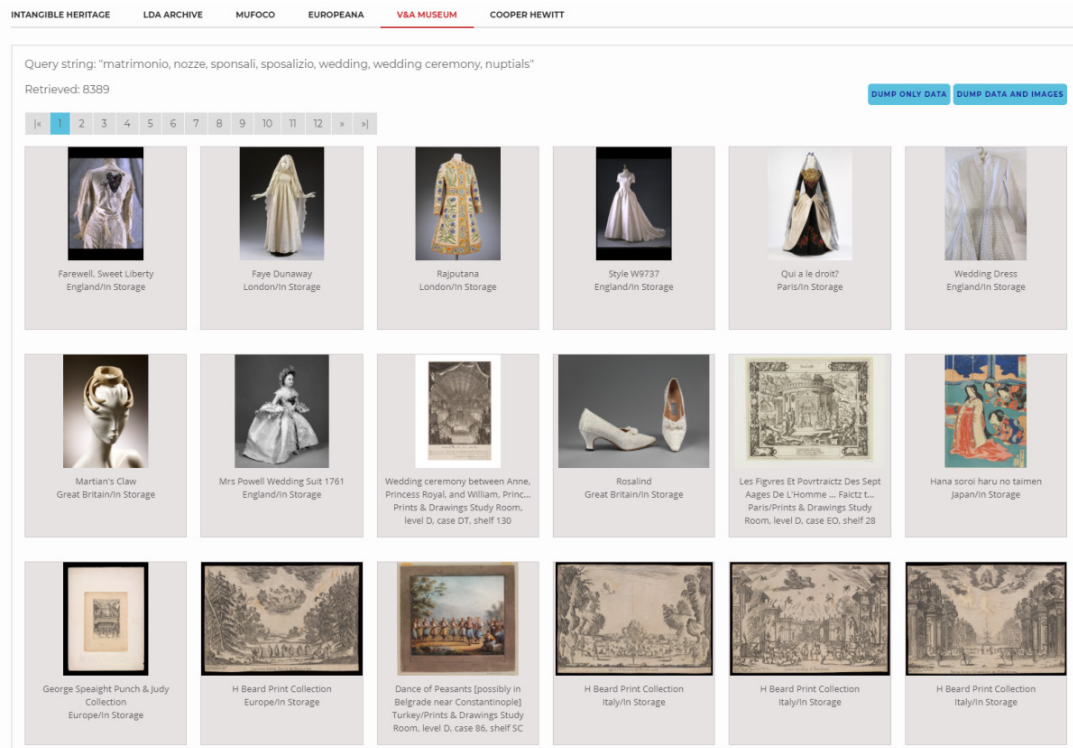


A platform for safeguarding cultural memory: the QueryLab prototype

Maria Teresa Artese and Isabella Gagliardi

CNR – IMATI Milano, Italy



Searching Wedding with QueryLab, 2019.

The 2003 Convention for the Safeguarding of the Intangible Cultural Heritage led to a proliferation of ICH websites on dialects, music, dance, traditional customs, knowledges, and other cultural expressions. These great number of websites, together with the impossibility to navigate and search them altogether, is the starting point of QueryLab, a prototype dedicated to the integration, navigation, search and preservation of intangible heritage archives in a single framework on the web, with the possibility for users to save their results in virtual private or shared inventories, to contribute to the dissemination and promotion of ICH, and to keep it alive. The analysis of ICH inventories on the web has led to the definition of ICH-light, a minimal metadata structure able to act as a platform for safeguarding cultural memory. The system presented here has been completely designed and some features have been implemented and tested with users, who have appreciated them.

Keywords: common metadata structure, integration of ICH archives, search, browse, and navigate tools.

Introduction

In recent years we have seen an increasing interest in the conservation and enhancement of traditional cultural heritage with particular regard to issues such as rural culture, daily life, the minor arts and crafts. The expected effects of globalization and homologation policies on local identities have also helped to strengthen interest. In this scenario, emphasis has recently been placed on the so-called intangible heritage, as defined by UNESCO in the 2003 Convention for the Safeguarding of the Intangible Cultural Heritage, with particular regard to the protection of dialects, local cultures, music, dance, theatre, traditional customs and knowledge. Examples of online intangible cultural heritage archives are those in Scotland, France, Spain, France, Spain in relation to Europe, created after the Convention, while South Korea, Japan and China have defined strategies to safeguard their traditions much earlier than the UNESCO Convention.

Today many inventories can be found on the web, regarding tangible and intangible cultural heritage. According to their organization of data, they can be classified into different categories:

- websites where the data are strictly closed and structured with proprietary metadata, raising the so called data silos problem;
- websites that collect data from different sources and store it in a common structure;
- websites that provide web services to open up their data to researchers;
- web pages without any underlying database or storage structure, where the elements of intangible cultural heritage are listed and described as plain text on static web pages.

From the analysis of such different websites we have verified that they often require specific knowledge to search for information effectively and to fully benefit from the results found. In addition, the same search must be replicated several times for different archives of interest.

These are the problems we intended to overcome with QueryLab (<http://arm.mi.imati.cnr.it/querylab>), a platform dedicated to the integration, navigation, search and safeguard of tangible and intangible heritage archives on the web.

The purpose of the developed prototype is multiple: on the one hand identify different ICH archives or inventories, integrate them in one place, without duplicating the data. On the other hand, the creation of a metadata structure makes it possible to create a platform that is able to safeguard cultural memory. In addition, QueryLab, like museums and online archives, requires tools and methods to search, browse, and navigate multimedia content. When designing a system that can handle multimedia data, such as QueryLab, these major issues must therefore be addressed:

- Which navigation paradigms should be offered to users?
- Which information should be used for search?
- How can non-expert users interact with the system intuitively?

Also, although archives follow different approaches, an experiment has been done to use the same terms to query different archives, with interesting results.

QueryLab helps to identify and evaluate approaches to inventory the diversity of ICH expressions, with the aim of safeguarding them. It explores innovative ways and means in which digital tools can be effectively used to integrate inventories of intangible cultural assets, with the aim of querying, navigating, exploring and enjoying them in a single place, using a common framework.

The paper is organized as follows: the related work is summarized in the following section. Below is a description of the design and creation of QueryLab, with some technical details, together with the details of implementation and use. Finally, conclusions, with preliminary assessments, and future developments.

In this paper, all issues related to archives of intangible cultural heritage, their integration, tools and models for search, navigation and enjoyment with serious games are seen from a technological point of view, leaving to scholars and experts in the field the purely cultural part.

Related works

As already mentioned, the purpose of QueryLab is to provide a common access point to several archives of intangible cultural assets, offering search, visualization and other storytelling tools, to be used across all archives at the same time.

The problem of integrating data from different sources is very topical and has been studied from different points of view. The most famous example of integration is the EU portal Europeana, which brings together not only intangible heritage, but also books, audio and film material, photos, paintings, maps, manuscripts, newspapers and archives in a single digital website combined with the functionalities of Web 2.0. It provides direct access to Europe's digitized cultural heritage. Europeana collects metadata on objects, including a small image.

From the point of view of possible technological solutions, Open Linked Data (LOD), with SparQL endpoints are, together with the RestFul API architecture, the most popular approaches to interact and explore data sets.

As far as the identification of archives/inventories of intangible assets is concerned, our starting point was Map of e-Inventories of ICH, written and coordinated by Memória Imaterial - a non-governmental organisation accredited by UNESCO and based in Portugal (Sousa, 2017).

Another source of inspiration is the ACCU Asia Pacific Database on Intangible Cultural Heritage, where ACCU stands for Asia/Pacific Cultural Centre for UNESCO (<https://www.accu.or.jp/ich/en/>). This

inventory is about Traditional/Folk and Performing Arts and data are compiled by experts from the Asia-Pacific region.

UNESCO itself offers inventories of ICH items that have been included in its lists or are still under evaluation.

However, to the best of our knowledge, many of these archives offer very limited tools for searching and viewing data, as well as the user is allowed to consult each archive/inventory individually at a time.

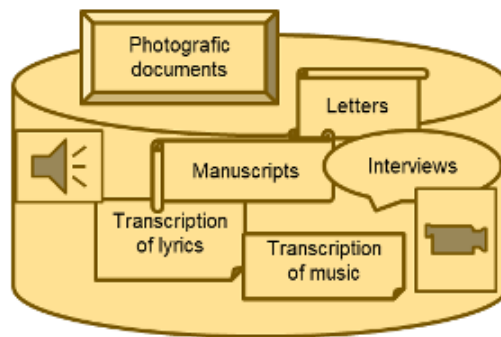


Figure 1: Contents of typical ICH archive.

Designing QueryLab

In order to correctly create and identify data structure, functionalities and tools to be available for the system, a requirement analysis phase was faced. In particular, to create an ICH framework, we focused on the following criteria and aspects:

1. ICH archives, whose data can be integrated in QueryLab, focusing on
 - technical tools to be used to extract data;
 - policies and intellectual property consideration;
 - quality of data;
 - safeguarding of data.
2. data to be collected, considering
 - size: the amount of data handled can be huge and constantly increasing, this may require finer and more selective interrogation and display modes;
 - multimedia: many images, audio and video can accompany the textual data to represent more directly the information, also to witness how events change over time (Figure 1);
 - complex: some types of data are interrelated and interdependent. Strategies for their integration, both in query and visualization, should be provided;
 - detail level: ethnographers, experts in social history, etc. identify the cultural heritage to be included in the archives as well as the tradition bearers, it is therefore necessary to consider different levels of depth and descriptions;
 - alive: according to UNESCO, ICH is constantly recreated by its bearers, and neither of the two events is ever totally identical;
 - multilingual: data can be available in multiple languages and can also be expressed in local dialects.

3. metadata structure to collect data from different sources
 - should be able to collect the minimal information needed to perform queries;
 - should always keep the link to the original resources;
 - should adapt to different types of ICHs, different languages and levels of depth for their description;
 - should be able to follow evolutions and changes over time.
4. goals to be achieved
 - target search: users are seeking for specialized information;
 - category search: users have no specific idea of what they are searching: e.g. carnivals or food fairs;
 - "around me": what's up around me? There are events for children? Something to do outdoors?
 - study: users are seeking for in depth information.
5. different types of web users
 - experts: people who access the web only for specialist consultation, or study purposes;
 - community: people who know cultural expressions of intangible heritage and help to keep them alive and to suggest new ones to inventory;
 - tourists: people who want to be informed about events, fairs, carnivals and so on around them, to enrich their knowledge and live new experiences;
 - web users: people who consult the on-line systems, looking for materials of interest, browse through the information available jumping from one topic to another;
 - younger generations to whom transmit the tradition.
6. devices to be used

it must be taken into account not only the different size and resolution of the various devices, but also the different purposes and needs for which a site is visited. For example, if the ICH archive website is consulted by a desktop PC, the aim may be to study and deepen knowledge, but when required by a smartphone, typically during a trip, the purpose may be to explore and discover new things. Also on smartphones, the use conditions may be different, with a less sophisticated hardware, and a lower connection speed, but often equipped with additional hardware, e.g. GPS.

With respect to traditional web sites, ICH call for innovative and inclusive tools for the search, visualization and browsing (Artese et al., 2017, Lopatovska et al. 2013; Lopatovska 2015), here listed in increasing order of complexity:

- providing an easy access to data through standard search tools, adapted for pc, tablet and smartphone,
- facilitating access with tags and keywords,
- integrating information on the web,
- integrating glossaries or lexical resources,
- developing innovative tools for the visualization and access to the information on the web: e.g. storytelling, timeline browsing, serious games, 3d, augmented reality, etc.
- designing and implementing content based retrieval and clustering algorithms; recommendation and similar to/suggestion tools, search by colour, mood, texture, shapes, ..., automatically extracted from text and multimedia.

Creating QueryLab (with some technical details)

QueryLab allows users for query, navigating and browsing data collected from different archives, related to Tangible and Intangible Cultural Heritage. The steps to create the prototype are as follows (described later in more details):

- Identification of ICH archives;
- Integration;
- Definition of a common metadata structure.

Identification of ICH archives

The first stage in creating QueryLab is to identify and collect websites related to intangible cultural heritage, that is living traditions inventories or oral traditions, practices, craftsmanship collections. The analysis of this kind of web sites (Artese & Gagliardi, 2015) has led to a first list of inventories meeting the criteria defined that have been successfully integrated:

- **Europeana Collections.** Is the EU digital platform for cultural heritage. Contributed by more than 3,000 institutions across Europe, their assembled collections let users explore Europe's cultural and scientific heritage from prehistoric to the modern day (<http://www.europeana.eu>).
- **Victoria&Albert Museum.** Is the world's leading museum of art and design, holding many of the UK's national collections and housing some of the greatest resources for the study of architecture, furniture, fashion, textiles, photography, sculpture, painting, jewellery, glass, ceramics, book arts, Asian art and design, theatre and performance (<https://collections.vam.ac.uk/>).
- **Cooper-Hewitt, Smithsonian Design Museum.** Is the only museum in the United States focused on historical and contemporary design and is the curator of one of the most various and exhaustive design collections in existence - more than 210,000 design objects spanning 30 centuries (<https://www.cooperhewitt.org/>).
- **LDA, Lombardy Digital Archive.** Is the online Archive of Ethnography and Social History of Lombardy Region that, since 1972, preserves, studies and enhances documents and images related to life and social transformations, to literature and oral history, to material culture, to the anthropic landscapes of the Lombard territory (<http://www.aess.regione.lombardia.it/ricerca>).
- **MuFoCo, Museum of Contemporary Photography in C. Balsamo (Milan, Italy).** It contains a subset of over one million and 800 thousand photographic works - prints in black and white and colour images, slides, negatives, videos, installations - taken by about five hundred Italian and foreign authors. It is a significant example of contemporary photographs and a cross-section of photography after World War II to the present days. (<http://www.mufoco.org/collezioni/>).
- **IntangibleSearch.** Is the online collection of “living good” of Lombardy Region and Alp territories which occur through oral traditions, languages, performing arts, technical knowledge, social practices, rituals and festive events (<http://www.intangiblesearch.eu>).
- **ACCU Data Bank.** Is the Asia Pacific Database on Intangible Cultural Heritage, that offers data on flat web pages compiled by experts from the Asia-Pacific region, including Australia, Cambodia, Fiji, Kyrgyzstan, Tajikistan, Tonga and Vanuatu (<https://www.accu.or.jp/ich/en/>).

Integration using RestFul API architecture

The integration of archives - that can be either local or on the web to query them all together - can be achieved using the REST API web services provided by the owner of each inventory. Several web services developed by various data providers have been studied, this technology allows us to interact with the online database to obtain data in response to a query, which is executed through a GET request with the HTTP protocol. The web service developer also provides support tools ranging from short documentation to a real console where HTTP requests can be tested.

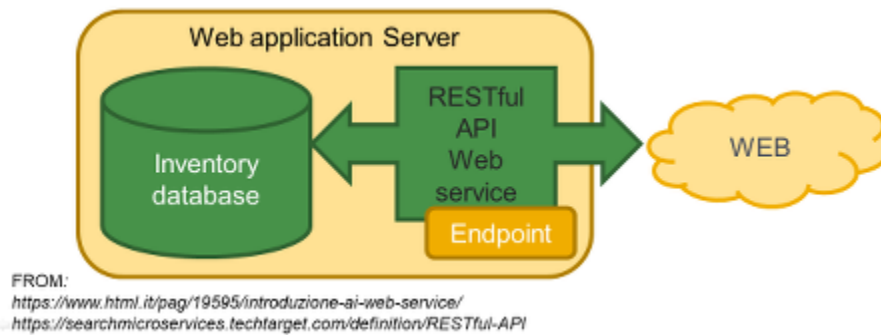


Figure 2: RestAPI web service: a system to interact with archive data.

Communication with each inventory through the REST API methods has been encapsulated into a specific software layer that manages access to several data records. The useful information to be obtained are:

- name of the asset,
- link to the original resource,
- link to a representative image,
- reference date,
- location, by name of the place or by geographic coordinates,
- author name,
- keywords.

The analysis and testing of different types of web services has highlighted that:

1. the API key or token provided by the service to query data should be easy to get and should be given for free, in some case it is not required, as for the Victoria&Albert Museum website.
2. the query method should allow data to be filtered using free text, not just a simple extraction of all the documents in the collection. Sometimes Boolean operators between words can be used, to specify more sophisticated queries.

3. methods to query data specifying destination fields, such as location, author, date should be provided. This enable to apply query refining and to develop different ways to interact with data.
4. if the “faceting fields” are offered by the web service, it is easy to extract indexes on specific fields, such as keywords, period of time or location, allowing the building of histograms or maps or other graphics solutions to group and show retrieved data.
5. retrieved results are provided in JSON (JavaScript Object Notation) format, which is easy for humans to read and for machines to parse, providing both the data and metadata at the same time.

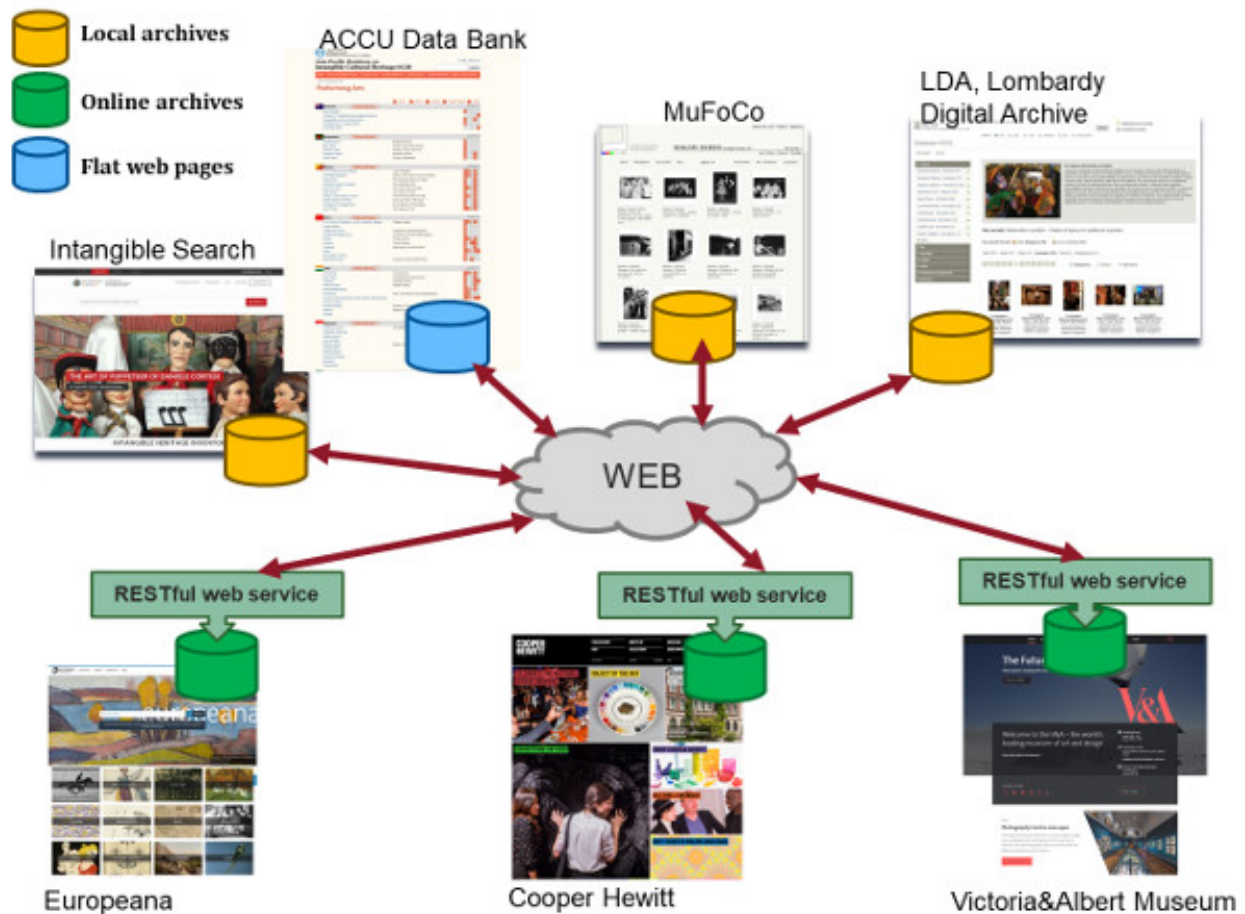


Figure 3: How to integrate different inventories.

The integration realized is shown in Figure 3, local archives could be integrated directly by querying their metadata through the database server, but it is a good practice to develop a web service, server side, for each local archive considered. This has a twofold benefit because it gives the opportunity to open local archives for external querying, and also because it makes the QueryLab query module completely

independent from the metadata of the single archives considered. Currently, this process is under construction and data are now extracted using their specific data structures through database queries. As for integration of inventories made of static web pages, such as ACCU Data Bank, the method is detailed in the next section.

The logical schema of QueryLab platform is shown in Figure 4, which shows that its core is the software layer for the interaction/query with the different web services, to make the query phase transparent to the different metadata and the addition of new inventories easy and seamless at any time. As data is always queried "at home", there is no need to keep local copies or updates of the inventories.

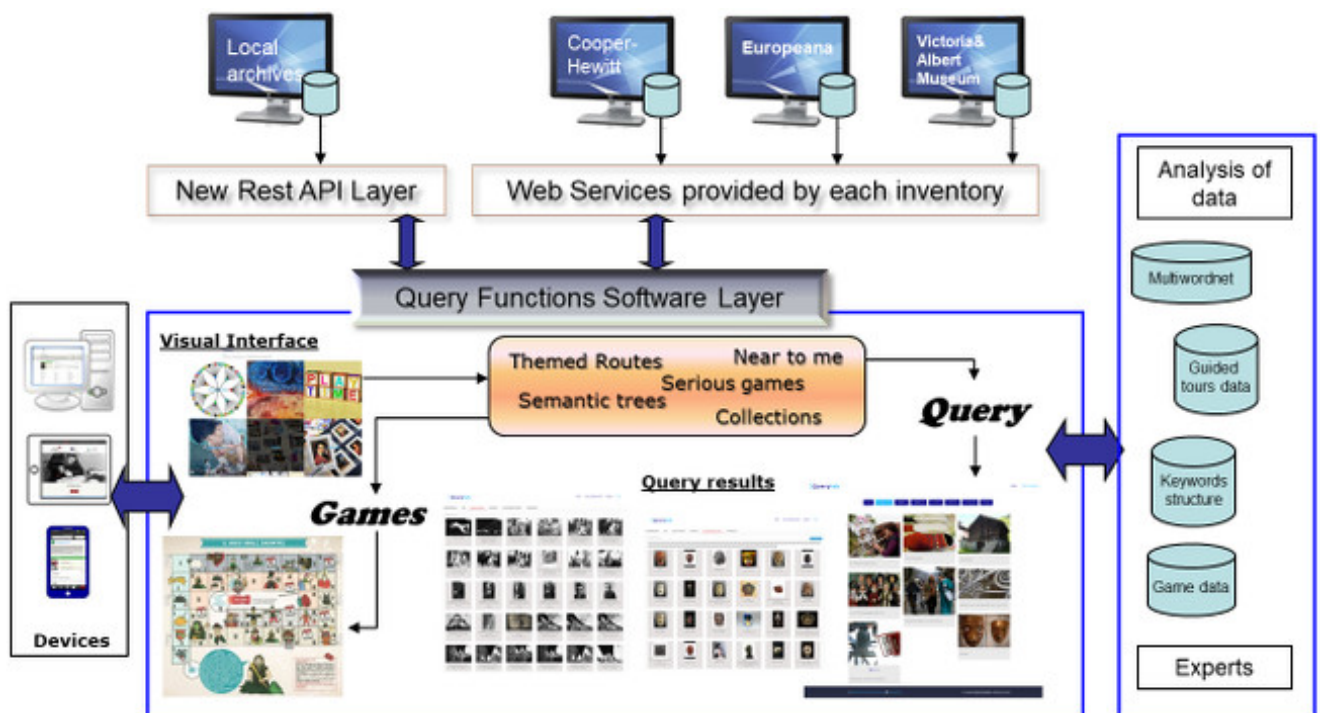


Figure 4: Logical schema of QueryLab.

Definition of a common metadata structure

During the analysis of the inventories to be used for the QueryLab system, many interesting ICH archives have been found that do not have an underlying database or do not provide a web service to query them. It is clear to us, however, that all these data have several metadata in common, such as:

- the identification name,
- the UNESCO category to which they belong to,

- the location,
- a date,
- a brief description,
- a link to a web page where they are described in detail.

This led us to define a metadata structure, called *ICH light*, able to collect and store them, creating procedures to automate the extraction process when possible, so as to retrieve and also preserve this information, acting as a safeguarding platform for cultural memory.

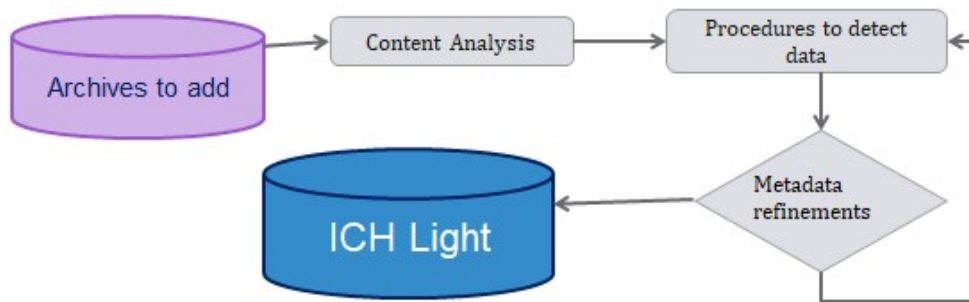


Figure 5: Definition of a common metadata.

The metadata structure should also be able to adapt to different ICH types, and different languages with which they are described, allowing to preserve different levels of depth of the description, and to collect the evolutions and changes over time that ICH items, typically by their nature, require to describe.

Figure 5 shows the first step in defining ICH light metadata structure.

Two inventories were used for the first metadata test. These two archives have been chosen because although they are very distant from a territorial point of view they are composed of similar types of intangible assets: this allows us to set up a comprehensive metadata structure able to capture the similarities and differences in the cataloguing (see Figure 6):

- IntangibleSearch, with 326 ICH items in 4 languages, the starting point for the development of QueryLab tools.
- the Data Bank on Traditional/Folk Performing Arts in Asia and the Pacific, collected by the Asia/Pacific Cultural Centre for UNESCO, with 152 documents in English from different countries of that area (<http://www.accu.or.jp/ich/en/about/introduction.html>).

The first is a typical data silos database, available locally and published through the website dedicated to it, while the second is realized with simple static web pages, containing descriptions and images. For both, procedures have been developed to extract the information able to populate the metadata structure created, called ICH Light, and thus obtain a new inventory, which we have called *IntangibleHeritage*, that has been integrated with the others available online.

The platform is intended to be completed by back-end tools to collect and manage data from the participating subjects. Other databases are currently being studied for inclusion in the IntangibleHeritage inventory.

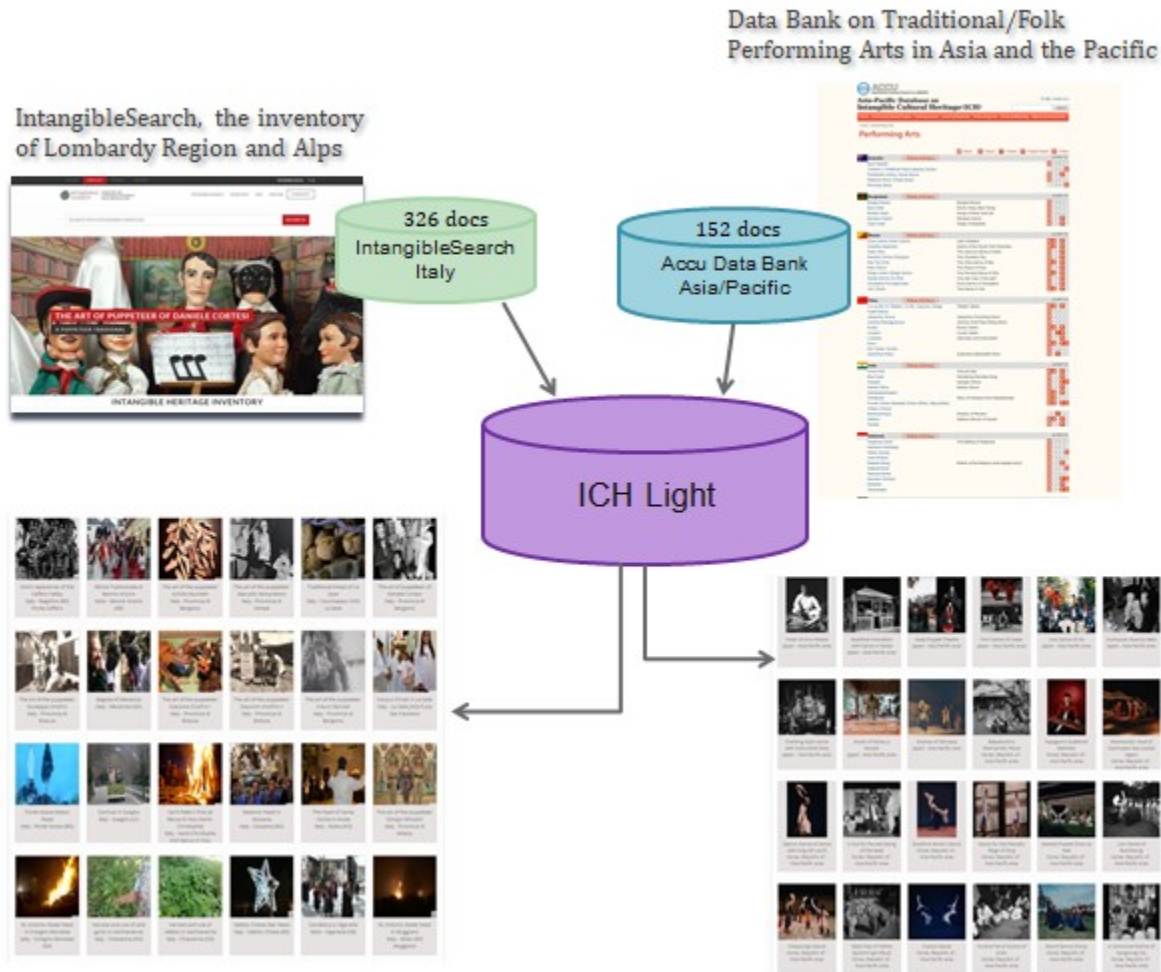


Figure 6: First test of population of ICH Light metadata.

Using QueryLab: tools and methods to search, navigate, enjoy the data

The platform architecture, its purpose and the integration of data from different sources have required careful and accurate design of different ways of searching and displaying data, to allow all users to interact with QueryLab successfully, even if not experts in the field, or are not familiar with the content or language in which the terms are expressed. Multimodal means of navigation and search have been designed and implemented e.g. guided tours, keyword analysis and serious games. Besides a standard search interface, which allows searching the different archives as if it were a single one, innovative and easy-to-use search tools have been studied using the available keywords and tags. The basic idea is to leverage the semantics of the keywords and tags, present in all the analysed archives, combined with the post-editing work done by experts specialized in the field. This provides the architecture on which to develop storytelling tools.

The tools developed so far concern the automatic generation of semantic structures, to expand or narrow the search results (semantic trees) and the creation of hierarchies between keywords, that allow the development of thematic paths. The games and the user collections sections are currently being developed, while the production of maps, calendars and timelines is under study for future developments.

Semantic trees

To take full advantage of keywords or tags associated with each document, it would be useful to switch from simple word lists to hierarchical structures of specialized terms, organized by tree. To achieve this we used WordNet, a large lexical database in English, where nouns, verbs, adjectives and adverbs are grouped into groups of cognitive synonyms (synsets), each of which expresses a distinct concept. Synonyms are linked by conceptual, semantic and lexical relationships. The use of a lexical database allows us to find the correct semantic tree in which each tag or keyword is located, as shown in Figure 7.

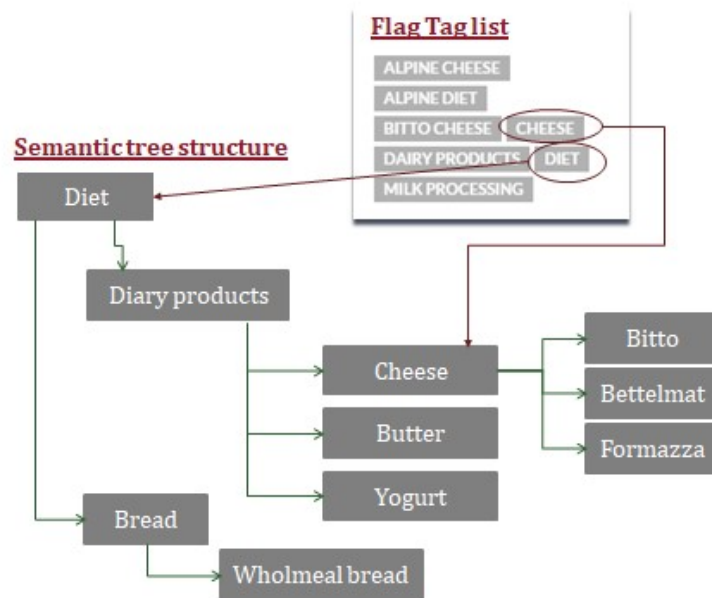


Figure 7: Flat tag lists and structured tag lists.

With MultiWordNet (Artese & Gagliardi, 2014), the multilingual version of the WordNet, is possible:

- to search both English and Italian terms to get relative translations;
- to get all different meanings, called synsets, of a keyword, and use all terms belonging to a specific synset to make the queries;
- to enlarge or refine the query through the tree structure taken from the MultiWordNet.

An algorithm has been implemented to identify synsets, hyperonyms, hyponyms and correlated terms from Multiwordnet database, given a keyword or tag.

Semantic trees help user in performing queries on the web: the QueryLab interface provides the complete structured tree of parent/child terms (using MultiWordNet) related to the term provided by

the user in Italian or in English. The tree of structured synsets is shown and the user can choose his intended meaning among the possible ones to query the system: all the terms (synonyms) contained into the chosen synset, in both languages, are then used. To facilitate the choice of a term, a list of tags extracted from local databases is shown to the user to help him in making his choice.

Figure 8 display the synsets tree built when the user selects the tag "magic" from the list of tags and from all the synsets he selects "magic trick, conjuring trick, ... illusion, deception". All these terms are used for searching in the different inventories. Figure 9 shows the results from Europeana and IntangibleHeritage.

magic

MULTIWORDNET SEARCH

Synsets

Coordinated Terms

Hyponyms

- > supernaturalism [Nome - Religion] a belief in forces beyond ordinary human understanding
 - > exorcism (esorcizzazione) [Nome - Religion] freeing from evil spirits
 - > magic (magia) [Nome - Religion] any art that invokes supernatural powers
- > performance (esecuzione) [Nome - Art] the act of presenting a play or a piece of music or other entertainment; "we congratulated him on his performance at the recital"
 - > juggle - juggling [Nome - Art] throwing and catching several objects simultaneously
 - > encore (bis) [Nome - Art] an extra or repeated performance; usually given in response to audience demand
 - > contortionism (contorsionismo) [Nome - ///]
 - > **magic trick - conjuring trick - trick - magic - legerdemain - illusion - deception (gioco di prestigio - trucco magico - magia)**
[Nome - Art] an illusory feat; considered magical by naive observers
 - > extemporization - extemporisation - improvisation (improvvisazione) [Nome - Art] a performance given without planning or preparation
 - > rendition - rendering - interpretation (interpretazione) [Nome - Art] the act of interpreting something as expressed in an artistic performance
 - > dramatic production - dramatic performance (recita) [Nome - Art] a performance of a drama

Figure 8: The semantic tree for the word "magic".

Thematic paths

To allow users to navigate the archives along paths designed by experts in the field, a section called Themed Routes has been created, where keywords or tags defined in advance by specialists are organized hierarchically into categories and subcategories. Each category is accompanied by commonly used keywords and terms, when available, with an Italian and English translation and a representative image. The highest level categories are the themes. A small metadata structure has been defined to store data: main elements are the label, the highest level, with a representative image and hierarchically organized keywords and tags, in a fashion similar to MultiWordNet.

The structure has been defined to allow easy insertion of new categories at any time, and the customization to new inventories, highlighting themes and subjects of interest to users, or topics of particular relevance.

Figure 10 shows the categories of the main theme "Rituals", with subcategories if any. It is interesting to

note that the themes and categories defined for an inventory often provide satisfactory results in all the other inventories to which they are applied. The themes and categories defined in such a way provide quick guided tours to be used for data extraction and navigation and are useful for users who are not familiar with the contents of the inventories presented (Clough et al., 2017).

Users can browse among predefined paths, exploring and retrieving semantically similar documents. Figure 11 shows the results for category “Traditional dance” performed for the local LDA Archive and for Victoria&Albert Museum, where different types of objects can be found: images together with musical transcriptions, audio and video.

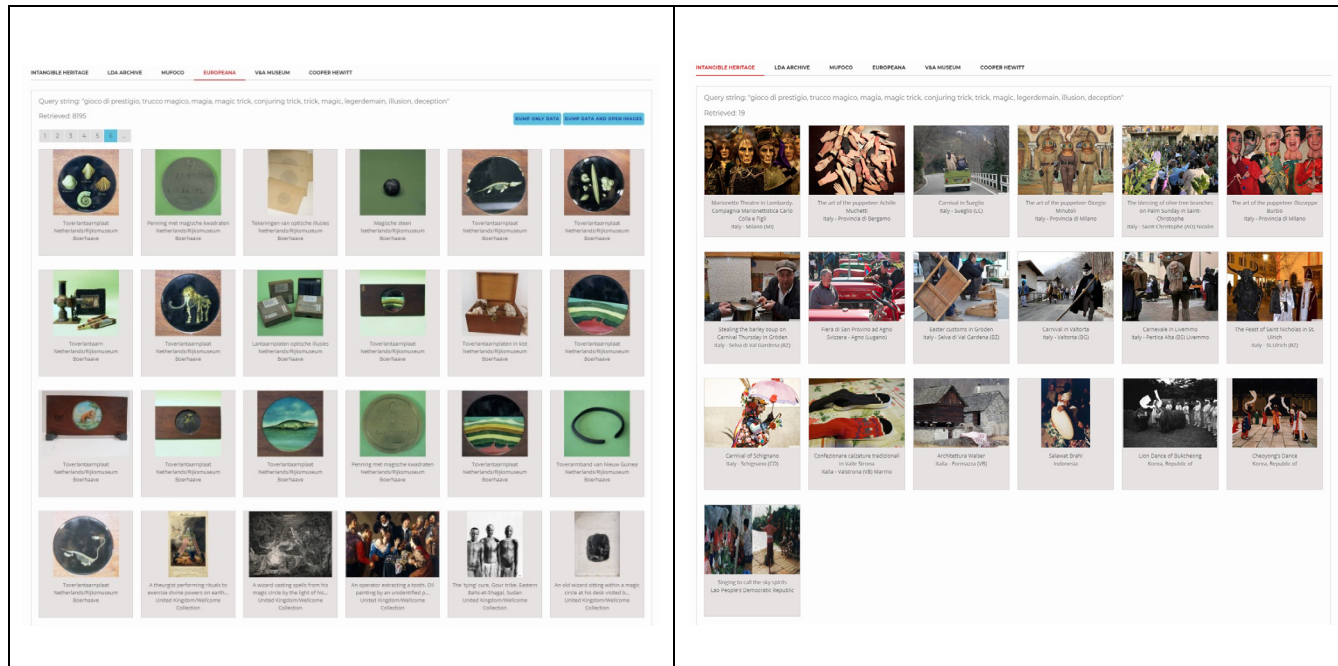


Figure 9: The results for the word “magic” from Europeana on the left and from IntangibleHeritage on the right.

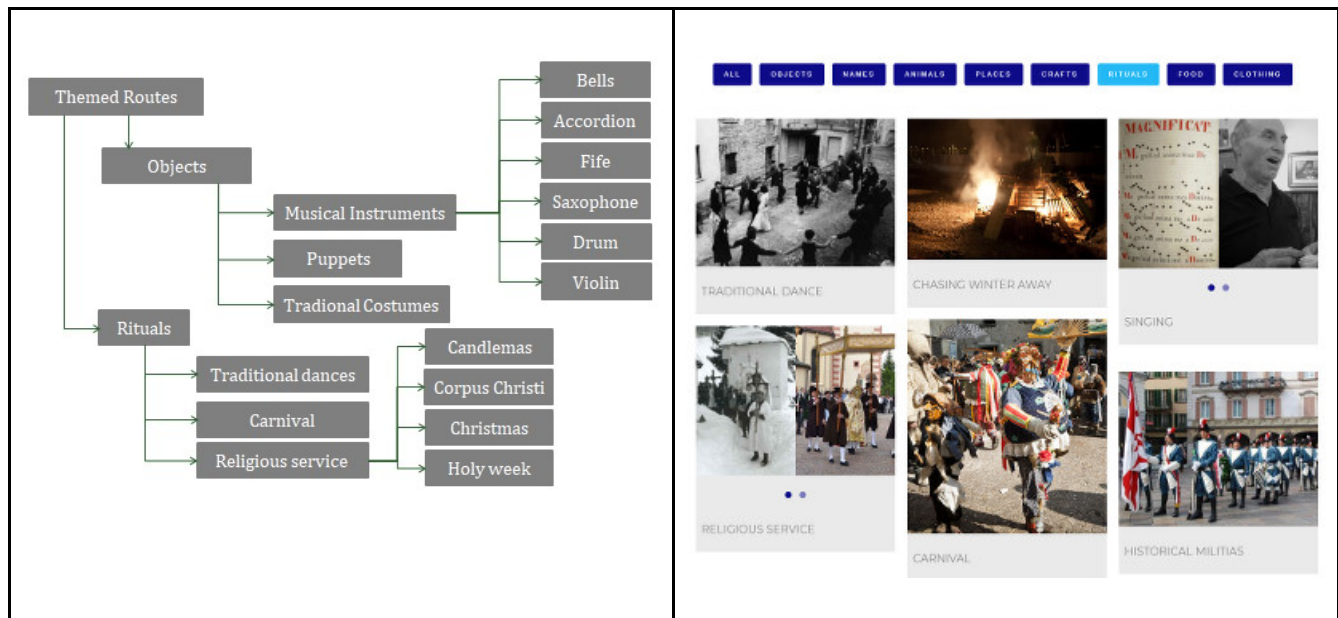


Figure 10: Keyword structure created by experts on the left and the categories of the main theme “Rituals” on the right

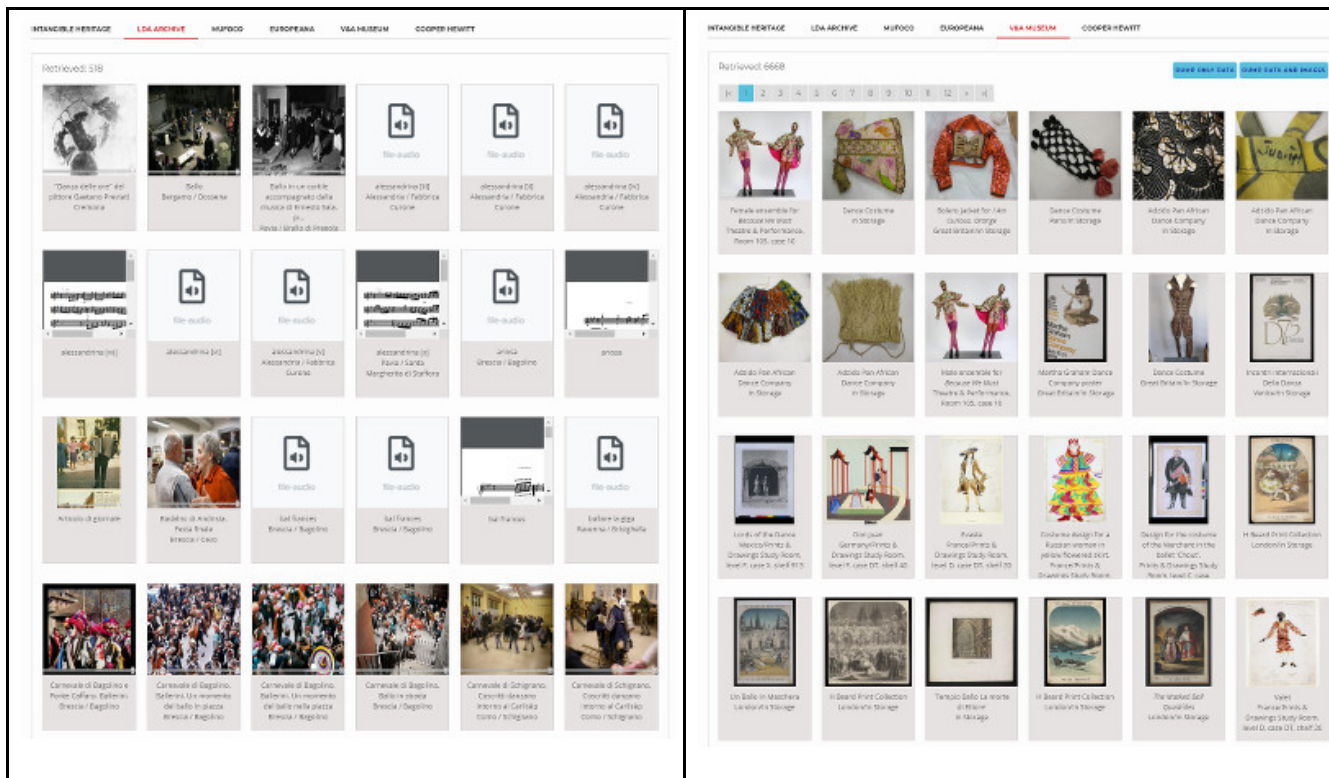


Figure 11: Results for "Traditional dance", from LDA Archive on the left and Victoria&Albert Museum on the right

Serious Games

Serious games are a very timely and engaging way to communicate with a wider audience and ordinary people through play and discovery. For this section we were inspired by a board game made using the rituals, characters and knowledges contained in the IntangibleSearch archive. The idea is to create random interactive game tables, where the individual quizzes are extracted from the very data of all the archives involved so far, inviting users to investigate the contents to complete the game. It has been defined a structure and created an archive for designed quizzes, containing a series of questions and answers indicated and selected by experts, where each of them is supplied by:

- the category,
- the score assigned in case of correct answer,
- the level of difficulty,
- the keywords and
- a reference image.

The inspiration comes from the game "Snake and ladders", where several cells are linked together. Using the quiz database, each scoreboard created is different from the others and new question/answer pairs can be added at any time when new inventories are added to the system. Users are encouraged to explore the inventories to find solutions and improve their scores and knowledges. (Bellotti et al., 2012; Mortara et al., 2014). This section is currently under construction.

User Collections

The user may need or want to remember or store items and documents found during his navigation: images, documentaries, songs, movies, rituals, street performances found using the search and navigation tools that would otherwise be inevitably lost when the browser page or application is closed. The tool we are developing allows each registered user to create and maintain several personal collections of documents, labelling each collection created with a name. The collections created by users become small virtual archives that can be shared with others, to disseminate and promote the inventory contents, or can be collected for private use, to retrieve interesting contents in an easy way. Figure 12 shows the example of the shared user collection "Characters".

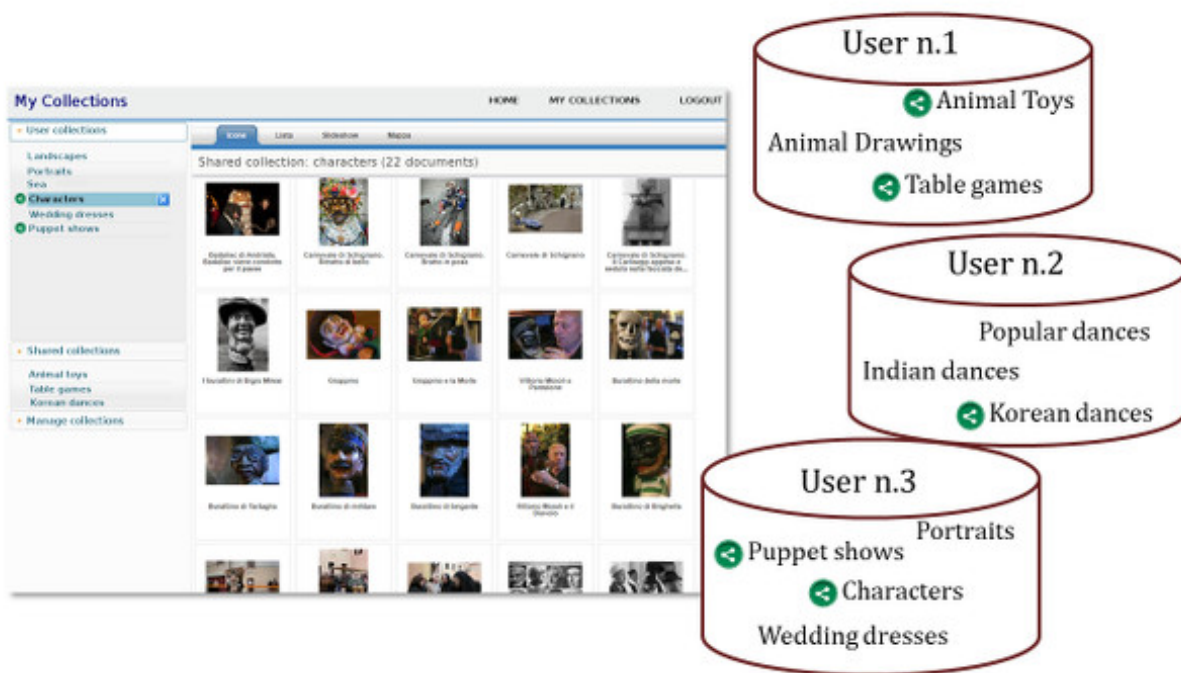


Figure 12: Example of the shared user collection "Characters".

Conclusion and future works

The paper has presented QueryLab, a prototype devoted to the integration, navigation, search and safeguard intangible heritage archives on the web, with the possibilities for the users to save their results in virtual private or shared collections. The analysis of ICH archives and inventories on the web has led to the definition of *ICH-light*, a minimal metadata structure. The platform has been completely designed and some features have been implemented and tested with users. The development is designed for different devices, focusing on mobile systems, using Bootstrap 4.0, Javascript and PHP language for the development, together with MYSQL for the underlying database. The use of REST API web services to query inventories allow upgrading with additional archives at any time.

Some preliminary evaluation has proved that the system has been appreciated by the users.

With regard to future developments, the topics that will be covered are:

- Creation of a “near to me” function to let user explore ICH assets around him;
- Creation of faceted indexes, to refine queries;
- Definition of content-based retrieval tools on multimedia data;
- Introduction of automatic keyword extraction algorithms to automatically structure Themed Routes;
- Introduction of MongoDB database to store ICH Light data, which facilitates multilingual approaches;
- Identification of more ICH inventories, with particular attention to plain pages that cannot be queried;
- Realization of an integrated framework with back-end module to manage ICH Light data and allow the shared participation of other associations/institutions/tradition bearers that may add new ones;
- Developing web services to open ICH Light database created;
- Evaluation of the QueryLab system through structured questionnaires.

References

- ARTESE, M. T., CIOCCA, G., GAGLIARDI, I. (2017). Evaluating perceptual visual attributes in social and cultural heritage web sites. *Journal of Cultural Heritage*, 26, 91-100.
- ARTESE, M. T., GAGLIARDI, I. (2014). Multilingual specialist glossaries in a framework for intangible cultural heritage. *International Journal of Heritage in the Digital Era*, 3(4), 657-668.
- ARTESE, M. T., GAGLIARDI, I. (2015). UNESCO Intangible Cultural Heritage Management on the web. In *Encyclopedia of Information Science and Technology*, Third Edition (pp. 5334-5347). IGI Global.
- BELLOTTI, F., BERTA, R., DE GLORIA, A., D'URSI, A., FIORI, V. (2012). A serious game model for cultural heritage. *ACM Journal on Computing and Cultural Heritage*. 5, 4.
- CLOUGH, P., HILL, T., PARAMITA, M. L., GOODALE, P. (2017, September). Europeana: What users search for and why. In *International Conference on Theory and Practice of Digital Libraries* (pp. 207-219). Springer, Cham.
- GORDEA, S., HASKIYA, D., MARRIOT, A. (2017) Europeana DSI 2–Access to Digital Resources of European Heritage. D6.1: Advanced image discovery report.
- GORDEA, S., SIMON, R. (2017) Europeana DSI 2–Access to Digital Resources of European Heritage. D6.4: Pilot for time-and-place discovery.
- LOPATOVSKA, I., BIERLEIN, I., LEMBER, H., MEYER, E. (2013). Exploring requirements for online art collections, *Proceedings of the American Society for Information Science and Technology* 50 (1) 1–4.
- LOPATOVSKA, I. (2015). Museum website features, aesthetics, and visitors’ impressions: a case study of four museums, *Museum Management and Curatorship* 30 (3) 191–207.
- MORTARA, M., CATALANO, C. E., BELLOTTI, F., FIUCCI, G., HOURS- PANCHETTI, M., PETRIDIS, P. (2014) Learning cultural heritage by serious games. *Journal of Cultural Heritage*. 15, 3, 318-325.
- Representational State Transfer (n.d.). In Wikipedia.
https://en.wikipedia.org/wiki/Representational_state_transfer [09/10/2019].
- SOUSA F. (2017). Map of e-Inventories of Intangible Cultural Heritage, MEMORIAMEDIA Review 1 Art.1.

Websites:

Asia-Pacific Database on Intangible Cultural Heritage: <https://www.accu.or.jp/ich/en/> [09/10/2019].
 Cooper Hewitt API documentation: <https://collection.cooperhewitt.org/api> [09/10/2019].
 Cooper Hewitt Homepage: <https://www.cooperhewitt.org/> [09/10/2019].
 Europeana Collections: <http://www.europeana.eu> [09/10/2019].
 Europeana REST API Console: <https://pro.europeana.eu/page/api-rest-console> [09/10/2019].
 Europeana Search API documentation: <https://pro.europeana.eu/resources/apis/search#get-started> [09/10/2019].
 Intangible Search: <http://www.intangiblesearch.eu> [09/10/2019].
 JSON format: <https://www.json.org/> [09/10/2019].
 Lombardia Digital Archive: <http://www.aess.regione.lombardia.it/ricerca> [09/10/2019].
 Multiwordnet: <http://multiwordnet.fbk.eu/english/home.php> [09/10/2019].
 Museum of Contemporary Photography in C. Balsamo: <http://mfc.itc.cnr.it/home.htm> [09/10/2019].
 ProgrammableWeb, APIs (Application Programming Interfaces) University for museums and art and heritage: <https://www.programmableweb.com/category/all/apis?keyword=museum%20and%20art%20and%20heritage> [09/10/2019].
 REST: REpresentational State Transfer: <https://restfulapi.net/> [09/10/2019].
 Victoria&Albert Museum: <https://collections.vam.ac.uk/> [09/10/2019].
 Victoria&Albert Museum API documentation: <https://www.vam.ac.uk/api/> [09/10/2019].