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Archaeological virtual reality as an infrastructure - exploring methods for a more practical information management

Introduction

Virtual archaeology suffers from a paradox of lacking, and of an overload, of resources. From a researcher's point there is seldom enough information on a particular site or subject to make satisfactory virtual representations of the past. From an information management point of view, virtual archaeology produces information and archivables in such amounts that their efficient storage and occasional retrieval becomes a critical issue. The key for managing both, the non-existent information and as a consequence, approximations and inconsistencies, and the existing data in the virtual models, is to develop functional measures for efficient and communicative documentation.

This article discusses documentation and usage issues of virtual reality documents in archaeology from the information management point of view. The focus is on defining theoretical premises on how and based on which grounds, a VR is a feasible research tool and a medium of communication in archaeology. The issue is conceptualised by using argumentation (Freeman 1991; Kircz 1991; Sillince 1992) and infrastructures (Star and Ruhleder 1994, Star 1995) approaches. From this discussion a proposal of "argument paths" is derived for an approach of enhancing usability of the archaeological virtual realities. Special emphasis is placed on supporting the functionality of the document by documentation strategies.

Multiple dimensions of archaeology

Different uses of virtual archaeological applications do raise a question on degrees and consequences of usage. Many of the possible practical applications of VR in archaeology proposed by Maurizio Forte (2000, 250-251) have by now, if not had by then, been realised in various projects, and a number of new functions for the techniques have been introduced since then. Another question on the extents of virtual archaeology as a phenomenon presented in the same article (Forte 2000, 250), has received, on the contrary, considerably less attention.[1] Despite the diversity of projects and definitions of, and definitions used of, virtual reality applications, the overall aims of VR in archaeology have remained more or less the same from the beginning. As a provocative generalisation might perhaps be argued that most of the researchers being aware of the conceptual problems regarding the visualisations in general, do wash their hands of the problem by emphasising their scientific and scholarly aims rather that providing aesthetic images. It is highly questionable whether the rationale and the significance of VA for the archaeology as a scientific discipline, have been explained or adapted to the practical applications consistently.

The thing in the VA is not in creating a spatio-temporal simulation of a past structure or phenomenon. The thing is how this practical achievement does progress the scientific research and in general, the understanding of the past. Barceló (2001) discusses the question insisting on the imperative of implementing a true interactivity by placing the focus on the communication aspect in the virtual, before the user experience can enter to a virtual reality proper. Emphasising communication may be grounded also on the derivative of the most commonly presented explicit motivations for creating VA applications, which is by no doubt disseminating knowledge of the past in the sense of communication. (Forte 1997, 12) The communication here has to be understood as a rather inclusive concept to consist of communication of a scientist to him/herself, communication within the scientific community and communication of science to the general public. In this sense even the personal research motive of creating virtual realities may be seen as a communication where a scholar arranges source data in a manner that the data communicates its essential information content back to the scholar him/herself.

Aspects of the communicativeness of the archaeological virtual realities have been recognised as a grave practical problem during recent years from the documentation point of view which is a familiar one for archaeology. The fear of not being able to deliver information on the accuracy of archaeological data and the premises on different interpretations to the audience has lead to a discussion on practical ways of documenting the models properly in scientific sense. (e.g. Ryan 2001, Pekkola 2002, Niccolucci and Cantone 2003, Vatanen 2003) As noted already (Vatanen 2003), the debate has been focused, from a quite atomistic point of view, on rather mechanical issues of inserting this-and-that kind of metadata to the documents, instead of discussing also how and for what purpose the VR is actually expected to be used, and how the practical usability could be supported.[2]

Barceló refers to Hollan and Stornetta article of 1992 "Beyond being there" which discusses the problems of assuming that traditional face-to-face communication functions on computerised environment. This basic observation is indeed confirmed as a correct one by a number of usability trials. (E.g. Chen & Czerwinski, M. 1997; Westerman & Cribbin 2000; Büscher et al 2001) The complete picture is however by no means an uncomplicated one, and a functional usability springs from an amalgam of adapting both traditional and novel communicative techniques and approaches. Complementing the earlier observations, more recent research on the premises of human-computer interaction (HCI) and especially on the computer supported collaborative work (CSCW) has suggested a number of functional approaches to tackle the problem.

A rather widely discussed paper "Steps towards an Ecology of Infrastructure" by Susan Lee Star and Karen Ruhleder (1994) examined a well known collaborative computerised environment called Worm Community System (WCS) used by biologists studying genetics. The authors conceptualised the focus of their research by using a concept of an infrastructure to make visible the choices, politics and relations traditionally invisible in the structures. Star and Ruhleder view on infrastructure is to understand it as a relation between different entities than an entity, or a thing, itself. The concept has been referred to especially in literature on (management)

information and knowledge systems, CSCW and classification. (Bowker & Star 1994; Monteiro et al 1994 etc.)

The point where genetics, collaborative work and infrastructure meet archaeological virtual realities, is at possessing a common aim of making something collectively known and used. Even though a VR is not a work group, strategies learned in and applied by CSCW research provide useful ground for enhancing the communicative capabilities of archaeological virtual realities. Archaeological VR is a dynamic (in the sense of historic processes, and the transitions in the archaeological stratum and the model, see Barceló 2001, 224-229) multi-actor (the historic creators and users of the present material cultural remains, excavators, researchers, public audience) environment where different identifiable and hidden needs, ideas, politics, possibilities and states of willingness do coexist.

Infrastructures of Paths

Making a practical tool out of the infrastructures is far from being a straightforward task. Both the communication of arguments, and the dissemination of the political, are rather non-graphic processes that are difficult to represent in a multi-dimensional environment. Communicating an argument to an audience is according to the classic rhetoric theory, a progressive task consisting of cycles of motivation and presentation. The strategy is still available in a non-linear universe, though not readily exploitable by using conventional methods. Carter (2003) discusses the aspects of rhetoric functioning in hyper-texts which in their structural alignment resemble virtual realities as already in the beginning. Different tactics of expressing arguments in non-linear documents presented by Carter can be utilised in documenting the virtual realities. An essential difference between the two does though exist. Thinking of the purpose and place of the documentation, in a hyper-text the argument is in the document, and in the virtual reality the argument is built on the document.

Of the argumentative tactics presented in the literature, the Freeman argument analysis model seems to offer the most functional basis for implementation of the VR documentation. (Freeman 1991) Freeman extends argument diagram presented by Toulmin (1958) to cope with larger arguments consisting of a set of sub-arguments. An illustrative visual metaphor of the argument structure could be a path that leads the audience, occasionally not exactly straight but often bending, crossing and uniting with others, and passing through a number of stages to a final conclusion. The path metaphor is drawn as a practical proposition for coding arguments functionality into the virtual realities.

A path is defined in this context as a basically linear structure which guides the audience through the essential entities of the VR. Depending on the level of ontological information attached to the virtual reality document, an argument path can be constructed as a flat list of references to different relations and data objects in the ontological data (level A). This presupposes however the presence of motivation -type ontologies (because_that, because_of, due_to, derived_from), and support for expressing and tolerating inconsistencies, probabilities and assumptions within the ontology. A less developed variant of argumentation paths (level B) can be accomplished as a list of references to specially written objects containing the sub-arguments. Level C represents the trivial

case of an external document with references to the VR describing the argument.

Conclusions

The question on how to document effectively the genre of documents referred to as "virtual realities", is not a problem of virtual archaeology own. The demand for efficient management of information stored in similar documents is critical also in a number of other applications. Mutual benefits should and could thus be found in interdisciplinary efforts.

Virtual archaeology has though considerable contributions to offer regarding the general effort on the future of scientific publication, multidimensional documents and virtual realities. The rather unique variety of source data in multiple formats, the temporal span, scientific uncertainties and inconsistencies, and especially rather well established methods for coping these inconsistencies make archaeology an interesting case from the more general point of view.

The proposed method for virtual archaeology documentation has to be considered as an approach. The recent research in documentation and presentation of non-linear information has clearly shown that even though the general aims of the different actors are relatively consistent, the supportive methods for an effective use of information differ considerably. Argument paths intend to contribute on the issue of difficult comprehensibility in the content-based documentation. Further research is definitely needed on descriptors and the data upon which the argument paths are to be built. The most critical question is though the direction to which the usage patterns of the virtual realities are evolving: what for and for what purposes the virtual is used in reality.

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