Museum context in a pedagogical environment

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1 Introduction

Museums are knowledge-dense organizations. Unfortunately, not much of this knowledge can be reached outside the museums. There is, though, an interest in presenting this knowledge in relation to the museums' collections to the public in a pedagogical way. One of the proposed ways of doing this is utilizing technical solutions. In many cases this has been done by simply presenting a selection from the museums' database content on a searchable web page together with static information. This is not an acceptable solution if the goal is to use the information as a resource for further learning and education.

If the museums shall be able to use their data and information as a resource for producing pedagogical content new tools are needed. Development of these requires methods to model the existing information. Important, though, is also to model the context related to this information in order to support learning. *Context* can be defined as "*everything that is used to give some meaning to a message*" (Cahour & Karsenty, 1993). When reproducing the museum context it is vital to take both museum and IT pedagogic into account. In the project KMM, Knowledge Management in Museums, we work with developing new tools and models for organizing, accessing and providing knowledge from museums.

In this article, we will start with presenting an example from a museum's database demonstrating information regarding a mummy. Then different types of knowledge needed in a pedagogical environment for museums are described. The article ends with conclusion and discussion.

2 An example

In the Victoria Museum of Egyptian Antiquities, Uppsala University, one can find brightly painted mummy-coffins and linen-wrapped mummies together with more usual things like household objects (www.gustavianum.uu.se/vm/victeng.html). Information related to the different objects is stored in a database, see *Figure 1*.

Collection	Victoria Museum of Egyptian Antiquities
Inventory	VM363
Name	Tau-her (pseudonym used for informal identification)
Object	Human remains: Mummy
Properties	Adult male
Ownership	Donation of the Crown Princess Victoria of Sweden 1893
Comments	…

Figure 1. An entry in a database for museum objects in the Victoria Museum.

This database works well for storage of information for the personnel within the museum. But the information is far from enough if it should be used as a base for learning. The professionals, who present the exhibitions for the public, usually have a very good understanding of how to present the material. Thus, when deciding the context to be stored in a system supporting learning, great emphasis should be taken to their expertise.

When Geoffrey Metz, curator of the Victoria Museum, presents the collection's mummies for, e.g., school children he starts with describing the Egyptian world of ideas (interview 24th May 2006). The children have to understand the Egyptian philosophy regarding the life after death to understand the Egyptians way of taking care of their dead bodies and wrap them as mummies. Furthermore, his experience is that this is a way to deal with the children that otherwise might be frightened by the thought of the dead bodies. After that he introduces the mummies and explains the embalming process. Furthermore, he informs the children how the mummies can be used in research, e.g. that the old parasites found in mummies can be used for finding new ways to deal with these parasites nowadays.

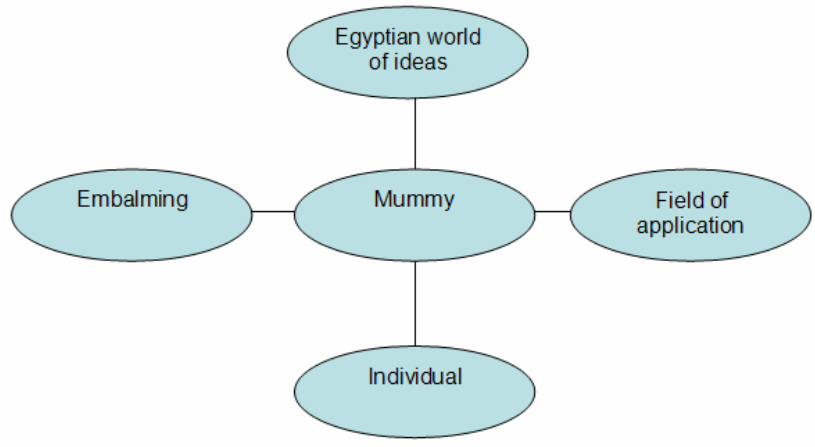

Figure 2. Proposed domain context for mummies.

In *Figure 2* an abstraction of the described knowledge can be seen. We call this the domain context or the domain knowledge. It is important to see the distinction between information and knowledge; knowledge is an understanding of information. This understanding can be based on studies and experiences.

3 Demands on a pedagogical system

Good museum pedagogues have deep knowledge about the objects they are presenting. But this knowledge has to be presented in an interesting way, which presupposes an understanding of the audience and how the material can be described from a pedagogical view for these people. Therefore, a pedagogical environment has to deal with knowledge bases describing the domain, pedagogical issues and knowledge about the current user.

3.1 Domain context

The most important part of a pedagogical system's knowledge base is the reproduction of the domain context. This reproduction has to be rich enough to be the base for generating different kinds of presentations and explanations of the domain to fulfil different users' needs (Edman & Hamfelt, 1999; Edman 2002). The domain context may, e.g., comprise knowledge about what an object has been used to, how the object has changed through history, how it has been

fabricated, who invented the object, and how it is related to other similar objects (Bengtsson, 2005).

In *Figure 2* the context for mummies was presented on a high abstraction level. Now we will further elaborate parts of this context. In *Figure 3-5* very brief descriptions of selected domain knowledge are presented.

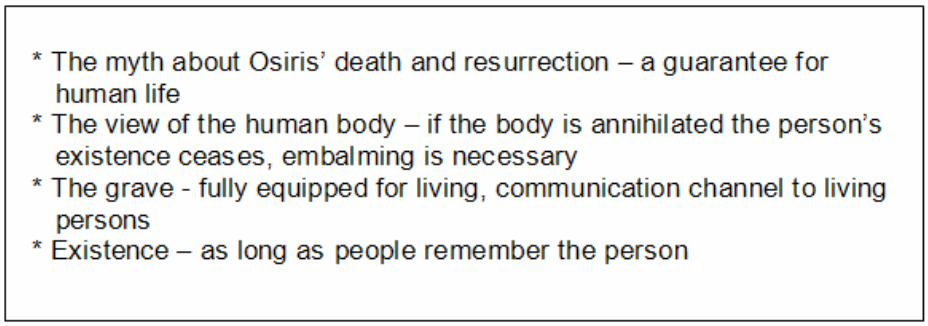

Figure 3. The Egyptian world of ideas.

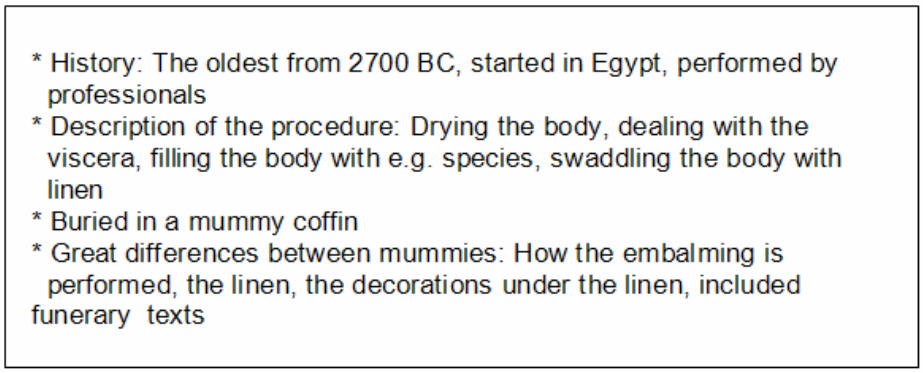

Figure 4. Embalming a body.

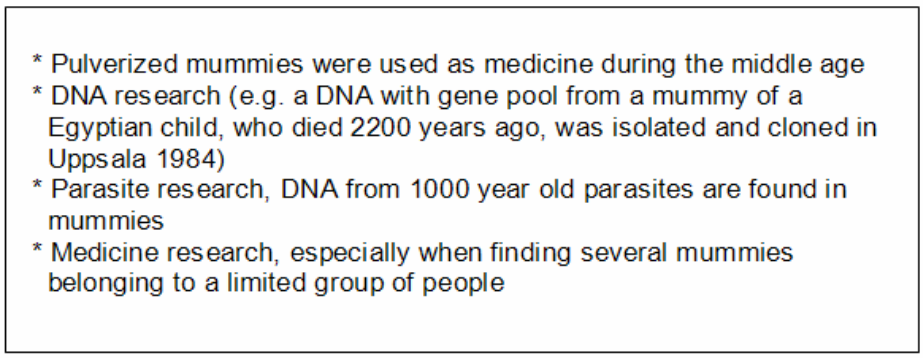

Figure 5. Field of application.

Reproducing domain context in a system is a complicated task. One way, though, is to model the knowledge in form of concepts. The domain knowledge in *Figure 6* is a step closer to a conceptual form of the context in *Figure 2*. The individual Tau-her will inherit all the properties that the mummy concept has, e.g. how the embalming can be performed. In *Figure 7* the concept for individuals can be seen instantiated for a special person, Tau-her.

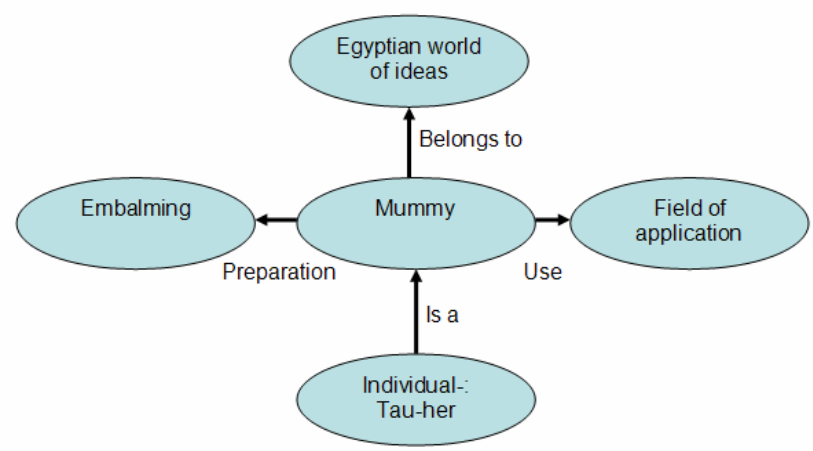

Figure 6. Domain context for mummies from a conceptual view.

* Name: Tau-her
* Gender: Male
* Age: Adult
* Period: 21st Dynasty, about 950 BC
* Profession:
* Medical status:
* Appearance: Damage to the face, probably caused by amulet hunters
* Investigation of the mummy: Scanned 1999 at Uppsala University Hospital. Found that it the body was a male and not a female, which the name on the coffin states.
* Coffin: Bears the name of the priestess Tau-her

Figure 7. Information about an individual.

For more than ten years two groups within CIDOC have worked with developing an ontology for culture heritage information. The work has resulted in CIDOC Conceptual Reference Model. CIDOC CRM "provides definitions and a formal structure for describing the implicit and explicit concepts and relationships used in culture heritage documentations"

(http://cidc.ics.forth.gr/). We will utilize the CIDOC CRM ontology for the reproduction of the domain context in the KMM project.

3.2 Pedagogical context

According to Nunes and Fowell (1996) learning is "a process of constructing knowledge and developing reflexive awareness, where the individual is an active processor of information". The constructivist approach to learning dominates learning theory today (Morphew, 2002). Constructivism views learning as an active knowledge construction process that builds upon previous experienced knowledge by the learners in accordance to their different learning styles. One person can have a good memory for what he/she has heard, while another one needs to see an image or read a text to remember. This influences the personal learning style.

Marton *et al*. (1996) argue that there are two main strategies for learning; shallow and deep. In a shallow approach to learning the person focuses on memorizing sets of facts, reproducing parts of the content and thereby developing an atomic view. The deep approach takes place when the learner focuses on significant issues in a particular topic and reflect on what he/she has read, relating the own previous knowledge to the new knowledge obtained. The learner looks for the overall meaning of the material, and thereby develops a holistic view, which is desirable. We see the deep learning strategy as being in concordance with the constructivistic approach.

The constructivistic approach can also be found in the factors fundamental for learning defined by Woods (1994). These factors relate to motivating the learner, providing goals, giving the context, selecting knowledge that is not known by the user, ordering the presentation of this knowledge and planning the presentation, facilitating the learning by being active and aiding the learner to recall information that he/she might like to reinspect.

3.3 User context

If you want to change the learner's way of thinking about a phenomenon it is reasonable to start from how the learner actually understands and thinks about it (Marton, 1997). Thus, it is vital to start from the user's point of view in a system supporting learning.

As mentioned above, people learn in accordance to their different learning styles. The reason may be that humans have different kinds of intelligences (Gardner, 1999), which influence their learning styles. Examples of the different intelligences are verbal-linguistic, logical-mathematical, bodily-kinesthetic, and visual-spatial.

Moreover, part of the user context is the user's age and, possibly, the gender. Important is also the purpose for the search of information and the user's own knowledge about the domain. As stated earlier, the learner builds new knowledge upon his/her earlier understanding of the subject.

4 Conclusions and discussion

In a system supporting learning it is important to take into account the user context, e.g. the current learner's background, needs and learning strategies. A prerequisite is that the context mirrors the domain knowledge in different ways so the system can generate presentations suitable to the user. The system's reasoning with the domain context should be based on heuristic rules imitating the tutoring strategies the pedagogues in museums and teachers are using. Thus, the pedagogical context consists of these heuristic rules. Even the user context can be modeled in form of heuristic rules. The tutoring strategies should be based on the constructivistic view and support deep learning. Woods factors, listed in 3.2, give valuable suggestions for the actual design of the user interface.

In the pedagogical environment a *meta-program* will handle the *interactions with the user, the user context, the domain knowledge, and the pedagogical context*. The meta-program performs a knowledge-based reasoning based on the different knowledge sources (cf. e.g Edman, 2001).

When the user is communicating with the system this meta-program will support the learner in his/hers *searching* for information and *elaboration* of it. The presented information should be on the right knowledge level and be possible to utilize in an active way, e.g. for fulfilling a task, solving a problem, or participating in a game. Gaming and simulation has proven to be very effective ways of enhancing learning (Samuelsson, 2006).

The reasoning in our pedagogical environment for museums is quite advanced, dealing with a different knowledge sources. We are working with CIDOC CRM as a model for storing the domain context and heuristic rules for describing both the user and the pedagogical context. So far, our experiences show that the chosen forms of modeling are promising and can satisfy our needs. But we are only in the beginning of our project with developing methods and tools for implementing pedagogical environments for museums.

In our work with investigating how to reproduce museum context in IT-systems we co-operate with five museums; Västernorrlands, Stockholms, Halmstads, Grennas, and the Uppsala University's Gustavianum. This collaboration ensures that the research is based on the museum needs. The work is done within the KMM project where the museums are partners together with the universities in Uppsala and Luleå, municipalities, and private companies, i.e. a Triple Helix project. Through the municipalities we get the opportunity to test the pedagogical environments.

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