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## To Whom it May Concern? The Users and Uses of Digital Archaeological Information<sup>1</sup>

*Abstract:* In order to ensure the functional, not only physical sustainability of the earlier and current archaeological information resources, a special emphasis is needed on the functional aspects of preservation. This paper reports on a study, which has explored the interface between the human patterns of information use and the methods of structuring and organizing archaeological information and knowledge. The empirical case study was based on a series of thematic interviews with archaeology professionals from the Nordic countries. The study informs future development of information systems and information services for archaeology and cultural heritage professionals. The results of the analysis shows that there are two critical success factors. Several recommendations are proposed on how to improve archaeological information work and its outcomes.

### *Introduction*

The techniques and methods of capturing and preserving archaeological information have been discussed broadly in the literature. However, the further uses and users of the data and their implications to the information have seldom been discussed in a comprehensive manner. Archaeological research projects and heritage organisations have concentrated on producing data for their own present use without specific concerns about the prospective users of the created and processed information. In order to ensure the functional, not only physical sustainability of the earlier and current archaeological information resources, a special emphasis is needed on their functional sustainability.

This paper reports on a study, which has explored the interface between the human patterns of information use and the methods of structuring and organising archaeological information and knowledge. The study presents a concise analytical description of archaeological work and information work from an information management point of view. The results of the analysis concluded there are two critical success factors and proposed several recommendations on how to improve archaeological information work and its outcomes. The outcomes of the investigation inform about future developments of information

systems and information services for archaeology and cultural heritage professionals, placing a specific focus on the extended life-cycle and evolution of the information and its uses.

### *Empirical Study*

The empirical investigation of the present study was conducted in a qualitative inquiry, which comprised altogether 25 thematic interviews (HIRSJÄRVI / HURME 1995) of cultural heritage professionals, each averaging 120 minutes in length. The discussion on the different interview themes was informed and structured according to the notions of free form thematic discussion and storytelling in the spirit of “creative interviewing” (FONTANA / FREY 2000).

The informants were archaeologists from Finland and Sweden, who worked in various roles within the cultural heritage sector. As the roles of the individual informants were mixed the discussion is based on work roles and related knowledge activities instead of individuals<sup>2</sup>. One interviewee was typically involved simultaneously in several activities such as field archaeology, academic research and education. The interviews were conducted by the author during the spring and autumn in 2004, digitised, transcribed and analysed using a combi-

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<sup>1</sup> The article is based on the doctoral dissertation of the author (HUVILA 2006).

<sup>2</sup> For a cross-comparison of individual information behaviours and work role related information behaviours see HUVILA 2006.

nation of grounded theory (CORBIN / STRAUSS 1990) and schema based approaches (RYAN / BERNARD 2000, 782–784), which was elaborated on in the later stages using writing as an explicit form of inquiry (RICHARDSON 2000). It was indicated to the interviewees that the study was about information work and its development in the archaeology sector. The interviewer had several years of experience working with archaeologists. Due to this, the interviewees were repeatedly told to be explicit about their views to avoid any false assumptions based on the earlier experiences of the interviewer.

The theoretical coding of the data was based on the observations of a likely significance of the recurring patterns of the similarities and dissimilarities in *formal work duties* (e.g. collection management, field work, teaching) and titles (e.g. antiquarian, project researcher, lecturer, researcher), *environments and scenes of work* (e.g. museum, archaeological site, university), *objects interacted with* (e.g. shovel, computer, collection of finds, literature, pottery), and *activity*, how it is done, its meanings, purposes and values (e.g. to unearth and document an archaeological site, to tell the public about the Bronze Age, to teach archaeology students). The practical analytical work progressed by constructing a theory based on discernible patterns in the discussion between the interviewer and the interviewee.

The data was analysed using a method based on role theory (BIDDLE / THOMAS 1966), soft systems methodology (CHECKLAND 2000) and ecological approach (GIBSON 1979) based method denoted *information work analysis* (HUVILA 2006). Altogether seven work roles (field archaeology, antiquarian, academic research, academic teaching, public dissemination, cultural heritage administration and infrastructural development) were identified and described using a combination of root definitions, use case modelling, classification of information interactions (COOL / BELKIN 2002) and analysis of information horizons (SONNENWALD / WILDEMUTH 2001).

### Findings

A comprehensive analysis of the research data may be found in HUVILA (2006). Due to the limitations of space, only the findings, which are relevant from the point of view of the present study, will be discussed thoroughly.

This study uses information horizon as an instrument for explicating the information resources,

which are involved in the information interactions. According to Sonnenwald, the information horizon is a space where an actor can act (SONNENWALD / WILDEMUTH 2001). Information horizon is a space where the work resides and which explicates the information “instruments” used to pursue it. Besides explicating the resources, the information horizon maps provide a method for visualising the work role and information interaction specific processual relations of the resources. It became apparent during the study that the information horizons do converge with the work roles, even though there is no apparent linkage between the work roles and the use of individual information sources.

Archaeologists work with a broad variety of information objects, but the core of the information sources consists of a fairly limited set of materials. Therefore, it is not the materials themselves, which make the work roles distinct. The source use becomes distinct due to the organisation of the information horizon and due to the existence of focussed starting resources in the information seeking process (SONNENWALD / WILDEMUTH 2001, 13). The notions of starting resources, balanced resources and ending resources, or *transmitters, carriers* and *receivers* (SONNENWALD / WILDEMUTH 2001, 13) have been used within the information horizons theory to denote information materials, which are typically used first, in the middle and in the end of the work role related information processes. Transmitters mark an entry-point of information interactions, the carriers are used through the subsequent interactions and the ending resources represent the objects, where the information interactions typically end.

The information horizon of the **Field archaeology** role is centred on a site or an area of archaeological interest. Field archaeologists are essentially users and creators of information while they prepare and execute excavation projects. The horizon spreads out from the geographical location and the period to grasp the relevant information in a diversity of sources. The information work is carried on by a congruent use of diverse resources, cyclically returning to the starting point and by a constant process of information acquisition through observation. The process is essentially cyclic and iterative. It is lasting as many iterations as the obstacles of the *access* information interaction allow.

The **Antiquarian** role works with a horizon, which shares the characteristic of focussing on distinct pieces of archaeological evidence with the field archaeology work role. Antiquarians’ information

work comprises of primarily organising and indexing, with duties touching upon modifying, storing, and retrieving information. The perception of the sources typically starts from the local collections database (*transmitter*, instead of focussing on a geographical location or a site, cf. field archaeology) and spreads out to grasp a spectrum of archaeological literature and other information sources (*carriers*) related to an artefact. The information horizon of the antiquarians is organised around iterations, which start from the antiquities register or a collections database. The process does, however, only seldom end at the database. The most typical *receiver* is the artefact, which served as the impetus to the seeking process. The field archaeologists and antiquarians tend to consult sources for the primary purpose of finding descriptions of their objects of study and of relevant comparative materials. Field archaeology refers to the descriptions of the excavated site or surveyed area and to the corresponding observations, which have been done elsewhere, while antiquarian work role focuses on the seeking of the artefact or artefact group specific descriptive information.

**Public dissemination** professionals are primarily interested in broader archaeological themes rather than on individual pieces of data. A typical *transmitter* is the general archaeological and historical literature, which is capable of shedding light on a particular phenomenon such as the clothing in the Middle Ages or childhood in Viking Age Sweden. The process carries on to the literature (*carrier*) and typically ends with a finding of suitable archaeological objects for display or publication (*receiver*). The public dissemination work role is directed towards modifying (or editing) and communicating archaeological information. The information has to have a meaning in the context of its designated audience in order to make a difference.

The information horizon of **academic researchers** places an equal emphasis on the archaeological material as a plausible entry point. However, unlike the rest of the previous work roles, the scholarly research tends to have notably fluctuating entry points (*transmitter*). The horizon consists of a fairly broad variety of scholarly information sources, which are being used according to the actual information needs. The needs and the subsequent process of information seeking is likely to start with an unequalled insight instead of a directly phraseable query. Information seeking for scholarly purposes shows visible patterns in respect to the breadth and depth of the ef-

forts. The patterns are however, significantly mixed in comparison to the other work roles (*carrier*). Similar to field work research, the scholarly information process of the academic research work role tends to end only when practical, either oncoming or pre-planned, limits are reached (*receiver*). The academic researchers frequently underlined the significance of archaeological reports as first hand information sources although they made often equally critical comments on their limited scope, which was stated to be a consequence of constrained resources in archaeological field work.

**Academic teaching** relies broadly on the current scholarly literature. The role of well-known and locally available literature is central both as a starting resource (*transmitter*) and as an actual information source (*carrier*). The notion of "being well-known" is rather complex. A book or an article may become well-known to an individual who acts in the academic teaching work role by personal recommendations, public exposure within the scholarly community, in reviews and critiques, and to a degree, in advertisements. An individual information process of planning and running a course ends with the literature (*receiver*), although the overall process of academic teaching may be seen as an illustrative example of iteration and continuity. Academic teaching expects authoritative academic information. Besides the actuality and authority, the practical limitations of time and resources make the teachers look for processed and compact summarised information on the current topics of the courses. Academic teachers are principal utilisers of information. They access, filter, distribute and network information.

**Cultural heritage administrators** rely heavily primarily on the archaeological investigation reports, and secondarily, on institutional databases as *transmitters* and consequently as *carriers*. Unlike the antiquarian role, the database work is not independent, but is combined with the literature and other complementary sources in the cultural heritage administration. It acts more typically as a surrogate, and as an instrument to find the relevant reports. All informants working in the cultural heritage administration work role noted that the usability of the reports varies considerably. The principal problem from this particular work role point of view is the lack of evaluation of the site and its significance. The spectrum of the used information sources varies significantly depending on their availability and the perceived importance of the information interaction. A typical *receiver* in the cultural heritage ad-

ministration related information horizons is a relatively detailed description, which effectively fulfils or exceeds the imminent needs. Cultural heritage administrators' information work comprises primarily accessing and using information.

The **Infrastructural development** work role relies on a rather different information horizon than the rest of the work roles. The information sources as well as the typical *transmitters* are mostly technical and methodological. The developers seem to rely only secondarily on the core of the archaeological sources. As with the research and development work in general, the information horizon of the infrastructural development evolves in an iterative fashion. Infrastructural developers use information in order to synthesise and create new applications of the existing techniques and technologies.

The relevance of explicating transmitters, carriers and receivers in the information horizons is in their indicative value on the purposes, meanings and values of the information work and its related work. The organisation of the information horizon converges closely with the associated work roles and the related system of information work. Carriers do seem to give indication on the qualities of the information needed. Receivers, their nature and existence, appear to indicate the depth and continuity of the interest of the interaction. Transmitters seem to be especially good in indicating the motivations and entry points behind the work related assignments, thus giving a relatively good indication on the types and qualities of the information sources and repositories, which are likely to be useful in the context of the work role.

The overall lack of useful and complete archaeological databases was widely acknowledged. The same notion applies to all forms of electronic media. Only one informant, who works with a specialised natural science topic in the field of archaeological research, was a heavy user of electronic resources. In spite of the scarcity of the resources, many of the interviewees were enthusiastic about them (cf. LÖNNQVIST 1988, 75).

All archaeologists interact with information of a broad quantitative range. The focus of interest may be a tiny sherd of an artefact from a small site. The scrutiny could conversely grasp large quantities of sites and finds, predefined collections or databases of information, or it may cover, theoretically speaking, everything. All archaeological work grasps individual information objects: sites, areas and single artefacts. Similarly, all informants emphasised ex-

PLICITLY or implicitly the recurrent need and desire to personally consult physical artefacts and sites even if a surrogate existed. The constituent distinction between the different work roles is in the organisation of the information objects. Antiquarians and cultural heritage administrators work particularly with data, which is organised according to some principle. The organisation may reside in varying forms, in a collections database or on a map. The distinct feature is, however, that the organisation exists and the focus of the information horizon is an entity of information. The information work is centred on a notion of "what is" even if the work is evolving constantly. Field archaeologists contribute to the emergence of organisation by documenting sites and finds. However, for a field archaeologist, the perceived site is still essentially a sample of "what might be". Similarly, the public dissemination, academic research, academic teaching and infrastructural development work roles concern themselves with equally indefinite sets of information objects, where an individual artefact or site is an instance of a larger phenomenon.

*Tab. 1* summarises the observations made on the work role related information horizons. The columns recapitulate the work roles, transmitters, the nature of the first accessed information (descriptive, affective, summarising or evaluative), its specificity and the primary mode of access. The analysis reveals three broad categories of 1) specifically description oriented (field archaeology, antiquarian), 2) general subject specific (public dissemination and academic teaching) and 3) evaluative (Cultural heritage administration and infrastructural development) lines of information work. The characteristics of the three classes coincide in the academic research work role, which may adapt any of the three approaches depending on the research question.

The analysis of the layout of an information horizon by identifying transmitters, carriers and receivers provides some grounds to argue that the relative homogeneity of the archaeologists' information use is largely ostensible. A significant amount of the uniformity may be traced to the rather limited practical choices and possibilities of selection. Especially in Finland and Sweden, the communities of the archaeologists are relatively small and only a small proportion of all work is published to have a wider distribution. The subterranean flow of information through personal communication and participation is fundamental for the success of the information work. Therefore, it is plausible to state that the ar-

Work role	Focus of interest	Principal transmitter	Information	Specificity of information	Quantity of objects	Mode of access
Field archaeology	Site	Investigation report	Descriptive	Specific	Set	Search/browse
Antiquarian	Artefact	Collections database	Descriptive	Specific	Database	Search/browse
Public dissemination	Subject	General literature	Affective	General	Set	(General level) browse
Academic research	(varies)	(varies)	(varies)	Specific	Set	Search/browse
Academic teaching	Subject	General literature	Summarising	General	Set	Browse
Cultural heritage administration	Site	Investigation report	Evaluative	Specific	Database	Search
Infrastructural development	Method	Technical literature	Evaluative	Specific	Set	Browse

Tab. 1. Aspects of work role specific information sources.

archaeological information work is essentially a social and contextual matter.

### *Information Process*

The information process of the archaeology professionals grasps the entire life-cycle of information (BORGMAN et al. 1996) from the creation to the organisation, dissemination and use. The process is both multidimensional and multifaceted, iterative and intensive. Different types of information are being created, organised and used at the same time. Similarly, a single piece of information may be organised, disseminated and used contemporaneously in different instances. The following sections situate the various phases of the information process in the life-cycle of information and elaborate the process by discussing it in the context of situatedness, politics, cognitive authority and trust.

The findings of the present study indicate that the archaeological information process is essentially cyclical. The gamut of the individual processes within the archaeological information process makes it act as a meta-process, which consists of an infinite number of individual situated processes. The essence of the information meta-process is the layout formed by the individual instances of interactions with information (such as accessing, creating or organising, see HUVILA 2006), which emerge both

simultaneously and consequently within the different contemporary and succeeding information processes. The map of the different contemporary dimensional processes is formed by the work roles, which determine the *loci* of the individual interactions in the framework of the individual processes. The work roles penetrate through the meta-process, but have still their foci on the different phases of the life-cycle. The academic research is focally an activity of authoring and modifying information, while the infrastructural development and cultural heritage management are concerned with accessing, filtering and using existing resources. The antiquarian work role involves organisation and storing. The public dissemination and academic teaching roles encompass distribution and the field archaeology comprises using and creating.

The layout of the work roles on the life-cycle of information shows clearly that the archaeological work is multi-faceted even within the context of one individual work role. The occupational profiles of the individual informants distribute over the complete meta-process of archaeological information and the life-cycle of information. The typical work-flows of the individuals on an institutional or operative level are difficult to establish. A characteristic profile consists of diverging roles, which are combined to a varying extent. In spite of the variety, the scattering of the individual foci of the information interactions is relatively low. The occupational pro-

files of some of the informants grasp the entire information life-cycle, even though the profiles were mostly biased towards some of the broad sectors of the life-cycle model.

### *Discussion and Conclusions*

The success of the archaeological information work relies on the convergence of a variety of factors. In spite of the general complexity of the phenomenon, certain factors do clearly have a more profound effect on the fortunes of the work and information work than others. The idea of analysing critical success factors (CSF) is based on that particular observation. The analysis of the success factors and the later developed Critical Success Factor method has been a widely used approach in the information management research starting from an influential article by DANIEL (1961). The approach was later elaborated and made popular by ROCKART (1979) and used by, for instance, WIDÉN-WULFF (2001).

The findings of the present study, especially the observations on the pertinence of change, transience of authority, adequacy, fitness and appropriateness have deep effects on the dynamics of archaeological information work. They invite the proposition that the critical success factors of the archaeological information work may be collated in the notions of *fit* and *sustainability*. Besides mastering the practical characteristics of the work and information work process, the informants felt clear about the precise work they were personally involved in. The major issues and the consequent critique was pointed towards the frame of the archaeological work (i.e. resources, HUVILA 2006, 112–115) and of the related information work (e.g. the issues of findability and usability of information, HUVILA 2006, 229–254).

The notion of fit relates to the mutual coherence of the communities of stakeholders. The most fundamental problem of fit in the archaeological information process is the problematic gap between past human beings and the present community of archaeologists. It is essentially a scholarly issue of archaeology, but its presence has also a large impact on the information work. An equally consistent information management issue of fit is the bridging of the gaps between the different work roles and the notions of work within the community of archaeologists. The polarisation of the archaeological work to the professional and scholarly spheres needs special attention. The professional work needs to become

even more professional by developing the processes and by emphasising both the economic and usage oriented criteria. At the same time the scholarly work should be given a proper position and space in the work process in order to allow the intellectual benefits to emerge. At present, it is clear that the needs and viewpoints of the producers and users of the archaeological information do not meet at a satisfactory level, and the archaeological work risks both the wasting of resources and the loss of unrecoverable knowledge potential through an only partially effective management of the information resources and knowledge.

The sustainability of the archaeological information work concerns the physical endurance of the monuments and archaeological collections, and the economic sustainability of the maintenance work. Another dimension of the sustainability is the sustainability of the transfer of the intellectual work in archaeology. The paradigms, priorities and manners of expression do change over time. Despite the changes, the ability to communicate the information needs to be maintained and, in effect, made sustainable over time. A focus on the amount and technical accuracy of the minute technical details of the documentation is not enough to attain this objective. A special emphasis is needed on the communication of the purposes, meanings and values of the work, plus the contexts and situations of the information.

The analysis of the informants' information work and information source use also rationalised a series of explicit recommendations, which affect the management and support of the archaeological information work:

- 1) The prevalent positive attitudes towards digital data repositories and information resources should be taken as an impetus to work further on computerised archaeological information management and the development of electronic information resources.
- 2) The present efforts to secure the completion of a comprehensive documentation of each archaeological investigation need to be further emphasised to avoid the loss of information due to inadequate or unfocussed reporting. Simultaneously, there is a need to consider more closely the relationship of the documented details and their relevance to the presumable forthcoming use of the reports.
- 3) The findings of the present study suggest that the process of emergence of knowledge could be better described as something happening than

something being done. Even if a large amount of knowledge related activity is intentionally knowledge orientated, the studied material clearly shows that the constituent factor behind the eventual knowledge is not something “being done”, but rather something “taking place”, because a diversity of things are being done. The archaeological fieldwork provides a means to construct an estimation of past human activities in the relative vicinity of a precise geographical location. The actual estimation is not, however, a predetermined construction, but an amalgam of intentions, and of contextual, systemic, infrastructural and environmental determination. The process is controllable, but only to an extent.

- 4) The physicality of information bears a special significance in the archaeological information work. It seems that the development of the archaeological information practises and techniques need to be explicitly sensitive to the physicality and careful in the attempts to substitute it.
- 5) Considering the patterns of information use in the archaeological work, the findings of the present study indicate the constituency of maintaining a persistent framework of data structures, the need for a special emphasis on the tracing and description of the relationships between different entities present in the information infrastructures, a focus on the purposes, meanings and values associated with the information, and of allowing the information itself to be contextually determined.

Besides the two critical success factors and the list of recommendations, a further key observation of the present analysis of the archaeological work relates to the overall significance of the information work in the context of archaeology. It is apparent that the archaeologists need increasingly thorough education in the information management related topics such as documentation, storage, management and use. It is important to raise the awareness and understanding of the information management and the mastering of the related basic techniques among the archaeology professionals themselves. Besides this elementary work, it is apparent that there is a further need for a group of information management specialists with a thorough understanding and experience of the archaeological frame of reference.

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