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PRACTICE ARTICLE

Closing the Loop: Automating Links to Open Access Versions of Articles in Faculty Profiles at a Large Research Institution

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ABSTRACT

Introduction: Universities implement faculty profile systems for a variety of reasons, including to increase visibility of research produced at the institution. These profiles often connect with other campus systems, particularly institutional repositories. This article describes a collaboration at the University of Colorado Boulder aimed at integrating the institutional repository with the faculty profile system, which then expanded to encompass the automated creation of profile links to open access versions of faculty articles from any journal or repository.

Description of Program: To achieve the initial project goals, a cross-campus team from the University Libraries and the Faculty Information System developed a strategy of using Unpaywall as an intermediary data source to connect the institutional repository with the faculty profile system. This also allowed for the development of an automated process for generating links to open access content from any journal or repository, which resulted in the creation of over 35,000 links to openly available content in faculty profiles, including over 2,900 links to content in the institutional repository. These links provide public users of the faculty profile system with a simple way to access all openly available research produced at the university. This article describes the development and implementation of this project as well as lessons learned.

Next Steps: The ongoing collaboration provides additional opportunities to unlock data for monitoring rates of open access publishing and self-archiving, informing library collection development decisions, and connecting to other data sources to reveal further insights.

Keywords: open access, researcher profiles, institutional repositories

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INTRODUCTION

Universities are implementing faculty profile systems for a variety of reasons, and these systems often interact or integrate with institutional repositories (IRs) and research information management (RIM) systems in different ways. With regard to IRs in particular, these integrations tend to focus on workflows related to faculty-authored open access (OA) content. At the University of Colorado Boulder (CU Boulder), a team composed of members of the University Libraries (Libraries) and the Faculty Information System (FIS) collaborated on a project that began with the goal of closing the loop between the faculty profile system (CU Experts) and OA versions of faculty-authored articles in the CU Scholar IR. As the project progressed, it evolved to encompass a much broader scope centered on using Unpaywall as a data source for connecting CU Experts with not only content in CU Scholar but also any faculty-authored article published in any OA journal or deposited in any OA repository.

CU Boulder is a large public research university with over 3,000 faculty across all categories (e.g., tenured and tenure-track faculty, research faculty, teaching faculty, etc.). Through the FIS team, CU Boulder maintains a record of information about its faculty, including annual reports of activities, research outputs, creative works, awards, and areas of expertise. This information is compiled from several data sources. All tenure-track and full-time instructor faculty are required to self-report information about their activities in teaching, research, and service on at least an annual basis through the custom-built Faculty Report of Professional Activities (FRPA) system, which utilizes a locally branded version of the Symplectic Elements software called CU Boulder Elements (CUBE) to help gather data about faculty research outputs published each year. A subset of the faculty information maintained in FRPA and CUBE is used to populate public faculty profiles in CU Experts, which runs on the open source VIVO software. In addition to the data sources maintained by the FIS team, the Libraries have operated the CU Scholar IR since 2014, and it is currently built on a Samvera-based technical stack. As of 2023, CU Scholar contains over 17,000 articles, theses and dissertations, data sets, and other research outputs produced by CU Boulder faculty, staff, and students. CU Scholar also serves as the designated location for faculty to self-archive OA versions of published articles in accordance with the CU Boulder Open Access Policy adopted in 2015.

The Libraries have a long-standing collaboration with the FIS team to utilize data from their systems, including CUBE, to help identify eligible articles that faculty can deposit in CU Scholar each year as part of a larger OA policy workflow (Johnson et al., 2019). As this collaboration developed, the Libraries became interested in the possibility of integrating CU Scholar with CU Experts by including links to all CU Scholar versions of faculty articles in the public CU Experts profiles. Motivations for this integration included providing an additional way for users to discover content in CU Scholar via links from CU Experts, exposing

greater numbers of CU Boulder faculty to CU Scholar, and offering a means for public users of CU Experts to access open versions of paywalled content authored by CU Boulder faculty. This article describes the approach the Libraries and FIS collaboration took to accomplish this goal and how the scope of the project then expanded to include links in CU Experts to OA versions of faculty articles from all OA journals and repositories. The article concludes with lessons learned from the development and implementation of this program as well as potential next steps for the collaboration.

LITERATURE REVIEW

A review of the existing literature sheds light on where the work described in this article fits in the context of other universities' efforts related to faculty profile systems, RIM systems, and IRs. Universities have developed and/or implemented faculty profile systems for a variety of reasons, including exposing wider audiences to an institution's research outputs, connecting current or potential students with the work of faculty who might serve as mentors or advisers, tracking research impact across campus units, and providing a way for various public constituencies to connect with faculty experts (Givens et al., 2017). The literature reveals a variety of ways that libraries have been involved with researcher profile systems on their campuses, and IR-based collaborations offer a common pathway to libraries becoming involved with these systems (Rand & Stager, 2018; Sweeper & Ramsden, 2020). One motivation for these collaborations (e.g., integrating IRs and faculty profile systems) results from efforts around implementing university OA policies (Finnie Duranceau & Kriegsmann, 2015; Smart, 2019). Once involved with faculty profile systems, the value librarians bring to these collaborations often involves knowledge of bibliographic data and metadata sources as well as a keen understanding of how the scholarly communication landscape operates, particularly regarding how research reaches broad audiences (Givens et al., 2017). This same expertise has been identified as critical to library involvement in the related RIM space, in which RIM systems often interact with IRs and faculty profile systems in a variety of ways (Bryant et al., 2017). It also should be noted that the term Current Research Information Systems (CRIS) is commonly used and widely understood in Europe in contrast to the U.S., where terminology related to this space is far less standardized; therefore, this article, which presents a case study from a U.S. institution, follows a similar practice to Bryant et al. (2017) in using RIM as a general term. The literature on CRIS and IR integrations, which could be more relevant to institutions operating in a different environment than that of this case study, identifies many ways in which these two types of systems interact and even merge (de Castro et al., 2014; Schöpfel & Azeroual, 2021). As seen in the general RIM space, opportunities for librarians to lend expertise to CRIS and IR integrations also tend to focus on improving data quality through knowledge of metadata sources and standards (Schöpfel & Azeroual, 2021). The experience at CU Boulder described in this article largely reflects the literature regarding the context and motivations for collaborations between library-based IRs and faculty profile

systems as well as related RIM systems. That said, the specific approach taken at CU Boulder to use a third-party data source to integrate the IR with the faculty profile system while simultaneously improving coverage of OA content across the board appears to provide a unique contribution to the existing literature.

As described in detail in subsequent sections of this article, Unpaywall became a vital component of the CU Boulder project. Unpaywall is an open database containing information about tens of millions of articles from over 50,000 journals and repositories, and it is a particularly valuable source for identifying what (if any) OA versions of articles may exist (Unpaywall, n.d.). The literature reveals several other library uses of Unpaywall and related data sources in efforts related to IRs, RIM systems, and researcher profile systems. Often, these efforts focus on using Unpaywall in combination with other data sources to populate IRs either directly or via RIM systems (Sergiadis, 2019; Wittenberg, 2019; Peplinski et al., 2022; Lappalainen & Narayanan, 2023). In one related case, an institution used Wikidata as an intermediate data source to populate faculty profiles in a somewhat overlapping way to how Unpaywall is used at CU Boulder (Lemus-Rojas & Odell, 2018). Another study identified potential limitations of using Unpaywall as a data source for large-scale tracking of OA article statuses; however, this took place in 2018, so it might not reflect the status of the coverage and quality of metadata included in Unpaywall at present (Akbaritabar & Stahlschmidt, 2019). In summary, Unpaywall has emerged as a relatively common data source to use in a variety of workflows related to populating campus and library systems with information about faculty-authored OA articles. The project at CU Boulder differs from earlier efforts in its use of Unpaywall as the primary data source for automating the direct creation of links in the faculty profile system to OA content in the IR, OA journals, and other OA repositories.

DESCRIPTION OF PROGRAM

Development and implementation

To accomplish the initial project goal of populating links to CU Scholar content in CU Experts, a small group of collaborators from the Libraries and FIS met on several occasions to brainstorm possible approaches to this work. After considering and deciding against using a vendor-provided tool, the group decided to focus on a first step of showing proof of concept by using a relatively manual process to add links to all OA versions of articles available in CU Scholar to the CU Experts faculty profiles. The Libraries collaborators provided the FIS developers with metadata from CU Scholar about these articles, including titles, CU Boulder authors, CU Scholar URLs, and DOIs for published versions. The FIS developers were then able to match that metadata against the information already in CU Experts and create a new field for the CU Scholar URLs in the CU Experts article records. This proof-of-concept

project was successful in adding over 700 links to CU Scholar content in CU Experts faculty profiles, and the group discussed the possibility of continuing with this process going forward. In such a scenario, the Libraries collaborators would compile the metadata from CU Scholar on an annual or possibly more frequent basis, and the FIS team would replicate the process of matching the metadata and adding the CU Scholar URLs to the CU Experts records. While this process would have met the initial project goal, it relied on quite a bit of manual effort on both the Libraries and FIS sides of the collaboration, including making sure that the process regularly took place at the agreed upon time. As a result, the group decided to continue to explore how to automate this process. The group discussed using an application programming interface (API) to harvest information from CU Scholar into CU Experts. This would have been the preferred method for the FIS team, but an API for CU Scholar did not exist at that time. CU Scholar did have an Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) feed, which the group also briefly discussed using, but this would have required significant development work. Ultimately, the group landed on an idea to bridge the API and OAI-PMH approaches by utilizing the Unpaywall API, which already included CU Scholar data. This was because Unpaywall harvests data using OAI-PMH, and the Libraries had previously registered CU Scholar as an Unpaywall data source.

The FIS team then evaluated the Unpaywall API from a technical implementation perspective and found it to be an appealing option based on its ease of use, liberal usage policy, inclusion of DOI functionality in the API, and extensive documentation. By simply passing a DOI for an article as a parameter to the Unpaywall API, it returns extensive information about the article in a well-formed JSON structure. Within an hour of the meeting in which the project team decided to use Unpaywall, the lead collaborator on the FIS team determined that the required data for the project could be harvested using existing techniques employed in CU Experts workflows, so minimal effort would be required to integrate data from Unpaywall. CU Experts already harvested data from a different third-party API and integrated it with existing publication data via a method that also employed passing DOIs to the API as parameters. Thus, it was straightforward to clone this harvesting process for the Unpaywall API. Integrating this data was simple due to the nature of the CU Experts VIVO Elasticsearch integration, which was built with the specific intent to simplify data integrations of this sort (Elsborg et al., 2016).

It was at this point in the collaboration that the scope of the project expanded significantly because of the decision to use the Unpaywall API. The lead on the Libraries side of the collaboration recognized that the Unpaywall API would allow harvesting of links to all OA versions of CU Boulder faculty-authored articles in addition to just those in CU Scholar. By focusing on all faculty-authored articles already included in CU Experts, there was immediately no further need for any type of metadata export from CU Scholar. Instead, the FIS team would start by matching all DOIs for articles in CU Experts against the DOI property in the

Unpaywall API. This would identify all articles that were in both the CU Experts and Unpaywall data sources. Next, the team determined which properties from the Unpaywall API would be useful to pull into the CU Experts article records. Since CU Experts is a public-facing system, the emphasis was on information that would be useful to help CU Experts users easily identify which articles they could access openly. The team determined that presenting multiple OA versions of the same article would be confusing to public users, so the “best_oa_location” property from the Unpaywall API was selected for use. According to the Unpaywall documentation, this property uses “an algorithm that prioritizes publisher-hosted content first (e.g., hybrid or gold), then prioritizes versions closer to the version of record [... and] then more authoritative repositories” (Unpaywall, n.d.). The one exception the team made to using a single “best OA” version for article records in CU Experts was if there was also a version of the article in CU Scholar that was not considered the best version by the Unpaywall algorithm. To determine this, the FIS developers used the “oa_locations” property in the Unpaywall database to match any articles in CU Experts that included “University of Colorado Boulder - CU Scholar” as an OA location. These records would then include links to both the “best OA” version and the CU Scholar version in the public CU Experts profiles. If the CU Scholar version was the same as the “best OA” version, then the CU Experts record would only include the CU Scholar link. This was done to preserve the initial goal of the collaboration to close the loop between CU Experts and CU Scholar. See [Figure 1](#) for examples of how these links appear in the CU Experts search interface.

Once the decisions regarding the Unpaywall API properties had been implemented, the FIS team automated the matching process between CU Experts and Unpaywall to update automatically once a week. In addition to the information contained in each article record, CU Experts also displays facets that can be used to filter articles when browsing or searching. The project team decided to include a new facet in this interface to represent the OA content added to CU Experts. Again, the priority for how to display this facet focused on what would be most useful and understandable for public users. The project team determined that simply creating an “Open Access = Yes” facet would be of most value to potential users since it would allow a single click to limit searching and browsing of CU Experts to only openly available articles (see [Figure 1](#)).

The implementation of this project in late 2021 immediately generated over 17,000 links to OA articles added to CU Experts records. As of 2023, that total climbed to over 35,000 links as more articles by CU Boulder faculty have been published and added to the CU Experts database. The number of links to CU Scholar versions of articles included in CU Experts rose to over 2,900 by 2023 as well. From a purely quantitative perspective, these numbers far exceeded the original expectations for the project, and the early trajectory of growth indicates that these numbers could continue to increase significantly.

The screenshot displays the CU Experts website interface. At the top, the CU Experts logo and name are visible, along with a search bar and navigation links. Below the header, there are tabs for Home, People, Organizations, Publications, Honors, Research, International, and About. A search bar is present with a 'share' icon, a '20' count, and an 'order by ... re:' dropdown. A list of filters on the left includes Publication Type, Author, Published In, Year Published, Author Organization, Author Research Area, Open Access (with a '20' count and 'OR' button), and Altmetric Range. The main content area shows three article listings, each with a title, a 'View this Publication:' section, and a 'CU Boulder Authors:' section. The first article is 'Time Variability of FUV Emission from Cool Stars on Multi-year Timescales' by Kevin France, published in the Publications of the Astronomical Society of the Pacific. The second article is 'Observations of Relativistic Electron Enhancement and Butterfly Pitch Angle Distributions at Low L (<3)' by Zhao Hong, Li Xinlin, and Baker Daniel N, published in Geophysical Research Letters. The third article is 'Into the danger zone: How the within-host distribution of parasites controls virulence' by Johnson Pieter, Calhoun Dana Marie, published in Ecology Letters. Each article listing includes a DOI, a publication date, a type (Journal Article), and an Altmetric score of 1.

Figure 1. CU Experts Interface With Clickable Icons for “Best OA” and CU Scholar Versions of Articles.

Lessons learned

The primary lesson learned as this project evolved from its original goal to its broader actual outcome came from the decision to pivot to Unpaywall as the primary data source. Initially, the focus on building a direct connection between CU Scholar and CU Experts obscured potential solutions that could provide an easier path to achieving the project goals while offering significant additional benefits. At first, it seemed counterintuitive that introducing a third system into the equation could reduce the amount of effort involved, but once this approach was fully explored, it quickly became apparent that using Unpaywall would provide the path of least resistance to a successful project. There is often some hesitancy involved in deciding to use a data source outside of the control of the institution and the project team, which could

also have contributed to Unpaywall initially being overlooked as a possible solution. While there are still risks involved in developing a solution that relies on any third-party data source (e.g., long-term sustainability issues), the benefits in this case far outweighed those concerns. In particular, the ability to address one of the primary motivations for the project at a far greater scale than initially envisioned made the decision to pivot to Unpaywall quite clear. This motivation involved providing an easy way for public users, who might not have access to paywalled articles authored by CU Boulder faculty, to use CU Experts to discover and identify OA versions of these articles. This could include campus communications staff who want to provide OA links to original articles in press releases for public consumption about groundbreaking research published by CU Boulder faculty. Similarly, journalists writing articles about newly published CU Boulder research could use CU Experts to identify OA links to include so that the widest possible audience could read the original research. Finally, local and state policymakers, who are often unable to access CU Boulder faculty-authored research in traditional subscription-only journals, could use CU Experts to find publicly available versions of these articles to cite in legislation and other policy efforts. All of these (and other) potential use cases stemming from the initial motivation to enhance CU Experts with these OA links were better served by the decision to use Unpaywall and the tens of thousands of additional OA links this generated in CU Experts. From a technical standpoint, the simplicity of the solution also allowed the FIS team to develop this integration with minimal time and effort. The FIS team, which is rather small, typically focuses on high-priority projects related to faculty reporting. Since this integration rapidly identified a solution and relied on existing techniques and processes, it did not have to undergo a formal project review, which most likely would have delayed or deprioritized this effort. The general ease of use of Unpaywall's REST APIs, relying on simple standards already utilized by the FIS team in existing systems, allowed for the rapid integration of the Unpaywall data (see [Figure 2](#)).

In addition, while the development and implementation of this project always focused on the end goal of adding OA content to the public CU Experts interface, the decision to pivot to using Unpaywall as a data source also resulted in the opportunity to create an internal data source that the Libraries could use to monitor OA trends at CU Boulder, inform collection development decisions, and serve as data for potential research on OA and other scholarly communication topics. The lead on the FIS side identified that it was easier to include the entire Unpaywall records for articles in the backend data feed for CU Experts instead of filtering out certain fields at that point in the process. As a result, the prototype that was developed for testing could easily display or integrate any Unpaywall property with the existing CU Experts publication records. Again, this was due to Unpaywall's method of sharing data via intuitive JSON structures. This testing interface gave the project team a way to experiment with adding Unpaywall properties to CU Experts facets and publication records, but it also became a valuable data source to maintain on its own. For example, the lead on the Libraries

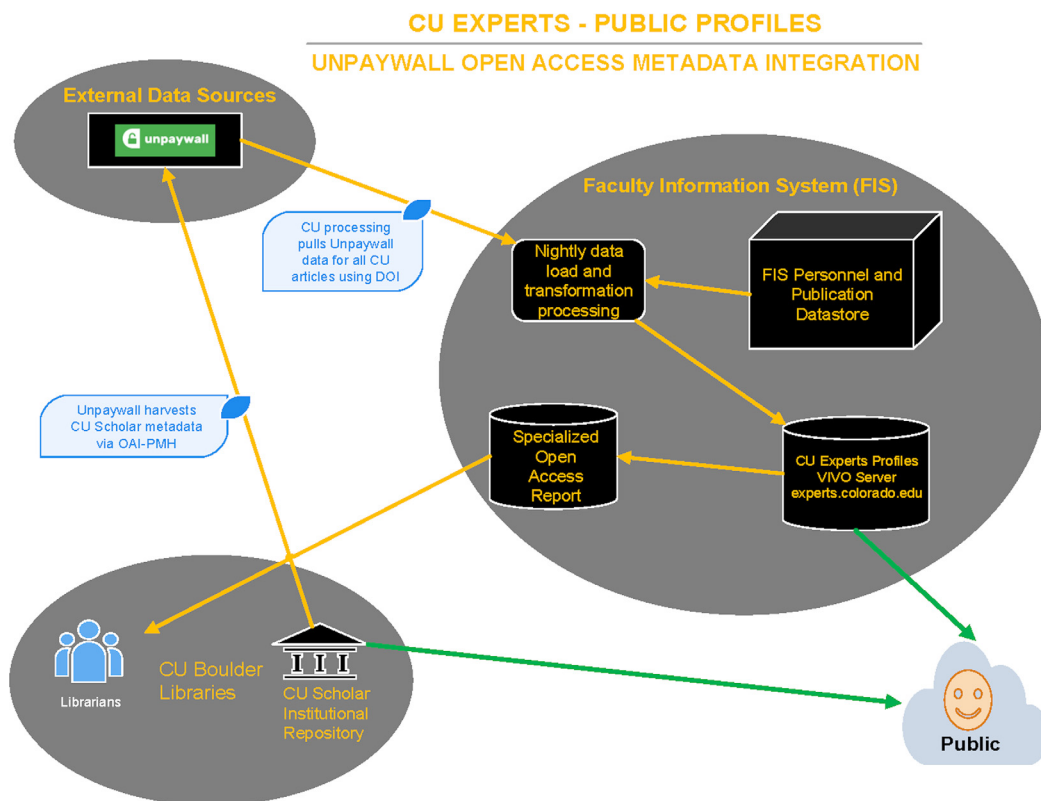


Figure 2. Diagram of Unpaywall Integration With CU Boulder Systems.

side of the collaboration found significant internal value in several of the properties that were ultimately determined to be of little interest to public users. One example of this is the “oa_status” property in the Unpaywall API, which provides information on the type of OA (e.g., gold, hybrid, green, etc.) of the version of the article. For most public users, this terminology would be unfamiliar and not particularly useful, but the Libraries are able to use this information to monitor the total percentage of articles written by CU Boulder faculty that are published in OA journals or deposited in OA repositories. Similarly, having access to all OA versions (“oa_locations” in the Unpaywall API) of a particular article could be overwhelming and confusing for many public users, but this information allows the Libraries to see how many articles are published by CU Boulder faculty in particular gold or hybrid journals, which aids in discussions around how to manage article processing charges (APCs) across campus. Similarly, the “oa_locations” property also provides the Libraries with information on all repositories that house versions of CU Boulder faculty-authored articles in addition to those in the CU Scholar repository that could be valuable in efforts related to federal funding agency public access policies. The development and ongoing maintenance of this internal data source was another unintended yet welcome addition to the original project scope.

NEXT STEPS

The Libraries will continue to monitor both the number of public-facing CU Experts records containing links to OA versions of articles as well as the data in the internal interface, which provides a more detailed view of the OA publishing and self-archiving landscape across campus. This data is already being used to inform decisions and strategic planning around collection development regarding OA. It will also be important to analyze how the existing Unpaywall links are adding value for users of CU Experts. This could involve utilizing Google Analytics to measure usage of the OA links in the CU Experts interface. An additional possible direction that could expand the potential research and decision-making utility of the collaboration would be to explore more external data sources with APIs that could be combined with the Unpaywall and CU Experts data to reveal further insights. One example of this could involve using the DataCite API to pull in links to research data sets related to articles with records in CU Experts to create automated connections between OA articles and publicly available research data. There also could be opportunities to use data sources containing grant information to automate the tracking of funding sources for OA articles, which could be useful in efforts related to measuring compliance with and impact of federal funding agency public access policies. As with the initial project itself, there is potential for this collaboration to evolve further in unexpected ways as well.

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