#### Exploring the Benefits for Users of Linked Open Data for Digitized Special Collections

#### White Paper #2

#### **Analysis of Early User Feedback**

Katrina Fenlon, Jacob Jett, Ryan Dubnicek, Timothy Cole, Caroline Szylowicz, Deren Kudeki, Melina Zavala, Alex Kinnaman

#### 1. Introduction

Digitizing cultural collections has manifest value for researchers' access to and use of primary sources (Palmer et al., 2009; Tibbo, 2003). But more could be done to optimize how digital collections are represented to support research and learning (Maron & Pickle 2013). Linked Open Data technologies offer exciting but nascent opportunities to enhance digital collections for research purposes; we have much left to learn about the specific benefits that linked data may offer users of digital special collections.

Funded by the Andrew W. Mellon Foundation, our project—"Exploring the benefits for users of Linked Open Data for digitized special collections"<sup>1</sup>—investigated strategies for integrating Linked Open Data (LOD) into digital special collections and explored potential benefits for users. The project identified methods for augmenting metadata with links to external resources, and for mapping legacy metadata into LOD-friendly vocabularies. In addition, the project developed and evaluated navigational and analytic features that exploit LOD.

This paper reports on a research study conducted to evaluate experimental, LOD-based features of digital special collections, which investigated the question: how do these features affect the use of digital collections for research? Because humanities researchers are the primary user group for cultural collections, this study focused on what humanities researchers might gain from LOD-based enhancements to digital collections.

Our study builds on a foundation of existing initiatives that are exploring LOD for cultural collections (Haslhofer & Isaac, 2011; Marcondes & Almeida Campos, 2016; Coyle et al., 2015; Allalouf et al., 2015; and others). Community incubation efforts such as *Linked Data for Libraries* (LD4L) and *Linked Open Data in Libraries, Archives, and Museums* (LODLAM) have created momentum for the increase of LOD in libraries. Nevertheless, there are significant gaps in our understanding of how LOD may benefit different users in different research contexts.

The study was conducted in two phases. Phase 1 comprised a series of usability interviews to assess our digital collections *prior to* the addition of LOD, to establish a benchmark for post-LOD evaluation. Phase 2 asked users to react to new interface features leveraging LOD and to

<sup>&</sup>lt;sup>1</sup> For project information, see <a href="http://publish.illinois.edu/linkedspcollections/">http://publish.illinois.edu/linkedspcollections/</a>. This is the second of two white papers produced by this project. For an overview of the technical processes and outcomes, see White paper #1: Transforming special collections metadata into linked open data: mappings, entity reconciliation, workflows implemented & lessons learned at <a href="http://hdl.handle.net/2142/99612">http://hdl.handle.net/2142/99612</a>.

assess the potential for LOD-based features of digital collections to serve their research processes.

In the next section we describe the collections that served as our test sites for this study. We detail the methods of our study in section 3. Section 4 summarizes the outcomes of phase 1 as a basis for phase 2. Section 5 describes the outcomes of phase 2 as they help us begin to understand the potential for LOD to enhance digital cultural collections as scholarly research environments.

#### 2. Test Collections

This research was based in two collections held at the University Library at the University of Illinois at Urbana-Champaign:

- The Motley Collection of Theatre & Costume Design<sup>2</sup>: A collection of 4,085 items related to theater productions designed by the Motley Group. The Motley Group designed costumes, sets, and props for more than 150 productions in England and the United States from 1932-1976. Items include digitized sketches, colored drawings and paintings, images of fabric samples, props and cast lists, storyboards, and black and white photographs.
- The Kolb-Proust Archive for Research<sup>3</sup>: A collection of approximately 40,000 research notes compiled by Professor Philip Kolb (1907-1992) from primary and secondary documents in his process of transcribing, editing, dating, and publishing more than 5,000 undated letters of French writer Marcel Proust (1871-1922). The research notes themselves are arranged in several distinct files<sup>4</sup> that together offer a panorama of Proust's life and milieu and of turn-of-the-century French intellectual life.<sup>5</sup>

#### 3. Methods Overview

The study was conducted in two phases:

- Phase 1 comprised a series of task-based interviews in which participants were asked
  to use our digital collections—prior to the addition of LOD—to accomplish a set of
  tasks. Participants responded to and reflected on the collections' usability and
  usefulness for the completion of those tasks, in comparison to two external sites.
  Phase 1 set usability benchmarks for phase 2.
- Phase 2, conducted *after* the implementation of several LOD-based features in our digital collections, repeated task-based interviews for one LOD-enhanced collection (the Motley Collection) and asked users to reflect on their research processes in general, and how LOD-based features would or would not benefit their work.

24 May 2018

2

<sup>&</sup>lt;sup>2</sup> http://imagesearchnew.library.illinois.edu/cdm/search/collection/motley

<sup>&</sup>lt;sup>3</sup> http://kolbproust.library.illinois.edu/proust/search

<sup>&</sup>lt;sup>4</sup> http://www.library.illinois.edu/kolbp/tour/cardfiles.html

<sup>&</sup>lt;sup>5</sup> http://www.library.illinois.edu/kolbp/categories.html

#### 3.1. Phase 1 Overview

In spring 2016, we initiated a first phase of research to set benchmarks for the usability of our test collections *prior to* the addition of linked open data. This phase of research comprised a series of task-based interviews with humanities researchers. To contextualize our findings about the usability of our test collections, these task-based interviews were designed to be comparative: each participant was invited to perform a set of search and browse tasks in one of the test collections, and then to perform a similar set of tasks in another topically related collection from another institution (see Table 1). As they performed tasks, participants were asked questions and invited to talk aloud about their experience and impressions of each collection and its interface, search and browse features, and metadata about primary sources.

We conducted a total of ten task-based interviews with faculty and graduate students in the humanities at the University of Illinois at Urbana-Champaign. They had disciplinary backgrounds in English literature, theater, and French. All interviews were conducted in Usability Lab of the Scholarly Commons at the University of Illinois University Library. Audio and video screen capture of each interview were recorded.

User group	No. participants	Test Collection	Comparison Collection
Α	5	Motley Collection	Harvard Theater Collection <sup>6</sup>
B	5	Kolh-Proust Archive	Boyary Manuscript Archive <sup>7</sup>

Table 1. Overview of comparative, task-based interviews

#### 3.2. Phase 2 Overview

In summer and fall 2017 we initiated our second phase of research to evaluate the uses and usability of digital collections augmented with features relying on LOD. There were two goals for this phase:

- Use: Assess how the addition of LOD-based features to digital collections might affect humanities researchers' use of collections for discovery, identification, access, and use of digital primary sources
- 2) Usability: Identify potential user-experience problems in our preliminary implementation of LOD-based features

This phase of research comprised both a second round of task-based user tests with domain-specific student researchers and a series of semi-structured interviews with humanities researchers, including faculty and staff interviewees. Each session lasted between a half hour and an hour. User tests followed the same task protocol as in phase 1, while semi-structured

24 May 2018

3

<sup>&</sup>lt;sup>6</sup> Harvard Theater Collection <a href="http://hcl.harvard.edu/libraries/houghton/collections/htc/">http://hcl.harvard.edu/libraries/houghton/collections/htc/</a>, made digitally accessible (in part, not in whole) through Harvard Digital Collections <a href="https://library.harvard.edu/digital-collections">https://library.harvard.edu/digital-collections</a>

<sup>&</sup>lt;sup>7</sup> Bovary Manuscript Archive / Atelier Bovary http://flaubert.univ-rouen.fr/bovary/index.php

interviews were conducted using a different instrument. In the first part of each of these latter interviews, we asked each participant general questions about their use of digital primary sources, including what kinds of sources they work with, how they use those sources differently at each stage of research, and how they go about finding, identifying, and accessing sources. Questions were oriented toward identifying aspects of their research processes that might benefit from LOD representations of primary source metadata. In the second part of each interview, we invited each participant to respond to three LOD-based features that were mocked up in our test collections. In their responses, we sought to understand how researchers might use the features and to identify potential usability obstacles in our implementation. Those features were:

- 1) An item-detail page augmented with two features: (1) a left sidebar containing contextual information and links to relevant external resources; (2) externally linked values within item-level metadata (see Appendix A)
- 2) A search result page augmented with a "knowledge panel" offering contextual information about named entities that are related to search results, with links to relevant external resources (see Appendix B)
- 3) An interactive social network visualization of relationships derived from LOD representations of named entities in primary sources (see Appendix C)

We conducted five task-based user tests, asking users perform test tasks using 3 resources: the original (i.e., pre-LOD enhancements) Motley resource, the Harvard Theater Collection resource, and the LOD-enhanced Motley resource. A total of five semi-structured interviews of humanities researchers at the University of Illinois at Urbana-Champaign were also conducted with: 1 faculty member, 3 PhD candidates, and 1 technologist with a humanities research background. These participants had disciplinary backgrounds in art history, theater, American history, and experimental archaeology. All user tests and interviews were conducted in Usability Lab of the Scholarly Commons at the University of Illinois University Library. We began recruitment in spring 2017, conducting user tests April-June 2017 and semi-structured interviews from January-March 2018. Audio and video screen capture of each session were recorded. In light of the scope of the study, we did not conduct a formal qualitative analysis of interviews; instead, this white paper offers a summary of main outcomes.

#### 3.3. Limitations

The central limitation of this study was its scale: both phases of this research aimed to be exploratory rather than conclusive, given the limited time available and the notorious difficulty of recruiting humanities scholars as research subjects. Not only was the number of participants necessarily small, but it was also necessarily local. Therefore, it was infeasible to find a complete set of participants with a natural research interest in our specific test collections, which cater to highly specialized, distributed, international research communities. This limitation is common to all studies of this sort; it is a byproduct of the specialization of humanities research. As one of our participants observed: "the 20 years of labor that we're

going to invest in the markup of this – in my case, 17<sup>th</sup>-century French corpus of descriptions of North America – will be really useful, but *most* useful to *one* researcher" (P4).

Studies of this sort are necessarily speculative. Our interviews aimed to evoke how participants *might* use *potential* features of collections. Thus, another limitation common to use and usability interviews about innovative technologies is the limitation imposed by participants' imaginations. Certain uses and usability issues are expected to be unpredictable, despite this research.

### 4. Phase 1: Preliminary usability outcomes

A complete summary of the outcomes of this phase of research can be found in Zavala, Kinnaman, Jett, Szylowicz, and Cole (2017). Here we reprise only those outcomes that set the stage for Phase 2.

This study did not find any consensus among participants about the effectiveness or usability of the assessed collections prior to their enhancement with LOD. Reactions to each aspect of each collection – from homepage design to navigation to item representation – were mixed. This speaks not only to natural variation among individual preferences, but to the well-established idiosyncrasy of humanities scholars' research processes.

The interviews generated numerous suggestions (some conflicting) about how the collections and their interfaces could be improved. Those suggestions are detailed in Zavala et al. (2017), and helped guide development of the LOD-augmented collections, which were assessed in phase 2.

One theme that emerged among the interviews, related to the potential for LOD to benefit collections, is that participants commonly wanted to see more diverse contextual information, both about primary sources and about collections as a whole, than they currently get. A few participants called for more information to be directly linked and actionable. Specific user comments on this theme include the following:

- More context relying on augmented or inferred information
  - Several participants wanted more options for advanced searching and sorting, and more information to guide selection among results. Such options as they called for would rely not only on showing additional metadata fields but on including inferred or augmented contextual information based on ontologies or links to external sources. For example, one participant wanted to be able to search and sort results not only by named entities in records, but by different types of entities named in the metadata—e.g., searching and sorting by authors of plays, and also by associated directors of performances of plays.
  - Some participants wanted more contextual information about entities and objects that are represented in or associated with primary sources, but that are not the focus of those sources. For example, one participant wanted to know the identity

of a *character* in a photograph, though the metadata was about the *photographer*. Another participant wanted more descriptive information about the things—like costumes—represented, even if not the focus of the source or its metadata.

- More context for collection as a whole
  - Some participants expressed confusion about the scope and holdings of each collection as a whole. This suggests room for improvement in how collections present contextual information about themselves and the scope of their contents.
- More granular, actionable, analytic connections
  - One participant called for more direct links between related sources in this case, direct links between Kolb's annotations and Proust's correspondence.
  - A few participants expressed an interest in seeing and being able to analyze relationships between named entities in the sources and metadata.

While not conclusive, these outcomes suggest that LOD—with the capacity to forge actionable connections between resources and contextual information—has substantial potential to enhance digital collections for a broad range of scholarly uses.

The final project report<sup>8</sup> describes how suggestions from phase 1 informed development of the LOD-augmented test collections. In particular, the LOD-based features aimed to draw in and display more contextual information—about primary sources, and about named entities in those sources and associated metadata—from external references. The project also implemented and tested an analytic feature, a social network graph, in response to the last request mentioned above, for actionable relationships among named entities in primary sources and metadata.

# 5. Phase 2: Outcomes of Linked Open Data for supporting research in digital special collections

Overall, participants expressed enthusiasm for the features made possible by the addition of LOD to digital collections, though their enthusiasm was not without qualifications.

Task-based user test participants generally appreciated LOD enhancements, specifically contextual information gathered from Wikipedia and suggestions of associated people shown when searching by name, but also evidenced some confusion around details of the information (e.g. context or role of an associated person) or its source. Similarly, some users preferred image-based browsing of Harvard Theatre Collection (HTC) to the enriched Motley interface, which incorporated more textual information. Most users who participated in tests expressed preference for the enriched Motley interface, but one preferred HTC, and another the original unenriched version.

\_

<sup>&</sup>lt;sup>8</sup> Find the final project report and other outcomes at: http://publish.illinois.edu/linkedspcollections/outcomes/

The remaining observations presented in this section (though preliminary and in need of reinforcement by future research) derive largely from the richer, semi-structured interviews and suggest specific ways in which features based on LOD may serve aspects of humanities research processes: offering new modes of access to collections, connecting across collections, adding contextual information to primary sources and search results, linking to external sources, and undergirding new analytic features. The main challenges for LOD-based features revolve around the fact that researchers' needs, even beyond being highly specific to their niche of interest, depend heavily on the immediate context of their current search.

#### 5.1. LOD for new modes of access

Participants are eager for new modes of access to collections of primary sources. This is true even when the primary sources themselves are already well known to participants, or when the sources are not unique. For example, one participant working in the domain of early American history noted that there are simply not many original sources remaining in existence to serve as evidence for his work and he is well acquainted with all of them. Nevertheless, he eagerly peruses new collections that present those sources in new ways or forge new connections between them. Participants want ways to make new kinds of connections between known sources.

#### 5.2. LOD for connecting across collections

Participants are also eager to see actionable connections forged among different, related collections of sources, or among related sources scattered across collections.

Every participant described the need to move between several (sometimes many) collections of primary sources in the normal course of their work, in order to do things like draw connections between sources or related entities, make comparisons, trace the provenance of objects, or begin to construct historical interpretations. The collections they use at once may range widely in their source, scale, scope, quality, and modes of access. Some were commercial, others the personal collections of scholarly peers. Some collections, such as a national library collection that aggregates hundreds or thousands of regional collections, are used as gateways for discovering and searching across other collections.

Every participant also gathered their own large, diverse collections of primary sources for personal use. A few participants shared these collections via social media. Others kept them private, but most expressed some desire to share their personal research collections more widely. One participant considered her own personal gathering as contributing to the reconstruction of a lost archive:

I think it's really important to restore this archive, which—these materials never really had a single source—they were basically completely erased by Franco regime. So you're working with something that just basically doesn't exist. It's very helpful for one person to take all of these things and put them together. –P2

Researchers might benefit from the ability to express or exploit still more granular connections: not just between whole collections or individual primary sources, but even between pieces or components of sources. One participant described his research as a process of *amalgamation*: "pulling out the small pieces of information that are sideways to the purpose of a given document and bringing them together to create a meaningful picture" (P4). LOD representation is promising for leveraging such granular connections.

This study suggests that a major benefit of LOD will be to implement connections between related resources that are scattered across diverse collections. Another participant's research often entails sifting through massive piles of archival materials to identify a few obscure materials; he noted, "Linking across collections would be just really helpful, and producing a finding aid for someone who has six letters in six different collections and that's the extent of their writing" (P3).

#### 5.3. LOD for adding contextual information to primary sources

We tested the use of LOD to augment an item-detail page with two features: (1) a left sidebar containing contextual information and links to relevant external resources; (2) externally linked values within item-level metadata (Appendix A).

Where LOD is used to import and display contextual information alongside primary sources, the researchers had very different needs and preferences for what *kinds* of contextual information should be displayed.

Most participants did not appreciate what one termed "thin context" derived from Wikipedia about named entities in records—unless those entities were very obscure or peripheral to the main query. They asked for richer, even interpretive information. One participant noted, "I guess that what would be really great is if this [the sidebar] wasn't 'Shakespeare' but ... some specific context for understanding the aesthetic of this costume," or something else of greater scholarly interest (P4). In contrast, another participant suggested that this kind of information might be useful for initial exploration of a collection, even for a user with significant domain knowledge: "There's utility in all of those things if you're careening through the collections doing a very broad sweep" (P3).

In cases where the sources and related entities are obscure, thin context can be valuable. One participant highlighted the value of thin contextual information for "fringe" entities—entities peripherally related to a source or a query, about which a user is likely to know less. Users may benefit from a feature that can highlight or offer thin context just for entities that are peripheral: either to primary sources, to metadata, or to the user's queries. Another participant gave the following example:

[Y]ou might find a very small tidbit of information on an 18<sup>th</sup>-century map that would be a really useful clue about something. Contextual information about the maker of that map -- ...I don't know where the information came from that these cartographers were representing. That is a typical problem. –P4

Ideally, contextual information should be tied to the nature of the query and the level of the research being conducted. What is useful contextual information for a student learner may be useless to an advanced scholar. One participant admitted the complexity of catering to diverse niches of scholarly interest: "Isn't the challenge though the granularity of it all? What different users are looking to be able to do with it?" (P4).

Even scholars with similar interests will seek subtly different kinds of contextual information depending on what they are doing at a given time. One scholar called for the contextual information displayed to be "adaptive" and to change over the course of his research process:

I can also appreciate that at a certain point of working with this collection this will be the wrong information and I'll want another kind of information to be foregrounded that creates a different context. –P4

How to effectively and efficiently make the presentation and functionality of LOD-added digital collections flexible or customizable for different audiences, or in different research contexts, is an open question.

#### 5.4. LOD for adding contextual information to search results

We tested the use of LOD to augment search results with a "knowledge panel" offering contextual information about named entities that are related to search results, with links to relevant external resources (Appendix B).

As we found in phase 1, phase 2 revealed a great deal of variation in how much and what kind of information participants wanted to see alongside search results. Most participants agreed that the LOD-based "knowledge card" feature was highly useful, especially for disambiguation of terms.

Participants were all enthusiastic about the potential for LOD to identify and display categories of related entities, e.g., the knowledge panel's "Related people" and "Related productions". But, of course, participants varied in specific preferences:

- One participant wanted this feature to display only those relationships about which
  the collection contained more resources, in order to help characterize the scope
  and coverage of the collection.
- One participant wanted the display of relationships to be a more information-rich, interactive visualization, i.e. a social network graph.
- One participant wanted to constrain relationship information to certain types of relationships—e.g., only fellow playwrights vs. related characters or historical figures.

The knowledge panel feature, particularly the aspects about related entities, relies on automatically derived or inferred information. One participant noted that if this information is incorrect, or its provenance at all confusing or vague, scholars will tend to discount the panel immediately, and it may detract from the credibility of the collection as a whole.

#### 5.5. LOD for linking to external resources

The main challenge for using LOD as a gateway to external resources, either within item-level metadata or alongside search results, seems to lie in picking the right destinations. Most participants perceived the linked resources tested in this project (especially authority sources such as VIAF, LCSH, AAT<sup>11</sup>) to be too obscure, unintuitive, or difficult to navigate. Participants unanimously wanted sources to link directly to other related collections and sources, or to gateways to collections and sources that are easy to navigate. Because what is "related" depends on the researcher and context, linking to sources that individual scholars deem relevant may pose a significant challenge.

One participant saw great potential value in the externally linked references to benefit research for primary sources across different languages. In exploring the authority pages she noted that:

If something like this existed for the Japanese research that I was working on, I think I would love that, because it would give me all the 80 different ways of writing this particular [term] that I could use for the search process. What I would love even more is if there was a way [to] aggregate the results of a search for all these different variants...I love the idea of using that [LOD] to break the language barrier –P1

#### 5.6. LOD for analytic features and annotations

A final feature tested the use of LOD to efficiently generate an interactive, analytic visualization: a social network graph. We developed an interactive social network visualization of relationships derived from LOD representations of entities in one digital collection (Appendix C).

Participants were excited by this feature above the others, some suggesting that such an interactive tool would constitute an invaluable addition to their research.

Several participants wanted more dimensionality to the visualization. Three participants each independently imagined a social network graph that also integrated geographic and temporal dimensions, or alternative map-based visualizations. One participant described wanting a similar visualization that showed connections, not just among related fine artists, but among hidden communities of everyday creators of visual culture, such as illustrators and designers. She also imagined mapping the movement of artists and corresponding cultural shifts over time.

Another participant imagined an ambitious, comprehensive geo-temporal map of material culture and objects: "One of my dream-world things that I've never seen a site do in terms of information aggregation: I have a three-slider space, time, object that I would love to have

24 May 2018

-

<sup>9</sup> https://viaf.org/

<sup>&</sup>lt;sup>10</sup> http://id.loc.gov/authorities/subjects.html

<sup>11</sup> http://www.getty.edu/research/tools/vocabularies/aat/

come into existence," through which users could interactively explore the history of material objects across time and space (P1).

Such visualizations could effectively rely on the same kind of extracted, linked data as the social network feature we implemented.

All participants also expressed enthusiasm for the annotation component of this feature. All wanted to see annotations by scholarly peers (and not the general public). Not all were willing to share their own annotations. A couple were hesitant to use the annotation tool as a personal research function, either because they did not trust the reliability or permanence of the site, or they did not understand the available export format (JSON). These participants were more likely to take notes in their own local documents.

What seemed to interest participants most about this feature was that it offered substantial new interpretive and analytic information, which simultaneously served to open up new avenues for research. In addition, they wanted the visualization to serve as an entry point to collections, to enable discovery of related items.

#### Future work

In summary, participants expressed enthusiasm for LOD-based features in digital special collections, along with qualifications and suggestions for how those features should be implemented. The tested features offered new modes of access to collections; forged connections between collections, sources, and external resources; enhanced contextual information about primary sources and search results; and visualized data extracted from primary sources. Researchers have highly specific preferences and processes for working with digital special collections; and while the addition of LOD certainly stands to benefit the use and usability of collections, the most effective applications will be flexible for or responsive to different kinds of users and evolving research contexts.

This exploratory study is intended as a pilot for future work on the potential of LOD to benefit research uses of digital collections. Future work should aim to increase the number of interviews along with the number and diversity of features assessed, and should target participants with research interests more closely aligned to the subjects of test collections.

#### References

Allalouf, M., Artyomov, A., & Mendelsson, D. (2015). LODLI: Linked Open Data back-end system for libraries interoperability. In *Proceedings of the International Joint Conference on Knowledge Discovery, Knowledge Engineering and Knowledge Management* (pp. 269–278). Portugal: SCITEPRESS - Science and Technology Publications, Lda. <a href="https://doi.org/10.5220/0005608602690278">https://doi.org/10.5220/0005608602690278</a>

Coyle, K., Silvello, G., & Tammaro, A. M. (2015). Comparing methodologies: Linked Open Data and digital libraries. In *Proceedings of the Third AIUCD Annual Conference on* 

- Exploring the Benefits for Users of Linked Open Data for Digitized Special Collections
  White paper #2: Analysis of Early User Feedback
- Humanities and Their Methods in the Digital Ecosystem (pp. 3:1–3:6). New York, NY, USA: ACM. https://doi.org/10.1145/2802612.2802615
- Haslhofer, B., & Isaac, A. (2011). data.europeana.eu: The Europeana Linked Open Data Pilot. International Conference on Dublin Core and Metadata Applications, 0, 94–104. http://dcpapers.dublincore.org/pubs/article/view/3625
- Marcondes, C. H., & Almeida Campos, M. L. (2016). Searching for a methodology to define culturally relevant relationships between digital collections in archives, libraries and museums. In 14th International ISKO Conference, Rio de Janeiro, Brazil, September 27-29. http://eprints.rclis.org/30904/
- Maron, N. L., & Pickle, S. (2013). Appraising our digital investment: Sustainability of digitized special collections in ARL Libraries, Association of Research Libraries and Ithaka S+R. <a href="http://sr.ithaka.org/researchpublications/appraising-our-digital-investment">http://sr.ithaka.org/researchpublications/appraising-our-digital-investment</a>
- Palmer, C. L., Teffeau, L. C., & Pirmann, C. M. (2009). Scholarly information practices in the online environment: Themes from the literature and implications for library service development. Dublin, OH: OCLC Research and Programs.

  <a href="http://www.oclc.org/content/dam/research/publications/library/2009/2009-02.pdf">http://www.oclc.org/content/dam/research/publications/library/2009/2009-02.pdf</a>
- Tibbo, H. (2003). Primarily history in America: How U.S. historians search for primary materials at the dawn of the digital age. The American Archivist 66(1), 9–50. https://doi.org/10.17723/aarc.66.1.b120370l1g718n74
- Zavala, M., Kinnaman, A., Jett, J., Szylowicz, C. & Cole, T. W. (2017). Linked Open Data for digital special collections: Benchmark case studies of two digital library websites. Report to the Advisory Board. <a href="http://publish.illinois.edu/linkedspcollections/files/2017/03/User-Case-Studies-Report.pdf">http://publish.illinois.edu/linkedspcollections/files/2017/03/User-Case-Studies-Report.pdf</a>

### Appendix A.

### Motley item before and after enhancement with LOD



#### **Linked Open Data Website**

ome Browse All

ome is Motley Collection of Theatre and Costume Design (New) is Sir Arthur Clarinate

#### External Resources

Sir Arthur Clarington

\* The Witch of Edmonton

The Witch of Edmonton is an English Jacobean play, written by William Rowley, Thomas Dekker and John Ford in 1621. The play—"probably the most sophisticated treatment of domestic trayed in the whole of Elizabethen-Jacobean drama"—is based on supposedly (more from Wildpedia) — DiRedia

#### \* Thomas Dekker (writer) (Autho

Gender: ma

Thomas Dekker (c. 1572 - 25 August 1632) was an English Elizabethan dramsist and pamphice as engish Elizabethan dramsist and pamphice spenned several decades and brought him into contact with many of the period's most famous Ositabeth (income from Wikipedia) VIAF Record BNF Record

#### Other

#### Tinyen, George (Helot)

. Gender: mai

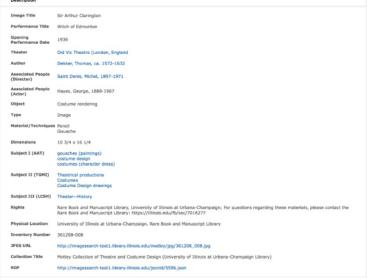
Michel Saint-Denis (September 13, 1897 – July 31, 1971), dt. Jacques Duchesne, was a French actor, theater director, and drama theorist whose ideas on actor training have had a profound influence on 1930s on, (more from Wikipedia) 1930s on, (more from Wi

#### DNB Record

#### Motley (Organization



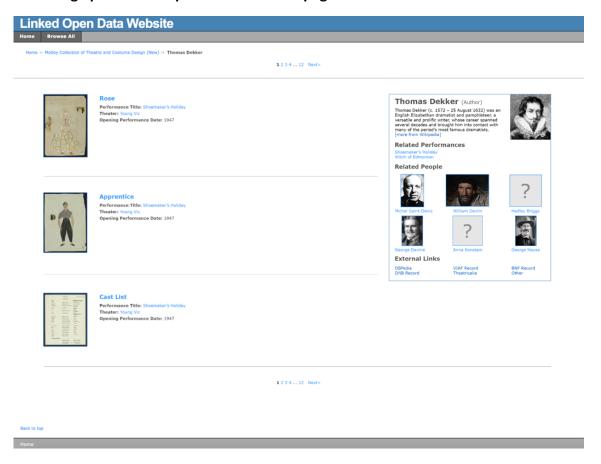




Back to top

#### Appendix B.

### Knowledge panel mockup on search results page



### Appendix C.

#### Interactive social network visualization

Network of Family Connections Derived From Notes of Philip Kolb About the Life of Marcel Proust



