Aggregating Metadata from Heterogeneous Pop Culture Resources on the Web

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Abstract

Japanese pop culture resources, such as manga, anime, and video games, have recently experienced an increase in both their consumption, and appreciation for their cultural significance. Traditionally seen as solely recreational resources, the level of bibliographic description by cultural heritage institutions has not kept up with the needs of users. In seeking to remedy this, we propose the aggregation of institutional data, and rich hobbyist data sourced from the web. Focusing on manga, a form of Japanese comic, this paper discusses classification and aggregation, with the goal of improving bibliographic description through the use of fan created data. Bibliographic metadata for manga was collected from the Japanese Agency for Cultural Affairs media arts database, along with several English language manga fan websites. The data was organized into classes to enable property matching across data providers, and then tested with existing ontologies and aggregation models, namely Europeana and the Open Archives Initiative's Object Reuse and Exchange, to determine their suitability in working with these unique resources. The results show that existing ontologies may be suitable for use with pop culture materials, but that new vocabulary terms may need to be created if there is an abundance of granular data that existing ontologies fail to properly describe. In addition, the OAI-ORE aggregation method proved to be more promising than EDM when examining the aggregation of related pop culture resources. The paper discusses these issues, as well as recommendations for addressing them moving forward.

Keywords: metadata; pop culture resources; Manga; metadata aggregation model; OAI-ORE

1. Introduction

Resources that fall under the umbrella of Japanese popular culture, such manga – Japanese comics, anime – Japanese animation, video games, and others, are important pieces of cultural heritage that have historically been treated as less significant than more traditional materials by various memory institutions. As both appreciation for the cultural significance and overall consumption of these resources is increasing, the need has arisen for improved resource description and representation of these materials by institutions that collect them.

While traditional cultural heritage institutions have historically created the bare minimum in descriptive metadata for pop culture resources, special institutions and hobbyist data providers have given the materials more attention. These institutions and providers range from libraries focusing on collecting materials from a single pop culture medium, to web resources such as Wikipedia or fan websites, the latter often containing the most abundant and granular information available for a given resource. Thus, using Linked Data concepts and technologies, there is an opportunity for memory institutions to improve the state of how their pop culture resource collections are represented using already existing, hobbyist created data from the web.

This paper outlines the exploration of this data sharing opportunity. Focusing on Japanese manga, the paper examines how resources are modeled between different data providers, specifically the Japanese Agency for Cultural Affairs and various non-Japanese fan websites, and

proposes a unified model for both. The discussion then moves on to aggregation, with an examination of current metadata models, namely Europeana's, and their suitability in aggregating pop culture materials. The remainder of the paper is organized as follows. Section 2 details background information and project goals. Section 3 lists related works and past projects. Section 4 discusses how different data providers handle manga and how they can be more formally classed, as well as some discussion on pop culture ontologies. Section 5 focuses on aggregation, discussing the suitability of existing models to work with pop culture resources, as well as the benefits of aggregation. Finally, Section 6 concludes with some points of discussion and outlines future work.

2. Pop Culture Data Providers & Research Goals

The goal of sharing data between traditional cultural heritage institutions and hobbyist oriented fan websites is central to this research. The logic behind this data sharing is that different types of data providers describe materials in different ways, particularly in the realm of pop culture. In this paper, pop culture resources is used to refer to a specific subset of Japanese resources, namely anime, manga, and videogames. While research into all of these is being undertaken, this paper will generally focus on manga, a form of Japanese comics.

When discussing different data providers and how description for pop culture resources differs between them, two main provider types are relevant. The first are more traditional cultural heritage or memory institutions, such as libraries, or corporate bodies with a professional interest in recording bibliographic data for these resources. While the data recorded differs between these institutions, it is typically traditional properties one would find in a library catalogue meant to keep track of on-hand items for collections, or record data relevant to business practices. In this study, the Japanese Agency for Cultural Affairs, or Bunkacho (文化庁) represents this data provider type. Bunkacho maintains a pop culture database for several media types at https://mediaarts-db.jp. For their manga database, the data came from a corporate body responsible for the physical production of manga, and was created with consultations from libraries. Thus, the level of description granularity and specific bibliographic properties matches that of a traditional library catalogue record.

For more granular pop culture resource data, one must look to hobbyist resources, which typically take the form of a fan website. As these data providers are not bound by traditional cataloguing rules and are usually open to editing by users, the data recorded tends to be much more granular than the previous provider type. Properties such as character names and relationships, story arc summaries, genres and tags, etc., are commonly found at hobbyist sources and missing from cultural heritage institutions. Past studies have shown that fans of pop culture materials are interested in minutiae (Fee, 2013), but this is also demonstrated plainly by the fact that when able to record bibliographic data themselves on editable fan websites or on Wikipedia, this granular data is what they choose to record. As manga is the focus of this study, several fan sites were chosen based on their large manga databases: Manga Updates (www.mangaupdates.com), AnimeNewsNetwork (www.animenewsnetwork.com), and MyAnimeList (http://myanimelist.net).

In this early stage, naming specific applications of our research is difficult, but as we seek to aggregate data from both fan web pages and cultural heritage institutions, the aim is to serve users of both of these sectors. For cultural heritage institutions, improving the amount and granularity of data within their records through the accessing of fan site data is one obvious benefit for users of those institutions; librarians at several US universities have expressed a desire to include this data in their records to the authors, though have been unable to for a variety of reasons, such as staff workload. The use cases for fan sites is less obvious, as they tend to have more data than the other providers being aggregated, so their amount of information would not necessarily increase from aggregation. There are, however, interesting possibilities if one considers making aggregated information from fan sites available as Linked Data, such as aggregations being made

available via a URI and acting as the representation for a manga Work which any site can reference, for example. Section 5.1's discussion on the OAI-ORE aggregation model discusses this idea further.

All of that said, the goal of this research is to enable the data sharing between these two different data provider types through classification and aggregation in an attempt to achieve a more thorough bibliographic description landscape for pop culture resources and better serve the needs of users of relevant cultural heritage institutions and fan sites. In addition to improved resource description, we hope to provide extendable aggregation methods for connecting data across languages.

3. Related Research

He, Mihara, Nagamori, & Sugimoto used Wikipedia, through DBPedia articles for manga, as a method of identifying FRBR Works using Linked Open Data (LOD) resources (He, Mihara, Nagamori, & Sugimoto, 2013). The authors used DBPedia as a reference authority in order to identify Work level entities of manga in the Kyoto Manga Museum's catalogue. While this study focuses less on DBPedia, it is similar in that it needs to identify Work level manga entities from web resources in the absence of a traditional authority.

Southwick (2015) looked at the transformation of digital collections metadata from the University of Nevada, Las Vegas, into Linked Data. The motivations given for the project were the desire to break up the isolated digital collection metadata silos, to connect data from multiple providers, and to improve search capabilities. As the goal of this research is to similarly connect isolated data through transformation into Linked Data, the lessons learned and technologies used were helpful.

The authors previously conducted a similar study on manga metadata aggregation (Kiryakos & Sugimoto, 2015) that focused on an EDM based model, which also meant to aggregate manga metadata from different provider types. The end goals remain similar, though the previous model focused on the use of EDM and BIBFRAME, and was more focused on harvesting data and making it work within the developed model. This study takes a different "bottom-up" approach, with modeling the original data taking priority, and includes hobbyist resources, absent from the previous work. Still, some foundational efforts and lessons learned during the previous work remain useful.

While most early work focused on EDM as a method for aggregation, more recent examinations of the OAI-ORE model have been undertaken. Ferro & Silvello (2013) define a formal basis for using OAI-ORE as a way to model whole archives. Their desire to formally define complex relationships between resources is in line with the study undertaken here. The exploration of nested sets and compound digital objects is also of particular interest, as it resembles the aggregation of various resources to form FRBR-like entities, such as a complex Work entity.

4. Bibliographic Metadata for Manga

This section describes the manga metadata sourced from the previously named data providers, as well as an attempt to classify them. Both Bunkacho and the web resources have uniform properties across their respective pages, though both lack a formal data model or classification structure. In order to properly map aggregate and map data across these provider types, some classification is therefore necessary. The section ends with a discussion on pop culture specific ontologies.

4.1. Bibliographic Data for Manga

The Bunkacho manga database, located at https://mediaarts-db.jp/mg/, catalogues three main entity levels for manga. While the data can be accessed directly through the website, the authors

were given access to the database files themselves. As the database was created in consultation with librarians, the data recorded is similar to that found in a traditional library catalogue record, though lacking any formal structure or vocabulary, e.g. RDA, MARC, etc. The Comic Works pages (ex. https://mediaarts-db.jp/mg/comic_works/XXX) represent the conceptual FRBR *Work* level for a manga. These pages contain a small number of bibliographic properties based on the manga, but represent the conceptual *Work* as they contain links to related

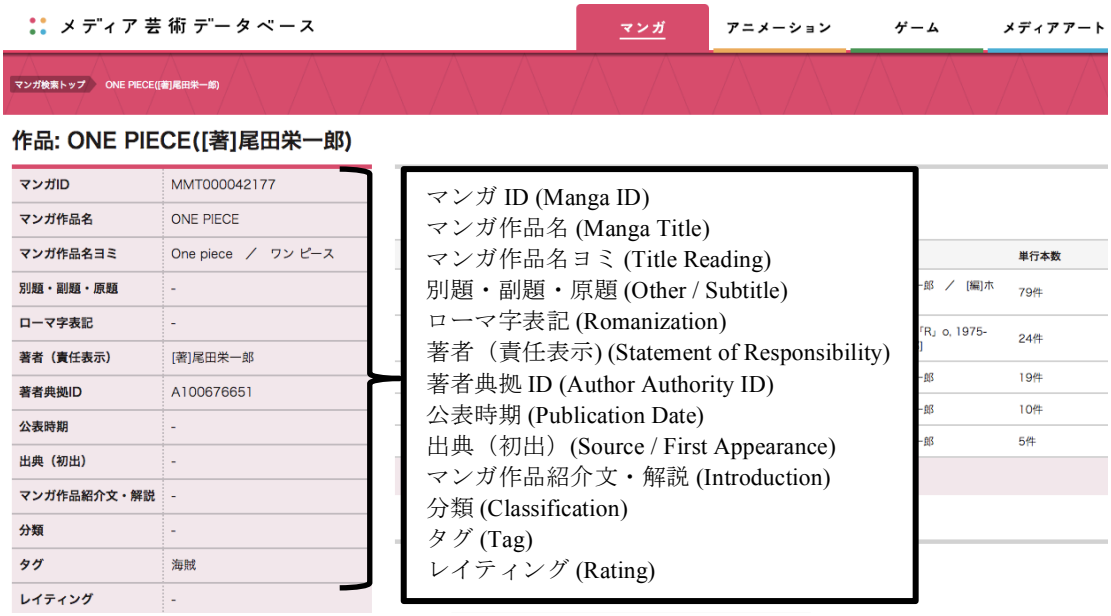

FIG 1. Screenshot of the Bunkacho Comic Works entry for the manga One Piece and added translations. Full page at https://mediaarts-db.jp/mg/comic_works/81200

entities in the database that are not manga, such as related anime entries. Therefore, while most of the data in these pages is based off of the manga *Expression* of the *Work*, they can still be seen as "home pages" representing the *Work* concept. An example of the Comic Works page is shown in Figure 1. Below this level are the Book Titles pages (ex. https://mediaarts-db.jp/mg/book_titles/XXX), which represent a combination of the FRBR *Expression* and *Manifestation* entities. If the Comic Works pages represent the conceptual *Work*, the Book Titles pages act as representations of the manga specifically, containing more manga-specific bibliographic data, as well as individual volume names and numbers. Despite most of the metadata on these pages being broad enough to apply to the *Expression* level, some properties are based on specific publication instances, thus representing the *Manifestation* levels as well. Lastly, the Books pages (ex. https://mediaarts-db.jp/mg/books/XXX) describe individual manga volumes, representing the FRBR *Manifestation* and *Item* levels. While most of the bibliographic data for the Books pages are at the *Manifestation* level, they contain some *Item* level data based on holdings information for a number of Japanese libraries. In regards to the size of the database, the amount of records vary depending on media type and FRBR entity level, but it is quite sizeable, with records for individual titles numbering over 80,000. This number includes separate editions, however, so the number of unique *Work* entities is closer to the 30,000 range.

As the Bunkacho database properties are similar to those found within traditional library catalogues, the data resembles existing generic bibliographic description models, with some changes. For example, prior to being published as volumes, manga are initially published as individual chapters in magazines at weekly or other regular intervals; a model designed to better represent manga, then, needs to incorporate these magazines and their relationships to volumes.

Manga metadata from fan sites – an example of which can be seen in Figure 2 – is quite different, with many of the bibliographic properties being unique to these data providers. This specific, granular data is the basis behind the goal of aggregating data, as it tends to be data fans of these resources are more interested in. The properties can differ between sites, but some examples that are present here and missing from Bunkacho and other traditional institutions are chapter titles, volume / plot summaries, tags and genres, character information, and spin-offs or related manga. Unlike Bunkacho, where direct database access was available, the authors had to use available APIs and HTML scraping to access data from these sources. While there do not appear to be any copyright issues, the sustainability of access, particularly through the HTML scraping method, needs to be investigated if a future project relies on constant data gathering. The number of individual *Works* handled by these sites is slightly less than the Bunkacho database, though still quite sizeable. AnimeNewsNetwork, for example, contains over 18,000 records, and MangaUpdates contains around 13,000.

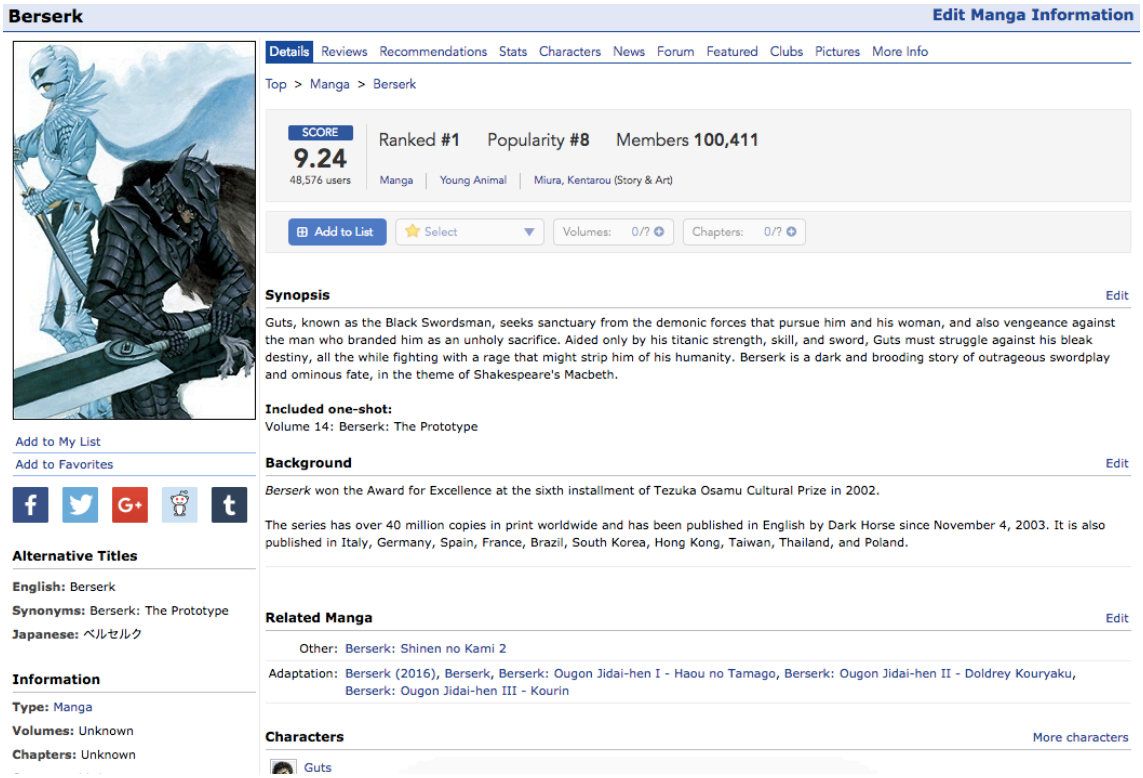

FIG 2. A sample fan site page from MyAnimeList for the manga Berserk. Full page at http://myanimelist.net/manga/2/Berserk

Importantly, the data from these different provider types is multi-lingual. While Bunkacho's database is in Japanese, the fan sites used here are English, despite containing data for Japanese resources and not English translations. As manga is a Japanese resource, Japanese data appearing in English records is common. In a previous study (Kiryakos & Sugimoto, 2015) using manga metadata from Monash University's JSC Manga Library and various US University libraries, the presence of Japanese data in the English records enabled the identification of related manga resources from Bunkacho's database when no official translation was available. Similarly in this study, the fan sites containing Japanese data enable the matching of related manga metadata across languages. While this allows for related resources to be identified and aggregated more easily at the property level, some issues arise when mapping at the class level, as will be shown in Section 4.2.

4.2. Classes for Manga Metadata

In order to more easily map the data between provider types, a self-defined class structure was created, and the properties from both Bunkacho and the fan sites were classed accordingly. This was done mainly as a preliminary process to determine how much of the data was similar across the data providers without having to do a complete mapping of all available properties across all data providers.

The majority of data from both Bunkacho and fan sites were placed into three main classes: Title, Agent, and Publication. An example of the class assignment based on the can be seen in Table 1, which shows Title class properties sourced from the various data providers. This broad class structure resembles some other bibliographic description models, such as BIBFRAME's 2.0 model (Library of Congress, 2016). In this early stage, a self-defined class structure was preferred to existing models, as it does not force the improper classification of the less traditional granular properties sourced from the fan resources, discussed further in this section.

TABLE 1: Title Class properties from Bunkacho database and manga fan sites.

Title Class	
Property	**Source**
マンガ作品名 (Manga Title)	Bunkacho
別題・副題・原題 (Other Title; Subtitle; Original Title)	Bunkacho
ローマ字表記 (Romanized Title)	Bunkacho
Title	MangaUpdates
Related Series	MangaUpdates
Associated Names	MangaUpdates
Serialized In (Magazine)	MangaUpdates
Category Recommendations	MangaUpdates
Name	AnimeNewsNetwork
Note [serialized in]	AnimeNewsNetwork
Alternative Title	AnimeNewsNetwork
Name	MyAnimeList
Serialization	MyAnimeList
Related Manga	MyAnimeList

As shown in Table 1, the mapping of properties becomes rather straightforward when organized into classes, particularly for the aforementioned main classes. Even among the Title main class, however, there are issues; for example dealing with title data that is in multiple languages can be problematic. Bunkacho data is generally in Japanese, thus the title data is in Japanese. The fan sites used in this project describe Japanese manga resources, but do so using translated English data, with Japanese data appearing as supplemental. This means that in Table 1, the Bunkacho property マンガ作品名 (Manga Title) would be mapped to the Associated Names property at MangaUpdates, rather than the Title property, which would be the English translated title. This is not a substantial issue at the moment, though it needs addressing before being able to determine how title data fits into subclasses such as Main or Alternate Title.

The main classes of Title, Agent, and Publication, along with some other classes such as an Identifier class and various subclasses, are able to contain the majority of the standard bibliographic data, particularly the data coming from Bunkacho. Classifying the more granular, manga-specific data, however is a current work in progress; properties that describe things such as character relationships or story arcs are typically absent from traditional bibliographic description models, and thus work needs to be done to create classes and subclasses that are able to logically describe this data. Petiya (2014) attempted this to an extent with comic books and

graphic novels. The resulting classes can be seen at https://comicmeta.org/cbo/. Aside from the creation of unique classes such as a "Comic" superclass, some from schema.org are used, such as schema:CreativeWork being a superclass for a ComicUniverse class. Further investigation is needed to determine whether existing classes, such as those from schema.org, are suitable for granular data for manga or other pop culture resources, or whether the creation of new classes is required.

4.3. Usability of Existing Ontologies

As Linked Data concepts are key to the sharing and description of the pop culture resources being discussed, there is the question of available ontologies that can be used to describe these unique resources.

For general bibliographic description, there are several vocabularies available for use that can sufficiently describe the majority of the properties from both Bunkacho and the fan sites. The authors' previous related study (Kiryakos & Sugimoto, 2015) experimented with the BIBFRAME vocabulary, which worked well, but has since undergone a 2.0 revision. The revision still looks to be suitable for description, but waiting for a more finalized version of BIBFRAME is advisable. Viable alternatives to this are the combination of other existing vocabularies, namely Schema.org and Dublin Core – National Diet Library (DCNDL), the latter of which is particularly useful for Japanese resources, as it already contains properties to describe data such as Japanese readings or transliterations.

For pop culture specific bibliographic properties, other issues arise. As one main goal of this research is to access the rich hobbyist data that is absent from cultural heritage institutions, one must be able to properly describe this data, particularly in a Linked Data context – in other words, using RDF based vocabularies. The vocabularies to describe this data, however, generally do not exist. There has been some work in creating some resource specific ontologies for pop culture resources (Petiya, 2014), but how extendable these are to other resource types needs to be examined. Petiya's ontology, for example, is rather thorough if one wants to describe American comic books and aspects of collecting them, but may be unable to adequately describe nuances of mediums in the Japanese pop culture sphere, such as diverse manga publication hierarchies or relationships to common spinoff media types such as videogames or film. Ultimately, the amount of granular data available will determine the necessity of these unique vocabularies; if there exists enough data that is unique to manga, anime, etc., that institutions would like to access, at least some new properties will have to be created to accommodate this. The majority of the data being described, however, is fairly standard with other bibliographic materials, so the opportunity to reuse parts of existing ontologies is present and will no doubt be performed.

5. Aggregating Pop Culture Data

This section discusses the suitability of existing aggregation models for pop culture data, and demonstrates some of the benefits of aggregation based on the manga example discussed throughout the paper.

5.1. Aggregating Using Existing Models

In connecting hobbyist and institutional data, and underlying aggregation model is required. Perhaps the most prevalent existing linked data aggregation model is the Europeana Data Model (EDM). The intended use of EDM is for aggregating cultural heritage data sourced from various European institutions for display on the Europeana web portal. Typically these objects are singular, unique items that exist in galleries or museums, and so the use of EDM with non-unique items such published manga is not as straightforward. The use of EDM with manga was previously examined (Kiryakos & Sugimoto, 2015) to determine how compatible pop culture materials were with the model. While EDM was suitable for some tasks, when it came to representing the various FRBR entities that are found with manga data, the authors found EDM to

be less than ideal; similar issues were noted in an EDM for Libraries document (Angjeli et al., 2012).

The initial issue was with the use of the mandatory edm:ProvidedCHO class. In EDM, the CHO (Cultural Heritage Object) represents the, typically unique, object being described, such as a painting or sculpture. While determining what the CHO represents when discussing a unique object such as a sculpture is usually clear, it is less so when dealing with objects such as literary materials with numerous copies, editions, publications, etc. Angjeli et al (2012) found that there was some confusion on whether to apply edm:ProvidedCHO to the specific *Item* of a textual resource, or the "edition level" representing FRBR's *Work*, *Expression*, and *Manifestation*. Consultation with Europeana revealed that a ProvidedCHO could represent both the *Item* and edition levels, with metadata establishing a relationship between the two, e.g. the edm:ProvidedCHO for an item is connected to the edm:ProvidedCHO of the edition through an edm:realises property. For a resource such as manga, however, the representation of multiple FRBR entities seems less than ideal due to the amount of relationships a single resource can have to related resources. For example, a single volume (*Item*) of manga can be connected to the manga series to which it belongs. This can then be connected to translation of the work, and both of these could in turn be connected to the manga *Expression* to which they belong. The *Work* level entity as well can connect the manga to an anime adaptation, something common among Japanese pop culture resources. Using EDM means that all of these different entities are represented as the same edm:ProvidedCHO class, and are connected through limited relationship properties such as edm:realises. As the authors wish to adequately model and describe relationships between pop-culture resources at each level of the FRBR entity hierarchy, a model that uses more than a single property to represent multiple FRBR entities is preferable.

Another promising method separate from EDM being investigated is the use of the OAI-ORE aggregation model (Lagoze et al., 2008). This model allows for the creation of a RDF-based Resource Map is created that describes an aggregation of existing web resources. For example, a series of web documents that all describe a single manga volume can conceptually be considered an aggregation, and a Resource Map can be created that asserts some amount of information about that aggregation. These aggregations can themselves be aggregated, possibly allowing for the portrayal of FRBR-like hierarchies within the model (i.e. a group of resources are aggregation for the *Expression* level, with multiple *Expression* level aggregations forming a *Work* level aggregation). As the Resource Map is given a URI, one possible outcome of this model is to create a Resource Map containing metadata based on aggregated resources, and use the URI as the web representation of whatever that aggregation may be describing. The feasibility of this will be determined in the near future, but the idea is a promising one.

While the best option moving forward still has yet to be determined, the OAI-ORE method may be the most suitable, at least when compared to previous efforts using EDM. It more readily utilizes existing web resources, and allows the application of bibliographic metadata to aggregations representing multiple FRBR entity types. The creation of Resource Maps representing different FRBR entity levels for pop culture resources may also enable interest web applications. Issues such as how easily this data can be automatically created, whether or not this would require much data harvesting, and what types of relationships between resources can be asserted within the aggregation model first need to be investigated before a more certain future path can be established.

5.2. Benefits of Metadata Aggregation for Pop Culture Resources

As stated previously, the goal of aggregating pop culture data, specifically using hobbyist resources such as fan sites, is to improve the granularity of data that is available for these resources. Like the Europeana portal, this means providing data for the same objects that comes form multiple perspectives, and multiple languages. The use of resources such as fan sites also enables describing the minutiae of pop culture resources, which are typically absent from traditional cultural heritage institutions. It also enables the filling in of gaps for bibliographic data

that institutions may have attempted to record, but remain blank for a variety of reasons. Figure 1 illustrates this, with several of the left sidebar properties containing no data. Fan sites can be utilized in a pseudo-crowdsourcing fashion to remedy this, helping to improve the amount of useful data in institutional records with data created by hobbyists.

Figure 3 shows an example of Bunkacho properties (middle) that are commonly unfilled, and grouped properties from previously mentioned manga fan sites that contain data that could be used as a supplemental to fill in the missing data. Thus, even if a traditional cultural heritage institution is unable to utilize some of the more granular data, there remains the opportunity to essentially have their missing data "crowd sourced" thanks to existing hobbyist resources.

While the idea remains to be more thoroughly examined, there is also the opportunity for fan sites to use an aggregated database centered around cultural heritage institutions as a type of pseudo-authority for pop culture resources. Existing library authorities are suitable for titles and creator names, but most other facets of these resources are inadequate; one simply needs to look at how existing Library of Congress Subject Headings terms are used to describe manga to understand this. Creating authorities based on institutions such as Bunkacho and the Kyoto International Manga Museum, and supplementing them with hobbyist data, would be beneficial for all parties and their users. Also, as mentioned in Section 5.1, an OAI-ORE method of aggregation may enable the creation of a Resource Map with a URI that can act as a web representation of a pop culture resource instance, allowing hobbyist sites to include their information in the Linked Data cloud once aggregated. These unique Resource Map URIs and the bibliographic metadata they contain could potentially act as the content of the pop culture "pseudo-authority".

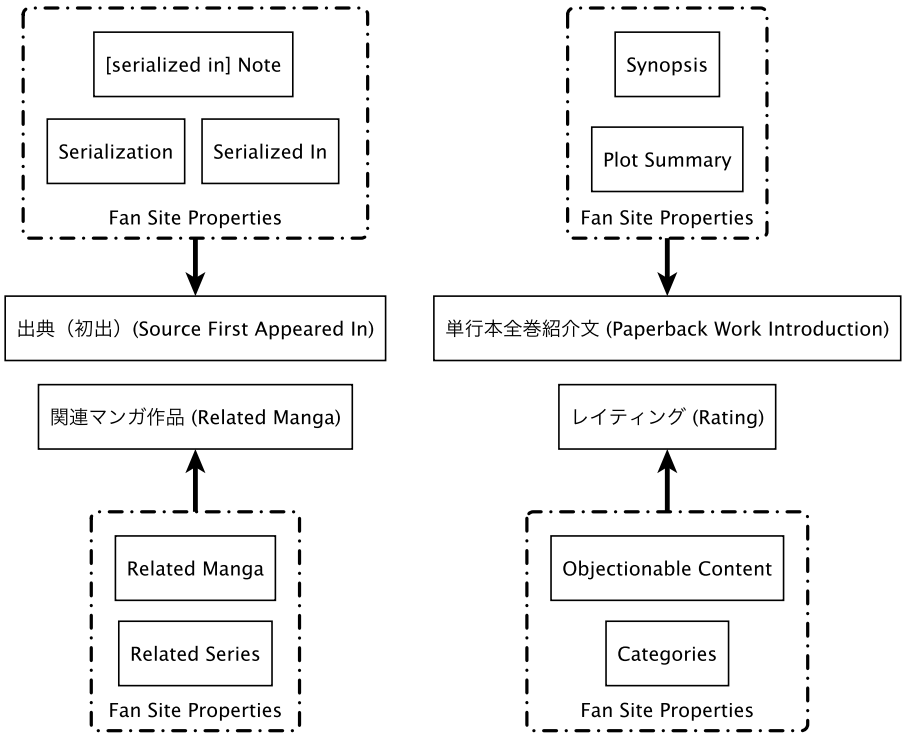

FIG. 3. Bunkacho properties that are typically lacking any data (middle) and grouped fan site properties that contain suitable data for those properties.

6. Conclusion and Future Work

This paper has outlined the preliminary work that has gone into aggregating pop culture metadata from traditional cultural heritages and hobbyist resources. Through the collection,

classification, and mapping of manga metadata, as well as the examination of how this data fits into existing aggregation models, the foundation for future work has been established. The inclusion of hobbyist data also builds on prior work, and makes available data that fans of these resources are genuinely interested in accessing.

There remains much work to be done, however, to realize the goal of improved pop culture resource description through metadata aggregation. As much of the hobbyist data being accessed is unaccounted for in traditional bibliographic description models, a formal classification scheme that is able to model this data should be created. Similarly, the ability for existing vocabularies to describe pop culture specific data must be investigated more thoroughly, as representing this data in an aggregation model is dependent on useable properties. Mentioned in Section 5.2, the ability for EDM to accurately represent the relationships between pop culture resources is questionable, particularly when one wants to aggregate data from multiple media formats, so a solution to this too needs to be investigated, be it through the use of alternative models or the development of new aggregation properties. The OAI-ORE aggregation method has just begun to be investigated for use with these materials, but it appears to be a promising alternative to our previous work, particularly in regards to possible use cases. This seems to be a practical basis for the creation of a web authority for pop culture resources, which would no doubt improve the information sharing landscape for these resources. While manga has been the focus of this and past research, the authors would like to experiment with the inclusion other mediums, such as anime and video games, as these resources typically have multiple explicit relationships between manga and each other. If future projects are able to address these issues, then the aggregation of hobbyist and institutional data should provide for an improved bibliographic description landscape for a wide variety of related pop culture resources.

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