

Unravel and Amplify

Harnessing XML to unlock archival collections at the National Library of Australia

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Libraries have a lead role to play in digital transformation. Through the digitisation of archival and filmed material, libraries can open the path to discovery of the collections they have carefully curated over time. The National Library of Australia has used Encoded Archival Description (EAD) as a standard for curated Finding Aids for archival collections. Harnessing the power of EAD XML the National Library's Trove team have developed a method to unravel and amplify the Library's 2000 EAD Finding Aids to create hundreds of thousands of object records. The amplification of these digital resources will change the way users discover and engage with collections of national significance. The Library's focus on digital projects will enhance the discovery of, and engagement with digitised content as it is created and updated in the Library's Trove service.

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1. Introduction

At the conclusion of this project a member of the Trove team clicked one button and within 24 minutes created and uploaded 73 686 fully indexed and comprehensive Dublin Core records direct into the Trove database, without any manual cataloguing. It took several months to get to this point, but this work has established a process for ongoing automated transformation of EAD Finding Aids into item-level discovery records, which will change the way users interact with special collections.

Collating, indexing and describing collections is an integral part of making primary resources available to skilled researchers, however, the structure and delivery of these collections can create an insurmountable barrier to access for casual researchers. Casual researchers must often decide if access to archival resources will provide a benefit equal to the effort required to find, access and interpret relevant resources. Creating smaller and simpler records for archival material removes roadblocks to discovery. Interoperable metadata schemas are the key that facilitates users utilising complex archival resources without the need to become entangled in traditional information hierarchies.

2. The Project

2.1 Impetus - Digitisation funding and desire for increased discovery

The primary drive behind this project was the desire at an organisational level to improve the discovery of the National Library of Australia's archival collections in line with the functions of the library as stated in the National Library Act 1960 (2016). The National Library has one of the largest collections of manuscript material in the Southern Hemisphere with both original materials and microfilm copies of European, Australian and Pacific archival originals.

In 2016, the Federal government provided one-off Modernisation funding to the National Library, through the Public Service Modernisation Fund, to improve digital infrastructure (National Library of Australia, 2018). A key Library asset, the microfilm of the Australian Joint Copying Project (AJCP), was identified as the focal point for digitisation and delivery under the auspices of this modernisation. The decision was based on the cultural importance of the material, the size of the collection and the need to protect the 10 000 microfilm reels from access specific degradation.

2.2 Planning

EAD – a mature standard at the National Library of Australia

The National Library identified the utility of the Extensible Markup Language (XML) schema, Encoded Archival Description (EAD), in the mid-2000s. The schema was developed and release in the 1990s as a tool that would, “help mitigate the fact that the geographic distribution of collections severely limits the ability of researchers, educators, and others to locate and use primary sources” (Pitti, 1997, p269). The aspirational nature of this work was met with some scepticism. There was concern that there would be a disconnect between the way archivists were expected to utilise the schema, developing Finding Aids in a hierarchical structure and the expectations of end users, who wanted to navigate collections in a more lateral manner (Tatem, 1998). The uptake of the schema in information management environments was and remains dependent upon the capacity of institutions to finance development, however, there has been an appetite to utilise the schema as a basis to harvest manuscript collections and ‘rank them highly’ in Trove for quite some time, not just for National Library collections but for Trove partner collections as well (Cathro, 2010).

Archivists in the Pictures & Manuscripts branch of the National Library adopted the EAD schema and for almost a decade have been creating and storing their manuscript Finding Aids as structured digital objects (National Library of Australia, 2011). While Finding Aids assist in the discovery of objects, research has suggested that this traditional method of delivery, even in the digital sphere, is less effective in communicating information to casual researchers, often resulting in confusion for non-experts (Gilliland, 2008). While Finding Aids are useful tools for providing context, they do match not the utility of a searchable library catalogue, or database in making items discoverable. While these rich Finding Aids were being created at the National Library, discovery of manuscript material remained reliant on access through static MARC records.

2.3 Technology

Metadata standards

In 2018 structured metadata for all AJCP collections was created by the Manuscripts team at the National Library using the archival software Archives Space. To create AJCP records the Manuscripts team transformed the data from the *AJCP Handbooks*,

a series of published Finding Aids that index and outline the AJCP collection contents as they appear in the microfilm. Once this highly detailed and accurate data was encoded in EAD Finding Aids, it was then copied into the National Library’s digital repository – the Digital Library Collection (DLC). With the Finding Aids available within the Digital Library they could be exploited to create records within Trove by translating the EAD XML into the Trove compliant DC Terms XML schema or, in the case of identities, EAC-CPF. Figure 1 shows this process.

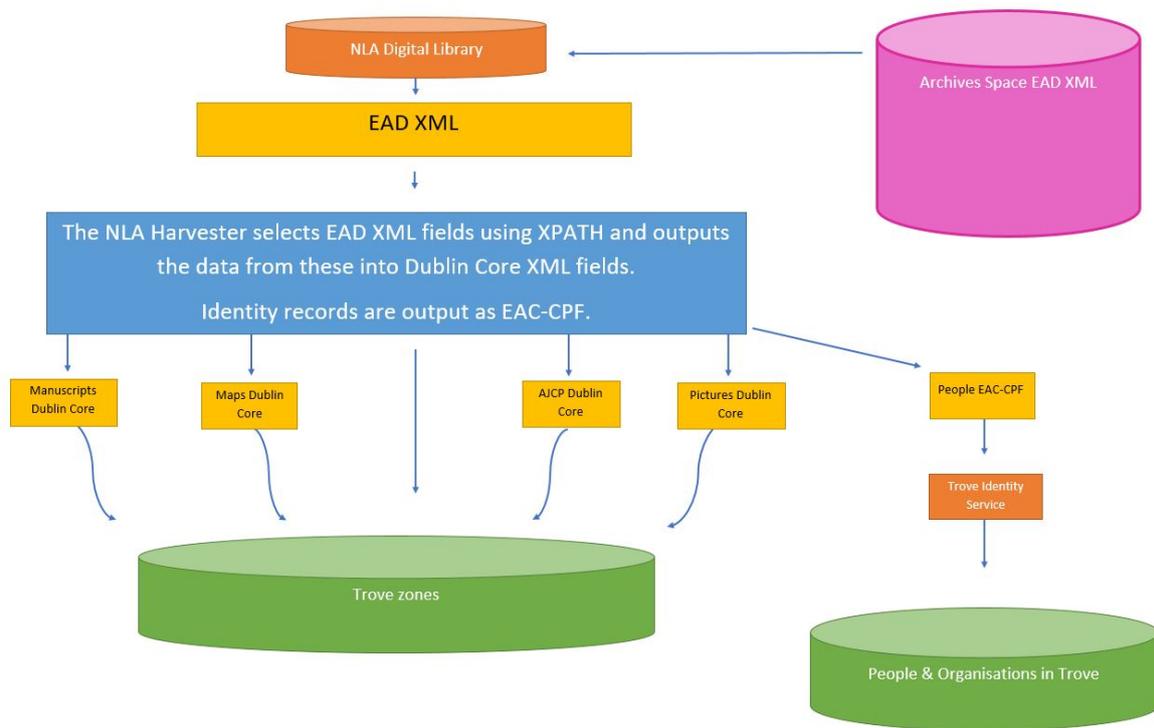


Figure 1

Software

The National Library uses software designed in-house to harvest metadata from partner repositories, normalise the data and then output it to the shared discovery service, Trove. This piece of software, the NLA Harvester, typically receives data from content partners, via OAI-PMH and API feeds. Once data is extracted from a content partner’s repository, the metadata is typically (though not necessarily) re-formatted using XSLT (Extensible Stylesheet Language Transformations) to fit a DC Terms or EAC-CPF schema that maps to Trove’s discovery layer. Previous projects undertaken by the National Library have shown this to be a highly extensible model for cross-

walking records from one schema to another (Berthon & Hickie, 2018; Hickie & Raadgever, 2015). The AJCP project built on previous work, by taking what the Library had learned about harvesting and cross-walking collections, applying the lessons learned, and treating the National Library's Digital Library as just another API-accessible repository.

Transferring data between systems

The National Library's Digital Library has an API that exposes the EAD Finding Aids, to which the NLA Harvester can make a request and receive back all recently updated Finding Aids. The NLA Harvester then uses the XSLT-based cross-walk to transform the metadata into the DC Terms Trove requires. Utilising a simple regular expression step the Harvester then splits each EAD into thousands of individual Dublin Core records, each describing a single item in the collection, with its own descriptive metadata. Figure 2 shows the type of data contained within an EAD Finding Aid, each container or 'stub' within the EAD sits within a larger container in a hierarchy. For example all 'c02 level' stubs sit within a 'c01 level' parent container, 'c03 level' stubs within a 'c02 level' parent and a 'c01 level' grandparent container, and so on, with some Finding Aids being up to seven or eight levels deep.

```

- <c01 level="series" id="aspace_6ac75fbed3f3718305d06f39dfef57c9">
  - <did>
    <unittitle>Watercolour sketches, drawings and photographs</unittitle>
    - <physdesc altrender="whole">
      <extent altrender="materialtype spaceoccupied">37 items</extent>
    </physdesc>
  </did>
- <c02 level="file" id="aspace_5857143860c7035409b6da206bc53b80">
  - <did>
    <unittitle>Australian sketches and watercolours</unittitle>
    <unitid>1</unitid>
    - <physdesc altrender="whole">
      <extent altrender="materialtype spaceoccupied">21 items</extent>
    </physdesc>
  </did>
- <c03 level="item" id="aspace_499d089aeef66f091b6aea57bd537346">
  - <did>
    <unittitle>Sydney Harbour and steeple of St James's Church</unittitle>
  </did>
  - <processinfo id="aspace_98bff5fbbdad9b68708fedaa22c3d82b">
    <head>Processing Information</head>
    <p>M688</p>
  </processinfo>
</c03>

```

Figure 2

Transforming from EAD to DC

Through the atomisation process Trove extracts each container and creates a corresponding record, each record takes metadata from that container, the parent container and every relevant ancestor container. Referring to the containers present in Figure 2, a record is created for the 'c03 level' stub, the XSLT then extracts data from the parent of that stub (c02) and the grandparent (c01) to fill in additional metadata fields and make the record richer, as in Figure 3.

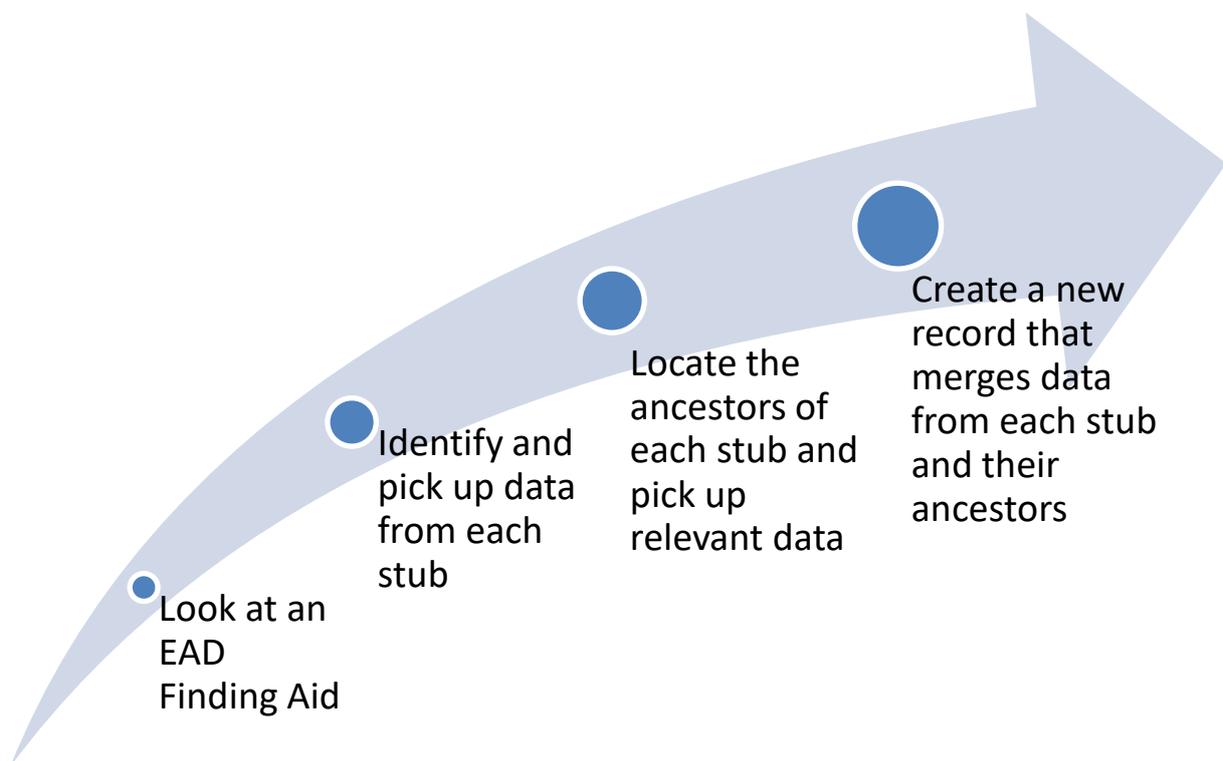


Figure 3

Figure 4 shows the data as it appears once the NLA Harvester has completed its transformations but before it is uploaded to Trove. To handle changes to container level data in the EAD records, a second weekly harvest is undertaken that mirrors the processes but marks all current content within an updated Finding Aid as superseded. This process reads all the permanent identifiers in the dataset and matches them to the permanent identifiers currently existing in Trove, any records that don't have a match are flagged within the Trove database for deletion and are automatically removed within seven days.

```

<?xml version="1.0" encoding="UTF-8" standalone="no">
<record nuca="ANL:DL">
  <header>
    <identifier>nla.gov.au/nla.obj-222971645</identifier>
  </header>
  <title>"Memorials sent to the Viceroy of Brazil with their answers while the Endeavour lay in Rio de Janeiro", (Item 2a), (from Papers of Sir Joseph Banks /
  Correspondence and papers of Sir Joseph Banks / . Correspondence, together with replies, sent to the Viceroy of Brazil while the Endeavour lay in Rio de Janeiro)</title>
  <subject>Endeavour</subject>
  <isPartOf>NLA MS 9</isPartOf>
  <isPartOf>Papers of Sir Joseph Banks</isPartOf>
  <isPartOf>Correspondence and papers of Sir Joseph Banks / . Correspondence, together with replies, sent to the Viceroy of Brazil while the Endeavour lay in Rio de
  Janeiro</isPartOf>
  <rights>Conditions Governing Access: This collection is available for research. </rights>
  <rights>Conditions Governing Use: Copying and publishing of unpublished manuscript material is subject to copyright restrictions. For such material, written permission to
  publish must be obtained from the copyright holder(s). Copying of unpublished material for research purposes is permissible 50 years after the death of the creator of the
  material. Items from this collection should be cited as '[Title or description of item], Papers of Sir Joseph Banks, National Library of Australia, MS 9, [item
  number]'.</rights>
  <identifier linktype="thumbnail">https://dl-uat.nla.gov.au/nla.obj-222971645-t</identifier>
  <identifier linktype="fulltext">https://dl-uat.nla.gov.au/nla.obj-222971645</identifier>
  <identifier linktext="View the Finding Aid" linktype="notonline">https://dl-uat.nla.gov.au/nla.obj-222963290/findingaid#nla-obj-222971645</identifier>
  <identifier>nla.gov.au/nla.obj-222963290 (finding aid)</identifier>
  <identifier>nla.obj-222963336 (series)</identifier>
  <identifier>nla.obj-222963455 (subseries)</identifier>
  <identifier>nla.obj-222971645 (item)</identifier>
  <type>Manuscript</type>
  <type>manuscript collection</type>
</record>

```

Figure 4

2.4 Results

Successful auto-creation of item-level records

The harvest process has been a success, the records created reflect the individual metadata entries for each specific container within each Finding Aid. Information taken from the top of the Finding Aid links each container record with a record at the collection record and the associated Finding Aid. When a digital object exists in the Digital Library, the object is linked directly to the Trove record for immediate online access by end-users. Collections with shallower hierarchies can have slight variations in the way in which data fields are used by the line area. These differences can be easily accommodated with simple tweaks to the XSLT.

Overall, the result of this work has been uniform mapping to Dublin Core elements in Trove, providing the most important metadata outputs in simple fields that reflect user discovery expectations, Figure 5 is an example record in Trove. This record has been machine generated, so there are no manual entries within the records. Any changes are made by the Manuscripts team in the original Finding Aid and these flow through to Trove via the process mentioned above. The process is now entirely automated, with updates flowing through on a weekly basis.



1849, English, Unpublished edition: St Mary's Cathedral, Sydney, 1849, (Item), (from Papers of James Coutts Crawford / Watercolour sketches, drawings and photographs / Australian sketches and watercolours (1))

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- Comments (0)

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Bookmark: <https://trove-test.nla.gov.au/version/257471054>
manuscript collection
English

Edition details

Cite this	
Title	St Mary's Cathedral, Sydney, 1849, (Item), (from Papers of James Coutts Crawford / Watercolour sketches, drawings and photographs / Australian sketches and watercolours (1))
Other Contributors	Crawford, James Coutts
Physical Description	manuscript collection
Part Of	Australian Joint Copying Project M600, M687-M688 Papers of James Coutts Crawford (as filmed by the AJCP) Watercolour sketches, drawings and photographs / Australian sketches and watercolours (1)
Subjects	<ul style="list-style-type: none"> Emigrant voyages Fitzroy mines, Victoria Geology: New South Wales Geology: New Zealand Mines and mining Paintings, drawings and prints: Maori Paintings, drawings and prints: New Zealand Paintings, drawings and prints: Queensland Paintings, drawings and prints: Sydney, New South Wales Richmond Hill mine, Victoria Bidwill, John C. Crawford, James C. Hodgson, Sir Arthur Loring, William, Capt. Mountfort, B.W. 1849 (Date) Australia (Place) Darling Downs, Queensland (Place) Eton Vale station, Queensland (Place) Glebe, New South Wales (Place) Miramara, New Zealand (Place) Mount Egmont, New Zealand (Place) New Zealand (Place) Queensland (Place) Taranaki, New Zealand (Place) Wanganui River, New Zealand (Place) Wellington, New Zealand (Place)
Summary	Diary
Terms of Use	<p>Conditions Governing Access: Available for access.</p> <p>Conditions Governing Use: Many of the records digitised as part of the AJCP are still in copyright. Readers wishing to publish or reproduce documents should seek permission, in the first instance, from the owner of the original material.</p> <p>Preferred Citation: Acknowledgement of use of this material should refer to the location of the original material and to the Australian Joint Copying Project. Items from this collection should include references to the location of the original material and to the AJCP nla.obj number, which serves as the online identifier for the digital copy. Example: M Series: Journal of Capt. James Cook, 18 February-23 September 1770, British Library Add. MS 27885 (AJCP ref: http://nla.gov.au/nla.obj-1234)</p>
Language	English
Related Resource	Existence and Location of Originals: Private residence: Brigadier H.N. Crawford, Fife, Scotland.
Identifier	<ul style="list-style-type: none"> nla.gov.au/nla.obj-727824327 nla.gov.au/nla.obj-727822228 (finding aid) nla.obj-727824023 (series) nla.obj-727824048 (file) nla.obj-727824327 (item)

Figure 5

Possibility of errors

It is important to remember that in all the metadata humans create, there will be errors and omissions, despite the best efforts to the contrary. It is unlikely that any business could release a corpus of over 73 000 records, all at once, without there being some minor errors. An omission of relevant data is almost inevitable in an extensible dataset and requires a large amount of testing from a specialist who has a good understanding of the material, while errors such as mark-up tags incorrectly appearing in content can be more easily identified and managed by a data specialist. As part of the process it was recognised that both the National Library Manuscripts and Trove data teams needed to work more closely to align expectations and improve data quality before final product release. The result being higher data quality and a significantly reduced risk of errors.

3. Discussion

Project goals – Access, Discovery, Openness

This project was undertaken in support of a larger scale project designed to enhance access, protect the current AJCP collections from degradation and gain staff efficiencies. In particular, this project aimed to enhance the capabilities of current non-users of the AJCP to locate information that they hadn't realised was available and improve access for all researchers, both new and experienced. The Trove team's aim was to design records that capture new users and push AJCP content into new web environments, addressing the need for information in locations that current non-users inhabit. The Trove team also sought to allow more advanced users, designers and developers to create their own alternative methods of entry by making the data available through the Trove API. The aims of this project were to improve meaningful access, enhance the discovery of these services and open the AJCP collection up to a wider audience.

3.1 Meaningful access

Importance of metadata creators and transformers working together

The original remit for this project was to apply Trove's mapping capabilities to the AJCP metadata content outputs, in order to facilitate increased use. As XML is extensible there are an infinite number of data combinations that can be used create elements and represent works. The success of the project relied upon the power of

the EAD schema in delivering standardised content across time and collections. Archival collections are unpredictable, therefore it is not possible to foresee every eventuality, so establishing best practice guidelines at the start of the encoding process enabled developers to more easily predict the outcome as (Dow, 2005) states in their discussion on EAD, “the closer you stick to your guidelines, the better your data will play with others” (p117). In order to build the best DC records the Trove team consulted with the Manuscripts branch on a regular basis to decide on the most relevant fields and how these fields should be mapped to Trove’s Dublin Core. Trove then built a list of preferred fields as the mapping progressed. The inheritance and application of singular elements in an XML EAD output across multiple individual records, contextualises each digital object within a hierarchy, or enables researchers to access each record as a distinct object in the digital realm. Objects still rely on organisation in traditional ways (Fulton, 2010) but providing pathways that bypass these hierarchies allows researchers to determine the meaning of an object that depending entirely on their requirements.

[Shifting the value of experts from facilitating trusted access, to creating trusted metadata](#)

This project took an evolutionary approach, which allowed for the creation of simple metadata to service the Trove user interface and the API effectively. In this context the impact of knowledge experts in data creation cannot be understated, as Kramer (2015) noted in a review of EAD, “to be discoverable and usable, metadata records need to be problem-free and accurate” (p6). Without accurate metadata there is no scope to share information effectively. Utilising information previously stored in small notations or in the immense minds of collection managers at the data creation stage, coupled with the interoperability of XML metadata means that researchers will have opportunity to compare and contrast different information from a range of sources without moving between environments (Herring, 2011). This may reduce the need for expert knowledge at the access end, which, while an intimidating prospect for service delivery highlights the immense, on-going need for experts to work at the description level. For forward thinking archival organisations, it can provide the impetus to increase the amount of experts who are providing description level services. This will enable accurate, context specific metadata access to a wide variety of audiences with varying skills.

3.2 Discovery

Rewarding all information seeking behaviour

The cultural impact of enhanced access is significant when viewed in the current context of web discovery. Successful information seeking behaviours in Web 2.0 environments require high level information seeking skills, but also a digital competence that many do not possess. To engage wider audiences, there is a need to design for simpler, search strategies (Nicholas & Clark, 2015). In the Digital Library space there is an impetus to provide open, unstructured and interlinked data to enhance discovery (Kruk, Westerki, & Kruk, 2009; Sherratt, 2013). The importance of the information professional as an intermediary in the information seeking environment has dwindled, as alternate information seeking behaviours are rewarded with richer results, as Sherratt (2013) noted in his discussion of the Trove service, to be truly supportive Trove needs, “to be able to support the process of discovery, enrichment and meaning-making wherever it might happen.”

The information professional must design channels of discovery that improve the chance of low skill, shallow searchers finding richer content that meets their needs. XML provides the underlying infrastructure required for system integration and interoperability through data exchange (Gourley, 2002). Trove is based on a set of interoperable systems that feed into a network of interfaces, but on the surface appears to be one simple system. Within the system, the ability to navigate between items and discover relevant collections based on an initial search has always been present, but limited in scope and volume. Utilising the EAD extant for AJCP collections completely revitalises this method of discovery and enhances the ability of user’s to determine the path of least resistance to the most relevant items for their research. This data will create a platform on which a broader system of discovery will extend across partner collections in Trove, not just those that the National Library has collected and described.

More access points, more opportunities for re-use

The development of automated processes for transforming EAD into user-oriented discovery records provides opportunities for Trove to expand access to the rich metadata created for complex archival collections. Contextual links between manuscript material, digital publications, catalogue records and biographical entries will be greatly enhanced. The enhanced metadata will also allow for greater

interoperability between Trove and external systems, as the data harvest from AJCP collections is made available in Trove's public facing API. The ability of external actors to exploit this data means that it can form part of a larger network that captures users on the web, wherever they show interest in the subject matter. This program utilised the already extant data within the National Library's EAD Finding Aids to generate records that would not only be discoverable within the Trove interface but also on search platforms which are preferred by information seekers. Simplified terminology and digital content access not only removes the traditional constraints of time and distance but also of a literary modality that requires high level information seeking skills and digital competencies to access and understand important data.

3.3 Openness

Designing to suit the discovery behaviour of 2019 web users

Libraries and archives need to factor in changes to the way in which users consume and comprehend the information they receive. Developing digital content is a primary method in which libraries can continue to be pre-eminent providers of equality of access. This means improving metadata description to enhance discoverability, but also improving the way in which information reaches individuals in the community. In the web space, the concept of meaning is evolving from the interactional model championed in the Web 2.0 (O'Reilly, 2005) to a more predictive model, predicated on designing adaptable services for user needs, based on their requirements over time, what some have termed Web 3.0 (Morrow, 2014; Nations, 2018). The concept of meaning in this environment is contingent upon evolving to suit users' understanding rather than through definitive call and response mechanisms. The focus of design needs to be on making relevant content discoverable by users with limited research experience, in their unique context. In essence, "interacting with customers within their own environment need(sic) to become the norm" (Onete, Albăstroi, & Dina, 2017) This doesn't just mean creating human readable content that can be more easily discovered but also allowing machine readable metadata to be released through API's so that web developers can exploit the data for their own portals and projects.

Keeping information open

The importance of open access to primary resource material in a world in which dis-ordinate information sources produce complex and contrary models is paramount (Kenderes & Morrissey, 2018; Orenstein, 2018). In the corporate context Orenstein

(2018) notes that record keeping promotes accountability and transparency, necessary elements in open cultural exchange. Trove has attempted to amplify important archival collections so that, users can find these resources and understand the context in which they were created serendipitously, rather than through intense effort. This is a significant shift for some existing users of the National Library's collections, and the need to stage an orderly transition is vital to ensuring these users continue to both see and interpret the information they receive. The previous method of access, which involved intense research efforts, will be superseded in this context and in the future. This type of landmark change in the research market can create friction between users that have 'done it the hard way' and the libraries that are providing special collections to a wider audience. The final release of the AJCP is being carefully managed so that all current stakeholders are not left behind. However the importance and impact of improving access to the broader community and keeping information open cannot be understated.

4. Conclusion

Information, easily accessible and readily available, delivered where the information seeker is located, is the expectation of new information seekers. In response to this demand for more information, libraries can continue to fill the role of gatekeeper, providing digital clues to discovery of collections, growing the user base for licenced services and providing access based on temporal and geographic rules. The alternative is to lead the way in digitisation and data delivery making discoverable the collections which have been carefully curated over time through standardisation and metadata interoperability.

A focus on leadership in this sector provides libraries with the opportunity to provide their collections to a growing online audience while potentially reducing the on-going costs of licensing and access restrictions. Libraries must not be afraid to utilise every tool at their disposal to create meaning within their management systems. This may mean venturing into a world of extensibility, where the metadata we use to map meaning utilises the extensive knowledge of collection managers to generate metadata but does not rely on traditional information hierarchies as the primary

pathway to discovery. Instead libraries can empower users to decide how they access information and when they access information most relevant to their needs.

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