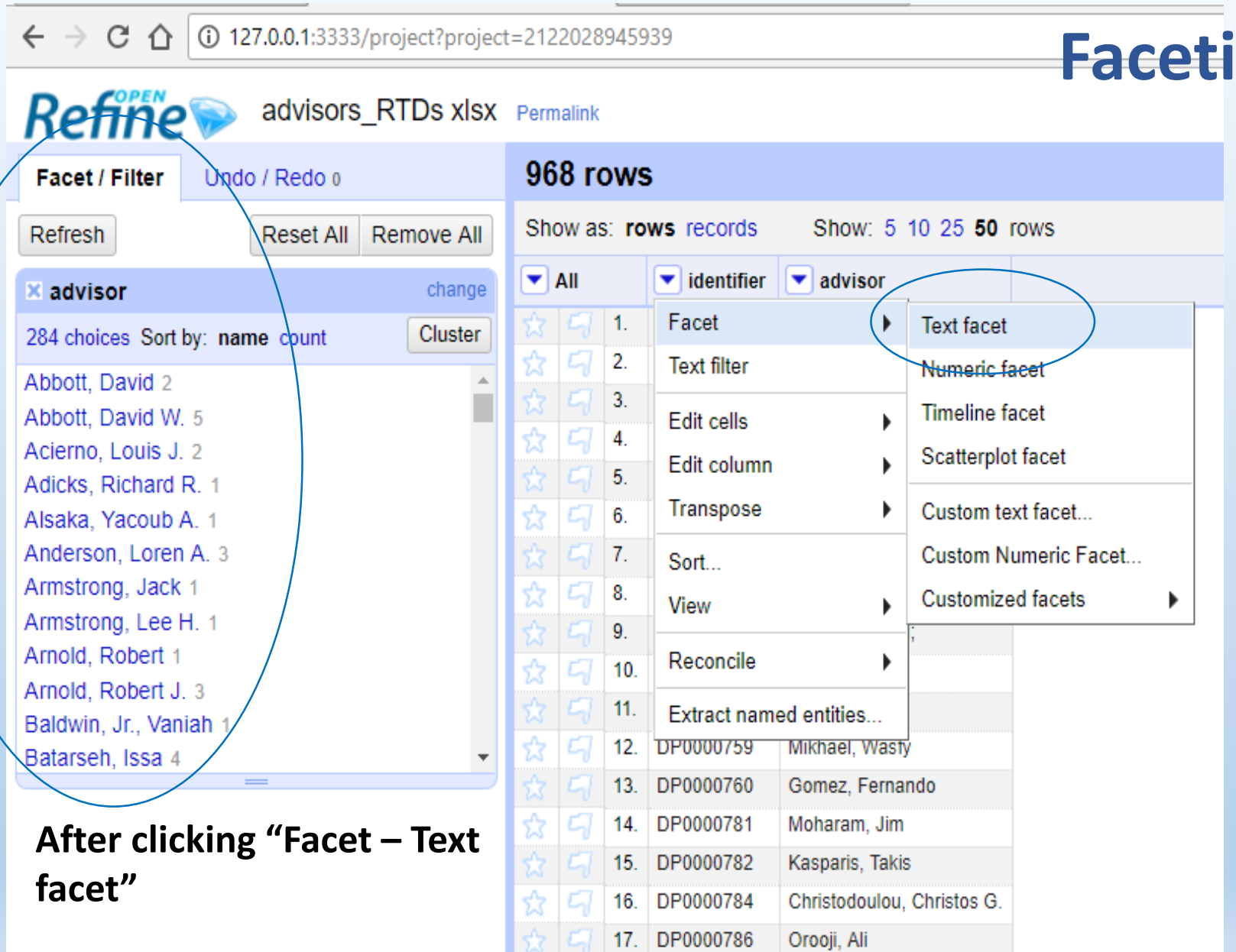
Adding LC and VIAF Links to Advisor Names



Click “Create Project”

Adding LC and VIAF Links to Advisor Names

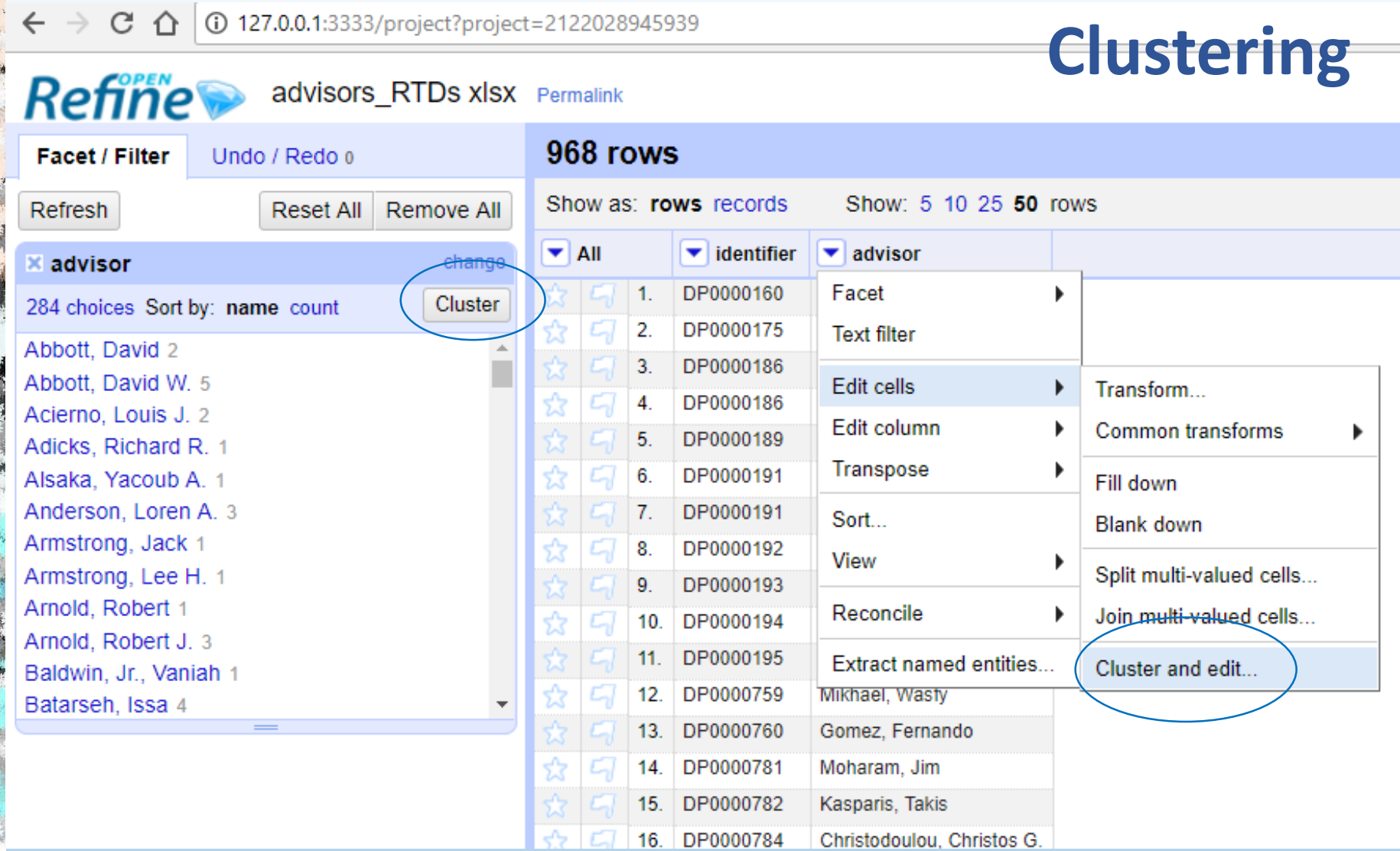
Faceting



After clicking “Facet – Text facet”

Adding LC and VIAF Links to Advisor Names

Clustering

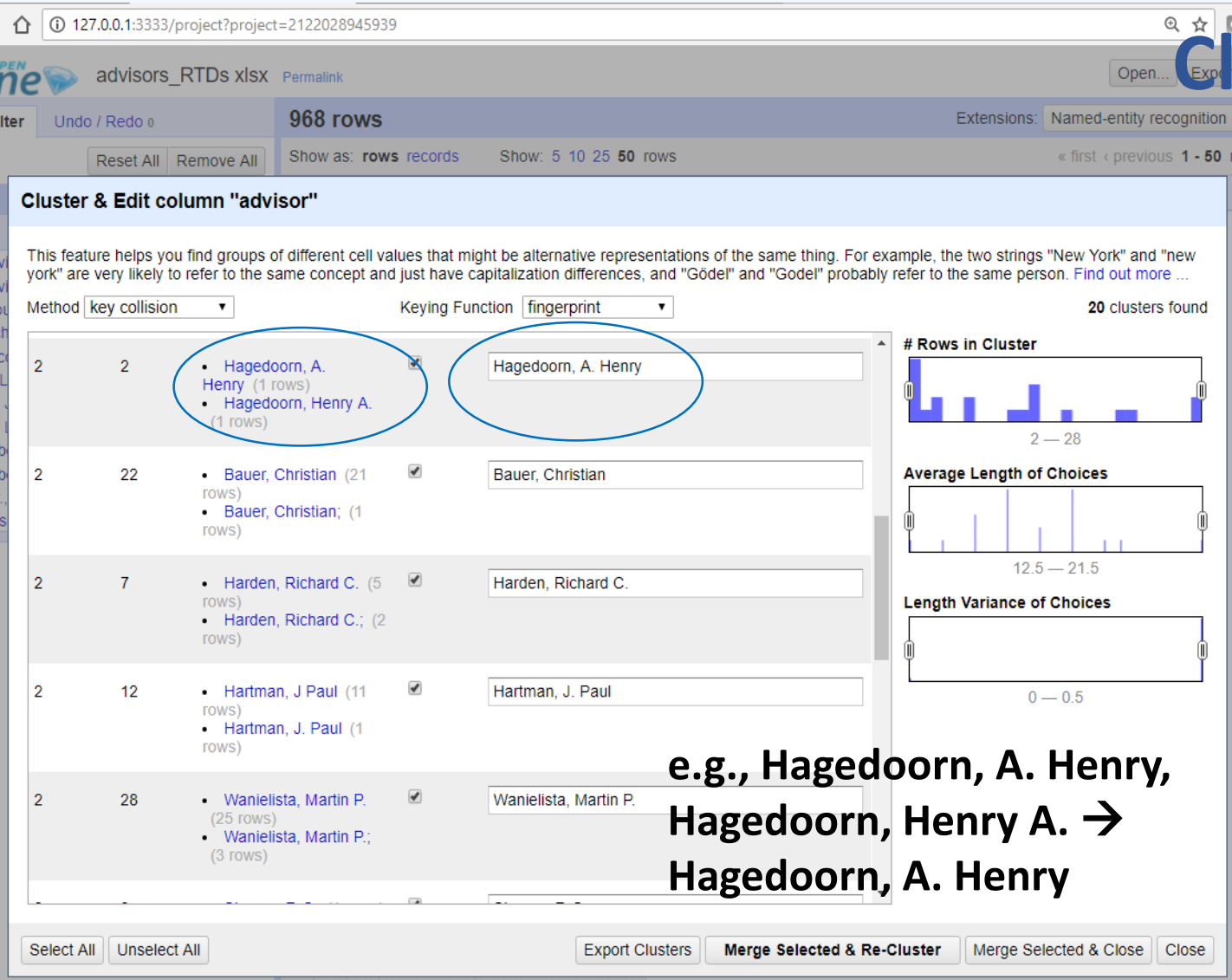


Click “Cluster” on the left, or click “Edit Cells – Cluster and edit” under “advisor” column

Adding LC and VIAF Links to Advisor Names

Clustering

Cluster & Edit column "advisor" (Method: key collison, Keying Function: fingerprint)



Adding LC and VIAF Links to Advisor Names

Method: nearest neighbor ▾ | Distance Function: levenshtein ▾ | Radius: 1.0 | Block Chars: 6

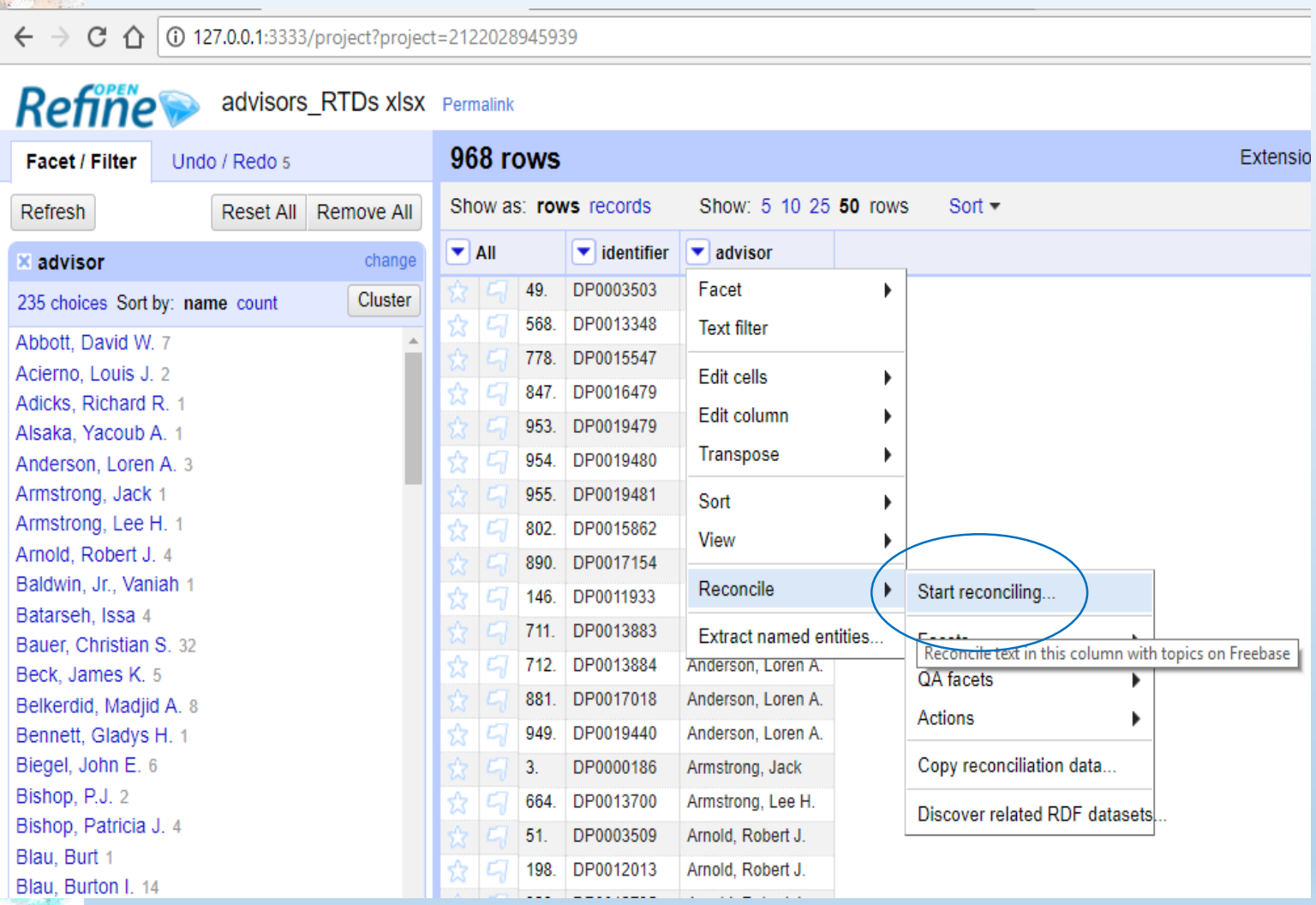
Clustering

Cluster Size	Row Count	Values in Cluster	Merge?	New Cell Value
2	8	• Frank, Fredric D. (7 rows) • Frank, Frederic D. (1 rows)	☑	Frank, Frederic D.
2	6	• Schrader, George F. (5 rows) • Schrader, George A. (1 rows)	☑	Schrader, George F.
2	5	• Snelson, Franklin F. (4 rows) • Snelson, Franklin (1	☑	Snelson, Franklin F.

Cluster & Edit column "advisor": Try other algorithms

Adding LC and VIAF Links to Advisor Names

Reconciliation

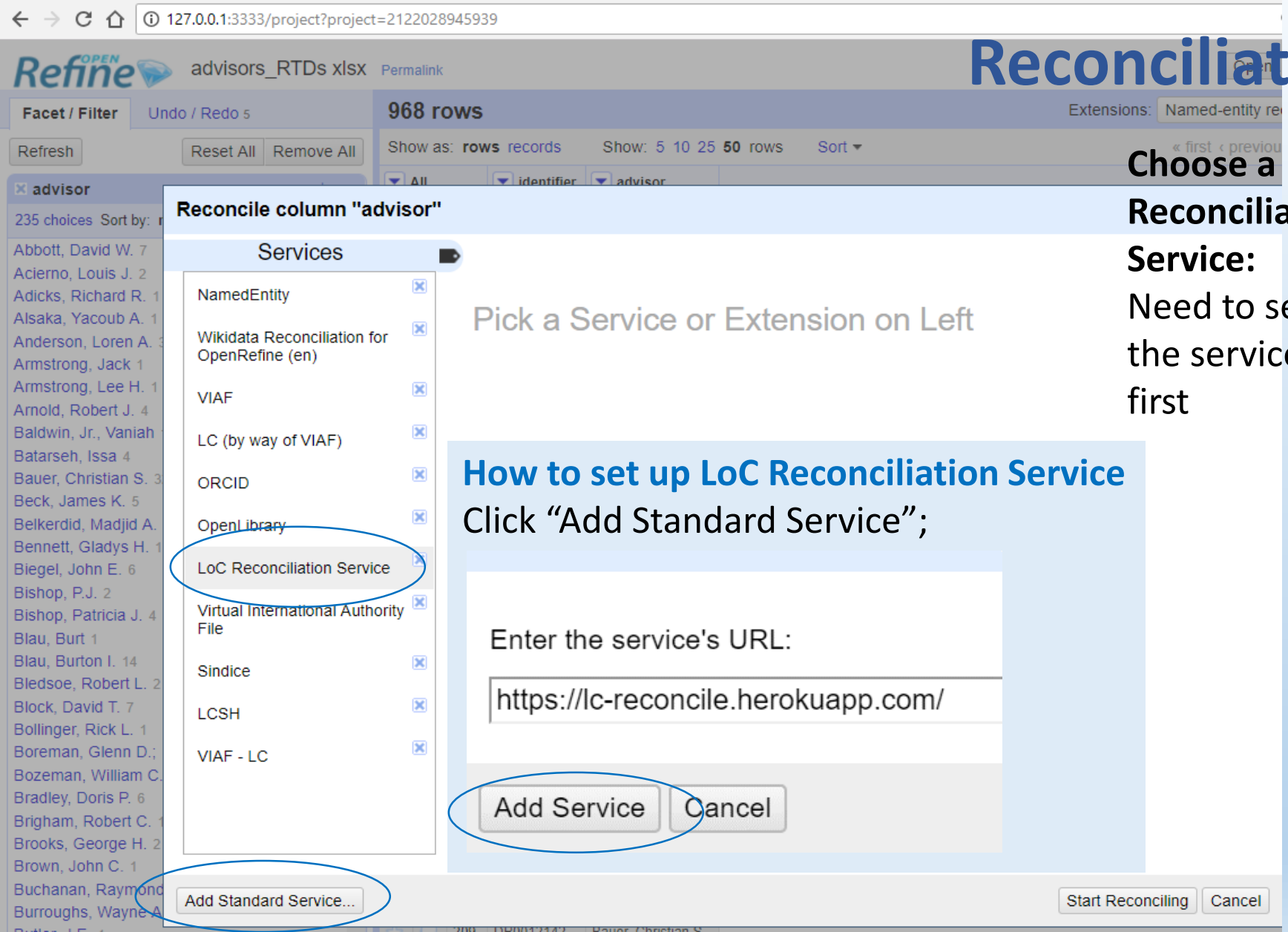


Sort by advisor;

Click "Reconcile—Start reconciliation"

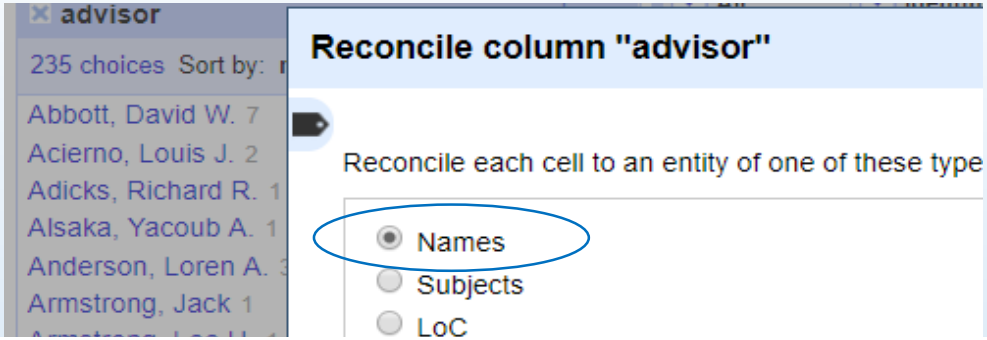
Adding LC and VIAF Links to Advisor Names

Reconciliation



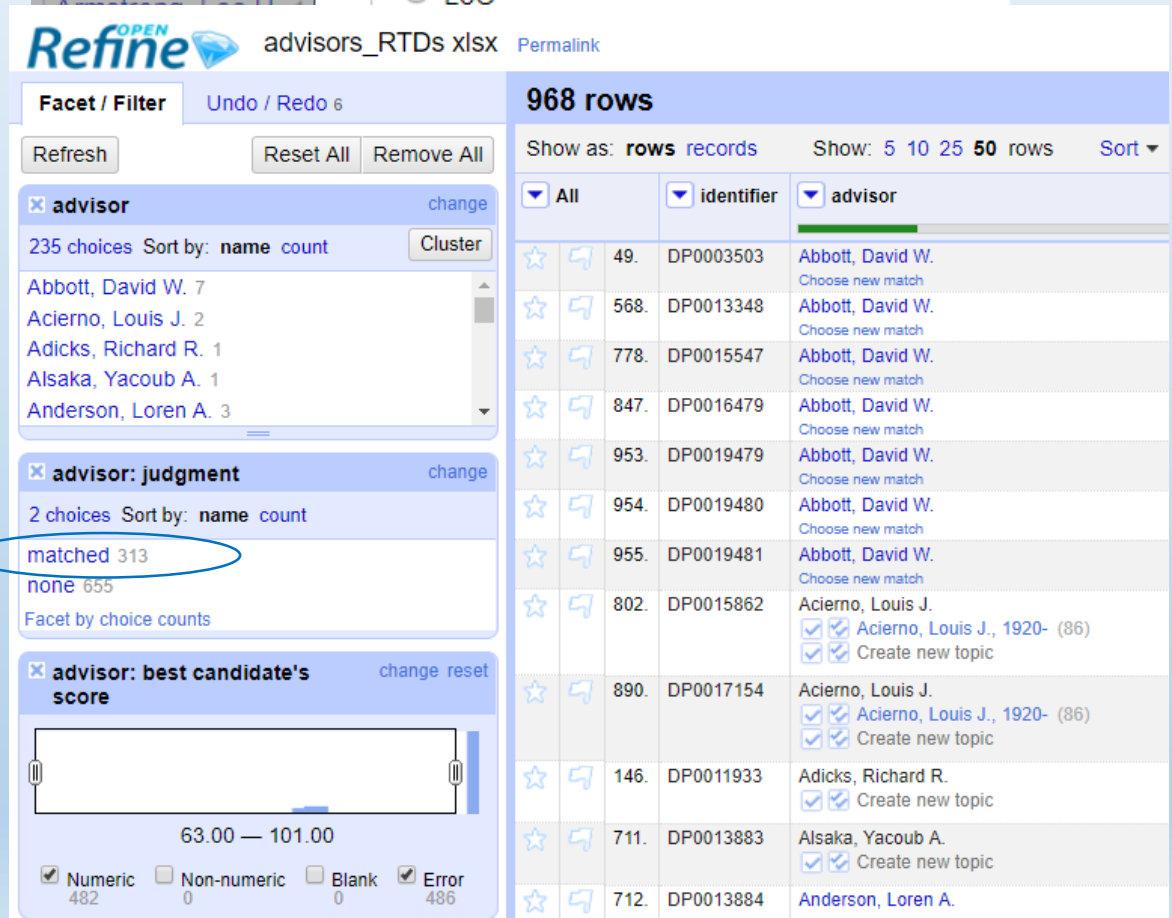
Choose a Reconciliation Service:
Need to set up the service first

Adding LC and VIAF Links to Advisor Names



Reconciliation

Leave “Names” as default;
Click “Start Reconciling”



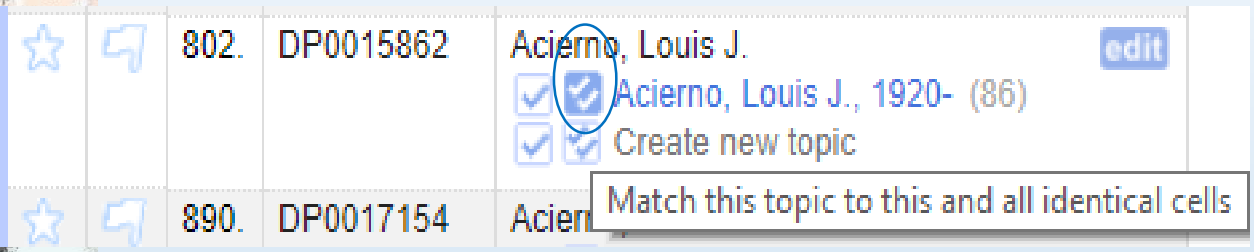
Matched 313 (about 32.33%).

Adding LC and VIAF Links to Advisor Names

Review

- For names linked, click the name to check;
- If it's not the right person, click "Choose new match";
- It opens several options, re-check and apply.

Adding LC and VIAF Links to Advisor Names

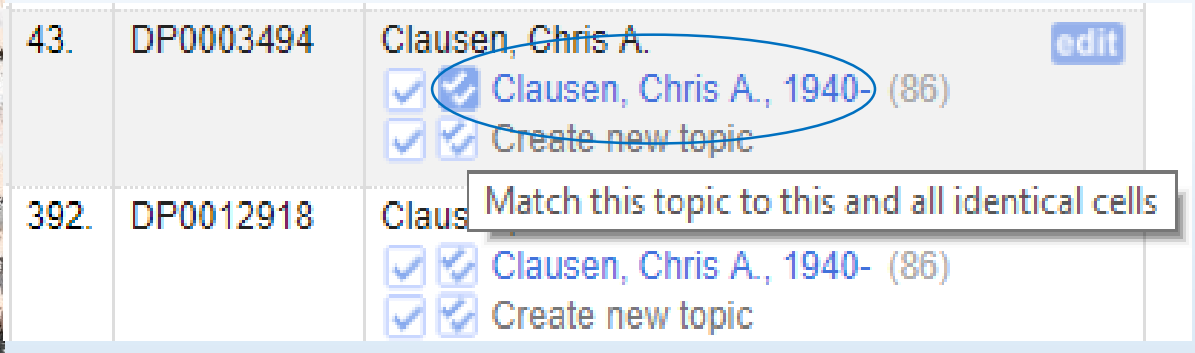


Click the link under "Acierno, Louis J.", it opens:
http://id.loc.gov/authorities/names/n85099714.html
Acierno, Louis J., 1920-
Sources
found: His Comprehensive cardiac rehabilitation and prevention, c1985: CIP t.p. (Louis J. Acierno, M.D., F.A.C.C., F.A.C.P.; associate prof. of pub. health, Univ. of Central Fla.) data sheet (b. 1920)
found: His A history of cardiology, 1993: CIP t.p. (L.J. Acierno; Univ. of Florida, USA)

Review

- For names unlinked, click the other options to check;
- If it's the right person, click ✓ (apply to this cell only) or ✓✓ (apply to all identical cells) to apply.

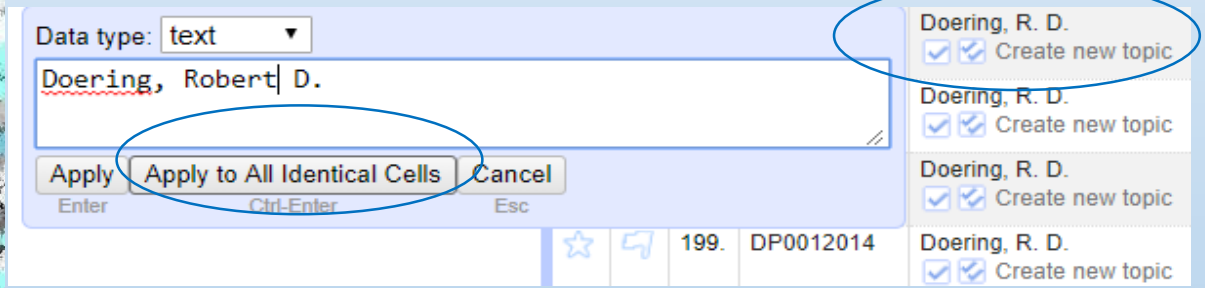
Adding LC and VIAF Links to Advisor Names



Clausen, Chris A., 1940- http://id.loc.gov/authorities/names/n78032138.html

Sources

found: His Principles of industrial ... 1978: t.p. (Chris A. Clausen, Dept. of Chem., Fla. Tech. U., Orlando) pub. info. (b. 12/7/40)



Doering, Robert D., 1925- http://id.loc.gov/authorities/names/no2018055990.html

Has Affiliation

Organization: Florida Technological University

Organization: University of Central Florida. Department of Industrial Engineering and Management Systems

Associated Locale Orlando (Fla.)

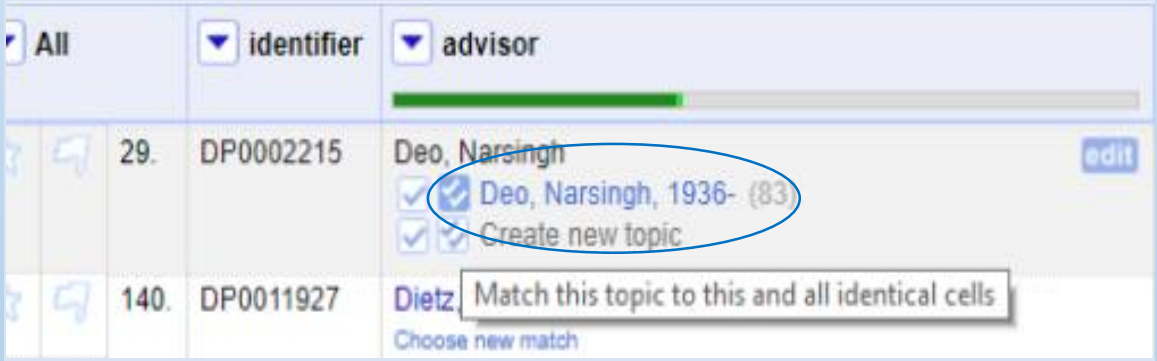
Review

- For names unlinked, click the other options to check (e.g., the LC links below);
- If it's the right person, click ✓ or ✓✓ to apply;
- If no right name found, click "Create new topic";
- Input the right name and apply.

Adding LC and VIAF Links to Advisor Names

Narsingh Deo, 1936-
http://id.loc.gov/authorities/names/n2006056273.html
Sources
found: Sysło, Maciej M. **Discrete optimization algorithms**, 2007: CIP t.p. (Narsingh Deo)
found: LC database, July 20, 2006: (Deo, Narsingh, 1936-)

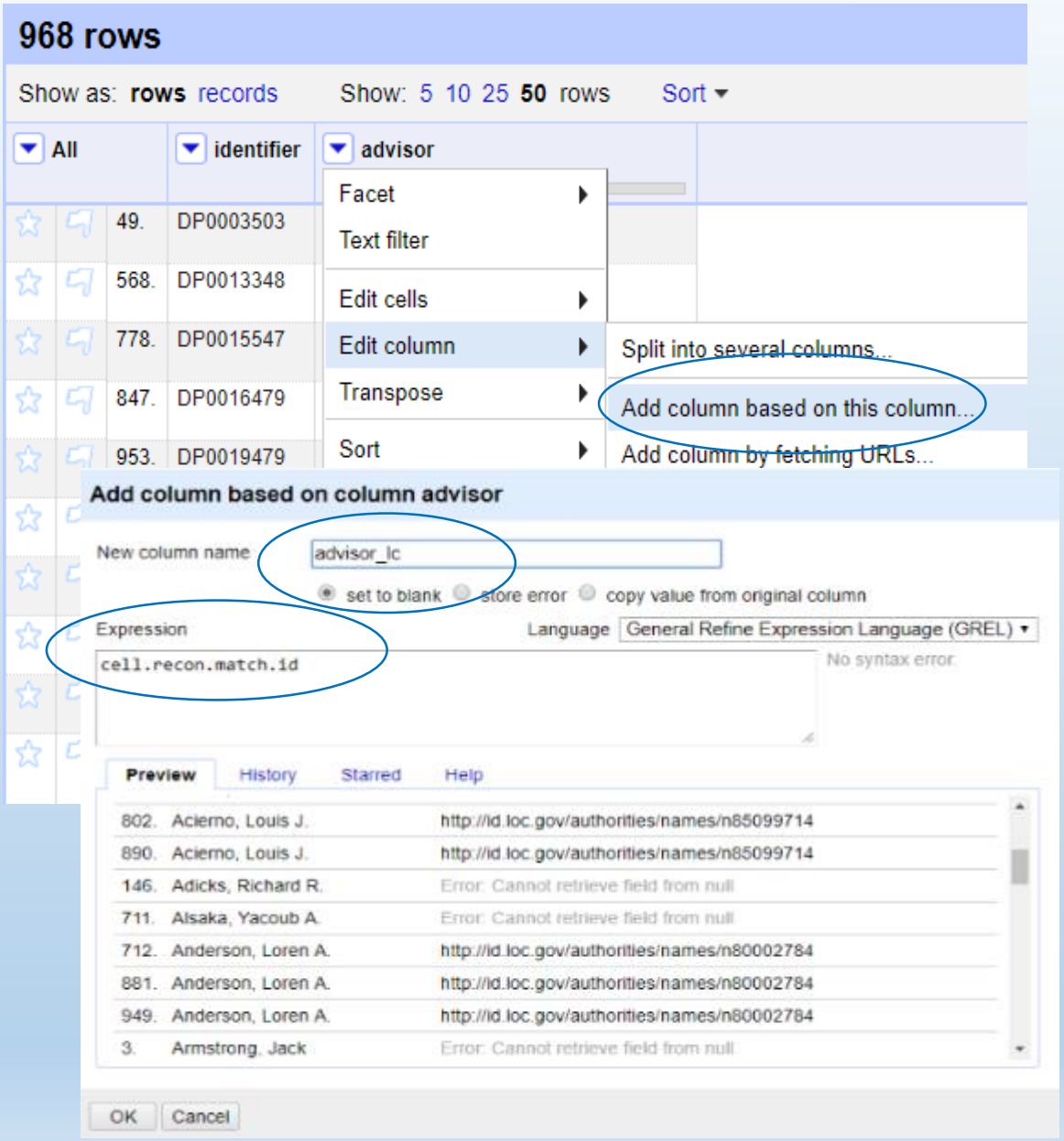
Wikipedia: https://en.wikipedia.org/wiki/Narsingh_Deo
…**Narsingh Deo** is a professor and Charles N. Millican Endowed Chair of the Department of Computer Science, **University of Central Florida**…
Books
Discrete Optimization Algorithms: With Pascal Programs (with M.M. Syslo and J. S. Kowalik), Prentice-Hall, Englewood Cliffs, N.J., 1983, 542 pages.



Review

- If LCNAF doesn't provide enough information, further check the web (e.g., Wikipedia, Amazon books, obituaries, university website, newsletter…)
- When confirmed that it's the right person, click ✓ or ✓✓ to apply.

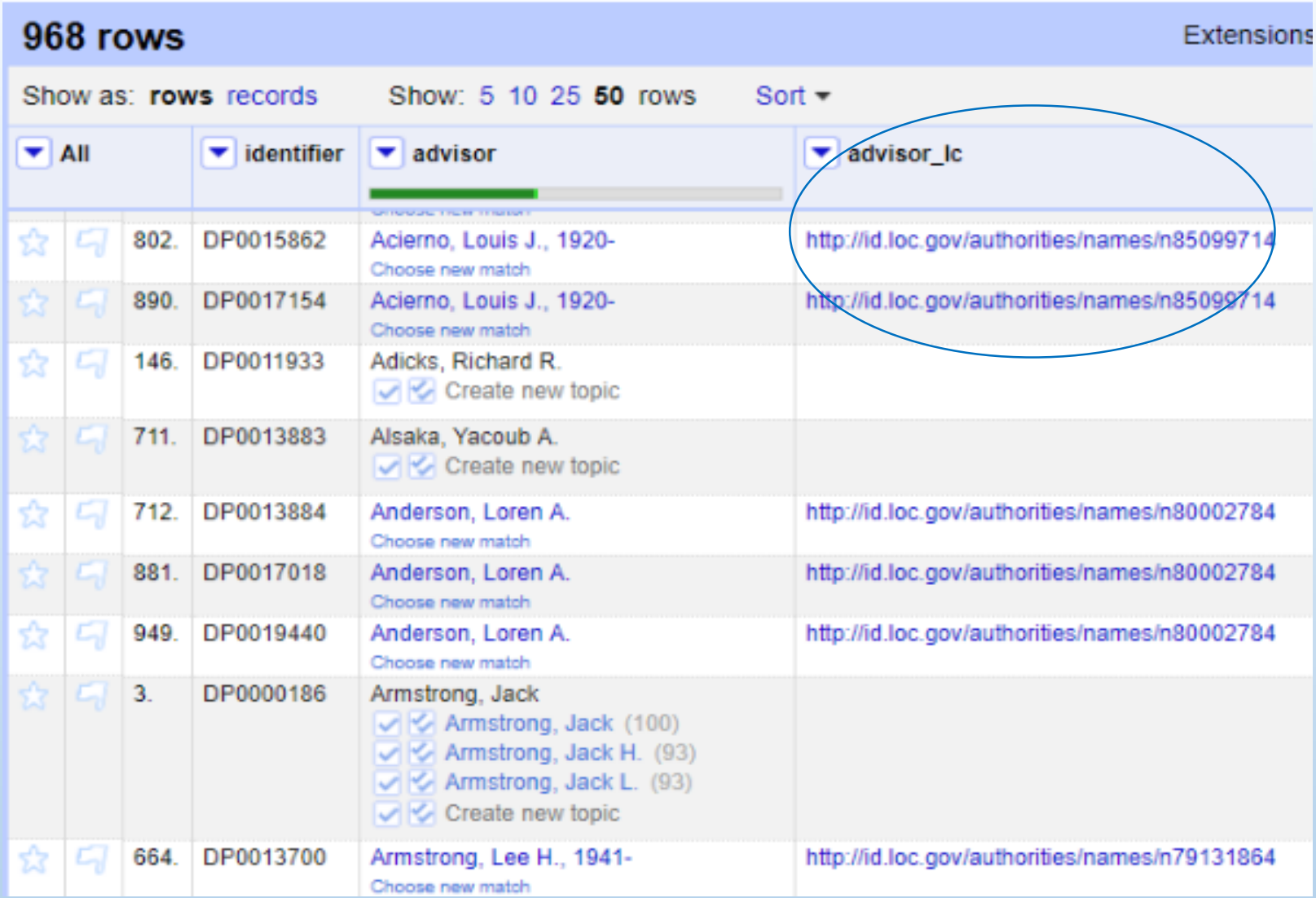
Adding LC and VIAF Links to Advisor Names



Add Column for URLs

- Edit column—Add column based on this column
- In the opened new window, fill in:
  New column name: advisor_lc
  Expression: cell.recon.match.id

Adding LC and VIAF Links to Advisor Names



968 rows

Extensions

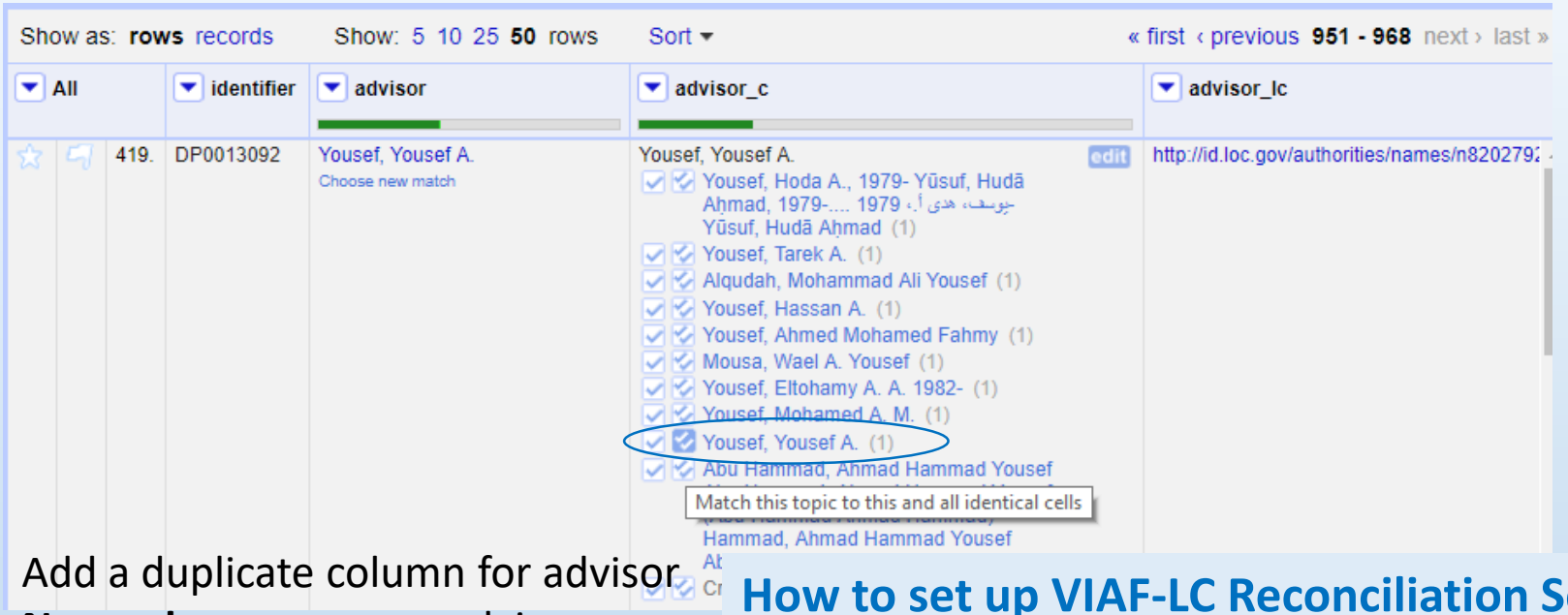
Show as: **rows** records Show: 5 10 25 **50** rows Sort

All		identifier	advisor	advisor_lc
802.	DP0015862	Acierno, Louis J., 1920- Choose new match	http://id.loc.gov/authorities/names/n85099714
890.	DP0017154	Acierno, Louis J., 1920- Choose new match	http://id.loc.gov/authorities/names/n85099714
146.	DP0011933	Adicks, Richard R. Create new topic	
711.	DP0013883	Alsaka, Yacoub A. Create new topic	
712.	DP0013884	Anderson, Loren A. Choose new match	http://id.loc.gov/authorities/names/n80002784
881.	DP0017018	Anderson, Loren A. Choose new match	http://id.loc.gov/authorities/names/n80002784
949.	DP0019440	Anderson, Loren A. Choose new match	http://id.loc.gov/authorities/names/n80002784
3.	DP0000186	Armstrong, Jack Armstrong, Jack (100) Armstrong, Jack H. (93) Armstrong, Jack L. (93) Create new topic	
664.	DP0013700	Armstrong, Lee H., 1941- Choose new match	http://id.loc.gov/authorities/names/n79131864

Add Column for URLs: LC Links added

Adding LC and VIAF Links to Advisor Names

Add VIAF Links



Add a duplicate column for advisor

New column name advisor_c

Expression value

[advisor_c] Reconciliation

Select **Virtual International Authority File service**

(*Give more options to choose from if not matched directly)

Or, select **VIAF-LC service**

How to set up VIAF-LC Reconciliation Service

Click “Add Standard Service”;

Enter the service’s URL:

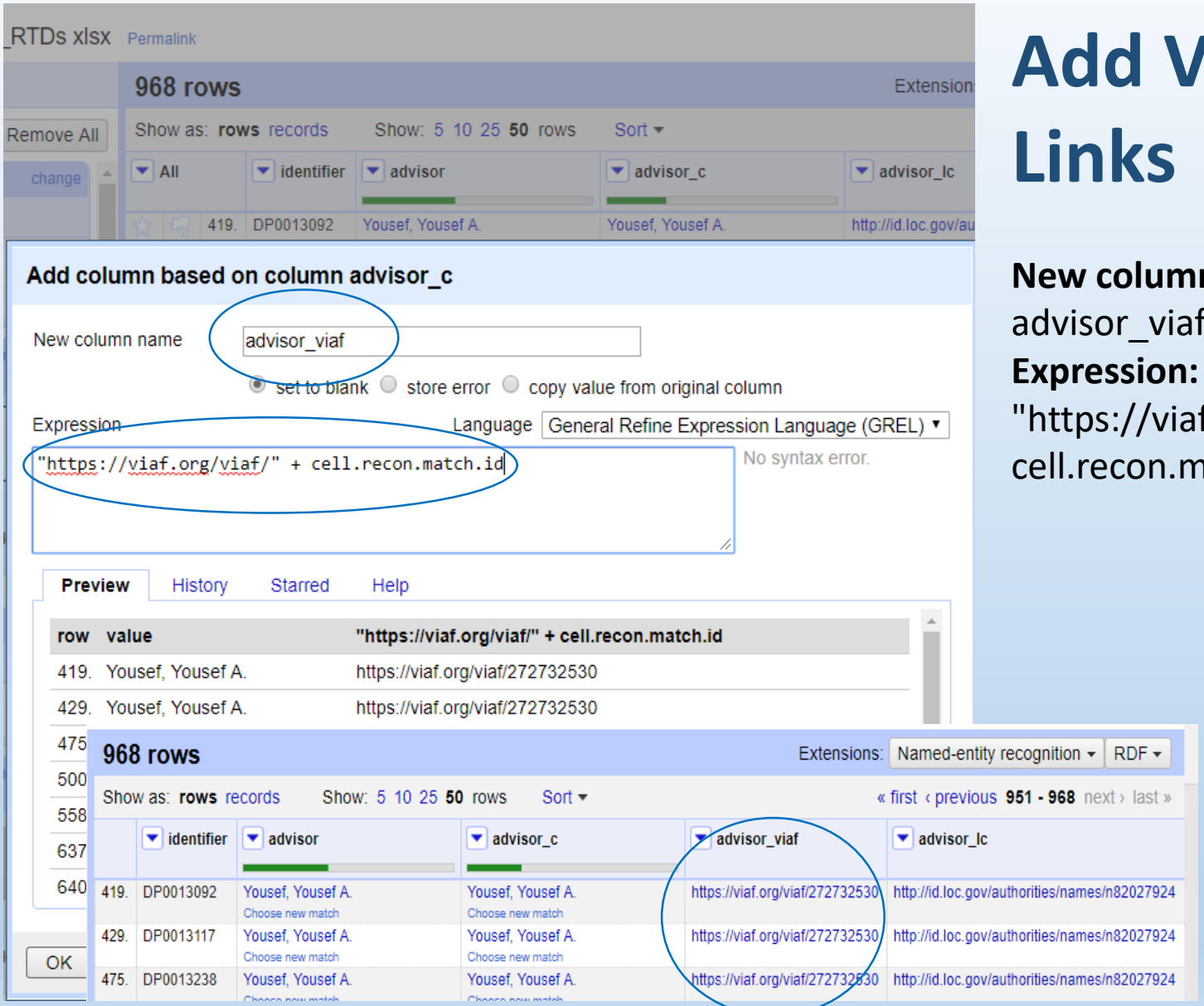
http://refine.codefork.com/reconcile/viaf/LC

How to set up Virtual International Authority File service

Enter the service’s URL:

http://iphylo.org/~rpage/phyloinformatics/services/reconciliation_viaf.php

Adding LC and VIAF Links to Advisor Names



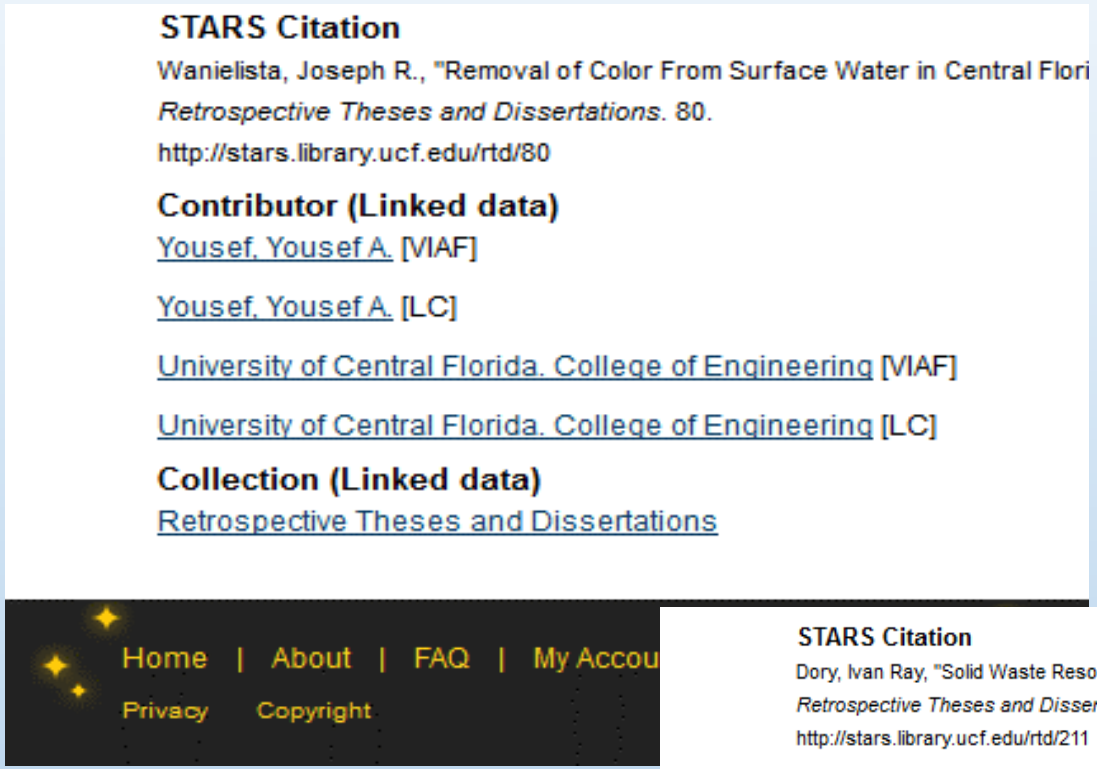
Add VIAF Links

New column name:
advisor_viaf
Expression:
"https://viaf.org/viaf/" +
cell.recon.match.id

VIAF links added

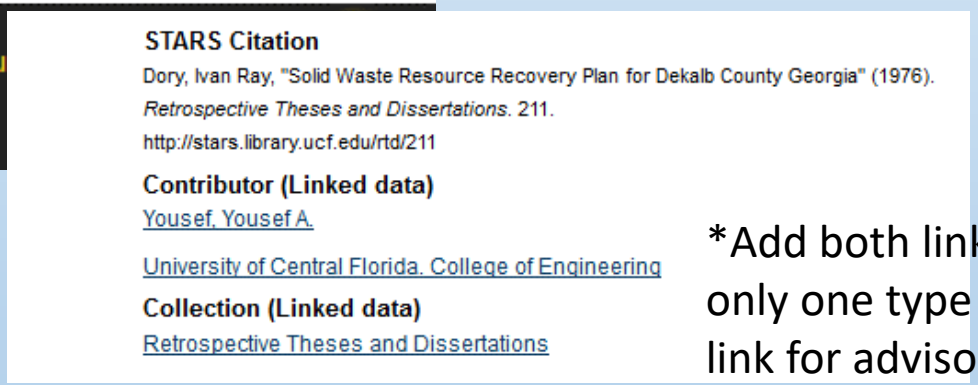
Adding LC and VIAF Links to Advisor Names

- **Display in the IR**



http://stars.library.ucf.edu/rtd/80/

LOD links added for:
Advisor name
College name



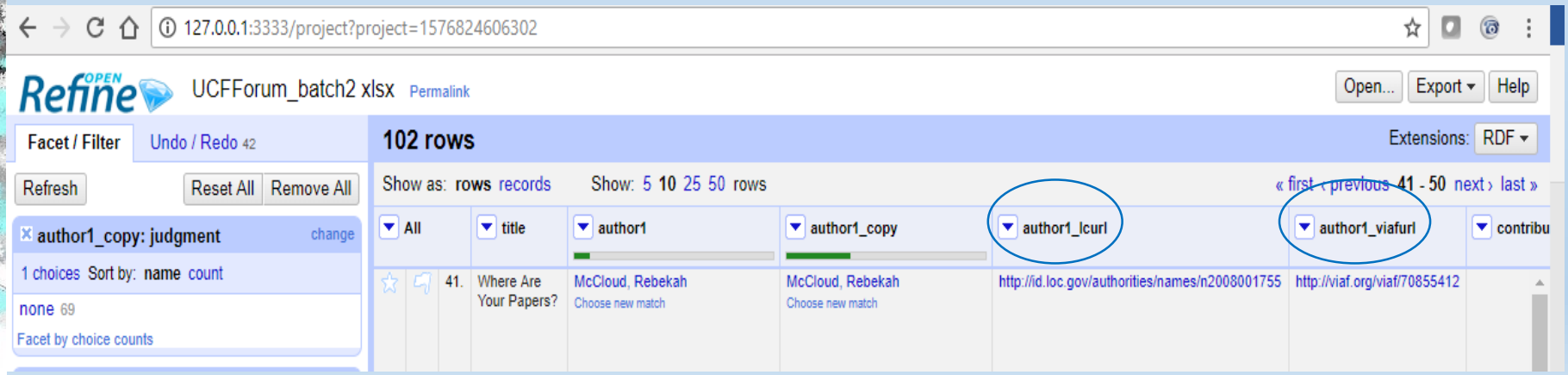
http://stars.library.ucf.edu/rtd/211/

*Adding LOD links for the advisor names is a work in progress.

*Add both links or only one type of link for advisors (e.g., VIAF, or LC)

Adding LC and VIAF Links to Author Names

- **Using Expression to Format Multiple Links**
  - Expression **Language: General Refine Expression Language (GREL)**
  - First, run reconciliations and get VIAF and LC links;
  - Then add columns, e.g.,
    - Edit column – Add column based on this column
    - **New Column name** author1_**viafurl**
    - **Expression** "http://viaf.org/viaf/"+ cell.recon.match.id
    - Edit column – Add column based on this column
    - **New column name** author1_**lcurl**
    - **Expression** cell.recon.match.id



Adding LC and VIAF Links to Author Names

- **Using Expression to Format Multiple Links**
  - **Add column based on this column**
    - **New column name** author1_viafurl_lcurl
    - **Expression**

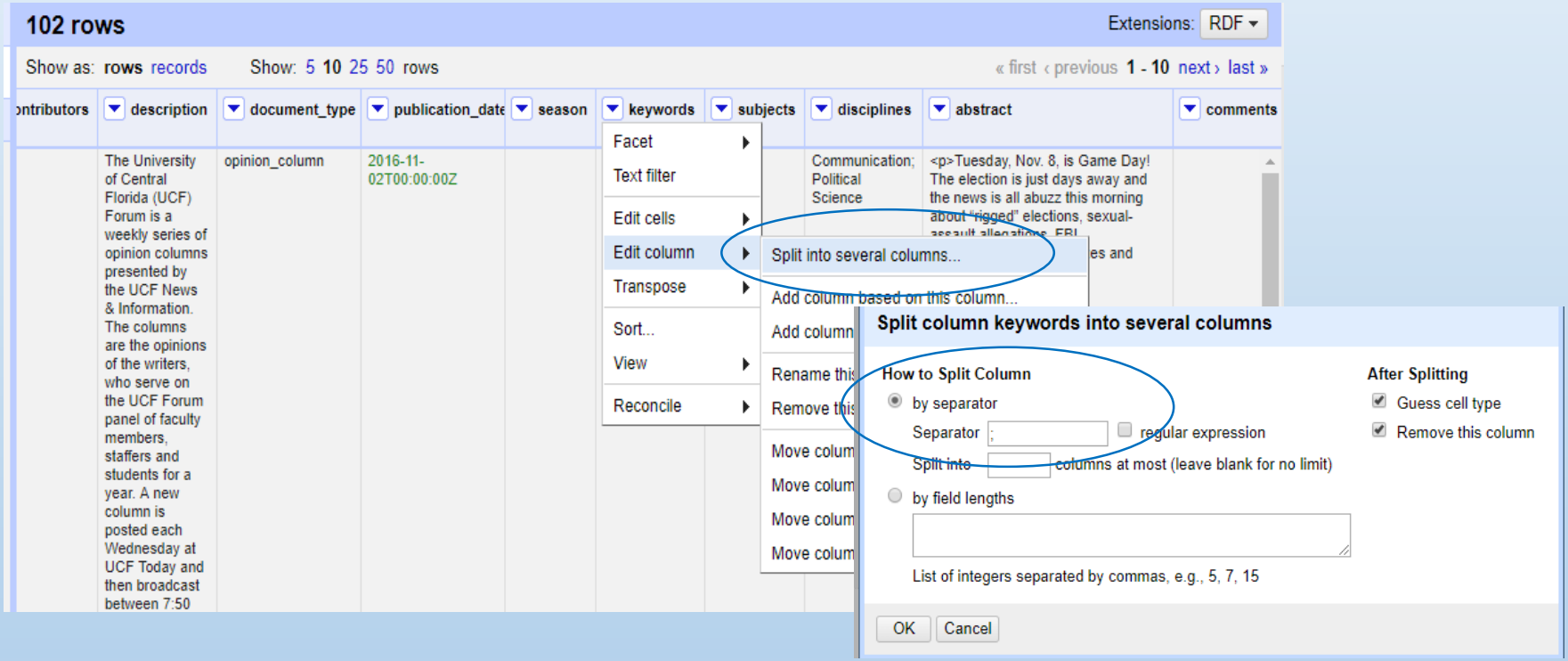
      cells["author1_viafurl"].value + " " + cells["author1"].value + "[VIAF] " + cells["author1_lcurl"].value + " " + cells["author1_copy"].value + "[LC]"

rows « first ‹ previous 41 - 50 next › last »

author1_lcurl	author1_viafurl	author1_viafurl_lcurl
http://id.loc.gov/authorities/names/n2008001755	http://viaf.org/viaf/70855412	http://viaf.org/viaf/70855412 McCloud, Rebekah [VIAF] http://id.loc.gov/authorities/names/n2008001755 McCloud, Rebekah [LC]

Adding LC Subject Links to IR Records

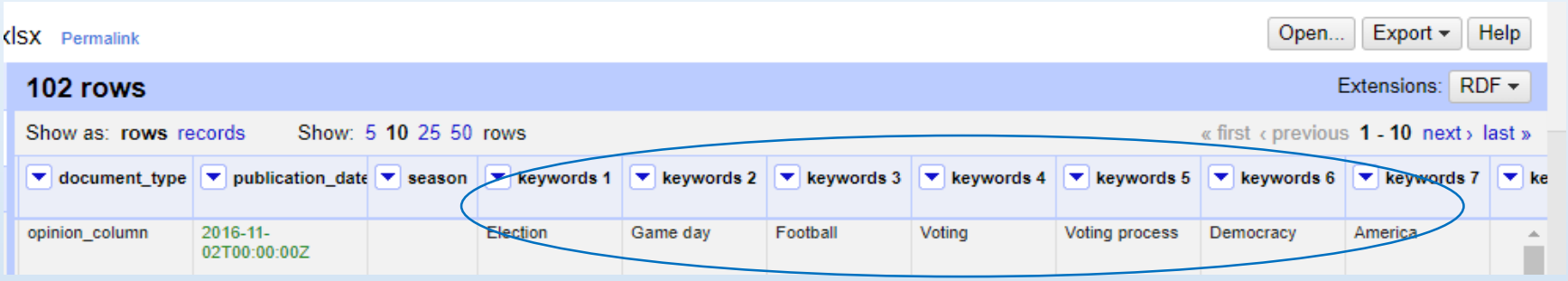
- **Create a project for one “UCF Forum” dataset in OpenRefine;**
  - Its keywords field has a mixture of controlled and uncontrolled terms taken from the articles and supplied by the Metadata Librarian;
  - The goal is to add LOD links for the controlled terms.
- **Splitting Keywords into Several Columns**

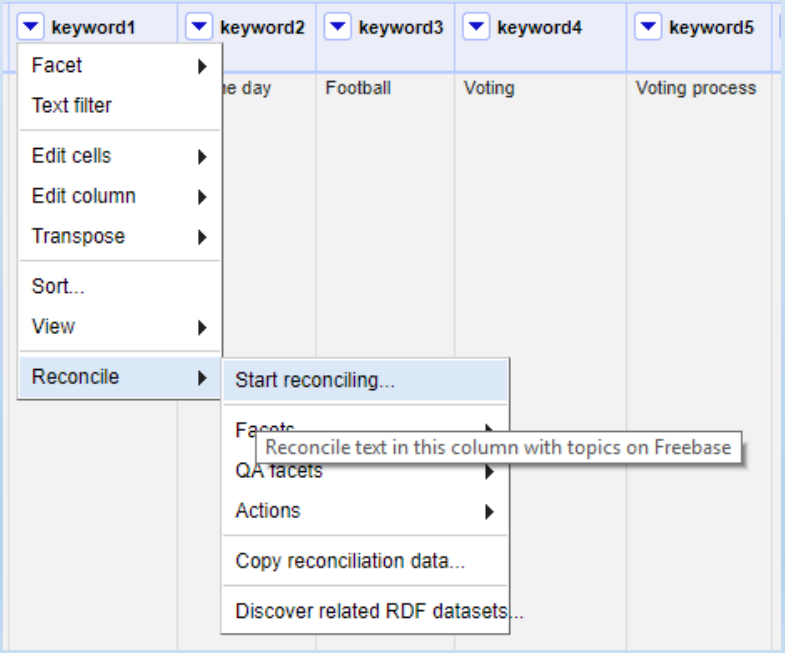


Under “Keywords”, click “Edit column – Split into several columns”; “by separator “;”

Adding LC Subject Links to IR Records

- **Create a project for one “UCF Forum” dataset in OpenRefine;**
- **Keywords splitted into Several Columns**





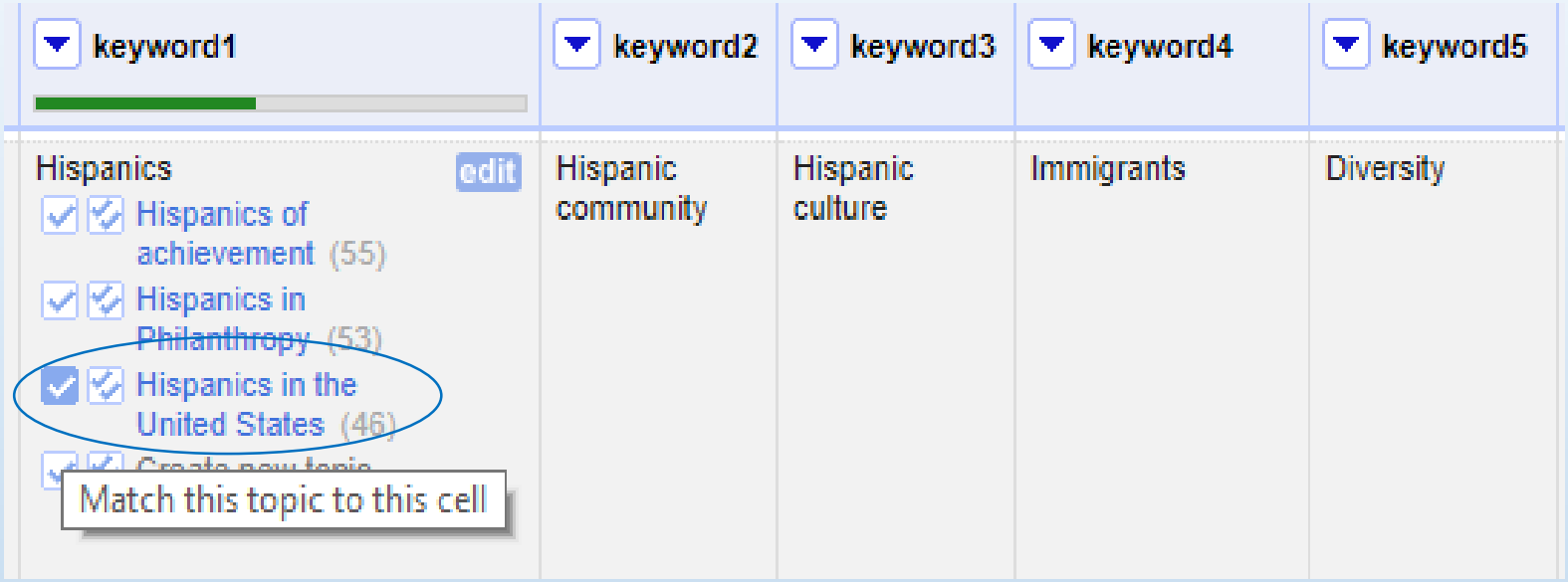
Top graph:
Keywords splitted (by default, e.g., keywords 1, 2, 3…)

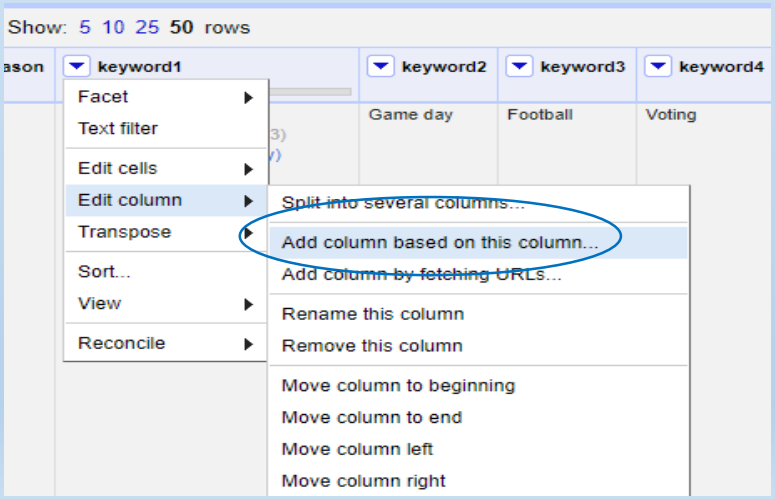
Rename the fields, delete the space in field names
keywords 1, 2, 3… → keyword1, 2, 3…

Left graph:
Reconcile column “keyword1”
Reconcile each cell against **LoC Reconciliation Service**

Adding LC Subject Links to IR Records

- **Review, select and confirm matched values** (when needed)

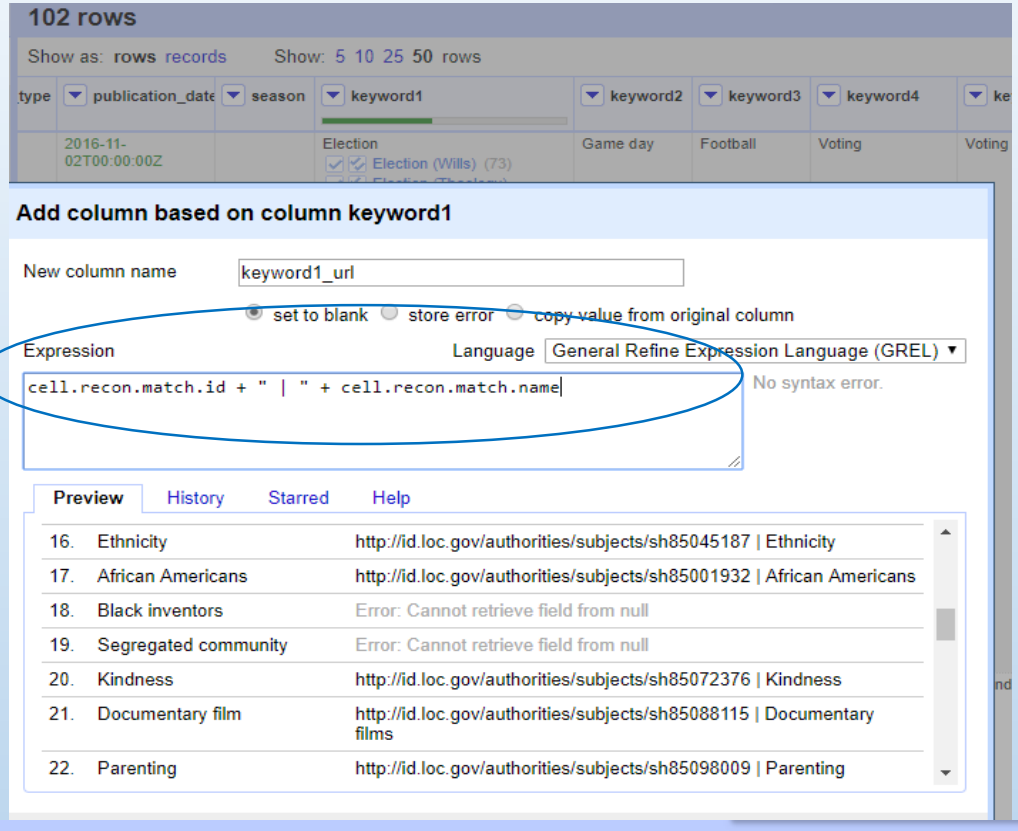




Edit column – Add column based on this column

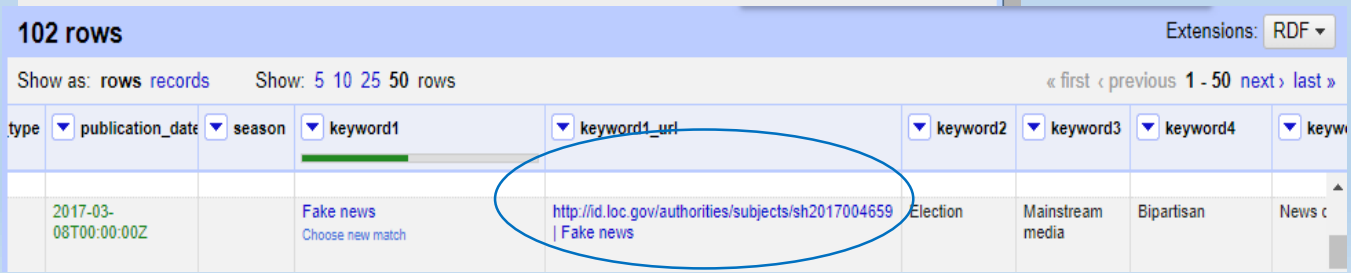
Adding LC Subject Links to IR Records

- **Adding column for links**



New column name
keyword1_url

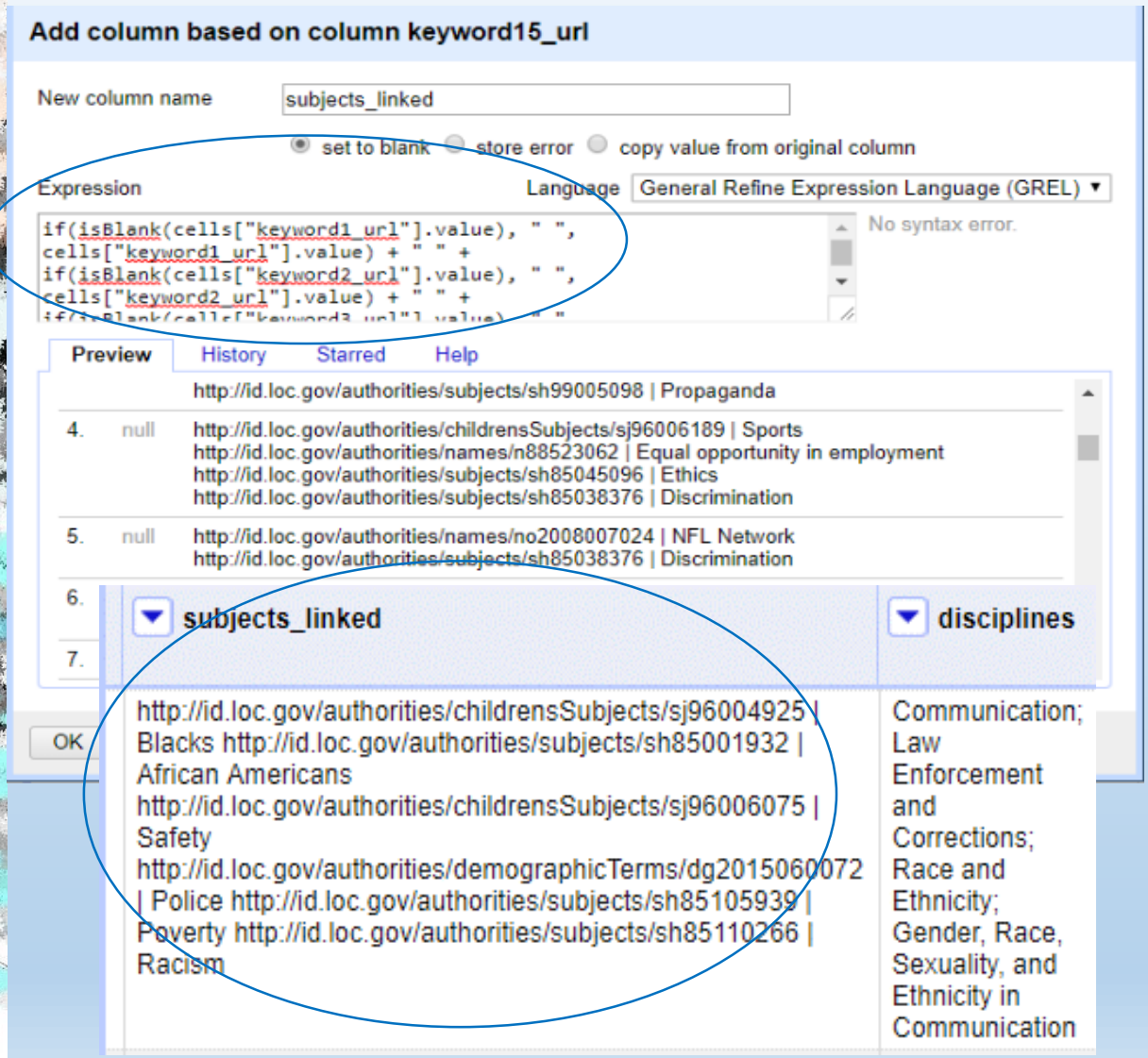
Expression
cell.recon.match.id + " | "
+ cell.recon.match.name



Links added for keyword1; Repeating the same process for keyword2, 3, 4…

Adding LC Subject Links to IR Records

- **Putting Links together**



Putting all subjects and their links together in a column

New column name subjects_linked
Expression

```
if(isBlank(cells["keyword1_url"].value), " ",
cells["keyword1_url"].value) + " " +
if(isBlank(cells["keyword2_url"].value), " ",
cells["keyword2_url"].value) + " " +
if(isBlank(cells["keyword3_url"].value), " ",
cells["keyword3_url"].value) + " " +
if(isBlank(cells["keyword4_url"].value), " ",
cells["keyword4_url"].value) + " " +
if(isBlank(cells["keyword5_url"].value), " ",
cells["keyword5_url"].value) + " " +
if(isBlank(cells["keyword6_url"].value), " ",
cells["keyword6_url"].value)
```

(*can add more values)

Subject links display together

* Use “|” or other dividers to separate subjects

Adding LOD Links to IR Records

Violence is Not a Virus, but it is Transmitted

Roberto Hugh Potter, *University of Central Florida*

Description
The University of Central Florida (UCF) Forum is a weekly series of opinion columns presented by the UCF News & Information. The columns are the opinions of the writers, who serve on the UCF Forum panel of faculty members, staffers and students for a year. A new column is posted each Wednesday at UCF Today and then broadcast between 7:50 and 8 a.m. Sunday on WUCF-FM (89.9).

Publication Date
9-5-2012

Keywords
Violence; Mass shooting; Firearms; Gun violence; Assailant; Firearm; Criminal behavior; Criminal violence; Campus violence

Introduction
Recent mass shootings have again brought out the "violence is a disease" crowd. The thinking is that if we reduce the availability of firearms, we will decrease violence.

Subjects
Violence; Mass shootings; Firearms; Criminal behavior

Creator (Linked Data)
Potter, Roberto Hugh(VIAF); Potter, Roberto Hugh(LC)

Collection
UCF Forum

Publisher
University of Central Florida

Source
https://today.ucf.edu/violence-is-not-a-virus-but-it-is-transmitted/ (UCF Today: UCF Forum)

Type
article

STARS Citation
Potter, Roberto (2012). Violence is not a virus, but it is transmitted. UCF Today, 2012-09-05. Retrieved from https://today.ucf.edu/violence-is-not-a-virus-but-it-is-transmitted/

UCF Forum note
Information presented on this website is considered public information (unless otherwise noted) and may be distributed or copied. Use of appropriate byline/photo/image credit is

Download

INCLUDED IN

Communication Commons, Criminology Commons

SHARE

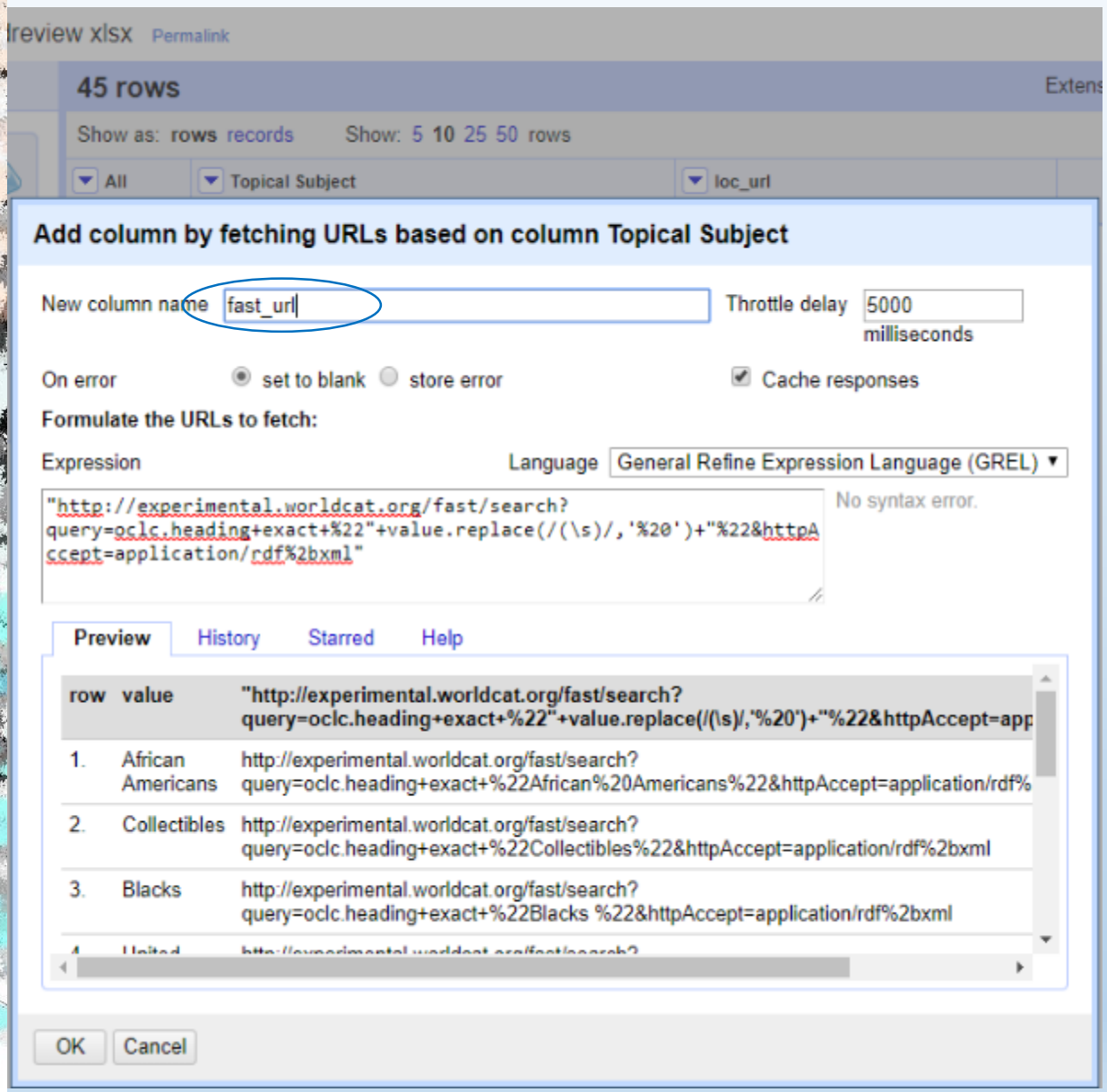
Subjects
Violence; Mass shootings; Firearms; Criminal behavior

Creator (Linked Data)
Potter, Roberto Hugh(VIAF); Potter, Roberto Hugh(LC)

Collection
UCF Forum

An Example in the IR
http://stars.library.ucf.edu/ucf-forum/186/

Adding FAST by Fetching URLs



Add column by fetching URLs based on Topical Subject column
(Click "Edit column—add column by fetching URLs" under "Topical_Subject")

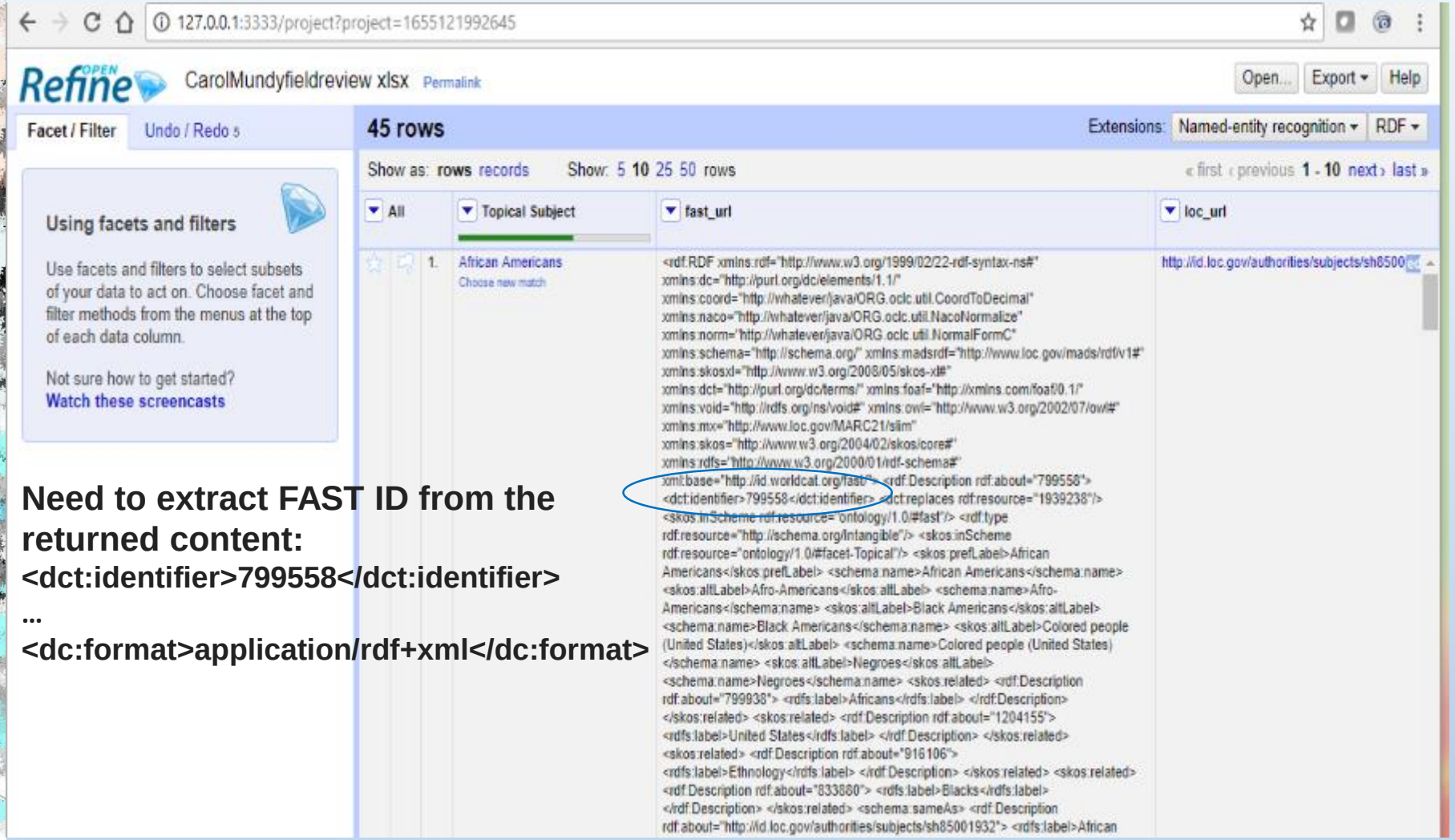
New column name
fast_url

Expression
"http://experimental.worldcat.org/fast/search?query=oclc.heading+exact+%22"+value.replace(/(\s)/,'%20')+"%22&httpAccept=application/rdf%2bxml"

*Query FAST for RDFXML return

Adding FAST by Fetching URLs

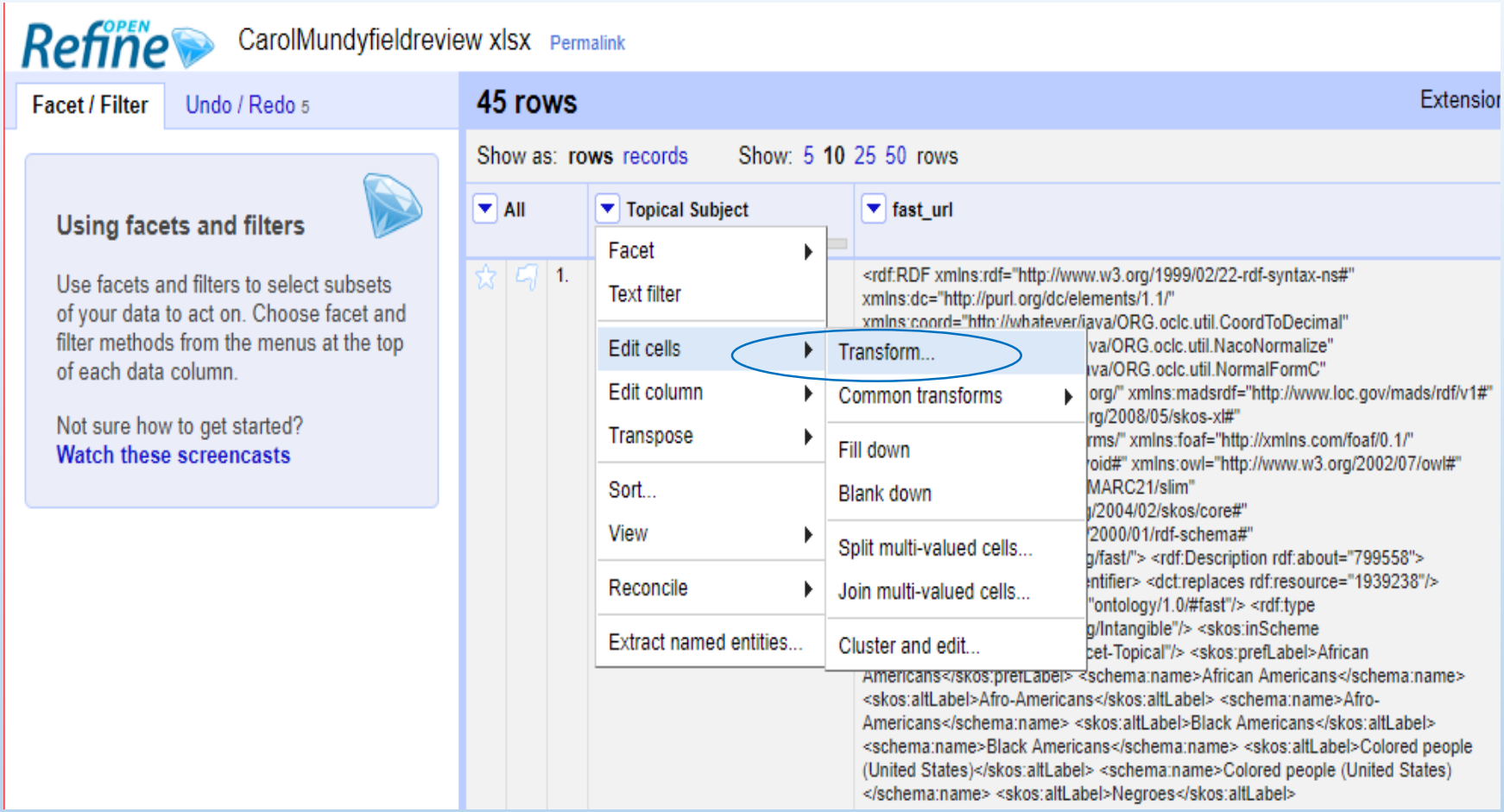
Text Transformation



Need to extract FAST ID from the returned content:
<dct:identifier>799558</dct:identifier>
…
<dc:format>application/rdf+xml</dc:format>

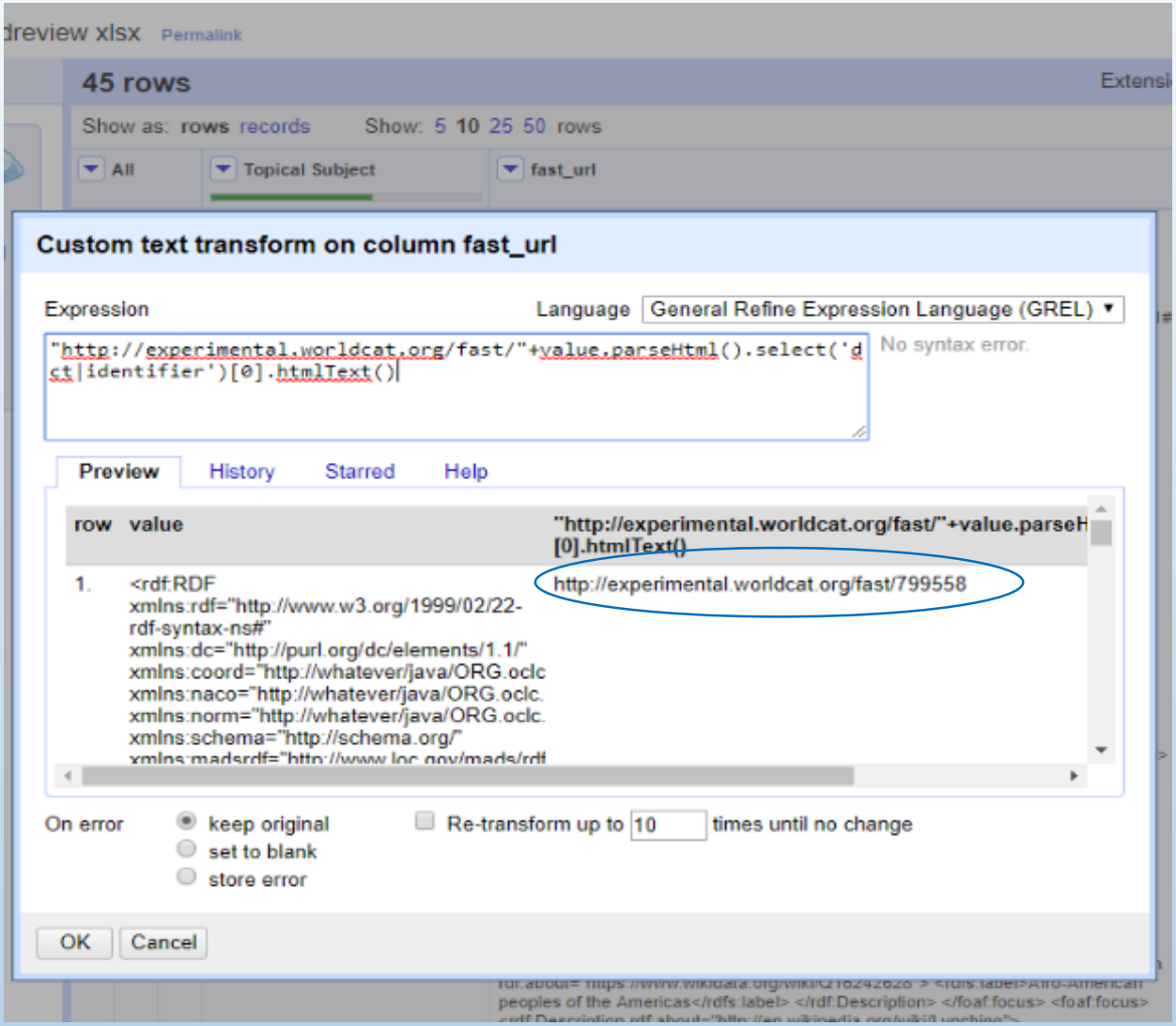
Adding FAST by Fetching URLs

Text Transformation



Edit cells – Transform…

Adding FAST by Fetching URLs

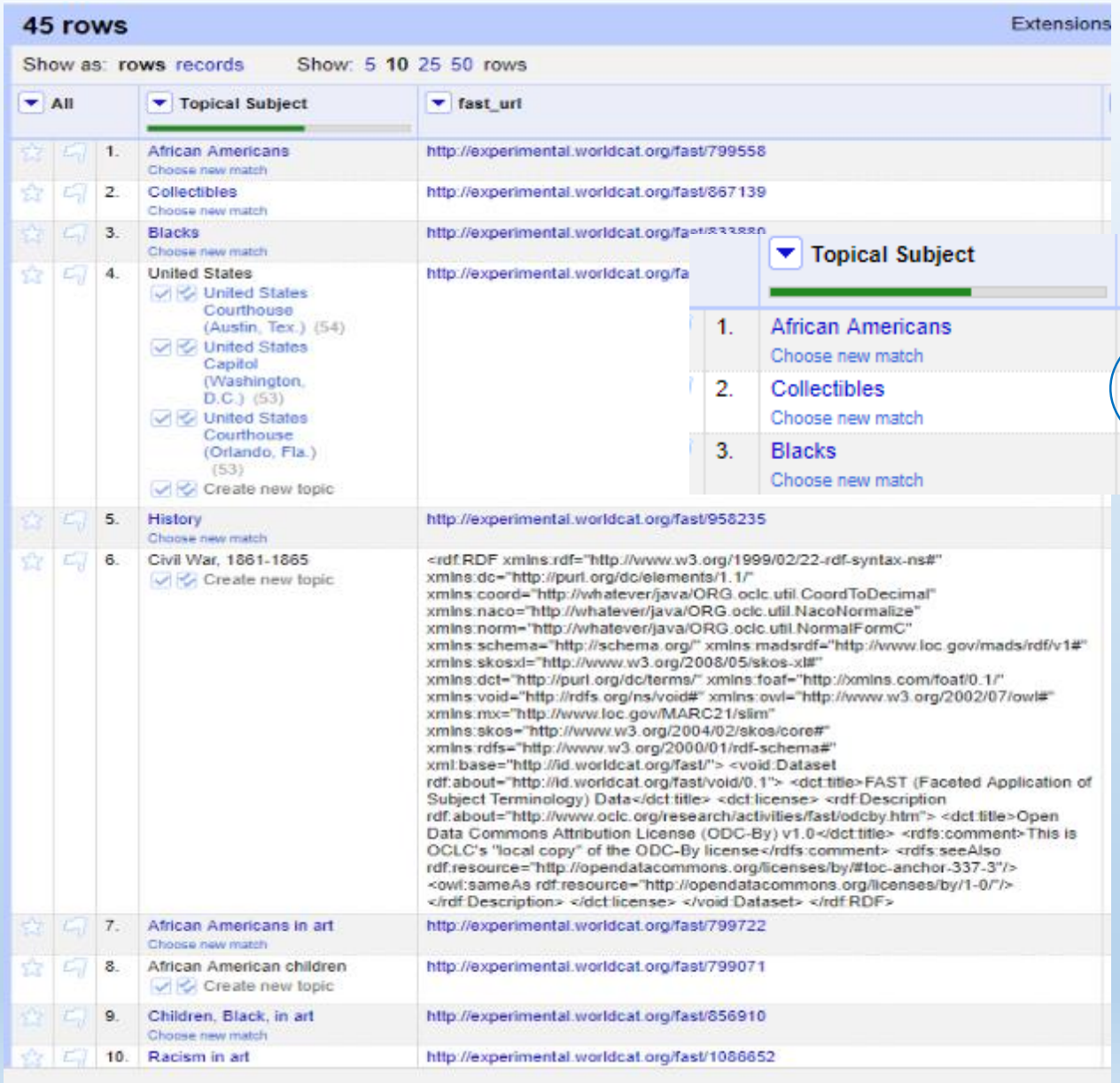


Text Transformation
(Extract FAST identifier from the returned content)

Expression

```
"http://experimental.worldcat.org/fast/"+value.parseHtml().select('dct|identifier')[0].htmlText()
```

Adding FAST by Fetching URLs



45 rows

Extensions

Show as: **rows** records Show: 5 **10** 25 50 rows

	All	Topical Subject	fast_url
1.		African Americans Choose new match	http://experimental.worldcat.org/fast/799558
2.		Collectibles Choose new match	http://experimental.worldcat.org/fast/867139
3.		Blacks Choose new match	http://experimental.worldcat.org/fa
4.		United States United States Courthouse (Austin, Tex.) (54) United States Capitol (Washington, D.C.) (53) United States Courthouse (Orlando, Fla.) (53) Create new topic	http://experimental.worldcat.org/fa
5.		History Choose new match	http://experimental.worldcat.org/fast/958235
6.		Civil War, 1861-1865 Create new topic	<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#" xmlns:dc="http://purl.org/dc/elements/1.1/" xmlns:coord="http://whatever/java/ORG.oclc.util.CoordToDecimal" xmlns:naco="http://whatever/java/ORG.oclc.util.NacoNormalize" xmlns:norm="http://whatever/java/ORG.oclc.util.NormalFormC" xmlns:schema="http://schema.org/" xmlns:madsrdf="http://www.loc.gov/mads/rdf/v1#" xmlns:skosxl="http://www.w3.org/2008/05/skos-xl#" xmlns:dct="http://purl.org/dc/terms/" xmlns:foaf="http://xmlns.com/foaf/0.1/" xmlns:void="http://rdfs.org/ns/void#" xmlns:owl="http://www.w3.org/2002/07/owl#" xmlns:mx="http://www.loc.gov/MARC21/slim" xmlns:skos="http://www.w3.org/2004/02/skos/core#" xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#" xml:base="http://id.worldcat.org/fast/"> <void:Dataset rdf:about="http://id.worldcat.org/fast/void/0.1"> <dct:title>FAST (Faceted Application of Subject Terminology) Data</dct:title> <dct:license> <rdf:Description rdf:about="http://www.oclc.org/research/activities/fast/odcby.htm"> <dct:title>Open Data Commons Attribution License (ODC-By) v1.0</dct:title> <rdfs:comment>This is OCLC's "local copy" of the ODC-By license</rdfs:comment> <rdfs:seeAlso rdf:resource="http://opendatacommons.org/licenses/by/#toc-anchor-337-3"/> <owl:sameAs rdf:resource="http://opendatacommons.org/licenses/by/1-0/"/> </rdf:Description> </dct:license> </void:Dataset> </rdf:RDF>
7.		African Americans in art Choose new match	http://experimental.worldcat.org/fast/799722
8.		African American children Create new topic	http://experimental.worldcat.org/fast/799071
9.		Children, Black, in art Choose new match	http://experimental.worldcat.org/fast/856910
10.		Racism in art	http://experimental.worldcat.org/fast/1086652

	Topical Subject	fast_url
1.	African Americans Choose new match	http://experimental.worldcat.org/fast/799558
2.	Collectibles Choose new match	http://experimental.worldcat.org/fast/867139
3.	Blacks Choose new match	http://experimental.worldcat.org/fast/833880

FAST links added

*If returned text doesn't include a FAST identifier, it'll display the original text;
If more than one match, will pick up the first one (index[0])

Other Possibilities

- **Augment Data with Reconciliation Services**
  - Reconcile genre values to AAT terms
  - Reconcile places to GeoNames
  - Reconcile ORCID…
- **Reconcile Against Local Vocabularies**
  - **reconciliation-csv**
    - http://okfnlabs.org/reconcile-csv/
    - Possibilities: Reconcile various fields in OpenRefine against local controlled term lists, e.g., medals, ranks for Veterans Oral History
- **Next Steps**
  - Keep adding more LOD links to personal names, subjects and college/department names to digital collections;
  - Continue to explore OpenRefine and related services to enrich metadata and improve workflow;
  - Promote, explore and link authors/researchers to personal identifiers.

Resources

- Berners-Lee, Tim. Linked Data https://www.w3.org/DesignIssues/LinkedData.html
- BIBFRAME http://BIBFRAME.org/
- DBpedia http://wiki.dbpedia.org/
- DPLA http://dp.la
- Europeana http://europeana.eu
- FAST: Faceted Application of Subject Terminology http://id.worldcat.org/fast
- FAST Linked Data API. https://www.oclc.org/developer/develop/web-services/fast-api/linked-data.en.html
- Free Your Metadata. Linked Data. http://freeyourmetadata.org/
- GeoNames http://www.geonames.org/ontology/documentation.html
- International Standard Name Identifier (ISNI) http://www.isni.org/
- LC Linked Data Service: Authorities and Vocabularies https://id.loc.gov/
- Mak, Lucas et al. A Lightweight Structured Data Implementation Using JSON-LD and Schema.org for Digital Repository.
- Mitchell, Erik T. Building Blocks of Linked Open Data in Libraries. Library Technology Reports (vol. 49, no. 5)
- Mitchell, Erik T. Three Case Studies in Linked Open Data. Library Technology Reports (vol. 49, no. 5)
- Motley Collection of Theatre and Costume Design (New)—Hamlet--Caesar. http://imagesearch-test1.library.illinois.edu/cdm/ref/collection/motley-new/id/599
- OCLC Linked Data https://www.oclc.org/developer/develop/linked-data.en.html
- Open Researcher and Contributor ID (ORCID) https://orcid.org/

Resources

- OpenRefine. http://openrefine.org/
- OpenRefine. Documentation For Users. https://github.com/OpenRefine/OpenRefine/wiki/Documentation-For-Users
- OpenRefine Recipes. https://github.com/OpenRefine/OpenRefine/wiki/Recipes
- OpenRefine. Reconcilable data sources. https://github.com/OpenRefine/OpenRefine/wiki/Reconcilable-Data-Sources
- OpenRefine. Reconciliation. https://github.com/OpenRefine/OpenRefine/wiki/Reconciliation
- Orbis Cascade Alliance. OpenRefine for Metadata Cleanup. https://www.orbiscascade.org/openrefine-for-metadata-cleanup/
- Orbis Cascade Alliance. OpenRefine for Metadata Enrichment. https://www.orbiscascade.org/using-openrefine-for-metadata-enrichment/
- Ozmeka. https://github.com/ozmeka/ozmeka
- Reconcile-csv: http://okfnlabs.org/reconcile-csv/
  Reconcile-csv in GitHub: https://github.com/okfn/reconcile-csv
- Schema.org Vocabulary http://schema.org/docs/gs.html#schemaorg
- Tay, Aaron. OpenRefine, & reconciliation services - learning the ropes. http://musingsaboutlibrarianship.blogspot.com/2017/03/openrefine-reconciliation-services.html
- The Linked Open Data Cloud https://lod-cloud.net/
- Transforming Library Metadata into Linked Library Data: Introduction and Review of Linked Data for the Library Community, 2003–2011 http://www.ala.org/alcts/resources/org/cat/research/linked-data
- Virtual International Authority File (VIAF) https://viaf.org/
- Williamson, Evan Peter. Fetching and Parsing Data from the Web with OpenRefine. https://programminghistorian.org/lessons/fetch-and-parse-data-with-openrefine
- Worldcat Identities www.worldcat.org/identities

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- Lucas Mak, Metadata and Catalog Librarian, Michigan State University Libraries

- Systems, University of Central Florida Libraries

- Image credits
  - 5 Star Open data (http://5stardata.info/en/)
  - Linked Data (https://www.w3.org/DesignIssues/LinkedData.html)
  - Linked Open Data Cloud (https://lod-cloud.net/)

Thank you!

Contact

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