Geographical Information is an Act, not a Fact

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1. INTRODUCTION

The main thesis of this paper is that representing geographical information as a data-set, should rather be replaced by representing a set of activities. This approach is motivated by the following consideration: the representation of real world objects differs from the representation of what we say about real world objects. Philosophers have discussed this issue since ages, and we cannot ignore their work, but our purpose is to bring a computer scientist vision to this debate. More precisely we pretend to bring a database-oriented perspective.

Currently, geographical databases are only able to deal with what is said about real world objects. It would be preferable to record the whole process of object investigation, not the just the result. By object investigation, we mean the context of an object discovery and study in terms of space, time, agents and technologies involved. This is what we name: recording the act, not the fact.

This paper discusses how to introduce this activity process and illustrates our approach on underwater archaeological data, which are gathered in a difficult context, where imprecision and uncertainty are present at every stage of the information production process. The full recording of all information as a set of activities, will enable us to perform further reasoning on, possibly contradictory, beliefs of differing confidence.

2. INFORMATION CREATION ACT IN UNDERWATER ARCHAEOLOGY

What is important is not only a data by itself, but the whole data creation process. The two principal operations in this process, are the instantiation of an object for some part of the geographical space, and then the attribution of certain properties to this object. This constitutes the elementary insertion of any data into a GIS: it is a complex activity, which occurs in space and time, and is performed by a particular agent, under particular circumstances.

The first activity, denoted the *initial commitment*, consists in choosing an appropriate domain ontology [Guarino, 1995], i.e. the set of the expected universals to which we attach the individuals that can be observed. Then we discuss the act of instantiating on these individuals, i.e. which attributes to consider, which values for these attributes, and also how individuals relate to each other, in particular through their location and date. This aspect benefits from the notion of *conceptual representation model* (CRM), introduced in information science, for the documentation of patrimonial objects in museums, and which encloses a formal definition for an activity. CRM was extensively developed under the name of CIDOC CRM (*Committee on Documentation of the International Council of Museums*) and recently became an ISO standard. The CIDOC CRM can be named “task ontology” in the sense that it provides entities for a general representation of permanent items and entities for temporal items, mainly “events” and “activities”.

We illustrate our approach in the context of the VENUS project [VENUS]. One of the goals of this project is to propose a methodology for representing the archaeological knowledge that can be associated with deep underwater photographic and photogrammetric missions. In this context, the interpretation of the observed space is so difficult, and the interpretation so uncertain, that it is mandatory to collect the data related to the observation, together with the data recorded during this observation. Hence, photogrammetry is the instrument that determines a space and time reference for studied objects.

Then, what we named the “initial commitment” is obvious: the answer to the question “what is there?” is crucial, and will hamper any further observation about what is supposed to be there. For the Pianosa survey, the answer is: “there are ancient amphorae”. From there, the choice of the ontology is clear: the description of the amphorae at roman time. A domain ontology has been established by SBAT (Soprintendanza per i Beni Archaeologici della Toscana), and it allows to choose among some dozens of amphorae types. On each amphora type, we can define several measurable zones, and we can compute geometrical primitives by least squares method onto the measured points: a circle on the rim, on belly points, a line between bottom point and the center of at least one of these two circles [Drap, 2005].

Obtaining an amphora representation requires to merge measurements, and theoretical model from the SBAT ontology. The theoretical template gives information on the remarkable zones of the amphorae: rim, belly, handles, bottom. The measurements, done by human agents or machines, can confirm or infirm the template.

In principle, the database stores data in terms of elements, i.e. concept and properties, of both the domain and task ontologies. This will allow to query any amphorae item, as it is already possible, but also to query any activity that produced these items. It will allow further researchers to use the data and to be able to understand the cause of any doubt or disputable data. Morevover, due to the formal representation of these ontologies, inference procedures will be able to perform complex operations, e.g. consistency checking.

3. CONCLUSION

We conclude that this approach can be a systematic and general manner of collecting any geographical information. Even if this proposition of recording the activities may seem a bit fastidious and resource consuming, in term of computer memory and time. But the expected gain can prove to be very important on the longer term.

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VENUS (VirtualExploration of Underwater Sites) http://www.venus-project.eu