Triple O (Ontology Of Ontology):
A Digital Data Survey for Japanese Archaeology (JAD2)

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Abstract

Ontology, such as the International Committee for Documentation's Conceptual Reference Model (CIDOC-CRM), has been of archaeological interest for overcoming the problem of dispersal and fragmentation of heterogeneous archaeological resources. The use of the CIDOC-CRM and the development of archaeology-specific ontology require a good understanding of archaeological information. However, it is not known what archaeological information exists and to what degree it is available to whom. Two statistical surveys, known as the Digital Data Surveys for Japanese Archaeology (JAD2 Survey), have been undertaken for Japanese archaeology in order to comprehend the overall situation of seemingly versatile archaeological resources. This paper investigates part one of the survey, which includes the Web contents of archaeological organizations (Maizo Bunkazai Centers); the second will be examined in a different article. Through these surveys, it will be possible for archaeologists to discuss the future strategies of archaeological information systems and the potential and risk of ontologies for information sharing.

1 What is "Ontology of Ontology"?

Archaeological information is a mess. It exists in different formats and in various levels of quality and quantity. It is owned by different organizations in wide-spread locations. But almost everybody agrees that it is useful to share such fruitful cultural information. Therefore, many professionals have struggled to find a better system to integrate heterogeneous data in cultural heritage. In accordance with national/ international data standards in this discipline, numerous metadata standards and description schemas have been produced. Cross-domain metadata standards such as Dublin Core Metadata Element Set (DCMES) offer some help for this purpose, but the idea of information exchange did not go further than sharing a subset of different datasets. As a result, the loss of some important information was inevitable. Then, a messiah arrived: Ontology. The CIDOC (International Committee for Documentation) of ICOM (the International Council of Museums) has developed a domain ontology called CIDOC-Conceptual Reference Model (CRM). This ontology does not try to force data providers to use a certain schema of data description; rather, it attempts to create a mediation system by specifying and clarifying the concepts that are needed for the exchange of cultural information. The CIDOC-CRM aims to cover all aspects of heritage information and to facilitate conceptual compatibility for the integration and exchange of the information without semantic loss (Crofts et al. 2003). The ten years of tremendous work resulted in the submission of this ontology to the International Organization for Standardization (ISO). Consequently, the CIDOC-CRM has almost acquired an ISO standard (ISO/PRF 21127, current ISO stage on 2006-06-06: 60:00 international standards under publication). Although the CIDOC-CRM initially aims at museum documentation, it is extensible for various cultural domains; therefore, archaeologists are now trying to test the validity of the CIDOC-CRM for archaeological information.

For example, the AMA (Archive Mapper for Archaeology) project attempts to provide an open source tool to map different archaeological data in various European countries to a CIDOC-compliant form (EPOCH n.d.). As the Semantic Web, a future form of the World Wide Web, becomes a reality, ontologies like the CIDOC-CRM will increase in value.

As seen in the process of the development of the CIDOC-CRM, there seems to be a premise among heritage experts that cultural information is difficult to exchange because it is heterogeneous, fragmented, and dispersed. That is probably true, but it seems that the assumption is mainly based on the experience of the experts. It is, actually, not well known to what degree heritage information is created, used, stored, published, and preserved. Archaeology is not an exception. Archaeologists may talk about ontologies and standards without knowing the actual situation of archaeological information.

The term, ontology has its origin in philosophy. It is a fundamental study of being or existence. The framework of the "Ontology of Ontology" is, therefore, the rationale for the use of ontology in archaeology. As mentioned above, if the main reason for the use of ontology in archaeology is problematic fragmentation and diversity of data, it seems very important to prove the archaeologists' premise of the diversity. This ontological thought about archaeological ontology (the framework) leads to the need for statistical survey on archaeological data (Figure 1). What archaeological data is created, used, and preserved, particularly in digital format? In what ways are these tasks accomplished? Where are the data stored? How are they accessed? Who owns the data? These are fundamental questions to be investigated. Based on such a survey, the practical use of ontology should become more comprehensive, and, indeed, the statistics would be a trigger to answer questions such as

the following. Is ontology really what archaeologists need in order to share their information? What ontology is necessary and suitable? What should be done for the future? Along with good practices of interoperability and data exchange by ontology, guidelines for digital archiving and data preservation can be discussed in the future.

2 Do We Know Ourselves?

As a case study of the archaeological data survey, Japanese archaeology was selected. It is an interesting example because the field archaeology organizations in Japan seem relatively centralized, and it would represent a part of the diversity of world archaeology. In fact, most of the archaeological applications of ontology in informatics are confined within Western archaeology; therefore, Japanese archaeology can serve as a representative for the field outside Western prominence. In addition, there are some interesting facts about Japanese archaeology. In 2003, there were about 8,000 rescue excavations in Japan, which constituted 93.7 % of all excavations. About 7,000 archaeologists worked in rescue archaeology, and a total of $815,000,000 was spent for that work (Independent Administrative Institution National Research Institute for Cultural Property, Nara 2005; Seino 2005; Tateno 2005). The impact of Japanese rescue archaeology is enormous. Like other countries, recording is the only way to preserve archaeological evidence for most of the salvage projects. It is, thus, easy to assume that a lot of data are recorded, analyzed, published, and preserved somewhere.

Currently, data are created in digital format, but no one knows the actual amount of data, the level of distribution, and the accessibility of such fruitful data. It is possible to get an overview of the situation, however, simply by counting the number of excavation reports, although unreported and unpublished data that have been collected cannot be known. The problem is that there are no statistics available covering various aspects of archaeological data. In addition, it is worth mentioning that archaeological computing has not yet risen as an established discipline in Japan. Therefore, the survey could function as a campaign to raise awareness of the sharp development of archaeological informatics. While it is not easy to find previous surveys of archaeological data published widely, there are several interesting ones.

2.1 UK Surveys

In 1998, the ADS (Archaeology Data Service) and the University of York conducted a survey for archaeological data and needs in the UK and Ireland, and published the results both on- and off-line (Condron et al. 1999). The project was supported by national bodies such as English Heritage, Historic Scotland, Cadw, and the National Monument Records of each country. This "Strategies for Digital Data" survey, based on massive questionnaires, investigated the amount and the types of archaeological data, preservation policies, file formats and software, and access to the Internet, as well as user needs for archaeological data. This survey corresponds to the Survey Part II (see below) in the researchers' surveys.

In the same year, the CBA (Council for British Archaeology) was commissioned to execute a survey for user needs of archaeological publications (Also known as PUNS). This survey focused on the use of traditional print
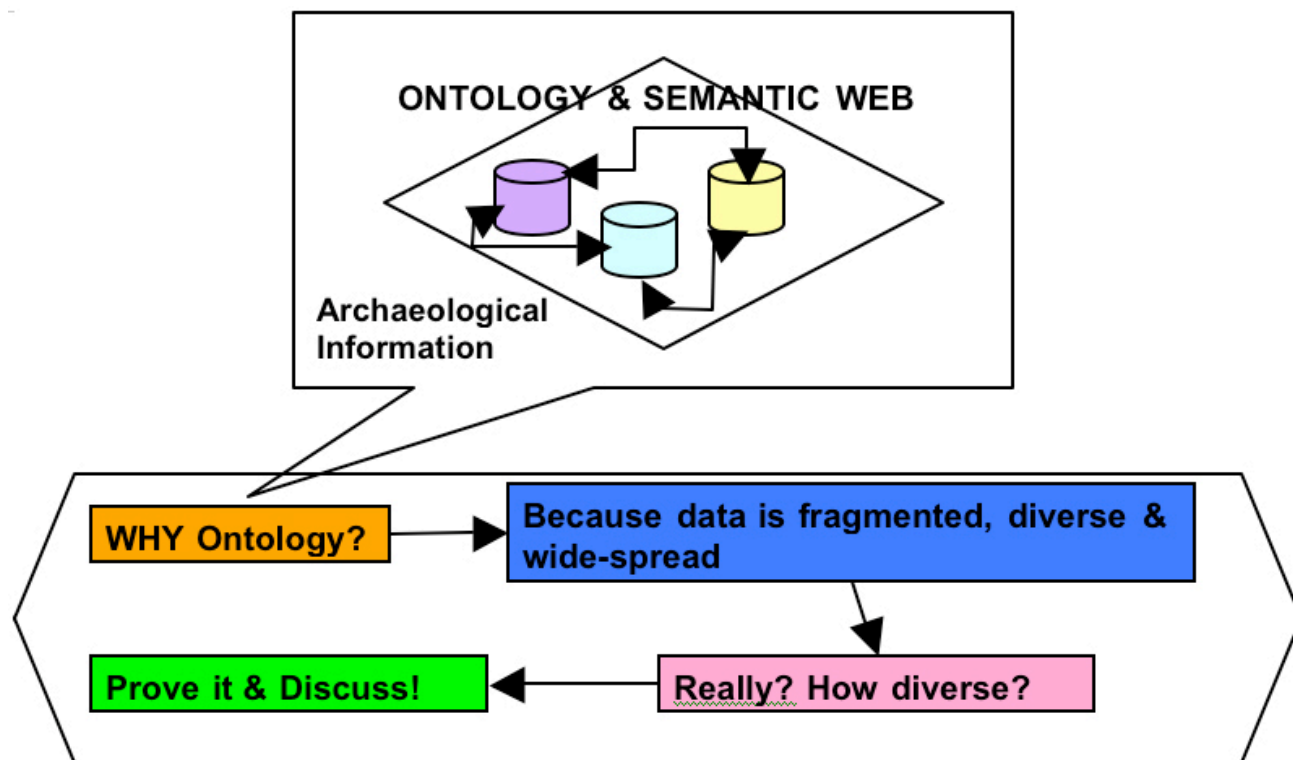

Figure 1. Framework of "Ontology of Ontology."

media for archaeological publication as well as growing desires for diverse media such as CD-ROM and the Internet (Jones, et al. 2001). In addition to an excellent background history of British archaeological publications, the report revealed archaeologists' attitudes toward publication; for example, the expectation for archaeological reports, and the constituent tendencies (by region, age, organization, etc) for use of different publications. The survey is, thus, very useful in the context of both digital and non-digital archaeological resources.

These two surveys were innovative in the sense that they illustrated the new use of archaeological information happening in the late 1990s. Without a doubt, the surveyors predicted the forthcoming big wave of information technology for archaeology. However, it is a shame that no similar surveys have been undertaken since then.

2.2 Canadian Surveys

Canada is another country that recognized an expanding role of information technology (IT) within the heritage sector from the early days of IT applications. In 1998, the CHIN (Canadian Heritage Information Network) carried out a survey regarding Internet use by heritage professionals. That study attempted to obtain the profile of Web users within the Canadian heritage community and to provide a benchmark against which results of future surveys could be compared (Thomas 2000:2).

In 1999, another survey was organized by the CHIN to determine who uses information technology in the heritage community and how and where it is used (Minister of Public Works and Government Services Canada 2001:7). The primary targets of this survey were museums. Therefore, the survey analyzed the use of information technology for managing collections, the use of computers and the Internet, and the extent of digitization activity, as well as museum interactions with other museums and organizations. These surveys were the first of this kind in Canada; however, they are now obsolete. It should be noted that British archaeologists and Canadian heritage experts had already begun to realize the impact of the use of computer in archaeology as early as 1998.

2.3 Japanese Surveys

In Japan, there are no equivalent surveys. However, Fujitani (2005) investigated the Web contents of archaeological organizations and explored the efficiency of dissemination of archaeological information. This paper corresponds to the Survey Part I (see below). Because of Fujitani's interest in effective information delivery, he only examined websites that had access figures, so that he could evaluate how Web contents affected the figures. This study is valuable in its own right, but some important organizations were excluded and he did not take the quantity of data into account.

The JDAA (Japan Digital Archive Association) (2001-2005) has launched extensive surveys, especially for the museum and library sector. It published five years of white papers regarding surveys of Web contents and digital archives in Japan. The surveys were well organized by the use of questionnaire methods and detailed the present state of digital archiving in a wide range of organizations, including art galleries, museums, libraries, and public bodies. The downside of the surveys is the lack of field archaeology. In addition, the poor situation of Japanese archives restricts the definition of archives to image databases, thus more versatile multimedia and geographical data such as 3D models, geographic information systems (GIS), and computer-aided design (CAD), which are very popular and unique in archaeology, were not well studied (for more detail, see Sugimoto 2005).

3 Aims and Methodology

3.1 Aims

It became clear from the previous studies that an up-to-date survey for the use of information technology for archaeological data is necessary. It is also important to the author that the survey focus on field archaeology rather than museum archaeology. This approach mainly originates from the assumption that field recording should yield vast amounts of data every year—which is often threatened by the lack of archive policies—along with the need to re-use data and to maintain its integrity. Moreover, the need for this view in Japan is emphasized by the fact that less attention is given to archives and information technology in field archaeology than in museums (Sugimoto 2005).

The main purpose of this survey is, therefore, to obtain the statistics on archaeological data stored in Japanese field-archaeology organizations, as well as the use of that data and the expectations of archaeologists. Particular focus is placed on digital data, which should have accumulated at an incredible pace for the last decade. The results of the survey enable Japanese archaeologists to discuss and propose future strategies of digital archiving in archaeology. In addition, from a more international perspective, this kind of objective view of archaeological data would be a foundation stone for the use of archaeological standards and ontology such as the CIDOC-CRM.

The survey is divided into two parts. The first survey overlooks the digital data available online (JAD2 Survey Part I). The second survey examines the digital and non-digital data available in-house (Survey Part II). This paper only reports the result of Survey Part I by analyzing digital data disseminated through the websites of archaeological organizations. In contrast, Survey Part II will discuss "hidden information" stored and accessible only within archaeological organizations by analyzing questionnaires sent to individuals and organizations.

As noted above, it is hoped that the survey itself will constitute an awareness campaign for the discipline. This is simply because archaeological computing has not been well developed in Japan and many archaeologists are still not familiar with applications of information technology. In particular, a survey website was created for the promotion of the survey and the recognition of computer

applications in archaeology: (http://www.chiron-training.org/go_sugimoto/digital_survey/).

3.2 Methodology

The survey (Part I) methodology is very simple. All websites were carefully reviewed in terms of quality and quantity: for example, the existence of specific contents, the quantity of files, dates, and so forth. The following categories of contents were examined: 1) organization, 2) website, 3) contact/access, 4) event, 5) disclosure, 6) fieldwork/excavation, 7) exhibition, 8) publication, 9) site, 10) artifact, 11) outreach activity, 12) educational/kids, 13) miscellaneous, 14) file format, 15) digital archives, and 17) Web GIS. In this paper, due to the constraint of space, only some of the above categories will be discussed.

In order to add more objectivity, two tools were adopted for analysis. HMTL validator (http://validator.w3.org) checks the validity of HTML code, while WebXact (http://webxact.watchfire.com) evaluates the accessibility of website contents such as metadata, broken links, last update, and WAI (Web Accessibility Initiative) checklists. Moreover, a MINERVA (MInisterial NEtwoRk for Valorising Activities in digitisation) handbook was used in order to evaluate websites. The handbook published by the MINERVA Working Group 5 (2005) proposed ten principles for the creation of high-quality cultural websites: transparent, effective, maintained, accessible, user-centered, responsive, multi-lingual, interoperable, managed, and preserved. The guideline provides checklists, practical tests, and criteria for the creation of cultural websites, which allows the author to ensure that the evaluation methodology and suggestions for the improvement of websites are based on a reliable source.

3.3 Target

Unlike the JDAA's scope, the survey regards field archaeology as the main area of interest. Since, as mentioned above, more than 90% of the excavations in Japan are carried out in response to development; excavation is almost a synonym for rescue excavation. Although private companies join this sector, the Maizo Bunkazai Center (underground/buried cultural property center: MBC, hereafter) has played a quintessential role in Japanese rescue operations for a long time. Most of the MBCs belonged to local governments, but the recent trend of privatization in the Japanese government has changed some of their statuses from local authority to independent juristic organization. It is not too much to say that MBC projects are the core of Japanese field archaeology. For this reason, the author is convinced that MBCs are the most appropriate organizations for the sampling for this survey. There are 47 prefectures in Japan, and the seemingly biggest MBCs in each prefecture were selected for the review. This selection was mostly made by the website of the Japanese Archaeology Association that compiles hyperlinks to MBCs (http://wwwsoc.nii.ac.jp/jaa2/links.htm#maibun). In this way, the survey sample is 47 and can cover some important organizations excluded in the Fujitani's survey.

4 The Result

4.1 Technical Accessibility

The power of the Web is in its universality. Access by everyone regardless of disability is an essential aspect.
-*Tim Berners-Lee, the W3C Director and inventor of the World Wide Web*

In a narrower sense, Web accessibility means that Web users with disabilities can perceive, understand, navigate, and interact with the Web, and that they can contribute to the Web (W3C Web Accessibility Initiative 2005). However, Web accessibility concerns are not only for people with disabilities, but also for people without disabilities. The proper Web accessibility mechanisms need to provide websites and software that are flexible enough to meet different user needs, preferences, and situations. It is probably quite common for most webmasters not to consider accessibility issues. In fact, only 6.4 % of the MBC's websites were validated by HTML validator (Figure 2). The other websites show errors (57.4%), fatal errors (23.4%), and lack of document type declaration (12.8%). WebXact also gives an impression of a lack of accessibility in websites. Overall, an average of 2.8 errors was detected out of the three WAI automatic checkpoints, while an average of three warnings were detected out of three manual checkpoints.

Accessibility is a one of the ten principles in the MINERVA handbook; therefore, the Working Group also reckons the compliance with the W3C Web Access Initiative's (WAI) Web Content Accessibility Guidelines (WCAG). It is, without doubt, a burgeoning issue. Heritage professionals need to realize that proper information delivery is not an easy task, but it is necessary for cultural websites to address all members of the community, because accessibility issues are now even considered in government policies.

4.2 Language

Language causes another problem. Since the Internet is a global phenomenon, language is a very important factor for Web development. However, only 6.4 % of websites include non-Japanese pages, all of which are English introductions to the organizations including the organization's mission statement (Figure 3). It is not very usual in Japan to encounter non-Japanese contents on the Web, but the globalization of the Internet will expand the possibility of accessing Web contents in different languages (Sugimoto 2004:32). For example, MINERVA Europe respects multilingualism of cultural websites since it consists of a wide range of members of the European Union (e.g., there are 20 official languages and about 150 estimated minority and immigrant languages in the enlarged EU). The MINERVA Plus Project's survey reports that 26-30 % of European cultural websites are monolingual, 43-47% are bilingual, and 26-27% are multilingual, while 68% are available in English (MINERVA Plus Project 2006). Although English

certainly plays an essential part on the Web, multi-lingual approaches cannot be underestimated. In Japan, Chinese and Korean are particularly important with regard to multi-lingual websites. It is also very interesting to assess what Japanese field archaeologists think about this language issue in Survey Part II. In terms of the universality of European websites, even sign languages and non-EU languages spoken by immigrants are matters of interest for the MINERVA (MINERVA Working Group 5 2005:46).

4.3 Fieldwork/Excavation

Fieldwork should be a central focus for the archaeological operations of MBC; however, 23.4% of websites do not have information about fieldwork/excavation (Figure 4). This is partly because of bureaucracy and the types of organizations. Some local governmental organizations have websites as a part of a bigger domain in which detailed information is not always available. It is also true that some small MBCs are a part of a big museum or archaeological site park. They tend to offer more information about visits and education.

The oldest date and the most recent dates of field projects were monitored, so that Excel's DAYS360 function can be used to estimate how long fieldwork information exists. There is a total of 249 years of fieldwork information, which means seven years of information per prefecture (and MBC). Seventy-five percent of the websites with fieldwork information have text and photos related to the fieldwork, while a surprising 47.2% have only a list of field projects undertaken. In some cases, it is extremely difficult to obtain detailed information about what and where excavations have been, or are being, done. More information will probably be found in the form of proper publication, some time after fieldwork has been completed. But the information about ongoing excavations is apt to be in such a list without sufficient information. The idea of "live archaeology" has to be discussed more for up-to-date dissemination of archaeological information. The Internet is a perfect medium for this purpose.

4.4 Publication

Publication is the most powerful tool for archaeologists. Without it, it is impossible to reconstruct and re-interpret sites destroyed by archaeologists, and to be responsible for the preservation of records of cultural properties. That is why the PUNS report attempted to describe how people use archaeological project publications and what they expect from them. The PUNS report also mentioned that electronic publication revolutionized the dissemination of archaeological information so that printed publication and dissemination, once regarded as virtually synonymous, are no longer necessarily the same thing (Jones et al. 2001). Two common theories of "publication as preservation" and "publication as dissemination" make it more interesting to examine the present state of Internet publication in the JAD2 survey.

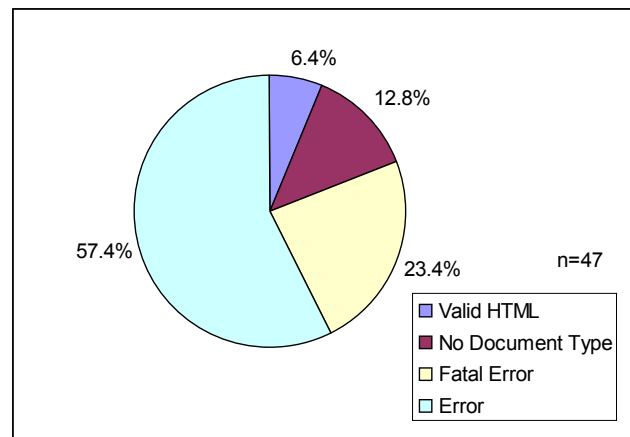Almost 77% of organizations produced information
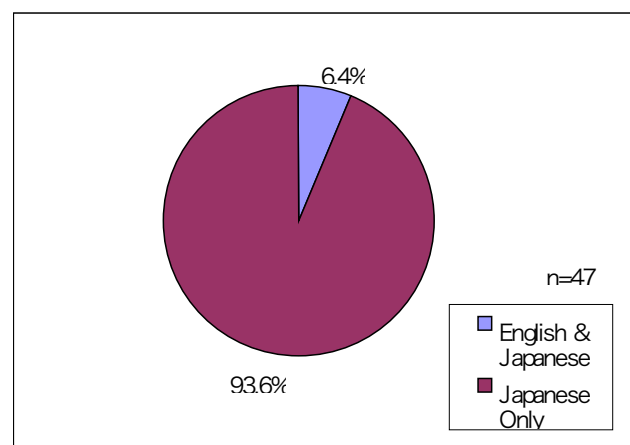
Figure 2. HTML Validation.
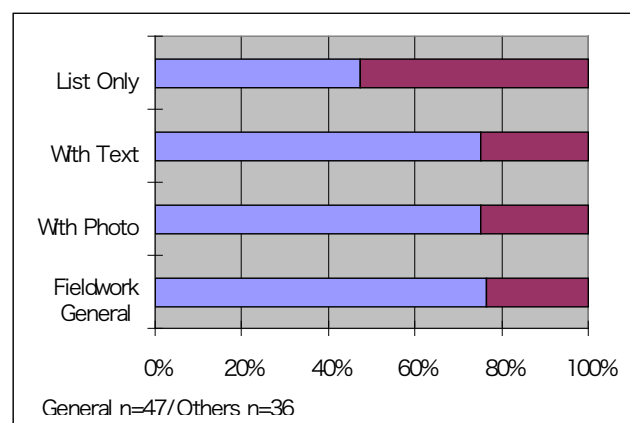

Figure 3. Language.

Figure 4. Fieldwork Information.

about publications (Figure 5). This figure overwhelmed the Fujitani's result of about 50 percent. The Internet publications of MBC are divided into five categories: research bulletins (Kiyo), annual reports (Nenpo), public newsletters (Koho-shi), on-site tour handouts (Genchi-setumeikai Siryo), and excavation reports (Hakkutu Hokokusho)[1]. The popularity of these publications shows a gap: whereas public newsletters (63.9%) and on-site tour handouts (41.7%)

Table 1. Distribution of Publication.

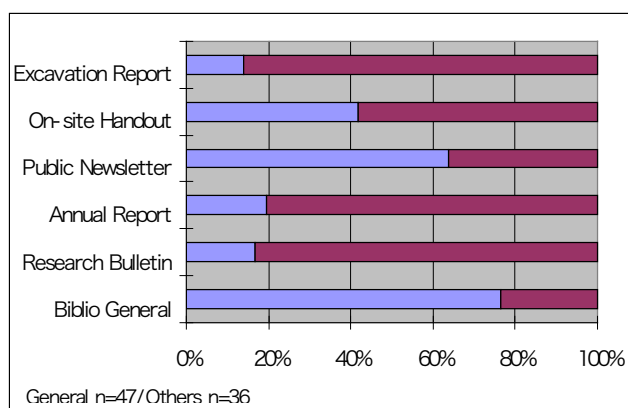|	Average Years	Average Volumes	Total Volumes
Research Bulletin DL	11.7	5.6	39
Annual Report DL	12.6	17.5	140
Public Newsletter DL	4.6	14.5	347
On-site Tour Handout DL	2.4	13.2	238
Excavation Report DL	23.7	75.0	450
Publication Sales	23.5		
Index of Bibliography	25.9		

Figure 5. Publication Information.

are high in popularity, research bulletins (16.7%), annual reports (19.4%), and excavation reports (13.9%) are low.

As seen in fieldwork, Excel's DAYS360 function allows the author to calculate the duration of publications. Table 1 summarizes the amount of downloadable volumes and the duration of downloadable publication. Some interesting patterns can be observed for different types of publications. Professional-oriented publications, including research bulletins, annual reports, and excavation reports, have much longer average years of informational use than public-oriented publications such as public newsletters and on-site tour handouts. This means the professional-oriented publications are not popular, but they are archived relatively well. The average duration times for volumes of each publication type are relatively similar, ranging from 13 years to 17 years, with the exception of 5 years for research bulletins and 75 years for excavation reports. These average figures are magnified by the actual holdings figures. Only seven MBCs provide 39 research bulletins, and only six MBCs hold 450 excavation reports. The concentration of downloadable excavation reports on certain MBC's sites and the lack of research bulletins as a whole are recognized. Although the annual report is a very specific publication, in terms of the volume, it seems to belong to the same category as public-oriented publications because it does not include detailed research content. Rather, it concentrates on digest information about the activities of an organization. In conclusion, this implies that there is a distinction between research publications and general publications. Although some MBCs are enthusiastic about excavation reports,

the survey would indicate that the Internet publication by MBCs is generally regarded as a short-term publicity and not as long-term archives of research.

Today, Internet-driven marketing is a significant option for heritage organizations. Museums in particular invest in online museum shops in order to increase the sales of goods. In the survey, sales information for publications is also investigated, since it is not widely known how MBCs attempt to sell their own products through the websites. In total, 23 years of publications are available for purchase (Table 1), but in most cases, there are only lists of publications that the organization has made. This figure almost corresponds to the index of bibliography (25.9 years), which is a list of publications, though are not necessarily made by the organization. In comparison with the average years of excavation reports, it seems that 25-years is a relatively reliable milestone for available information about publications. Thus, at least lists of large numbers of publications are open to the public, and it is possible to purchase them through contact with the organizations. In the future, online ordering systems will be a tool for MBCs to acquire new customers and interest groups.

4.5 Site and Artifact Information

The survey also analyzed information about sites and artifacts that MBCs have investigated. The evaluation relies on the availability of information with different elements such as maps, photos, texts, excavation history, bibliographic reference, GIS, and search function (Figures 6 and 7). Although the availability of site and artifact information as a whole shows obvious difference (site: 83.0%; artifact: 42.6%), there is great similarity for those elements. Photos (94.9% for site, 100% for artifact, respectively hereafter) and texts (97.4%, 95.0%) are seen in almost all websites that have site and artifact information. On the other hand, maps (33.3%, 10.0%), bibliography (23.1%, 15.0%), excavation history (43.6%, 10.0%), GIS function (2.6%, 0%), and search function (10.3%, 15.0%) are minimal. When it comes to the detail of the trend, interesting fluctuations are visible. Artifact information tends to have less connection to maps, excavation history, bibliography, and GIS. In contrast, artifact is comparable in prevalence to site with respect to the search function. Here, the implication appears to be that there is "de-contextualization" of artifact documentation.

In archaeology there are several stages of documentation. The first stage is the documentation regarding activities in the field (excavation/fieldwork) (Stage 1). Then, when artifacts are moved to a storehouse or museum, museum documentation starts (Stage 2). Finally, another documentation stage is required for the dissemination of information and publication (Stage 3). Between the stages, there might be Stage 1.5, Post-excavation, and Stage 3.5, Web dissemination and publication. Although MBCs seem to specialize in field operations, quite a few of them have exhibition facilities, organize educational events, and publish their fieldwork. Thus, they are usually responsible for most of the stages. Throughout these stages, loss of context (geo-reference) information is observable. In the field, artifact and site/

feature information are geographically associated to each other. However, sites and features are often excluded in the stage 2. When an artifact becomes an object in a museum, called "collection," accurate geographical information is lost. This situation may get worse in the further stages of publication and dissemination. In summary;

- Stage 1: Excavation/Fieldwork Documentation (Artifact and Site/Feature Geo-Referenced)
    Stage 1.5: Post-excavation Documentation (Artifact and Site/Feature Geo-Referenced?)
- Stage 2: Museum Documentation (Site/Feature often excluded, Artifact not well Geo-Referenced)
- Stage 3 Documentation for Dissemination and Publication (Artifact and Site/Feature Geo-Referenced?)
    Stage 3.5: Documentation for Web Dissemination and Publication (Artifact and Site/Feature not well Geo-Referenced)

This "object oriented" process of documentation can be called "de-contextualization" of archaeological information. The loss of context, however, would mean a gain of extra information such as the acquisition number, loan history, details of the artifact (measurement, scientific analysis, etc.), and educational interpretations of site/feature. De-contexualization may coincide with "re-contexualization" of cataloging, analyzing, and interpreting. As such, this process of de-contextualization could be called "Selective Documentation," which exemplifies the flow of archaeological data. In fact, from recording to publishing, raw data becomes information by archaeologists' selection and interpretation.

4.6 Web Digital Archive and GIS

Although it is difficult to define what "digital archive" means, according to the JDAA, it is a collection in a multimedia database which should include at least a certain number of images, possibly with such functions as enlargement and 3D view. Just over 36% of the MBCs' websites have digital archives within the site or have a hyperlink to a bigger site (Figure 8). Almost 60% of them have a search function, while 58.8% have an archive index. Captions/explanations of the archive collections are present in 58.8 % of the sites as well. Other functions are: the enlargement of archive objects (41.2%), object rotation/multiple views (17.6%), supplementary images for objects (17.6%), and sound function (6.0%). There are no websites that include Virtual Space. As an archaeological archive, sound function is awkward, but this categorization is based on the JDAA's survey that is aimed at various heritage institutions. Therefore, the figure proves that the websites have multiple subjects (e.g., oral history, intangible heritage, etc.). As graphed in Figure 9, Web GIS is not popular yet in these sites (14.9%), of which 42.9% only deal with an archaeological site. Some of the websites have functions including distance measurement (42.9%), area measurement (28.6%), non-archaeological layers (e.g., environmental information, etc.) (42.9%), aerial photographs (28.6%), and other functions (28.6%). However, each website has different levels of information and services. For instance, one example of such
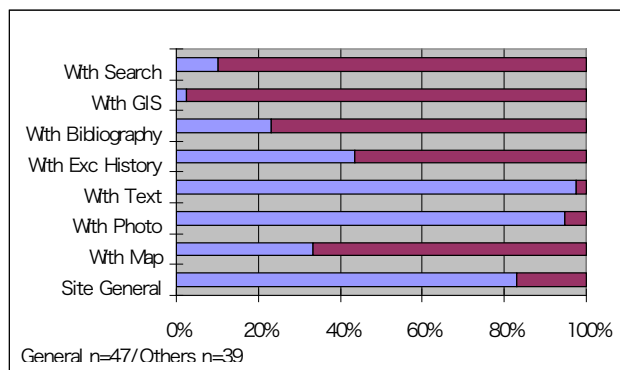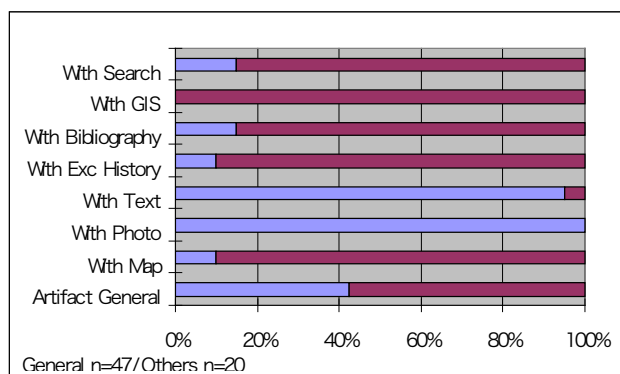

Figure 6. Site Information.

Figure 7. Artifact Information.

site-implemented Web GIS offers impressive functionality with versatile resources including photographs and excavation reports.

Generally speaking, Web archive and GIS functionalities tend to belong to prefecture portal sites. Thanks to the promotional activities of the JDAA, this kind of digitization project of cultural and natural heritage is developing rapidly, and is often taking place at the prefecture level. Moreover, local governments are now eager to develop integrated systems for various types of spatial information. The GIS-based systems would include more up-to-date information such as traffic, weather, and legal information concerning topics such as pollution, security, environment and city planning, and social information relating to topics such as education and health service (e.g., see Nagano prefecture 2006) In the same scope, cultural contents, typically tangible and intangible cultural properties held in each prefecture, are assembled in order to provide a single access point for users. This sort of local property management system should provide opportunities for establishing local identity and promoting tourism. It is also argued that these cultural Web services unlock the value of cultural heritage and are supposed to be used for education and enjoyment. However, such "Web effects" are not analyzed in a proper way. It would be interesting to assess the effectiveness of cross-domain GIS and digital archives in the cultural heritage context

With respect to maintenance and cross-subject contents, this interdisciplinary approach has benefits, since various cultural contents can be shared in one form. It is easy to find information from different genres of cultural and natural
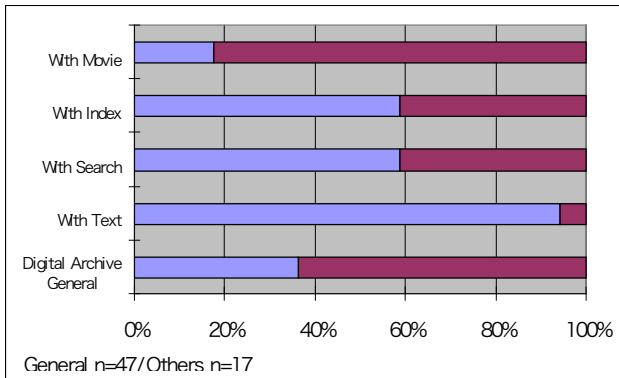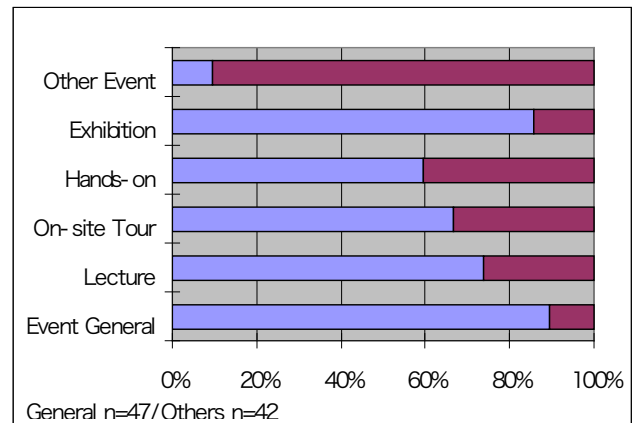
Figure 8. Digital Archive.
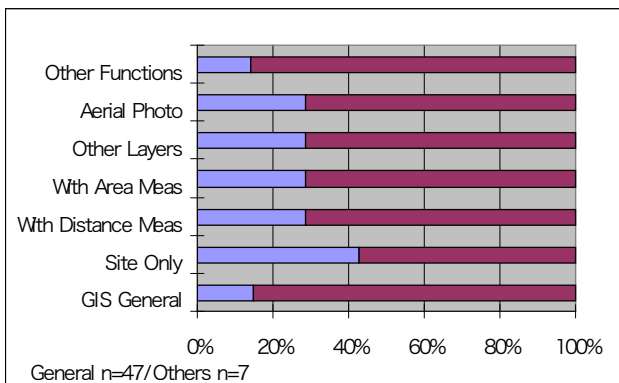

Figure 10. Event Information.
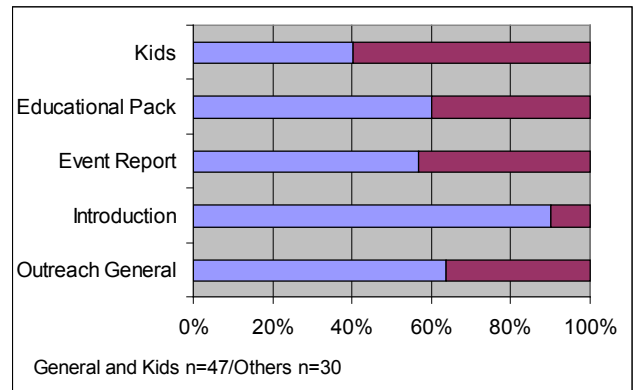

Figure 9. Web GIS.

Figure 11. Educational Information.

heritage, which means that the maintenance of portal sites and the management of such heritage would be optimized. However, problems may lie in the way of merging information, because different types of cultural/natural heritage information are apt to be generalized in order to achieve compatibility. In the future, ontologies such as the CIDOC-CRM and related technologies could resolve this problem, but it seems that heterogeneous information is subject to some sort of generalization and compromise in current Japanese archival portals.

4.7 Events and Outreach Activities

MBCs organize various kinds of events related to archaeology for the general public. Thanks to the recent awareness of "public archaeology," 89.4% of the MBCs websites hold some kind of information for events (Figure 10). These events consist of lectures (73.8%), on-site tours (66.7%), hands-on events (59.2%), exhibitions (85.7%), and related events organized by different bodies (9.5%). Although there is not much information on artifacts, exhibitions are extremely popular. In contrast, collaboration and promotion with other cultural organizations such as local museums, libraries, and art centers are not recognized. Virtual collaboration of integrated GIS and archive systems is underway, but physical collaboration might not be developed in prefecture.

Figure 11 shows that 63.8% of the Web pages contain outreach activities solely dedicated for educational purposes. These pages include introduction (90%), the report of past events such as school visits and hands-on events (56.7%), and information for an educational kit (60%). In addition, only 40.4% of MBCs have Web contents for children. When these figures are compared to the ones for general events, the results suggest that the information for lower education is less frequently provided than adult/life-long education. As many museums have recently hosted more educational events such as hands-on activities with the replicas of museum collections, MBCs need to make more efforts for public involvement of all generations.

5 Summary and Conclusions

The JAD2 Survey Part I provided an overview of information delivery on the Web in field archaeology, and allowed archaeologists to assess the current state of Web-based dissemination. The analysis of this kind of survey often relies on reading patterns and similarities rather than indicating differences. However, as seen in the concentration of downloadable excavation reports to some MBCs, there are also considerable differences in Web contents in terms of quality and quantity. For example, there are still plenty of plain Web pages consisting of basic document-type information on fieldwork, publications, educational activities, and news,

but thanks to the development of cutting-edge technology, some sophisticated contents of integrated GIS and digital archives can also be seen. It is useful to discuss the future strategies for archaeological information on the Web. Some recommendations for the improvement of cultural websites are already found in the ten principles of the MINERVA handbook; it is, therefore, not the intention of this paper to repeat such work. Rather, its purpose is to outline the summary of results in terms of the Japanese context, and indicate some vital aspects to be discussed. This summary could be expressed in the form of W and H questions:

- How:

  Without doubt, language and accessibility issues mean that the websites are not currently use-friendly. Although the discussion on Web accessibility has started just recently in Japan, the issues of language, metadata, and accessibility should be given more considered when creating a website and disseminating high-quality information.

- Which:

  Localization, nationalization, and globalization are burgeoning issues; however, there is a gap between localized/nationalized information and international needs. Standardization may lead to blocked developments, but, may result in efficiency. Taking an ontological approach into consideration, harmonizing with wider standards without the loss of local value will be an essential task. Another "which" question involves the selection of archaeological resources for digitization. More and more materials are acquired, but not all of the data can be digitized and uploaded to a website. The establishment of standard criteria for the selection of data is vital.

- To whom:

  The current target of Web viewers would be the general public, and the research use of websites seems unsatisfactory. Since commercial marketing is not the aim of this paper, to keep balance among different audiences is important. The academic and educational values of Web services have to be discussed carefully.

- With what:

  Extra features, such as prefecture integrated systems of web GIS and digital archives, are something to offer, but interdisciplinary contents pose some questions concerning information generalization, property management, and Web maintenance. More collaborative works have to be organized.

The proper Web dissemination of plentiful Japanese archaeological information should enhance the value of cultural heritage, support local identity and economy, and promote international research and tourism. Even if the JAD2 Survey Part I is not too creative in this global perspective, the value of Web evaluation is not to be underestimated, whatever the results. It should be also noted that the JAD2 Survey Part I is not complete. It contains a large

amount of other data not used in this paper. These data are categorized as follows: file size, instances of broken hyperlinks, update frequency, metadata, access figures, contact information (e-mail, phone, address), access information (map, opening dates and hours), organizational information (mission statement, history, types of services, personnel), exhibition (building layout and collection), miscellaneous (nearby sites and cultural facilities, FAQ, word reference, list of hyperlinks), downloadable primary data, Web functions (Bulletin Board System, submission forms, site map), downloadable files for disclosure (projects, budget, personnel), and download file formats. The interpretations of these enormous data sets are extremely valuable in order to reveal the present situation of archaeological information in depth, and to suggest more specific strategies for further work. The details of all JAD2 Survey data will soon be available in Japanese journals. In addition, the results of the Survey Part I have to be discussed more in comparison with the Survey Part II. The Survey Part II will investigate archaeological information created, stored, and used within MBCs, yet not remotely available. Hence, the difference between online information and offline information in field archaeology will be revealed. Moreover, in Part I, it was impossible to evaluate what users needed from websites, but Part II will clarify the professional archaeologists' expectations of Web information. As a result, two surveys can give detailed insights into the overall situation of archaeological information, which is a vital step toward the conceptualization of archaeological documentation, and toward the creation of an archaeology-specific ontology.

Needless to say, ontology like the CIDOC-CRM is very interesting, as if it is a promised land for desperate archaeologists. Although it is especially intended to be used in the domain of museums, it also enables field archaeologists to share heterogeneous archaeological data in an optimal way. But, if archaeology is the study of different past cultures in the world, cultural diversity has to be considered in the development of archaeological ontology. However, in reality, such a multicultural perspective is missing. For example, the official website of the CIDOC-CRM offers many references and projects, but most of them are concerned with the validation of the model in relation to heritage resources and metadata based on Western cultures and standards. In addition, the CIDOC-CRM is deemed acceptable by the ISO without consensus from outside ICOM/CIDOC. This lack of external agreement is dangerous. What is needed is competition. Just as there are Microsoft, Macintosh, and Linux users, it seems better for the cultural heritage community to create a standard ontology through competition; otherwise, this monopolistic situation might cause problems for practical use. This is not just a critique of the CIDOC-CRM; rather "Ontology of Ontology" perspectives are more required for further discussion on the use of ontology in archaeology. It is hoped that the JAD2 Survey will serve as a good starting point.

Endnotes

[1]Generally speaking, five categories can be described as follows. A research bulletin is a collection of research papers often written by fieldworkers and researchers of MBC, while an annual report contains information about annual activities of MBC. It often includes the digests/lists of annual fieldwork and publications. A public newsletter is a summary of MBC's activities to inform the general public of what is found and what events will be held. An on-site tour handout is a piece of paper distributed to the public during the on-site tour (Genchi-setumeikai) which is often taken place during the climax of excavation. An excavation report is a formal publication as a result of excavation.

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