Table of Contents

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Archaeological Computing Newsletter
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Notes to Contributors:

Contributions are welcome sent over email, on disk (most common word-processor formats, ASCII and LaTeX are all acceptable), or as double-spaced typescripts. Illustrations and figures should be no larger than A4 and capable of reduction by us to A5. Submission as PostScript files, or in other common graphics formats, is preferred.

Contributors should include details of their name and address, or position and affiliation.

Letters, comments, reviews of forthcoming events or publications are also welcome.

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Ranter's Corner — World Wide *What*?

A year ago I wrote the first 'Ranter's Corner' for *ACN*, confident that it would be easy to be controversial and stimulating, and that many other people would feel the need to moan in public. In the event, it seems that many readers of this august periodical have succumbed to 'Microsoftitis', defined in the *ArchaeoInformatica Dictionary of Archaeological Computing* as 'slavish adoration of the latest technological fad, and uncritical belief in the wonder that is a computer', and don't have anything to rant about. Is everything really going so well? I want to take the opportunity in this 'Ranters' anniversary piece to take a poke at the latest and greatest fad in computer circles, World Wide Web. I was partly prompted by Professor Longstaff's document in ACN 39, but this piece is no sense to be regarded as a criticism of Internet providers like him, but rather of those with inflated expectations.

Of course distributed multi-media material quickly available on the net is wonderful; I've been trying to promote such things myself for years. But now it has arrived, I am not so sure. It reminds me too much of the plethora of little publications we had in the late 70s when people discovered cheap offset printers:

- Anybody publishes anything with no editing or quality control;
- It is impossible to refer effectively to information because its ephemeral and probably will not be there next year;
- Young scholars use it as a way of 'publishing' their ideas which the traditional outlets will not accept;
- It is an invitation to splurge raw data all over the unsuspecting reader, *just because you can* (only now it's in colour);
- Archaeologists outside the fast track never see what's happening;
- You don't bother to ever do a serious publication because 'the information is all there on the net for anyone who wants it';
- The traditional publishing tools like indexes, proper bibliographies etc are ignored (despite the fact that World Wide Web actually copes with such things very well).
- The medium itself promotes eye strain.

Still, it is good to see SGML finally coming to the popular centre stage as everyone starts to mark up their documents in HTML.

It is not just WWW that upsets me, either. Many ACN readers will also be subscribers to the premier archaeology discussion list `ARCH-L`. What did they discuss for much of the spring of 1994? The place of the archaeologist in contemporary fiction![1] Sara Champion (Southampton University) gave an excellent presentation at the 1994 CAA conference on how Gopher servers and email lists could genuinely speed up and enhance a project, but isn't most of it either trivia or technical questions and news?

If you want a rule of thumb when you read about some new piece of scientific wizardry, watch out for the key phrase '*you can actually*'; as in '*you can actually* fly around the reconstructed Victorian bloggit kiln if you click here' (as if you ever wanted to), or '*you can actually* download 4976 different satellite images of downtown Lagos every 8 hours' (1 is too many) and 'if you click on here, *you can actually* get a spoken commentary by a 4 year

[1] OK, I admit, I was one of those who started it; and Anita Cohen-Williams produced an interesting list of books as a result.

Aegenet [pre-classical Aegean world] majordomo@acpub.duke.edu (the message should read SUBSCRIBE AEGENET–do not include your name)

AIA listserv@cc.brynmawr.edu

Anthro-L [general anthropology] listserv@ubvm.edu

ANE-L [ancient Near East] majordomo@mithra-orinst.uchicago.edu or listserv@oi.uchicago.edu

Ancien-L [ancient Mediterranean] listserv@ulkyum.edu

Artifact [material culture] listserv@umdd.edu

Classics [classical Greek and Latin] listserv@uwavm.edu

Ethnohis [general ethnology] listserv@hearn.edu

Mediev-L [Medieval history] listserv@ukanvm.edu

Museum-L [Museum studies] listserv@unmvma.edu

Natchat [Aboriginal peoples' issues] listserv@tamvm1.edu

Native-L [–ditto–] listserv@tamvm1.edu

Pacarc-L [Pacific Rim archaeology] listserv@wsuvm1.edu

Society for Archaeological Sciences Net srgibf1@wnv.dsir.gov.nz

News groups Gopher to Archnet at Spirit.lib.uconn.edu under sci.arch and sci.anthro

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Ask the Machine

The problem

Someone said that you start needing something just after getting it. This seems to be especially true for information systems: In the beginning, nobody believes in them; after some time, people start to think they might get useful; at the end, you cant live without one.

Yet, true information systems seldom work. When we ask something, we expect to get a quick, concise, accurate answer to what we meant to say rather than to what we actually said, and machines usually reply with lots of data, take too long, and understand us the wrong way. So we dont ask them.

This seeming contradiction makes information systems very difficult to design and run. Modelling one of them, constructing it onto whatever the platform, feeding it with the appropriate data, and providing ways to let the users access the information inside are each complex tasks which cant be successfully managed without a clear knowledge of the application environment and a pretty set of modelling tools.

The ideas

When I was asked to design and implement a database that could deal with archaeological information, I soon stumbled upon a wall: Modelling reality with a high degree of precision was difficult, especially within the intricate environment of archaeology, which inevitably trends to be no objective, undeterministic and, sometimes, even quite suspective.

I soon thought of something I had learnt some years ago. Object-orientation is a quite loose concept almost thirty years old, and OOMs (object-oriented methodologies) have been deeply developed into many directions by proficient authors, so we can say that, nowadays, they are theoretically mature. Though, commercial inertia has prevented them from entering the software factories, and all we can get about them is a bunch of fascinating books.

Object-oriented methodologies

OOMs push to the maximum the old premise according to which computers must come closer to humans rather than we humans move closer to computers; software is to be designed from analyzing the very objects that we can see around, touch with our hands or just imagine. Every object has some properties and some behaviour that characterizes it and gives it its *identity*. Objects can be classified into *classes*, which relate each other in a hierarchical way, the most specialized inheriting the features properties and behaviour from their more generic ancestors. Each class of objects exposes its interface to the world, allowing other objects to interact with them through it but *hiding the internal details* that form its implementation.

That way, OOMs provide a high degree of modularity, enhancing software internal quality, which, in turn, renders better programs, shorter development periods and lower costs. For more information on the subject, see the books listed in the Bibliography.

Archaeological considerations

The major aim in designing the system was to make it comply with our particular point of view of archaeology. We think that archaeological entities do not appear isolated, but they are spatial entities, related to its encircling context in a meaningful way and understandable and even predictable under this dimension. We are concerned with investigating the relationship between the archaeological record and the native landscape which with it merges into a whole, and, at a higher level, the shaping and organization of social space in every moment. Our work is framed by landscape archaeology, but only if we understand the latter as something much wider and more ambitious than studying the natural environment and the prehistoric use of land. Our research strategy tries to unveil the cultural structures underlying the different spatial levels of social activity, from the understanding of the world and the conceptualization of space, to the use of land, location of sites and domestic space, and even formalization of portable material culture.

Accepting such a challenge distributed strong implications over the archaeological practice, including our information management system. First, we wanted it to reinforce the development of the theoretical and methodological foundations that, equally influenced by the exposed point of view, we use to act upon the archaeological heritage. We also needed to record every piece of information we came across during our daily work. And finally, we wanted it to offer processing and analytical tools, which would let us reconstruct the past in order to re-inject a valuable feedback into the whole system.

The experience

So I chose an OOM to analyse the archaeological reality and design a model of it. The specific methodology I used is not on the books, but it is a synthetic one which has been elaborated taking the work of several authors as a theoretical base, as well as and my personal experience.

Modelling reality

During the analysis phase, six kinds of real-world entities or *classes* showed up. First of all, geographic classes could be used as locators and spatial context for the rest. Together with material classes, they could be acted upon through actuation classes. All of those could be described by descriptive and evaluative classes. Organizative classes would give some additional constructional glue to the rest.

Geographic classes

Geographic classes correspond to *objects which can be precisely located into a geographic context, being this inherent factor of major relevance.* This property can become visible through direct components, such as UTM coordinates or the name of the nearest town, as well as through associated components, such as the folklore record.

Some geographic classes appeared very soon, such as Locality and Site. Also, Geographical Zone showed to be very useful to group localities together. Archaeological Locality and Ethnographic Locality were then derived from Locality.

Material classes

Material classes map to *physical and tangible objects, originated intentionally or unintentionally through a production process* (i.e., a process of work and human labour). They can be spatially located via geographic objects.

Two big classes emerged: Fixed Structures and Free Materials. From the first class, Intentional Structures and Unintentional Structures were derived. In a similar way, Intentional Materials and Unintentional Materials were derived from the second one. This partitioning could appear unnatural at a first glance, but it revealed as very suitable after some test.

The class hierarchy branched and evolved deeply from this stem, giving many specialised subclasses such as Decorated Sherd or Flint Wall.

Action classes

Action classes correspond to *archaeological activities carried on at a point or interval in time, on a set of geographic or material objects.*

Two kinds of actions were obvious: Prospection and Excavation. From the first one, Extensive Prospection, Selective Intensive Prospection and Intensive Prospection were derived.

The temporal factor was to be considered here as many actions are usually taken in sequence. Therefore, the class Procedure was designed to group several actions in time peformed on one particular set of objects.

Descriptive classes

Descriptive classes match graphic representations understood as *elaborated objective abstractions on some other objects, usually with an instrumental or referential aim.* To develop them, knowing the object being described is enough.

Some descriptive classes show the original object in a realistic, non-processed way, such as Photography or Video. Some others, conversely, provide the result of a subsequent process

from the original object, such as Map or Plan.

Assessing classes

Assessing classes are also *elaborated abstractions on other objects, but they pose a subjective quality, and seek a standardizing or assessing goal.* To develop them, we must consider the object being described as well as some motivating conditions and a particular point of view.

Every geographic class can be subject of evaluation, as well as many material classes. An Assessable class was designed to make those classes inherit from it such a capability.

Some of the classes designed in this group were Heritage Context, Heritage Assesment, and Archaeological Assesment. Environmental Conditions was also included, as well as Archaeological Impact and Corrective Measures.

Organizative classes

Organizative classes provide the *structural and methodological support* which is necessary for the archaeological chore to take place. We mapped our already-developed working habits into a class hierarchy, designing classes such as Project, Daily Log and Staff.

Collecting information

Data came from a variety of sources. Paper files, personal notepads, even an old documental database. It had to be recompiled, redistributed and often compared against different instances of itself to extract as much information as possible.

The most time-consuming task was not collecting the very data, but getting the right connections and relationships among the objects detected. The class hierarchy had to be iterated through time after time until it got refined and mapped thoroughly to the reality we found to lay under the data. Such a cyclic cleansing is not a symptom of a poor design, but a feedback loop well contemplated in the OOM we were using. Also, already having a big amount of data to fit into the classes helped a lot in verifying the model.

Looking for a database (vainly)

OOMs provided very powerful conceptual tools, and let us map what we found around into a concise and neat model. But it also pushed us against a second high wall: As far as we knew, no products capable to implement the design were commercially available. So I started to think of implementing the model atop a RDBMS (relational database management system). Such a hard transition would involve a truly cruel model mismatch, but the chances of getting a brand-new, dazzling object-oriented database management system were close to zero.

In addition, just a few RDBMS for Windows were accessible those days. After trying a couple of products with quite poor results, Microsoft broke through with Access, and we quickly adopted it as our database development tool. Besides, Access offered a slight object-oriented flavour which would harmonize pretty well with the grown model.

Building the system

Translating the object-oriented model into a relational schema was not easy; in fact, many aspects of the original design, mainly the most complicated features and classes, were not

implemented. Classes were modelled as tables. Relationships among classes were implemented as primary keyforeign key links between tables as often as possible, and as additional tables when needed. Attributes were mapped to fields. Multi-valued fields originated tables or were completely ignored, depending on the trade-off priorities for each particular case.

Several interesting points appeared through the construction process. First of all, it made us think about what we considered solid and well-defined working habits. Sometimes, they were, in fact; but some others we found alternative ways for doing things which moved us closer to reality. For instance, sometimes a site cannot be located via a pair of coordinates. Rather, it extends over several localities, and a coordinate range or an approximate location must be given.

The model mismatch between the object-oriented and relational paradigms made some additional issues arise. The first and perhaps most puzzling one was the fact that, being impossible to implement an inheritance mechanism to reuse class features, we had to repeat links between tables as often as they should have been classified. For example: Any geographic class and many material classes can be evaluated. We had to implement one physical link for each assessableassessing class pair instead of providing Assessable and Assessing superclasses for them to inherit.

Iterative relationships were also difficult to implement. A structure can appear inside a bigger one, and this one, into the biggest. Querying such a link means traversing the path from object to object an undefined number of times, which cannot be done by traditional relational systems. We managed to do it by designing and building a separate query engine that bypasses Access, opening the database and processing the information on its own.

Several other applications have been designed and implemented: reporting utilities, minimum-interface data entry modules, global searchers, etc. They are all small chunks of functionality, each of them helping to cover the gap between the natural model and the actual one.

After the first year

The resulting information system, although relational, is deeply rooted into object-oriented ground. This allows us to regularly modify it and experiment new features using the reality out there as a guideline. We go on using Microsoft Access as our database core. We also use Visual Basic to provide extended functionality and better data extraction capabilities. We are exporting data into AutoCAD and plotting it, making long reports which involve more than seventy tables and putting information into the database at a ratio of 83 objects per day. We are also planning to implement some geographic-oriented, graphical features into the system, which would give it a more intuitive interface and begin the migration into a GIS-like solution. We are looking for an object-persistency mechanism and investing in computer equipment. We are asking the machine, and she's helping us in our everyday work.

Yet, we need the object-oriented stuff.

Bibliography

These are the main books on which the synthetic OOM we used was built upon. The most important one, however, is not listed here nor ever written; it should be built on account of the experience and knowledge of the archaeologists I work with.

Henderson-Sellers, B., 1992. *A Book of Object-Oriented Knowledge*, Prentice-Hall.

Hughes, J.G., 1991. *Object-Oriented Databases, Prentice-Hall International.*

Kim, W., 1990. *Introduction to Object-Oriented Databases*, MIT Press.

Martin, J. and Odell, J.J., 1992. *Object-Oriented Analysis & Design*, Prentice-Hall.

Meyer, B., 1988. *Object-Oriented Software Construction*, Prentice-Hall International.

Rumbaugh, J., Blaha, M., Premerlani, W., Eddy, F. and Lorensen, W., 1991. *Object-Oriented Modeling and Design*, Prentice-Hall International.

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Science Animated Inc.

A small business, provisionally entitled *Science Animated Inc.*, is about to be formed to provide low cost computer graphics to small museums.

Our primary interest will be the creation of animated walk-throughs of three-dimensional site reconstruction models. Essentially, a reconstruction of a site or building is created in three dimensions on a computer. Photographs or drawings of background scenery, decorative features, and artifacts can be placed within this model, and materials can be textured and colored to resemble the originals. We can also simulate sunlight and shadows for particular times of year and day. A video 'tour' through this model can then be created and either added to existing exhibition films or mixed with slides, drawings and two-dimensional animations to create a short film. We can also add synchronized music, dialog and sound effects to the visual presentation. Eventually we hope to be able to offer low-cost interactive computer presentations as well. Drawings and physical models of reconstructed sites are always of interest to the public, but they are static and difficult to modify. Computer models are more versatile and can readily be altered to take account of changing evidence or hypotheses while actual physical models cannot. A computer simulation can help viewers understand what a site might have looked like from many perspectives. It can provide a visual transition between actual ruins and hypothetical reconstructions by fading from one into the other, so that a building or room appears to grow from or fade into the ruins. It can also provide a dynamic illustration of chronological and spatial change within the site.

There has been some debate concerning the possible dangers of creating computer reconstructions of the past which are too photo-realistic and which might lead the public to mistake a hypothetical model of the past for empirical reality. We have reached the conclusion that it is worthwhile not to make computer-generated models extremely photo-realistic but to keep them looking like the artificial constructs they are. This effect can be achieved in any number of ways such as limiting the amount of texture mapping used in a model, slightly reducing the resolution of the image, or simply using a simplified color palette. Such models would also be easier and quicker to render and might actually appeal more to a public that takes photo-realism for granted but still thinks wire-frame models are high-tech. It is also possible to present a series of alternative reconstructions or to animate the building of the model with text or narration explaining the grounds for its reconstruction.

Along similar lines, there is some concern that the absence of people from such models creates a sterile and inaccurate view of the past. We share this concern but feel that the addition of actual footage of live actors may also serve to lend too much verisimilitude to a