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Cultural Heritage Data for Research – An Introduction

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This article is an introduction to the collected essay volume 'Cultural Heritage Data for Research – Opening Museum Collections, Project Data and Digital Images for Research, Query and Discovery', published in vol. 10.2, 2024 and vol. 11.1, 2025 of the Open Library of Humanities Journal (see https://olh.openlibhums.org/issue/905/info/). The introduction highlights some methods of approaching humanities data, and sheds light on current trends. In particular, it focusses on museum data as research data for Art History and Cultural Heritage Studies and describes new ways of data querying.

Introduction

The last fifteen years have marked a significant shift for cultural heritage institutions, particularly museums, in terms of their self-awareness and mission. The threefold mission of museums, addressing leisure, education, and research, is increasingly diverging. The digital transformation has introduced entirely new concepts regarding what a museum is, what it can offer, and how collections can be accessed. This shift affects not only the presentation of objects and the educational aspect, but increasingly involves a variety of research aspects related to the objects as well.

New possibilities are on the horizon, providing researchers with opportunities to go beyond the direct study of the objects. These possibilities pertain to the data concerning and surrounding the objects and documents that we typically study. They reside at the intersection where Art History meets Data Science. Museums and other cultural heritage institutions serve as the primary providers of art historical research data.[1] This type of data can be valued both as new primary sources for our fields and as the key research data we handle, especially within the discipline of Art History.

Nowadays, cultural heritage institutions are granting access to their collections in unprecedented ways. Beyond studying the physical artifacts, the digital transformation has engaged museums in meeting researchers' needs in two specific areas: for images, researchers now benefit from public domain images that are available for download and publication, as well as from the implementation of powerful, interoperable image standards such as IIIF. Regarding data, they have access to a wide range of information, including images and their metadata, artworks and their metadata, and all related information, such as artist details, dates, conservation data, provenance data, and more. All these areas now available to researchers significantly enhance research capabilities, provide a valuable service, and open new areas of study. With new tools and query methods emerging from the field of Digital Humanities, the collections are now revealing the data behind the objects through computational query methods, enabling new possibilities for using collections in academic research.[2] While museums offer online catalogs of digitized objects, only a portion of the information in the museum's internal database is visible to researchers on the museum's website. This is different when one enters through the backend via the query endpoint. Generally speaking, researchers need access to various data and information related to the artwork, the artist, the date, conservation details, provenance, and much more. This information can serve as valuable data for building research queries. Data compiled and elaborated

[1] See on Humanities Research Data, for example Cremer, Klaffki and Steyer (2018); Puhl et al. (2015).

[2] See as an introduction, for example, Hyvönen (2012); Jones and Seikel (2016); Bahnemann et al. (2021).

by museums is generally of exclusive interest to researchers and stands at the forefront of the intersection of Data Science, Museum Studies, and Digital Art History.

Images

Many museums have digitized their artworks and made a selection of objects available in their online catalogs. In these catalogs, images are often embedded on the page, typically only available for viewing, though occasionally they can be saved in a so-called Lightbox. This is currently (in 2024) the case with institutions like the National Gallery in London and the Rijksmuseum in Amsterdam, where subscribed users can create personalized image collections while the images remain within the same database environment. In doing so, museums are encouraging users to engage with their online platforms and activities at all levels of interest (leisure, education, or research-oriented) and with minimal access barriers, making them more accessible. Another straightforward and more open access approach is adopted by institutions committed to an open access strategy, by making their images available for download and further use under a CC0 license (public domain).

A digital image typically comes with the image data itself, along with related metadata. In recent years, these have evolved into a rich array of added values and interoperability. An increasing number of museums and cultural heritage institutions are converting their digital images to the IIIF standard.[3] The International Image Interoperability Framework was established in 2011 and formalized as an IIIF Consortium in 2015. It offers high-resolution images independent from the original database and collection, used by many institutions in the GLAM sector (Galleries, Libraries, Archives, Museums) and numerous digital projects. Images are formatted to work in different image viewer environments, not just the original database of the owning institution. Shared APIs (Application Programming Interfaces) link images across different databases. Additionally, these images can be manipulated and annotated, facilitating collaboration and sharing.[4] Many museums have adopted this standard, including the Getty Museum in Los Angeles, the Victoria & Albert Museum in London, Princeton University Art Museum, Harvard Art Museum, and many others. Public domain images and interoperable image standards are currently two areas in which various museums excel, assisting researchers in their work.

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[3] IIIF Consortium 2024 International Image Interoperability Framework. IIIF Consortium. https://iiif.io [Last Accessed 10 December 2024].

[4] See on IIIF and its new standards: https://iiif.io. For an introduction to IIIF's possibilities, see, for example: Snydman, Sanderson and Cramer (2015); Wolff, Probst and Bodenschatz (2024).

Museum Data through Guided Searches in the Online Catalog

Traditionally, museum collections have been accessible either by allowing access to the physical object at the museum or by providing an online digitized version of the artifact. Moving away from single institutional webpages, several museums have developed local joint catalogs with infrastructures that facilitate navigating through the online collection with guided catalog searches. As early as 2008, Dresden initiated the Daphne project for all museums under the Staatliche Kunstsammlungen Dresden (https://skd-online-collection.skd.museum). The advanced search mode includes criteria such as culture, material, technique, type, and more. A more recent example is the Düsseldorf database d:kult (https://emuseum.duesseldorf.de), which includes 13 collections. One of the largest joint catalogs is Art UK (https://artuk.org), which originally began in 2019 with eight project partners for a shared data harvesting initiative. This project is now fully operational, encompassing more than 3,000 institutions in the UK. The shared catalog enables guided searches for over 300,000 artworks, based on shared ontologies and vocabularies, which are essential for consistently addressing each dataset. In most of these catalogs, some search options can be combined and refined, though the searches typically do not allow for completely free combinations. The search begins in a granular way, with one category, such as material or artist, and then allows for the addition of further categories to refine the results. These guided searches are useful for researchers seeking specific information from a database. However, researchers are generally limited to the predefined search strategies that guided searches offer, which are designed to be user-friendly for both the general public and researchers alike without requiring specific preparation.

The advantage of guided searches is the accessibility of information without the need for specialized skills or knowledge. They are helpful for finding information and examples related to a specific material, culture, or date, among others. However, from a research perspective, there is a clear disadvantage in the inability to freely combine search categories or access all resulting data at once. Typically, searches yield an object list with images that must be accessed individually, without an option to download a comprehensive dataset. The British Museum in London illustrates that results can be offered in different ways. Their guided search encompasses a variety of categories, and the results are also downloadable in a tabular format (Excel). Making the data behind the object and online catalog accessible marks a significant advancement in research possibilities.

For researchers, however, selected guided searches may not always be ideal, as they limit the scope of queries at any given time. Other methods offering more flexibility and possibilities require substantial preparation, both from the data provider and the

researcher. Researchers need to understand how data queries work, which requires foundational knowledge of Data Science. Meanwhile, institutions must prepare their data for integration into the Semantic Web. As Daquino et al. write: 'Cultural heritage institutions are dealing with two urgent issues: on the one hand, they need to provide a complete and exhaustive semantic description of their data, and on the other hand, they have to open up their data to interchange, interconnection, and enrichment' (2017: 2).

Collection Data through Query Endpoints

For decades, museums have compiled data in internal databases, which were inaccessible to those not directly affiliated with the specific museum. Now, these internal databases are becoming accessible, for example, through query endpoints. Setting up these data and endpoints represents a complex undertaking for the institutions involved, especially when a query endpoint is designed to serve multiple institutions or consortia queries simultaneously. Over the past decade, there has been a gradual shift toward open data policies. Internal museum databases and their datasets are now being made partially or, in some cases, almost entirely available for scholarly use. Delmas-Glass and Sanderson have described the necessity of the semantic searches for institutions: 'The mission of cultural heritage institutions is to share knowledge effectively to further scholarship and it is important that they participate in the development of the framework that disseminates their knowledge in the Semantic Web' (2020: 21).

Early pioneers in opening museums to data science include the Victoria & Albert Museum in London, the Rijksmuseum in Amsterdam, and the Getty Museum in Los Angeles. The Rijksmuseum, for instance, has made more than 450,000 photographs and 650,000 metadata entries available since 2011.[5] Many other international museums have followed this path, such as the Metropolitan Museum of Art in New York, the British Museum, the Harvard Art Museum, the Walters Art Museum, and more. National cultural heritage institutions have also begun offering their data as shared sets, such as the Beni Culturali in Italy, the country's national cultural heritage organization.

The completeness of datasets offered by museums varies, depending on which categories a museum decides to make available. While some museums provide only basic information like artist names and work titles, others include more detailed data, such as acquisition dates, provenance data, exhibition loans, conservation statements, and much more. However, each museum decides how much and what kind of internal data is available for computational search. Researchers, of course, prefer datasets that are

[5] See for a description on the conversion of collection data to Linked Open Data, using the semantic RDF format, and ensuring compability with the Europeana Data Model (EDM) in Amsterdam: de Boer et al. (2012).

as comprehensive as possible to address complex questions. For example, they might explore a museum's acquisition policy for a specific art category during a particular time period and within a certain geographic region. Or they might investigate the acquisition and exhibition policies for specific Afro-American objects in international museums in relation to geopolitical events. Such questions are difficult to address using a traditional art historical approach. On one hand, access to this kind of data often cannot be obtained through a museum's public website, and would therefore require staff members to search internally for relevant materials. On the other hand, a large volume of data is essential to produce meaningful results. Ultimately, these kinds of queries enable researchers to tackle broader questions about objects using quantitative methods, as well as to analyze museum policies and conduct comparative studies. With these new query methods, museums become significantly more transparent.

Current trends in Digital Humanities demonstrate how computational queries can access internal databases via query endpoints. These methods rely on consistent data that adheres to general standards for data queries and Linked Data. In this context, the queries work with structured data derived from a knowledge base. This type of structured data becomes part of the Semantic Web, employing standards and software to ensure machine-readability, often utilizing ontologies and Linked Data.[6] These querying methods highlight the complexity of transforming original data for hosting institutions. Some of the biggest challenges include setting up the endpoint, dealing with inconsistencies in historically accumulated data, and accommodating various standards, ontologies, and classifications. For large and long-established collections, this preparation can require a substantial effort. Databases currently available almost always contain some inconsistencies, necessitating significant time and effort from researchers to clean and model the data.

These methods require specialized training in the research data lifecycle, enabling researchers to retrieve, model, visualize, and analyze data effectively to generate meaningful results. Various institutions have invested considerable time and resources into exploring different querying methods, resulting in an increasing variety of approaches to accessing data. For example, the Getty Museum, the Metropolitan Museum of Art, the Walters Art Museum, and the Cooper Hewitt Museum offer reduced datasets for download via GitHub, typically in formats such as CSV or JSON, which can

[6] For an example of structured data obtained through query endpoints, see Angelis and Kotis (2021). They offer an example on how to convert museum data into RDF etc. with the examples of the Museum of Modern Art and the Carnegie Museum of Art, taking these datasets from GitHub and converting them. The authors are proposing a pipeline for the researcher, how to integrate different museum data sets, convert these into RDF triples and open the data for SPARQL queries.

then be manipulated and analyzed. SPARQL endpoints are provided by institutions like the Getty Collection and Linked Art.[7] Additionally, photo archives such as the Fondazione Zeri in Bologna and the Pharos catalog have opened their holdings to Semantic Web technologies by offering SPARQL endpoints for querying images and data.[8] API endpoints are more common and are available from institutions such as the Victoria & Albert Museum, the Rijksmuseum, the Harvard Art Museum, the Getty Collection, Linked Art, and others. While SPARQL endpoints require learning a query language to retrieve data,[9] the complexity of using API endpoints varies. Depending on the setup, these may involve simple string coding or require the use of computer languages such as Python or R. Across all search methods, once data is queried—regardless of the method—it must be modeled and analyzed. Querying endpoints is becoming an increasingly diverse and complex topic. Data can be accessed through single endpoints, federated query systems, or shared endpoints, such as 'centralized materialized data-warehouses, that traditionally exists among data integration systems' with their 'mediators, which allow the user for querying several legacy data sources without extracting and loading data' (Bouchou Markhoff, Nguyen and Niang, 2017: 8).[10]

So far, most museums and cultural institutions have been working individually on query methods and endpoints. Only a few projects aim for a unified approach that integrates multiple entities into a single query. One such initiative was the OCLC-initiated Museum Data Exchange project, active from 2008 to 2010. Its goal was to enable data harvesting across nine project partners using freely accessible tools via the OAI-PMH transfer mechanism.[11] The project focused on evaluating data from different

[7] The British Museum used to offer a SPARQL endpoint, which is currently not active. They turned instead to a guided search model with an additional opportunity to download data sets (in 2024).

[8] While Pharos uses the CIDOC CRM as a framework—more specifically, the Linked Art Model as one of its iterations—one of its member photo collections, the Fondazione Zeri, is exploring a more complex set of additional ontologies to describe photographs in greater detail. In addition to these new ontologies, they also rely on various authoritative sources, controlled vocabularies, and datasets, including VIAF, Getty vocabularies, Wikidata, GeoNames, and others (see Daquino et al., 2017; Delmas-Glass and Sanderson, 2020).

[9] See for SPARQL: S. Harris & A. Seaborne (Eds.) 2013 SPARQL 1.1 query language. World Wide Web Consortium. https://www.w3.org/TR/sparql11-query/ . [Last Accessed 10 December 2024].

[10] These authors propose Ontology Based Data Integration Systems (OBDI) as the most effective way for Cultural Heritage Institutions. Other institutions and researchers are exploring with automated approaches. See, for the example of Shape Expressions (ShEx) as a method to access LOD and validate RDF data coming from library catalogs: Candela (2023).

[11] OCLC has been working since at least 1997 on an initiative: REACH (Record Export for Art and Cultural Heritage) – Investigating the Integration of Museum Data 1997. See for the second phase: Museum Data Exchange: Learning How to Share, February 2010. Final report to the Andrew W. Mellon Foundation (https://www.oclc.org/content/dam/research/publications/library/2010/2010-02.pdf, https://www.oclc.org/research/activities/museumdata.html). [Last Accessed 10 December 2024]. The following institutions participated in the creation and deployment of the data shar-

sources and estimating 'match rates' for a potential future joint collection. However, the project ended after a few years, and museums reorganized their efforts into different collaborative initiatives.

One such initiative is Linked Art (formerly the American Art Collaborative, Knoblock et al. 2017), a consortium of 14 U.S. museums that has been working since 2014—and reiterated in 2017—on a shared semantic strategy based on the principles of Linked Open Data (Sanderson and Newbury, 2017; Sanderson, 2018; Newbury, 2028; Page et al., 2020). The consortium developed the Linked Art Model as a profile of the CIDOC CRM ontology (incorporating Getty Vocabularies, JSON-LD format, REST API, and Python). Delmas-Glass and Sanderson describe the benefits of this approach: 'Linked Art provides shared data modelling solutions for most traditional scenarios that catalogers encounter when describing an object and the events it is part of, such as its production, publication, provenance, exhibition, publication, and representation in digital objects. It then allows for local extensions to complete the remaining 10 percent of use cases that may be institution-specific, or very complicated to describe' (2020: 22). This long-term project is now producing results in a beta version. The greatest challenge has been addressing the heterogeneity of datasets from different museums (Newbury, 2018; Page et al., 2020). Linked Art has developed a community and data model that can be reused by other cultural heritage collections, including museums (e.g., Getty) and photo archives (e.g., Pharos) (Delmas-Glass and Sanderson, 2020; Raemy, 2023). It serves both large-scale collective uses by major institutions as well as providing an accessible model for museums with limited expertise and staff. This is what Delmas-Glass and Sanderson explain: 'Linked Art aims to provide museums with the semantic framework and Web technology expertise to fulfil their ambition, without needing specific experts as parts of their permanent staffing' (2020: 21).

One of the largest collaborative catalogs is the museum-digital initiative (https://en.about.museum-digital.org). Launched in 2009, it now includes over 1,100 participating museums and more than 10,500 collections, with a total of over one million objects. While most participating institutions are located in Europe, the initiative also includes collaborators worldwide. The platform offers guided access for searches by keywords, institutions, timelines, and more. Although keyword search results cannot be downloaded directly, the site provides an API search with accompanying documentation.

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ing tools: Harvard Art Museum; Metropolitan Museum of Art; National Gallery of Art, Washington; Princeton University Art Museum; Yale University Art Gallery. The Cleveland Museum of Art, the Minneapolis Institute of Arts, the National Gallery of Canada and the Victoria & Albert Museum participated in the creation of the research aggregation, and the data analysis.

All these projects testify to the efforts, museums are making to render their data accessible for researchers. Nevertheless, the percentage of museums involved is in total still rather small.

New research methods and challenges

After two decades of development, the digital turn has significantly broadened the range of products a museum can offer. Since the establishment of public museums in the 18th century, museums have always been seen as places of education. However, their primary focus was never solely on students and researchers; instead, museums have historically bridged various public tasks. As repositories of cultural heritage, they have served civilization at large, displaying its heritage for the general public. Today, the digital turn has made it easier to address diverse audiences simultaneously or to focus on specific groups individually. While researchers were not traditionally a primary focus for most museums, changes since 2011 have enabled the development of research-focused services with immense potential for Art History and Cultural Heritage Studies. These services include online catalogs of objects with detailed descriptions, guided search tools, public domain licensed images, IIIF manifests, and queryable datasets available online or through endpoints. Museums, archives, and related projects now provide valuable primary sources for researchers, opening up new avenues for study that were previously impossible.

The traditional method of offering physical objects or their digitized representations is now complemented by detailed data about these objects and images. This evolution allows for entirely new kinds of research, including complex data queries that take collections into the realms of Data Science and Digital Humanities. Museum data as primary sources are establishing a new field at the intersection of Art History, Cultural Heritage Science, and Data Science, transcending the object itself. These qualified datasets, often structured within a Semantic Web context, represent a major new resource for art historical research. Until now, Art History has been divided into two distinct professional spheres: traditional Art History and the more practically oriented Cultural Heritage Studies. Now, cultural heritage institutions have the opportunity to provide primary source materials and data that are crucial for art historical research. This kind of contribution extends far beyond their traditional roles and enriches research in a variety of directions.

Museums and research data—whether as image data or object-related data—primarily address researchers. These institutions operate at the interface between cultural heritage organizations and university research. Projects initiated by cultural heritage institutions and applied to their collections ultimately serve the research

community. Traditional Art History, Digital Art History, and Data Science are increasingly converging, creating a unique opportunity for the field of Art History. Cultural heritage institutions are also increasingly engaging with the core areas of Digital Humanities and Digital Art History. However, this convergence requires both museum professionals and researchers to gain expertise in new methods, such as the Semantic Web and Data Science. Currently, the Data Science resources offered by museums are accessible to only a small number of students and researchers. Nevertheless, this field represents an area where museums and cultural heritage sites are most aligned within the realm of digital research. These institutions offer high-value primary materials for study, which are as enriching and beneficial as the physical objects themselves, which naturally remain essential to their mission.

Set-up of This Volume

This collection of essays on 'Cultural Heritage Data for Research' addresses issues related to the complex backend of setting up institutional and project data, as well as exploring various query methods. Establishing data infrastructures, semantic structures, and query methods is an ongoing challenge and remains subject to continual change. This dynamic nature applies equally to any research conducted using these data and methods. What is established today may look entirely different in a few years. Currently, many museums are undergoing significant changes to their initial iterations of query endpoints and setups. Indeed, this is one reason why some institutions are hesitant to contribute essays to this volume, as they are still in the process of refining their approaches. As a matter of fact, several endpoints that were available five years ago are currently closed and undergoing reconstruction.

The collected essay volume explores topics such as the Semantic Web, Linked Open Data, and Knowledge Graphs. Additionally, it includes case studies that discuss querying possibilities, highlighting the complexities involved as well as the advantages and limitations of these methods. Recognizing that data, structures, and methods are in a constant state of evolution, the essays aim to address some of the issues and present semi-permanent or temporary solutions. Despite these inherent uncertainties, this collection seeks to approach the subject from multiple perspectives, examining the roles of museums, institutional projects, and researchers. By doing so, it offers insights into the challenges and opportunities at the intersection of cultural heritage data and research.[12]

[12] All articles went through a double-anonymous peer review process. We would like to thank the many reviewers for their valuable contributions.

Discovering collection data through Linked Data

Robert Sanderson (Yale University)

Implementing Linked Art in a Multi-Modal Database for Cross-Collection Discovery

- Yale University has implemented a knowledge graph-based discovery system that brings together the various art, natural history, archival, conservation and bibliographic collections using Linked Open Usable Data standards such as Linked Art and IIIF. This system comprises more than 41 million records, which would expand to more than 2 billion RDF triples, and is thus at a similar scale to Europeana. This paper presents the lessons learned from the five year effort around the usability of linked data structures across the organization, the technologies needed to make use of the knowledge in a performant way, and the appropriate design paradigms for front end applications which make the graph easily and intuitively accessible to researchers and the public, including the necessity of consistency in data modeling, that records are an essential concept to maintain through multi-modal systems, and the use of hypertext and web caches to maintain the separation between systems.

Natalie Rothman and Kirsta Stapelfeldt (University of Toronto)

The Dragoman Renaissance Research Project in Library/DH Linked Data Partnerships

- The Dragomans Renaissance Research Platform represents a long-standing collaboration between the authors. The project explores the role of dragomans (diplomatic interpreter-translators) in mediating relations between the Ottoman Empire and its European neighbors from ca. 1550 to ca. 1730. The project leverages surrogates and transcriptions from multiple archival and secondary sources to produce a structured data set that can be queried using SPARQL. The Dragomans use case illuminates the potential of library-partnered DH projects, like other unique collections, to become machine-readable research data sets made available through generalized, sustainable architectures that also suit researcher needs for UI-driven query and display.

Marilena Daquino (University of Bologna)

Photo Archives and Linked Open Data. The Added Value

- In the last two decades, cultural heritage institutions have been revisiting the way they publish their data. Due to the rise of Semantic Web technologies and graph-based search engines, the shift in the technology stack has required many to reconsider also the way their data were organized. The appreciable byproduct

of this phenomenon has been the development of data literacy skills among cataloguers, archivists, and collection managers, who were in turn promised a revamp of the institution's image in terms of authoritativeness (due to the improved data quality) and attractiveness towards patrons (due to the enhanced search capabilities). In this article we describe how photo archives have embraced such a new paradigm, and we discuss benefits and limitations, moving from a representative example, i.e., ZERI & LODe, a project devoted to the publication of the catalogue of the Federico Zeri Photo Archive into Linked Open Data. The focus of the analysis is the (missed?) added value promised by Semantic Web technologies and the Open Data business model to cataloguers, scholars, and arts enthusiasts.

Research with cultural heritage data

Toby Burrows (University of Western Australia)

Exploring Knowledge Graphs for Medieval and Renaissance Manuscripts with SPARQL

- This article reports on research into the use of SPARQL for querying knowledge graphs, in the form of Linked Open Data triple stores, which relate to the history and provenance of medieval manuscripts. It looks at several recent initiatives and projects which rely on RDF and SPARQL, including Mapping Manuscript Migrations and the Wikibase implementation of Digital Scriptorium. As well as comparing and evaluating different ways of using SPARQL with manuscript data, the article looks at possible future directions in this field, notably the development of visual interfaces for SPARQL queries and the potential use of AI chatbots to formulate SPARQL queries.

Matthew Westerby (National Gallery of Art, Washington)

Annotating Upstream: Digital Scholars, Art History, and the Interoperable Image

- Written primarily from the position of an art historian engaged in digital research and data-intensive projects, this essay explores annotations on interoperable images and the possibility for annotations as 'thick data'. Images and descriptive metadata can be used and re-used in any number of contexts, but annotations are contextual fragments of scholarly insights that do not translate easily across domains. While data models for web annotation are clearly defined in a technical sense, their implementation is socially motivated. This essay gives a very brief overview the ecosystem of IIIF annotations as outgrowths of sandbox projects and Open Access initiatives at art museums and libraries. I suggest that art

historians should practice ‘upstream annotation’ by maintaining the data that constitute their annotation outputs while acknowledging the sociotechnical affordances and ephemerality of annotation spaces.

Angela Dressen (I Tatti, The Harvard University Center for Italian Renaissance Studies)

Medieval and Early Modern European, African and Asian ivory seen through the Data Lens

- Ivories of different natures are one of the oldest materials of artistic expression, and they have been used widely through space and time. The purpose of this article is twofold: on the one hand, to offer a data driven analysis of Medieval and Early Modern ivories in Europe, Africa and Asia (ca. 1000 to 1600); on the other hand, to offer a critical perspective on the proposed query method itself. Nine museums with 2123 objects have been chosen for this analysis, based on the availability of a query endpoint. The proposed method has clear advantages and disadvantages. To the advantages belong the possibility of researching through several museum holdings at the same time (once the dataset is modelled), to query museum object data on view and on deposit all together, to be potentially able to provide insights into a given category from a very broad perspective, but also to search for unusual objects. To the disadvantages belong the fact that data are changeable, and that the selection of the museums is driven by the availability of a query structure. Therefore, the choice of the museums is also problematic, if one wants to address an international comparison. Furthermore, each museum offered data only in specific fields, which adds complexity to an overall query.

Competing Interests

The author of this introduction is also the editor for the special collection.

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