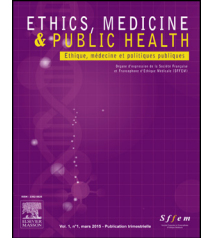




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ORIGINAL ARTICLE

USoM platform. Proposal for an international and transdisciplinary interactive tool for centralization and anthropological exchange around human remains[☆]

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Summary

Background. – In a previous article related to ethical reflection around the study of human remains and their biological products in archaeological, ethnographic and museum contexts, a general scientific isolation - going against the common interest and leading to certain forms of misconduct - had been raised. It appeared a real need to act in the direction of transparency and a transdisciplinary union.

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Methodology. – This conclusion led to further reflection on the strengths and technical creation of a tool dedicated to the exchange between sciences relating to the study of man.

Results/Discussion. – We propose the creation of a platform dedicated to all international scientific actors whose issues are related to research on humans. This involves proposing the development of a participatory/collaborative virtual platform on which scientific organizations would exchange their study materials, their samples, their tools, their knowledge, their reflections and hypotheses and then the resulting data in order to no longer work in isolation.

Conclusion/Perspectives. – This multidisciplinary vision to the study of Man, without spatial or chronological boundaries, will be a contribution to each of the disciplines involved and the benefits of this platform are multiple. However, this coalition approach exposes academic, technical and legal difficulties and represents a real challenge because it requires profound changes.

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The observation of scientific isolation and the ethical problems raised in a previous article [1] on studies on human remains and their biological products in archaeological, ethnographic and museum contexts, as well as the growing concerns of the scientific community on this issue, has led to questions about the causes and possible solutions. The lack of international unified laws and approaches, tools for centralization and exchange clearly appears to be one of the potential causes of this state, which in no way helps the development of a scientific cohesion for this common cause. It appeared necessary that all international scientists, working on human problems of any kind, could benefit from a common space for exchange.

Thus, the USoM platform¹ proposes the creation of a virtual area within which researchers will be able to share a human sample, the resulting analytical data, their method and expertise.

This multidisciplinary vision to the study of Man, without spatial or chronological boundaries, will be a contribution to each of the disciplines involved. Although the advantages of this platform are multiple, this transparency and cohesion vision exposes academic, technical and legal difficulties and requires redefining scientific approaches and relationships. This article aims to show the possible interests of a homogeneity of protocols, laws and of a scientific cohesion.

Common concerns and action needs

Major brake

Reflections and concerns about ethics issues and misconducts have multiplied in recent years and the question “who owns the human remains?” seems to channel all the complexity of human remains studies and limit potential actions to improve the situation.

In France, if the archaeological objects unearthed (of which are part the ancient human remains) are the property of the state², this latter, not being able to take charge of these remains on its own, delegates the responsibility and management of these human collections to various organizations.

Idem from a museum perspective, the collections belong to the public domain but are at the museum’s expense. And what about the property of the human ethnological sampling?

Anyway, although the state must be the owner and the decision-maker, in practice, considering its delegation, no supreme decision-making body exists. The decision-making power relating to these vestiges rests thus independently on the institutions in which these vestiges are preserved and even on the custodian.

Despite numerous actions to distinguish, in its status and its care, human remains from other anthropological objects in order to improve care and ethics issues due to the nature of these remains, the responses remain insufficient.

Although the elements mentioned are French, similar concerns stand out around the world with, in particular the notion of “finder-keeper” [2], thus demonstrating similarities in laws and practices on a global scale.

The Anthro-Responsibility conference was revealing in the sense that, even if the laws are different according to the countries, in practice/in the field, the result, the concerns and the ethical problems appeared identical.

Scientific current concerns

As raised in a previous article [1], from these non-uniform contexts, of delegation, from these independent collections and management centres arise from ethical problems which

² The name of the association at the origin of the platform.

³ And land owners equally if the land was acquired before the 2016 law (law n° 2001-44 of January 17, 2001 relating to preventive archeology and law n° 2016-925 of July 7 2016 relating to freedom of creation, architecture and heritage).

is harming research, the application of the statute of common good and to associated communities. In particular, are underlined the scientific isolation and the multiplicity of sampling, the appropriation/privatization, non-legitimate competition and the definitive disappearance of these vestiges.

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The conference Anthro-Responsibility was revealing in the sense that, even if the laws are different according to the countries, in practice/in the field, the result, the concerns and the ethical problems appeared identical. During these different world scientific meetings, transparency appears to be the key.

A possible solution

The USoM platform is a tool proposal to fight against the scientific isolation and the ethical problems previously cited. It's about facilitating access to samples and to the resulting data. In this way, scientific organizations (museum, archaeological conservation centre, research centre, etc.) would make visible/deposit in the platform, their sample/collections they want to make analyzed by specialists (researchers and students from various disciplines). After what all specialists involved are committed to deposit the resulting data (and to cited all involved parts in the channel, in publication case). Each anthropological human vestige³ made available on the platform (in the form of an individual descriptive sheet) by archaeologists, ethnologists, palaeo-geneticists and museum curators (having created a profile) will be able to benefit (thanks to the sending of the volume required by each requester) from a complete study (anthropological, macroscopic, microbiological, isotopic, microscopic, toxicological, radiological, environmental and then dating, DNA, etc.) thus making it possible to centralize the exchanges and the resulting scientific data. Thus, it will be beneficial to everyone - scientists but also associated communities and the human remains itself.

It's a first experimental version, a proof of concept that will take in place in the future months, which allow this tool to be developed with involved and user scientists. This platform proposal will materialize on a reduced scale in order to test the feedback from scientists wishing to form a coalition, in order to build and develop this tool together (charter, uniform protocols, scientific and ethics committee also includes people from traditional populations and people from the public, etc.). This virtual common place could then meet the two major needs, which are “to bring together” and “to protect”, but also to more specific needs to each discipline involved and then to the improvement of specific knowledge in archaeology/anthropology, (bio)ethics, pharmacy and medicine, museum and restora-

tion, criminalistics/judiciary, (bio)technology, environment, sociology/ethnology, etc.

“An on-line database of hominid remains sampling” was already considered in 2007 during “a workshop was hosted by the Max-Planck Institute for Evolutionary Anthropology in Leipzig” [3], showing international concern and an appropriated answer to the general and specific needs of the disciplines related to the study of Mankind.

Technical development of the platform

Generalities

A participative/collaborative virtual platform represents in computer science a user interactive interface allowing the access to remote data and computational treatments using forms. These treatments are based on web programming languages associated with a database. The creation of a participative or collaborative database means that any actor can, according to a set up configuration, contribute to the content. Therefore, it is essential that the information is standardized and normalized according to the needs of the different scientific and technical fields. This technical aspect needs a complete study concerning the type of data (microbiological, microscopic, toxicological, radiological, environmental, dating, DNA, etc.) and its computational format (computer coding).

The studies carried out on human remains (physical or biological) in archaeological, ethnographic and museum contexts are multiple. They are often conducted using different unilateral approaches on the same sample or type of data. The centralization of these scientific data and the results of these studies as digital repositories would provide a better opportunity to offer the possibility of conducting complementary and transversal studies, thus allowing synergistic and more complete analyses responding to the various human problems. The accumulation of data for each study object will facilitate the development of new approaches as well as larger scale studies through data science approaches. Among the latter we can get closer to machine learning, knowledge extraction and data mining methods.

However, the creation of the participative/collaborative virtual platform faces a major difficulty, in this case the diversity and heterogeneity of the results of studies on human remains. Indeed, the studies, depending on their period of time and the methodologies used, provide varied approaches and analyses. Prior knowledge of the scientific needs in each of the disciplines concerned will allow the construction of a conceptual scheme. The database will be structured according to this conceptual scheme.

Background

Virtual Research Environments have been defined as “innovative, dynamic and ubiquitous research support environments in which dispersed scientists can seamlessly access data, software and processing resources managed by various systems in distinct administrative domains via their browser” [4].

An important aspect here is the disciplinary nature of many of these tools. The European Commission has funded a

³ Every human remains containing biological potential: bone, tooth, soft tissue, dander, sediment from burials or latrines, formalin collections, ritual objects with blood or saliva projection, samples from genetic manipulations such as DNA extractions and Enrichment.

range of community-specific Virtual Research Environments as part of its e-infrastructure funding stream to enable researchers to collaboratively perform complex tasks such as integrating heterogeneous data from multiple sources, modelling, simulation, data mining, extraction and visualization:

- VI-SEEM - EVR for interdisciplinary scientific communities in Southeast Europe and the Eastern Mediterranean;
- MuG - Multi-Scale Complex Genomics for the study of genomics on a large scale;
- OpenDreamKit - Open digital research environment for the advancement of mathematics;
- BlueBRIDGE - Research environment design for decision support, innovation and governance;
- VRE4EIC - Interoperable European virtual environment for the development of interdisciplinary research and scientific collaboration.

From an IT perspective, such projects rely on a multitude of tools to facilitate sharing and collaboration, including web forums and wikis, collaborative document hosting, and discipline-specific tools such as data analysis or visualization. Tools that allow researchers to work together in real time on specific aspects of research (such as writing or analysis). The main objective of these online collaborative platforms is to connect geographically dispersed researchers to enable them to cooperate seamlessly on their research, also sharing research objects, ideas and experiences.

Technical constraints and existing technologies

Collaborative virtual platforms exist in various scientific fields such as genetics [5], astronomy [6], energy [7], biology [8], psychology [9], and many others. These virtual platforms allow the development of large-scale research projects, a synergetic expertise and knowledge on a virtual scientific and technical support. However, generally these collaborative virtual platforms belong to the same discipline or a disciplinary grouping within the same scientific field. The scientific enlargement of such virtual platforms would open up new research perspectives, new methodologies and knowledge that can be extracted from big data. It is in this sense that our proposal differs from traditional collaborative virtual platforms: transversality, multi-disciplinarity, openness to data sciences.

From a technical point of view, a collaborative virtual platform requires the following characteristics: adding an element, completing an element, searching for an element, searching according to specific criteria. This type of virtual plateau has a query language (for the semantic web). The most used query language is SPARQL. Many search engines allow to simplify or propose an alternative to the SPARQL language such as SimplePARQL, a new approach for queries based on keywords or Visual data Web allowing to explore the relationships between objects or Sparklis allowing to formulate semantically complex questions. In order to create our collaborative virtual platform, we need to analyze existing software, languages and technologies that meet the needs of scientists.

In terms of the technical deployment of the service, a study must be conducted to determine whether it is more

relevant to create this kind of platform entirely or to build on existing Open Source projects and add the required functionalities to them. Three software and software packages propose to set up collaborative virtual platforms with query and results interface: Omeka S [10], Collection Space [11] and Open Exhibits [12,13]:

- Omeka S: A web publishing system for universities, galleries, libraries, archives and museums. It creates a local network of independently organized exhibitions sharing a set of collaboratively constructed elements and their metadata. This web publishing platform provides institutions with a single administration and management framework for installation, software updates, and extension of functionality, appearance, and usability for all sites developed in the network. Together, these features provide Omeka S administrators with an essential balance between flexibility and control over their networks. Omeka S uses JavaScript Open Notation-Linked Data (JSON-LD) as its native data format, allowing Omeka S to be integrated into the Linked Open Data world. Each Omeka S resource (element, set of elements, media) has a URI, and the core software includes RDF (Resource Description Framework) vocabularies, which maximize the interoperability of its data with other data publishers;
- Collection Space: This is a modern collection management application supported by an internationally recognized non-profit organization committed to advancing the field of museology. With CollectionSpace it is possible to manage collections professionally with user-friendly web-based software; improve the management of the resources you hold in the public trust; support diverse collections in an effective, efficient and scalable manner; share data via web services and an advanced native API;
- Open Exhibits: This is an initiative that aims to transform the way museums and other informal learning institutions produce and share computer-based exhibits. Open Exhibits is both a collection of software and a growing community of practice.

All of these online software platforms have advantages and drawbacks, particularly in terms of extended functionality, customization and ease of use.

Conclusion and future work

The USoM platform proposes to remedy the scientific isolation and ethical problems caused by the creation of a scientific tool for communication, sharing and centralization. In order to prove the validity of the concept and the approach based on the concept of webservice, we plan to develop a minimal platform with the available means that is extensible and that can be deployed to a larger scale of use thanks to the modularity of its design.

First we will do a state of the art on the above mentioned platforms in order to identify the relevance of using one of these solutions in our project. If this is not the case, we will develop the platform entirely from scratch and this will require more financial and human resources. In the latter case, it will be necessary to identify the appropriate database and software architecture for the web service by

carefully choosing the languages to be used on the client and server sides in order to guarantee the interoperability, ergonomics, fluidity and security of the service.

The design of the USoM platform is an ambitious project that requires significant material and human resources but whose the benefits, forward, will be important. This vision deserve such a start engagement from each scientific user to lead toward the building and the fluidity of this tool and implant a different scientific conception and practice.

Disclosure of interest

The authors declare that they have no competing interest.

Given his role as Editor in Chief, Philippe Charlier had no involvement in the peer-review of this article and has no access to information regarding its peer-review. Full responsibility for the editorial process for this article was delegated to Côme Bommier.

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