

## Archaeology of the ballpoint pen or the interpretation and significant properties of archaeological findings

Isto HUVILA<sup>1</sup>

<sup>1</sup> Department of ALM, Uppsala University and School of Business and Economics | Åbo Akademi University

**Abstract:** Interpretations, meaning and the question of significant properties in the context of contemporary archaeological archiving are complex issues that pertain to the entire archaeological information process and spans from the past human activity to the deposition processes, field archaeology, documentation, archiving and interpretation of archaeological data. The aim of this study is to increase our understanding of the premises of how archaeologists interpret artefacts and to explore techniques for incorporating these premises as a part of an information system. The study is based on the analysis of the interviews of 25 Nordic archaeologists conducted by the author. The analysis of the interview transcripts resulted in three broad categories of properties of archaeological findings (A: observations, B: context of discovery and C: context of use). On the basis of the study, a prototype of a wiki-based framework was developed for capturing, expressing and debating the interpretations of digital archaeological data.

**Keywords:** archaeological information, meaning, documentation

### Introduction

The question of capturing and preserving interpretations, meaning and the significant properties in the context of contemporary archaeological archiving are complex issues that pertain to the entire archaeological information process. The making and re-making of meaning spans from the past human activity to the deposition processes, field archaeology, documentation, archiving and interpretation of archaeological data. In contrast to the rather prevalent polarism of technological (e.g., digital preservation standards, technical authenticity of digital repositories) and social approaches (e.g., institutional and individual trust, authenticity certifications, trustworthiness of interpretations) to the management of significant aspects of the data in archival and digital preservation studies oriented literature, there are fewer studies that simultaneously look into them both from a processual rather than merely ontological point of view (for exceptions, see e.g. KHAZRAEE & KHOO, 2011). The social and technological side of data and its use are intricately intertwined facets of a single aspect of the general process of interpretation and giving meaning to archaeological finds. The present study assumes a combined exploratory approach to the problem by discussing the premises of interpretations in archaeology and their representation. The aim of this study is to increase our understanding of the premises of how archaeologists interpret artefacts and to explore techniques for incorporating these premises as a part of an information system. This study is based on the analysis of the interviews of 25 Nordic archaeologists conducted by the author with a specific emphasis of the part of the interview related to the interpretation of archaeological objects. The interviewees were asked to discuss the interpretation and significant properties of archaeological objects and information with a specific reference to

a ballpoint pen as a hypothetical archaeological find. In contrast to earlier studies based on personal experiences, action research and ethnographies of specific projects (e.g. KHAZRAEE & KHOO, 2011; HUVILA, 2012), the use of a hypothetical archaeological object helped the interviewees to discuss their interpretative process on a more abstract level than in the context of a single project or type of find (object) or finding (i.e. all things archaeologists can find including objects, structures and sites). On the basis of the study, a prototype of a semantic wiki-based framework was developed for capturing, expressing and debating the interpretations of digital archaeological data was developed.

## Literature review

There is a relative abundance of theoretical literature on the meaning of archaeological findings. Archaeology has moved from being a predominantly antiquarian to become a positivistic and processual and further, a post-modern, hermeneutic and post-processual discipline (TRIGGER, 1989; HODDER, 1991; BUCHLI, 2007; LUCAS, 2012). The dominant premises and practices of interpreting the archaeological record have tended to change accordingly even if it is characteristic of the discipline that the earlier paradigms have been complemented rather than replaced by the new perspectives. In spite of certain tendencies to dichotomise between extreme and naive forms of empiricism and social constructivism, there is a relatively broad consensus that archaeological knowing have both social and empirical dimensions. As LUCAS (2012) suggests, archaeological record is about the past and how the past is discussed at the present. GARDIN'S (1980) cyclical model of archaeological reasoning visualises the same process as a cycle of observations and comments. Whereas the individual objects, measurements and field observations are (to a certain degree) less subjective, their authenticity in relation to specific pasts and their meaning in our contemporary society are questions of the past at the present. HOLTORF (2013) proposes that the authenticity (and meaning) derives from the material aspects of an archaeological object, but are fundamentally a result of how these aspects are perceived and experienced. The challenges of archaeological interpretation and documentation have been discussed in the context of empirical studies of how archaeologists work with information and knowledge (e.g. HUVILA, 2006; DAVIDOVIĆ, 2009; EDGEWORTH, 2006). The outcomes of the analysis of archaeological data, an understanding of the meaning and significance of archaeological finds are based on a complex melange of qualitative and quantitative data that originates from the archaeological stratum, earlier collective and personal experiences of participating individuals, archaeological literature, diverse analysis results and comparisons with other sites and materials. The body of relevant data consists, for instance, of measurements, scientific analysis results, objects, samples, drawings and photographs (GREENE, 1998). The different types of materials are seldom comparable *per se* and each type of data and findings tend to be interpreted according to specific conceptual models, which differ from one type of data to another (SIGNORE, 2009). This makes the codification and representation of different types of archaeological data an intricate problem (ORLANDI, 1993). Semantic technologies have been proposed as a solution to the problems of heterogeneity (SIGNORE, 2009), but at the same time, ontology and RDF based approaches have been criticised for assuming a too rigid formal approach for describing often highly uncertain and complex archaeological data (e.g. DE LUCA et al. 2006; ISAKSEN et al., 2011; MARTINEZ & ISAKSEN,

2010; SIGNORE, 2009; STENZER et al., 2011). Even if the most typical approach for accommodating both formal and unstructured data has been to use parallel systems, there are hybrid technologies such as semantic wikis that have been demonstrated to provide means for the management of different forms of semantic data and unstructured information within a single framework (HUVILA, 2012).

Besides the complexity and heterogeneity of data, the incompleteness of available archaeological information and the ambiguous relation of primary data and the consequentially emerging archaeological knowledge (THOMAS, 2006) is a challenge for the management and preservation of archaeological information. In spite of the increased precision of measurements and the growing amount of available data, the documented and documentable data represent always an unknown sample of the original data. Another related problem is that even the theoretical 'complete corpus of original data' consists only of miscellaneous remnants of past human and natural processes and is capable of providing only indirect evidence of the past human activity (LUCAS, 2012). Therefore, even in the best possible case, all archaeological inferences about the past are based on imperfect information, which varies in detail, type and quality and contains an unknown and unruly bias.

The intricacies of archaeological information do not, however, end with the documentation itself. Typical archaeological information practices tend to lead to additional discontinuities in the information process (GREENE, 1998) or the information continuum (OLIVER, 2010). Time constraints are a major contributing factor to that the focus of fieldwork is in excavation and data gathering. Interpretation and analysis takes place often months or even years later in post-excavation and reporting phases. In many cases, the actual fieldwork and later analyses and interpretations are made by different individuals. The discontinuities have been argued to be a major problem and a factor that leads to a suboptimal documentation of archaeological sites and investigation processes (THOMAS, 2006, 30) and undermine the scientific basis of archaeology (BERGGREN & HODDER, 2003).

Archaeology and archaeological information process differs from many other branches of the study of materialities and their respective information processes in that that for an archaeologist the materiality of material objects is, as BUCHLI (2007) notes, constitutive rather than arbitrary. The work with constitutive materiality function in parallel with the archaeological information process, which deals (from an archaeological perspective) with arbitrary and secondary forms of materiality. However, even if archaeology can be seen as a form of material culture studies *par excellence* (PREUCEL & MESKELL, 2007) and the process of interpreting archaeological findings as a constitutive process of "proposing meanings to objects" (GUARINELLO, 2005, 19), the subsequent informational process of relating these meanings and interpretations to the human past moves archaeologists from a constitutive to an arbitrary level of materiality. Similarly to the corresponding informational processes in interdisciplinary material culture studies (see e.g. TILLEY et al., 2006), the archaeological interpretations of the past can be described as outcomes of a mangle of practice (PICKERING, 1995), a complex interplay of material objects and human actors, rather than as a verbatim outcome of a direct investigation of the materiality. Drawing on Clark's (CLARK, 2003) and Donald's (DONALD, 1991) work on *hybrid mind*, a mind made of multiple "mergers and coalitions" (CLARK, 2003, 7) with external entities, SÄLJÖ (2012) makes remarks of how the contemporary digital tools function as an external memory system and how "many of these resources and our practices are conditioned by their continuous presence in our activities; we achieve results by using them". According to BENGTSSON

(2006), the material objects (such as media) have also a symbolic dimension that defines borders of activities in the everyday life. In the context of archaeology, NEWMAN'S (2011) remarks of recording exemplifies this interplay of materialities and interpretations by highlighting how recording and documentation influence and frame the archaeological perception of a site.

In contrast to the work with constitutive materiality of archaeological objects, both the documented practices of archaeological information work and the contemporary theorising point to that the significant properties of archaeological finds are situated and dependent on the experience, expertise and insights of interpreting archaeologists and their involvement in the different phases of the archaeological information process. In this context an interpretation is an argument made for the significance (or insignificance) of a find rather than an objective description of an observable state. The argumentative and practiced discursive nature of interpretations has been acknowledged in the methodological discussions (e.g. reflexive archaeology, HODDER, 2003), but has been reflected explicitly only somewhat occasionally in the development of new archaeological information systems and the representation of archaeological information (for exceptions, see e.g., HODDER, 2000; MORGAN, 2009; HUVILA, 2012; VATANEN, 2004). When the aspects of reflexivity or discursiveness have been considered, the practical implementations have had a certain tendency to be formal and structured rather than explicitly discursive (e.g. VATANEN, 2004; ESTEVA et al., 2010). Even if the introduction of technologies such as video diaries have been helpful in capturing unstructured utterances (KULITZ & FERSCHIN, 2013; BRILL, 2000), the most common mechanism of capturing reflexive data is freeform textual fields implemented in different database systems. In contrast to rich forms of media (video, audio, 3D), they are both easy to implement, search and retrieve at the present, and manage in the long run. A central problem that remains is that even if the significance of reflexivity and documentation of the documentation is acknowledged as a core function of archaeological documentation and a central premise of interpretation, there are widely different ideas of what to document and how.

Besides making a general remark of the complexity of archaeological information work, it is possible to summarise the main challenges capturing and preserving interpretations and significant aspects of finds and findings as related to 1) data and archaeological objects, their limits and intricacies, and 2) to the limits and complexities of archaeological information work. Considering this double-bind of process and information, it is feasible to suggest that the both need to be considered and addressed in the analysis of archaeological meaning making.

## **Methods and material**

The empirical material analysed in the present study consists of thematic interviews (HIRSJÄRVI & HURME, 1995) of 25 Swedish and Finnish archaeologists conducted by the author. The work profiles of the informants combined several aspects of archaeological work. None of them could be considered, for instance, as a 'pure' field archaeologist without any other duties. The method of selecting informants was based on theoretical sampling (GLASER & STRAUSS, 1967). The sample was balanced for relative representativity in terms of nationality, principal professional duties, archaeological expertise, institutional affiliation, place of study, geographical location of employment and gender. For the purpose of giving references, each of the 25 individuals was assigned a random number between 1 and 25. These figures are

used inside parentheses (e.g. #1) in all citations and references in the present text. The focus of the interviews was to discuss the practices and premises of archaeological work and information use. The length of the individual interviews varied between 105 and 180 minutes (median 150 minutes). The focus of the analysis was on one particular question: “How would you interpret this item [a ballpoint pen], what is interesting or important in it, what it might tell you as an archaeological object?” In addition, information with a direct relevance to the present discussion in other parts of the interviews were also included in the analysis. A hypothetical archaeological object was chosen instead of a ‘real’ artefact to avoid standard context and artefact type specific answers (e.g. pottery sherds or animal bones are always interpreted like this).

The interview data was transcribed and analysed using constant comparative method (GLASER & STRAUSS, 1967) to discern patterns of related to document use and especially their possible functions as boundary objects. Finally, after a preliminary analysis was finished the material was revisited using negative case-analysis (LINCOLN & GUBA, 1985, 309-313) with a specific purpose of finding contradictory evidence (as e.g. in ZACH, 2005) that would decrease the reliability of the drawn conclusions.

The empirical approach has some obvious limitations. Even if the theoretical sampling based method of selecting informants does not rely on quantities, the interviewed sample is relatively small and limits the possibilities to generalise the expressed views beyond the specific context of the group of interviewees. In order to control the overexpression of individual opinions, the presented analysis is based on views expressed by multiple informants. In spite of the limitations of the methods and material used, considering the exploratory aim of the present study, the lack of broader representativity were not considered to be a major issue. It is also obvious that the interview method and the use of hypothetical archaeological object in the analysis had both advantages and limitations. In an interview, the informants have an opportunity to articulate their intellectual process. At the same time, however, the resulting interview record is a subjective, consciously formulated and biased narrative. Similarly, while the use of hypothetical archaeological object helped the interviewees to decontextualise and generalise their thinking, at the same time, it also recontextualised their thinking to a situation that does not represent a naturalistic context of archaeological work. Conscious of these biases, the analysis places special emphasis on distinguishing articulations of practices and ideals (what informants would do vs. what they thought they should be doing), and on identifying the general (for their archaeological thinking) versus particular (for the specific object) in how the interviewees analysed the ballpoint pen as an archaeological object.

## Analysis

The analysis of the interview record revealed three broad groups of premises of interpreting a ballpoint as an archaeological object:

### A

#### Observations

- size
- form
- weight
  - o material
  - o object
- wear marks
- colour
- dating
- taste
- odour
- sound

### B

#### Context of discovery

- known
- alone
- unconventional

### C

#### Context of use

- comparison
- assumption
- experience/reaction
- trials of use
- trials of making
- reference
  - o literature
  - o colleague

All informants made some remarks of the observable characteristics (*observations*) of the analysed object. Informants tended to start their analysis by commenting on these features. Interviewees noted the *size* (length, diameter, breadth) of the pen as significant characteristic. Four informants (#14, #16, #21, #22) noted that the *form* of the object was interesting. Interviewees made also remarks of its *weight* and the weight of the material of the pen (plastic). Some informants also noted minor wear marks in the pen. Both the *size*, *weight* and *wear marks* lead to inferences on the possible uses of the object. Light weight was assumed to make a pen easily portable and the wear marks could tell something about how the pen might have been used. Several informants also noted the colour of the pen. Three of the interviewees (#2, #10,

#13) told explicitly that they would turn it around and see it from different angles to get new perspectives to the object. In practice, however, everyone turned the object in their hands while they were talking about it even if they did not comment their actions aloud. The *dating* of the object was similarly discussed by multiple informants as a factor that influences their interpretation. Most of the interviewees discussed the possible dating of the object on comparative premises. It is possible to check when the particular types of plastic and metal alloys have been used in the production of similar objects. Also the mechanism might be datable. Also the shape of the object might be helpful in dating the object on the basis of a typology and comparisons with written and photographic evidence of ballpoint pens. Three (#3, #7, #18) of the informants made remarks of the small text found in the object: “Made in Japan”. Finally, individual informants made remarks of the possibility to smell and taste the object for taste, texture and smell or to listen to the sound of the object (the mechanism).

The second category of observations related to the *context of discovery* of the object. The first most obvious observation made by the most of the informants was that they knew (the context is *known*) that the object was a ballpoint pen. Multiple interviewees noted that this knowledge makes it difficult to give a non-biased interpretation. The informants (e.g. #8, #9) noted that the fact that the object was presented to them *alone* as an loose item without any obvious context complicates interpretation and assessment of its authenticity: “Generally speaking one might say that you want to have a context, it makes the object” (#9). Some of the informants made references to the interview situation and interpreted the object in its context in the hand of the interviewer (e.g. #17, #19). Otherwise the context would have probably provided traces and clues that would have helped to properly interpret it. One of the informants noted also that an *unconventional* context of discovery might have a significant impact on the interestingness and interpretation of the object: “if I found this pen without anything, it would not be interesting, if I found it struck in the heart of a man, it would be terribly interesting” (#8).

The third category of observations related to the actual or assumed *context of use* of the object. Several informants noted that they would like to make *comparisons* to similar objects or objects with a potentially similar function. One of the informants (#1) noted that the object reminds of a spearhead, even if a closer look at the material might suggest that it might not be durable or sharp enough to be very effective. Several informants also told that they would make plain *assumptions* of what the object might be. A related category of approaches is to rely on earlier *experiences* (“Experience of the pen is an important part of the interpretation” #13), or to take one’s own first *reaction* to the object as a starting point. Informant #4 would consider how she would “react on form issues” of the object. Interviewee #16 “try to see how it has been manufactured: try to “see” the hands who have made the object”.

A common approach was also to *try to use* the object in different ways and to see what might happen. Similarly, the informants suggested that it might be useful to consider why would this kind of a mechanism have been developed? One interviewee suggested also an experimental approach of *trying to make* the object. Finally, a common approach was to seek references either from literature or by asking potentially knowledgeable colleagues. One informant would “draw a picture and show it to a colleague” (#1) and another would “look for similar objects in the literature” (#2). Interviewee suggested of trying “you look at different parts of it and would figure out some kind of a function” (#10).

## Interpretative process

Not surprisingly, the interviewees' ideas of the interpretation of the presented hypothetical archaeological objects parallel with those presented in the literature. In general, similarly to the earlier studies of archaeological information and knowledge production processes (e.g. HUVILA, 2006; DAVIDOVIĆ, 2009; EDGEWORTH, 2006), the process of assessing the authenticity and meaning of a ballpoint pen can be best described from the perspective of complexity. There was apparent cyclicity or spirality in the interpretative process that resembles the model of GARDIN (1980). Observations lead to interpretations that lead to further observations.

There are apparent limitations in the study. The material represents in practice a convenience sample of archaeologists from two Nordic countries and the qualitative inferences are generalisable only in an analytical sense. The use of hypothetical archaeological objects opened possibilities to shift the discussion with informants to a higher level of abstraction, but at the same time a lot of contextual richness was lost, an aspect frequently commented by the informants (e.g. #18, #19). The discussion of a contemporary object as an archaeological finding extends the chain of interpretation described by LUCAS (2012). The informants discussed the present (ball-point pen) in the past (in the context of archaeology) at the present in contrast to how, according to LUCAS (2012) the archaeological record is about the past and how the past is discussed at the present. At the same time, however, it was clear that even if the familiarity of the hypothetical object both facilitated and complicated the interpretative process, the general patterns of how the interviewees described their reading of the object were based on the experiences of both contemporary and past material culture, indifferent of the age of the artefact. Similarly to how the studies in the sociology of work has noted that the principled preference for 'scientific' evidence-based rather than experience-based knowledge has not reduced the practical significance of experience in different context from nursing to industrial work, it is apparent that also archaeological interpretation is guided by similar melange of experience and scientific, rational rigorosity. The interpretative process can be described as a *subjectifying action* (BÖHLE, 2013), interplay between subjective and objective constructions of reality. As BÖHLE (2013) proposes, subjectifying action does not only open additional sources of information for an individual. The additional sources of information are looked at from different perspective as a part of an interactive process.

Similarly to HOLTORF (2013), the interviewees tended to see the authenticity and meaning of the ballpoint pen as a derivative of material cues combined with experiences and the "age-value" of the object. The fact that the informants tended to start their analysis of the ballpoint pen by making remarks on the observable characteristics underlines this process and how the experiences build on the material cues of the objects. Similarly to BENGTTSSON'S (2006) study of media use in everyday life, the interviewees remarks showed how the material characteristics of the ballpoint pen created borders to how the archaeologists interacted with them and how particular types of characteristics of the object tended to lead to particular types of interpretations. Altogether five informants (#1, #14, #15, #21, #22) made references to the shape of the object and how it influenced their interpretations. The material of the object was commented similarly as a characteristic that guided the inquiry of the informants.

The three categories (A-C) that emerged in the analysis are also indicative of the interpretative process at large. The observations in the category A relate to the scrutiny of material objects in a constitutive sense (as in BUCHLI, 2007). In these observations the objects are of primary interest to archaeological reasoning and



meaning-making. In contrast, the contextual inferences made in categories B and C are a part of a constitutive process of “proposing meanings to objects” (GUARINELLO, 2005, 19) and tied to an informational process of working with archaeological information. The objects and their materiality become a part of a hybrid mind (DONALD, 1991; CLARK, 2003) of archaeologist. Their material properties enable direct and arbitrary connections to earlier experiences of other objects and their known and assumed contexts of use and production. They become a part of the archaeologists’ memory system and means to achieve ‘results’ (SÄLJÖ, 2012) i.e. interpretations and ideas of how the objects relate to the human past. In terms of Pickering, the role of archaeological objects in the interpretative process in the categories B and C can be described as a *mangle of practice* (PICKERING, 1995), a ‘mangle’ of human practices and material objects.

### Proposed system design

On the basis of the analysis we suggest that it might be useful if an information system could capture and represent the aspects of interpretative process in a semi-structured sense. This could help users of the system to get an overview of the premises and supporting evidence of the presented interpretations, and elicit discussion and debate on function and authenticity of the objects. A reference system was developed on the basis of the analysis and implemented as a structured Talk page in a Semantic Mediawiki based archaeological information infrastructure (Fig. 1). The proposed setup combines semantic technologies that have been suggested as useful in addressing the problems of heterogeneity (SIGNORE, 2009), but at the same time could capture the argumentative and complex nature of archaeological data (e.g. DE LUCA et al.; ISAKSEN et al., 2011; MARTINEZ & ISAKSEN, 2010; SIGNORE, 2009; STENZER et al., 2011). The approach is unable to address the incompleteness of available archaeological information, but can help to make the often ambiguous relation of primary data and the consequentially emerging archaeological knowledge (THOMAS, 2006) more transparent and to address the problematic discontinuities (e.g. GREENE, 1998; THOMAS, 2006; BERGGREN & HODDER, 2003) in the continuum of archaeological information.

The system was realised as a threaded discussion. The threads were constructed according to the interpretative model developed on the basis of the empirical study. Each category of premises (A-C) was represented as a single discussion thread, and the messages were coded with semantic tags according to the sub-categories referred to in the argument. Arguments can be written or communicated by using links, RDF triplets, images and other types of digital files that can be attached to the comments. The approach builds on the notion of reflexivity (HODDER, 2003) and earlier proposal of using argumentation theory as basis for constructing documentation systems (VATANEN, 2004). The threads provide a framework for comments and reflection on different central aspects of the findings that is semi-structured and supports the inclusions of both freeform utterances and structured formal descriptions.

After completing the prototype, the system was evaluated using a combination of simple heuristics (whether it contains all necessary functionality for entering the data described by the interviewees) and a description of a small number of test artefacts derived from collection catalogue of the Finnish National Museum. The

tests proved the basic usability of the approach even if its practical usefulness need to be determined in comprehensive field trials after the proposed functionality has been implemented in a documentation system

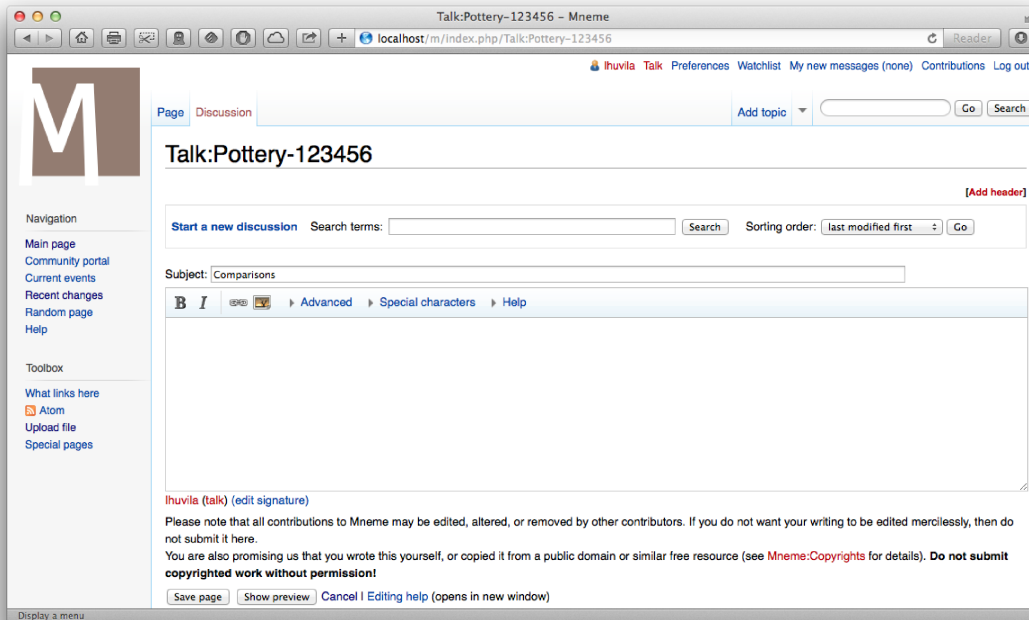


Fig. 1 – Screen capture of the prototype system (Copyright Author)

Both the proposed approach and implementation has some obvious issues that need to be taken into consideration. As WARWICK et al. (2009) note, the concerns do not only limit the usability and reliability of technology, but also pertain to the quality of the data being entered by the users of the system. Even if the findings underline the interactive and discursive nature of interpreting archaeological objects and determining their authenticity, there is plenty of evidence on the difficulty of eliciting online discussions (e.g. ARDICHVILI, 2008). Explicit discussions in online environments can be experienced time consuming (e.g. CURRAN et al., 2009; RIEGE, 2005) and there are many obstacles that hinder effective relocation of the largely implicit interpretative process to an explicit semi-structured information environment (e.g. HUVILA, 2012). Also the timing of the discussions and the potential challenges of engaging people to participate can be problematic. At the same time, it is necessary to structure the information and add semantic metadata in order to facilitate structured retrieval, for instance, interpretations relating to all objects that say “knack”.

Another aspect that needs to be taken into account is that the technique of discussions is essentially a trade-off between the searchability and manageability of highly structured metadata (ESTEVA et al., 2010) and flexibility and expressive power of non-structured data, for instance, in form of video clips (BRILL, 2000). The proposed categorisation provides a structured framework for freeform textual and visual descriptions and the argumentation process itself.

Finally, it is also necessary to consider the materiality and role of the proposed system as well. As SÄLJÖ (2012) notes, digital technologies have become a part of the hybrid mind of their users. This applies even to the prototype. It functions as a memory device, but influences also how interpretations are made. It sets borders of the behaviour of its users (as in BENGTTSSON, 2006) and becomes a material agent (as in

PICKERING, 1995) in the process of how the interpretations are made. Even if it would be tempting to judge the system's interference in the interpretative process as a problem, it does not need to be a negative phenomenon. It is merely something that has to be taken into consideration when designing the system (are these changes desirable or tolerable) and evaluating it during its use (is the system doing what it is supposed to do, and what else is happening).

## Conclusions

This study analysed the premises and the process of how archaeologists interpret artefacts using a ball-point pen as a hypothetical artefact. On the basis of the findings of an empirical study of the interpretation process, a prototype system was developed for capturing, expressing and debating the interpretations of digital archaeological data. The use of hypothetical archaeological object in the process helped the informants to anchor their discussion of the significant aspects of archaeological objects on their general properties instead of conferring the often highly context specific situational factors of individual materials and projects. The analysis of the interview transcripts showed that the interpretations and the resulting archaeological information builds on a mangle of observable characteristics and contextual inferences of the place of discovery and assumed use of the findings that together constitute their archaeological meaning. A prototype system was developed on top of a semantic wiki and threaded discussion component. The system builds on the categories of significant aspects of archaeological findings (observations, contexts of discovery, context of use) that emerged in the analysis of the interview data from the empirical study and provides one possible approach to tackle helps to highlight the processual, parallel and dual, socio-technical nature of authenticity of digital archaeological information and materials.

## Acknowledgements

This study is a part of the research project Archaeological information in the digital society (ARKDIS), funded by the Swedish Research Council Grant (VR) grant 340-2012-5751.

## References

- ARDICHVILI, A. (2008). Learning and Knowledge Sharing in Virtual Communities of Practice: Motivators, Barriers, and Enablers. *Advances in Developing Human Resources*, 10(4), 541–554.
- BENGTSSON, S. (2006). Symbolic spaces of everyday life : work and leisure at home. *Nordicom Review*, 27(2), 119–132.
- BERGGREN, A., & HODDER, I. (2003). Social Practice, Method, and Some Problems of Field Archaeology. *American Antiquity*, 68(3), 421–434.
- BÖHLE, F. (2013). Subjectifying Action as a Specific Mode of Working with Customers. In W. Dunkel, & F. Kleemann (Eds.) *Customers at Work : New Perspectives on Interactive Service Work*, (pp. 149–174). Basingstoke: Palgrave Macmillan.
- BRILL, D. (2000). Video-recording as part of the critical archaeological process. In I. Hodder (Ed.) *Towards reflexive method in archaeology: the example at Çatalhöyük*, (pp. 229–234). Cambridge: McDonald Institute for Archaeological Research.
- BUCHLI, V. (2007). Material Culture: Current Problems. In L. Meskell, & R. W. Preucel (Eds.) *A Companion to Social Archaeology*, (pp. 179–194). Oxford: Blackwell.
- CLARK, A. (2003). *Natural-born cyborgs : minds, technologies, and the future of human intelligence*. Oxford: Oxford University Press.

- CURRAN, J. A., MURPHY, A. L., ABIDI, S. S. R., SINCLAIR, D., & MCGRATH, P. J. (2009). Bridging the Gap: Knowledge Seeking and Sharing in a Virtual Community of Emergency Practice. *Evaluation & the Health Professions*, 32(3), 314–327.
- DAVIDOVIĆ, A. (2009). *Praktiken archäologischer Wissensproduktion – Eine kulturanthropologische Wissenschaftsforschung*. Münster: Ugarit-Verlag.
- DE LUCA, P., GENCO, L., DENTAMARO, F., PERRINO, G., CANNITO, C., D'ELIA, G., & DI ZANNI, A. (2006). Towards a Core Ontology for Sharing Knowledge about Cultural Heritage. Abstract of a paper presented in the 34th Annual Meeting and Conference of Computer Applications and Quantitative Methods in Archaeology CAA2006, Fargo, April 18-21, 2006.
- DONALD, M. (1991). *Origins of the modern mind : three stages in the evolution of culture and cognition*. Cambridge, MA: Harvard University Press.
- EDGEWORTH, M. (2006). *Ethnographies of Archaeological Practice: Cultural Encounters, Material Transformations*. Lanham, MD: Altamira Press.
- ESTEVA, M., TRELOGAN, J., RABINOWITZ, A., WALLING, D., & PIPKIN, S. (2010). From the site to long-term preservation: A reflexive system to manage and archive digital archaeological data. In *Archiving Conference*, vol. 2010. Society for Imaging Science and Technology.
- GARDIN, J.-C. (1980). *Archaeological constructs : an aspect of theoretical archaeology*. Cambridge University Press.
- GLASER, B. G., & STRAUSS, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research*. Hawthorne: Aldine.
- GREENE, K. (1998). *Archaeology: An introduction*. London: Routledge.
- GUARINELLO, N. L. (2005). Archaeology and the Meanings of Material Culture. In P. P. Funari, A. Zarankin, & E. Stovel (Eds.) *Global Archaeological Theory: Contextual Voices and Contemporary Thoughts*, (pp. 19–27). New York: Kluwer.
- HIRSJÄRVI, S., & HURME, H. (1995). *Teemahaastattelu*. Helsinki: Yliopistopaino.
- HODDER, I. (1991). Interpretive Archaeology and Its Role. *American Antiquity*, 56(1), 7–18.
- HODDER, I. (2000). *Towards reflexive method in archaeology: the example at Çatalhöyük*. Cambridge: McDonald Institute for Archaeological Research.
- HODDER, I. (2003). Archaeological Reflexivity and the "Local" Voice. *Anthropological Quarterly*, 76(1), 55–69.
- HOLTORF, C. (2013). On Pastness: A Reconsideration of Materiality in Archaeological Object Authenticity. *Anthropological Quarterly*, 86(2), 427–443.
- HUVILA, I. (2006). *The ecology of information work – A case study of bridging archaeological work and virtual reality based knowledge organisation*. Åbo: Åbo Akademi University Press. Diss. Åbo Akademi University.
- HUVILA, I. (2012). Being Formal and Flexible: Semantic Wiki as an Archaeological e-Science Infrastructure. In M. Zhou, I. Romanowska, Z. Wu, P. Xu, & P. Verhagen (Eds.) *Revive the Past: Proceeding of the 39th Conference on Computer Applications and Quantitative Methods in Archaeology, Beijing, 12-16 April 2011*, (pp. 186–197). Amsterdam: Amsterdam University Press.
- Isaksen, L., Martinez, K., Earl, G., Gibbins, N., & Keay, S. (2011). Interoperate with whom? Archaeology, formality and the semantic web. In *Proceedings of Computer Applications and Quantitative Methods in Archaeology*. Computer Applications and Quantitative Methods in Archaeology.
- KHAZRAEE, E., & KHOO, M. (2011). Practice-Based Ontologies: A New Approach to Address the Challenges of Ontology and Knowledge Representation in History and Archaeology. In E. Garcia-Barriocanal, Z. Cebeci, M. C. Okur, & A. Öztürk (Eds.) *5th International Conference, MTSR 2011, Izmir, Turkey, October 12-14, 2011. Proceedings*, (pp. 375–386). Berlin, Heidelberg: Springer.
- KULITZ, I., & FERSCHIN, P. (2013). Archaeological Information Systems. In H. G. Bock, W. Jäger, & M. J. Winckler (Eds.) *Contributions in Mathematical and Computational Sciences*, vol. 3, (pp. 147–155). Berlin, Heidelberg: Springer.
- LINCOLN, Y. S., & GUBA, E. G. (1985). *Naturalistic Inquiry*. Beverly Hills: Sage.
- LUCAS, G. (2012). *Understanding the archaeological record*. Cambridge: Cambridge University Press.

- MARTINEZ, K., & ISAKSEN, L. (2010). The semantic web approach to increasing access to cultural heritage. In C. Bailey, & H. Gardiner (Eds.) *Revisualizing Visual Culture*, (pp. 29–44). Farnham; Burlington, VT: Ashgate.
- MORGAN, C. L. (2009). (Re)Building Çatalhöyük: Changing Virtual Reality in Archaeology. *Archaeologies*, 5(3), 468–487.
- NEWMAN, M. (2011). On the Record: The Philosophy of Recording. *Internet Archaeology*, (29).
- OLIVER, G. (2010). Transcending silos, developing synergies: libraries and archives. In *Information Research 15 (4). Special Supplement: Proceedings of the Seventh International Conference on Conceptions of Library and Information Science – Unity in diversity – Part 2*.
- ORLANDI, T. (1993). Sulla codifica delle fonti archeologiche. *Archeologia e calcolatori*, 4, 27–38.
- Pickering, A. (1995). *The Mangle of Practice: Time, Agency, and Science*. Chicago: University of Chicago Press.
- PREUCEL, R. W., & MESKELL, L. (2007). Knowledges. In L. Meskell, & R. W. Preucel (Eds.) *A Companion to Social Archaeology*, (pp. 3–22). Oxford: Blackwell.
- RIEGE, A. (2005). Three-dozen knowledge-sharing barriers managers must consider. *Journal of Knowledge Management*, 9(3), 18–35.
- SÄLJÖ, R. (2012). Literacy, Digital Literacy and Epistemic Practices: The Co-Evolution of Hybrid Minds and External Memory Systems. *Nordic Journal of Digital Literacy*, (pp. 5–19).
- SIGNORE, O. (2009). Representing knowledge in archaeology: from cataloguing cards to Semantic Web. *Archeologia e Calcolatori*, 20, 111–128.
- STENZER, A., WOLLER, C., & FREITAG, B. (2011). MonArch: digital archives for cultural heritage. In *Proceedings of the 13th International Conference on Information Integration and Web-based Applications and Services, iiWAS '11*, (pp. 144–151). New York, NY, USA: ACM.
- THOMAS, J. (2006). The Great Dark Book: Archaeology, Experience, and Interpretation. In J. Bintliff (Ed.) *A Companion to Archaeology*, (pp. 21–36). Malden and Oxford: Blackwell Publishing.
- TILLEY, C., KEANE, W., KÜCHLER, S., ROWLANDS, M., & SPYER, P. (Eds.) (2006). *Handbook of material culture*. Thousand Oaks, CA: SAGE.
- TRIGGER, B. G. (1989). *A History of Archaeological Thought*. Cambridge University Press.
- VATANEN, I. (2004). Argumentation paths in Information Infrastructure of the Archaeological virtual realities. In M. der Stadt Wien Referat Kulturelles Erbe Stadtarchäologie Wien (Ed.) *Enter the Past - The E-way into the Four Dimensions of Cultural Heritage. CAA 2003. Computer Applications and Quantitative methods in Archaeology. Proceedings of the 31st Conference, Vienna, Austria, April 2003. (On the accompanying CD-ROM)*, vol. 1227 of *BAR International Series*. Oxford: Archaeopress.
- WARWICK, C., FISHER, C., TERRAS, M., BAKER, M., CLARKE, A., FULFORD, M., GROVE, M., O'RIORDAN, E., & RAINS, M. (2009). iTrench: A study of user reactions to the use of information technology in field archaeology. *Lit Linguist Computing*, 24(2), 211–223.
- ZACH, L. (2005). When is enough enough? Modeling the information-seeking and stopping behavior of senior art administrators. *JASIS*, 56(1), 23–35.

#### Imprint:

Proceedings of the 18th International Conference on Cultural Heritage and New Technologies 2013 (CHNT 18, 2013)

Vienna 2014

<http://www.chnt.at/proceedings-chnt-18/>

ISBN 978-3-200-03676-5

Editor/Publisher: Museen der Stadt Wien – Stadtarchäologie

Editorial Team: Wolfgang Börner, Susanne Uhlirz

The editor's office is not responsible for the linguistic correctness of the manuscripts.

Authors are responsible for the contents and copyrights of the illustrations/photographs.