GENREG

A Simple and Flexible System for Object Registration at The National Museum of Denmark

Lene Rold

Establishment of the GENREG database (GENREG is a Danish acronym for "object registration") began in 1987 and ended in 1994. The database encompasses all of the National Museum's departments, with textual data on more than 1,000,000 objects, and electronically stored images of around 200,000 of these.

The GENREG database was established by "retrospective" registration of selected object data from the museum's manual inventories and other archives. The oldest inventories go back almost 200 years, and some objects even stem from the National Museum's predecessor, the Royal Art Chamber, which was founded in the 16th century. The image base, however, was established through recent photographs of the objects.

The majority of the National Museum's collections naturally concern Danish objects. It has about 200,000 inventory numbers from Danish Prehistory and Middle Ages, any one of which can contain as many as several hundred objects; 400,000 inventory numbers from the Renaissance to Modern Times; 120,000 from the Ethnographic collections; and around 100,000 from several smaller collections.

The decision to register selected information on the collections in a database was taken in the mid 1980s when the National Museum, thanks to large private and national donations, was able to begin a major rebuilding and renewal phase. Part of the plans for the Museum's future, was to apply information technology (IT) in all areas in administration, documentation, research, exhibition and other means of giving public access to the collections.

GENREG was thus only a part of the total IT project, albeit the largest part since more than 150 man-years have gone into transferring data from the manual archives. In parallel with establishing GENREG a client-server network milieu was also established, today including more than 250 interconnected PC's. The museum's staff use common programs for text processing, statistics, graphics, and other standard programs, as well as an internal electronic mail system, e-mail, and Internet.

The rapid pace of development within IT has also influenced the registration of the collections. Since 1987 the GENREG system has developed from a rather simple relational text database into a multimedia museum management system which, slowly but surely, is replacing earlier manual registration routines.

An Example of the Use of GENREG

At ICHIM '93 Tine Wanning from the National Museum of Denmark presented the multimedia collection database "Ethnographic Treasuries in the Computer" (Wanning 1993). This multimedia system is available to the public in the Ethnographic Department's exhibitions. It contains in text and pictures the department's entire Eskimo-related collection - nearly 10,000 objects - of which around 3,000 are on display.

The electronic system uses data and images extracted from the museum's database and gives supplementary information about the objects on display. The system makes it possible to study any of the objects in the Museum's stores not currently exhibited. This application is exciting because the system can be used in many ways and by many target groups, ranging from school children and ordinarily interested museum guests, to researchers who visit the museum especially to study the Eskimo collection.

The Retrospective GENREG Database

The retrospective GENREG database is not one large database, but a number of databases designed and implemented to meet the requirements of each department at the National Museum. Nonetheless, all versions of the GENREG base were and still are compatible.

The ethnographic collections and a large part of the Danish collections from modern times were the first to be transferred to a database. These bases were implemented on the basis of two rather similar data models, using the Oracle database management system with user interfaces implemented in OracleForms version 2.0. This platform was, as some will perhaps recall, quite advanced in 1987.

While the registration was progressing, collection by collection, the GENREG project matured and was developed further. Thus the collections registered later were built on the basis of rather more sophisticated data models, and more user-friendly screen images implemented in Windows technology.

The image base was established from photographic slides, which by a process involving several steps were stored on video disks. The photography is now done with digital cameras using CD-ROM as an electronic storage medium for images in high resolution. Compressed images are available on the image-server for daily use. On the CD-ROM each image fills from 12 to 15 megabytes. In compressed form on the server's disks each image fills only 50 kilobytes, thus making it directly accessible on the network, e.g. in connection with GENREG.

The original GENREG system was designed and implemented after an analysis encompassing all the museum's collections. It was intended to build one common system wherein all types of object

information could be registered. The analysis supported the idea that this could be done, with the primary information concerning:

- **Accession**: allocation of inventory numbers, dates, and persons involved in connection with accession
- **Provenience**: the place an object was found, fabricated, used, and possibly its maker and users
- **Determination**: the date of an object, its classification, and designation
- **Description**: meassures, materials, motives, and decorations.
- **Administration**: placement, conservation, loan status

Problems with the Original GENREG System

It was quickly discovered that the objects being registered did not always follow the game rules as defined in the original analysis. Objects can be transformed and used in ways quite different from their original appearance and purpose, and objects can enter into a variety of relationships with other objects. The most interesting documentation in connection with research could thus not be registered in the rather stringent data model used in the first GENREG.

For example, we could not register in a well-structured way the change that happened when a silver table fork was transformed into a bracelet (Figure 1), but had to resort to free text or cross-referencing to describe what actually happened. Even something as banal as a flint axe from the stone age gives problems if one wishes to be entirely logical in documentation, since when one measures and describes such an axe, it should also be possible to register whether the axe was new and unused, or if it were a resharpened and later discarded tool which entered the earth before the archaeologist encountered it.

Documentation concerning objects' relations to other objects is still more complex and problematic. To name just one situation, though a frequently occurring one, objects can be used to fabricate other objects - even in prehistory. On rare occasions one has found both prehistoric casting moulds and, perhaps geographically far away, objects which were fabricated using this mould.

For both research and exhibition one is often very interested in seeing whole milieus, for instance a living room's arrangement, with all the objects found therein with their various functions and, not least, their meanings and symbolic values. The great majority of objects in a quite ordinary living room will have their individual histories, beyond the fact that at a certain point in time and space all were present together in just this living room.

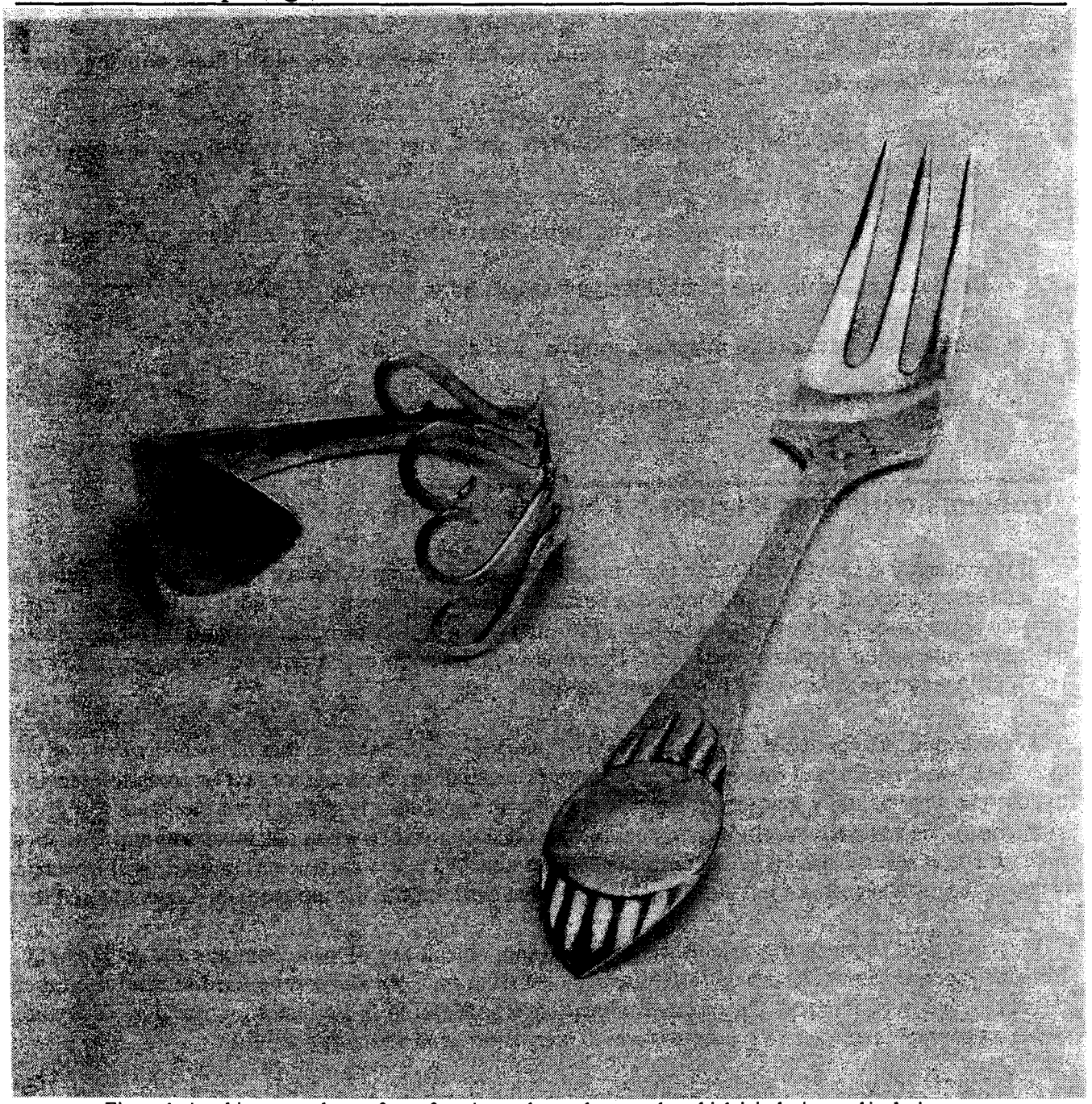

Figure 1: An object may change form, function and even the name by which it is designated in the inventory. Only cross referencing and free text in manual files would tell us the interesting story of how silver forks may be transformed into bracelets. In the GENREG system documentation of change and transformation of objects is possible by describing objects' form and role through their "life cycle".

Information and knowledge about objects of the kind just mentioned is present in the museum's manual archives. However it is there only implicitly and rarely in explicit form, if by explicit one means in a structured and searchable form. However, advanced search facilities for implicit knowledge will be necessary in a database oriented towards active research rather than just archiving information.

The original GENREG system and experience with retrospective registration showed that on several critical points the earlier manual registration procedure, which allowed one to describe especially interesting observations and to record knowledge, could not be transferred to the structured database system. The early versions of GENREG reflected the existing manual routines as used for administration, and the existing archival systems, more than it supported the scientific and pedagogical usage of the collections.

As the retrospective registration neared its end, and as the time became ripe to begin developing a new GENREG system for registering new accessions, it was therefore decided to seek a solution in which the quality demands for the documentation were up to the standards of the manual inventories. The knowledge about artefacts thus had to be structured, as only this could make the knowledge searchable and easily accessible for research and communication to the public.

The greatest challenge in developing the new GENREG system was therefore to attempt to structure knowledge in such a way that the information could not only be entered into the system, but also to ensure a dynamic continued development of the system by incorporating new developments in research and the production of new knowledge.

The Analysis for a New GENREG System

It is always difficult and problematic to change a large electronic system - and for that matter, an even harder problem to change a manual system - but the alternative, to let a system exist for the system's sake alone, is not fruitful.

Therefore in the beginning of the 1990s we decided to perform a new analysis, with the intent of restructuring the original GENREG system on the basis of the experiences gained through the retrospective registration, and especially the difficulties encountered when we wished to register implicit knowledge. Restructuring the system was already on the agenda, since at that time we saw the need to transfer the base to a client-server milieu, and to reform the user interfaces using windows technology. We chose ACCESS for the textual base and implemented the image side of the system in C++.

The concepts of analysing the relations between objects, events, people and roles in museum management systems have been of major interest since the late 1980s when the focus shifted from object data descriptions and definitions to the structures of data models. An example of this is the ongoing

discussions in the CIDOC data modelling work group resulting in papers published by Patricia Ann Reed (Reed 1995).

The analysis for the new GENREG system has been influenced by work of this kind but also by object oriented ideas as published in the computer science literature (Booch 1991). A preliminary report of the analysis for the GENREG system was published in 1993 (Rold 1993).

Where the original GENREG system was founded on archives and based on mechanising manual routines, the new analysis was done from an entirely different point of view. We tried, so to speak, to see reality "through the object's eyes," that is, to describe its lifetime from the time it was fabricated, used, and ended at the museum, and hereafter was administered, conserved, and moved about, and how it entered into various relationships with other objects during all these events.

Closer examination reveals that description and classification of an object should always be done in the light of the events within which the object participates. Example events include, the object's fabrication, usage, and scrapping; further, museal events such as conservation and storage can make major changes in an object's appearance.

The result of the analysis was very simple:

One object - or a collection of objects

participates

in one - or more - events

An **object** may be abstract and/or concrete, and whether it is the one or the other depends on the point of view. For example, a living room is an **abstract object** when regarded as a setting in which a group of other objects - tables, chairs, knickknacks - once appeared together. The living room can, as well, be a **concrete object** if it is seen as a room in a building - a room which can be described by measurements, number of doors and windows, etc.

Concrete and, to some extent, abstract objects are characterised by having:

- **Identity**: they exist and "are themselves". For instance, every single fork in a set of 12 identical forks has its own identity
- **Form**: dimensions, materials, colour, decoration
- **Role**: function, significance, symbolic value, age-, sex- and social milieu

- Objects may occur in relation to other objects in a given event. A given event can, however, be interpreted differently by the individual objects involved in it - for example one object may be used to produce another object. Thus the one object interprets the given event as a "usage" event and the other, as a "production" event.

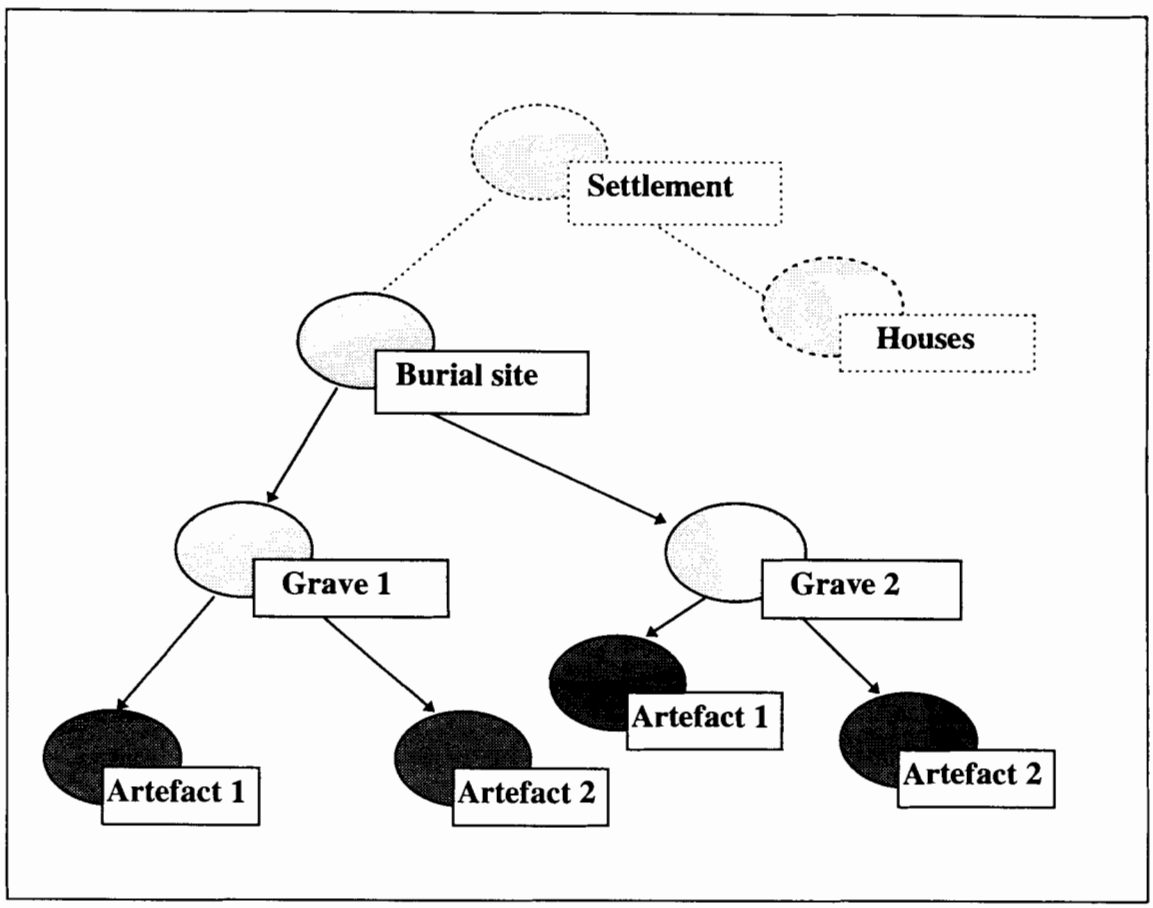

Figure 2: Hierarchical structure of abstract and concrete objects - the objects considered concrete are shown with a darker shade. The chart shows how a hierarchical structure may be enlarged both at the root and leaf level. The example shows how new objects may be discovered as excavation continues over a time in a certain area causing enlargement of the hierarchy at root level. In this example a burial site with 2 graves and grave goods were excavated first. Later on a nearby settlement using the burial site was discovered.

Relations between objects are of major interest and here abstract objects play a major role. Figure 2 shows an example of an object hierarchy consisting of a burial site with 2 graves and the artefacts found in these graves. In this example only the artefacts are considered as concrete objects. A hierarchy like this one may be enlarged, as for instance, more graves are excavated or if a settlement using the burial site is found in the vicinity.

An **event** is characterised by:

- **Time**: It happens at a definite point in time - or within a time interval
- **Place**: It happens at a definite place - or within a larger geographical area
- **Actors and actor roles**: Persons/institutions often appear in connection with an event - usually the actors bring about the event

Typical **events** are production, use, finding/collecting/excavating, accession, placement, conservation, etc. These kinds of events can be specified in more detail, for example an accession can be the result of a donation, an excavation, etc. Collection/finding can happen by excavation, a metal detector search, the result of an organised collection, etc.

Most events may be repeated, for instance for the same object one can register several usage events, loans, etc., and even reproduction or transformation events may occur.

Figure 3 is a structure chart of an object's "life cycle" indicating some of the events in which the object may participate. As shown, the dimensions time, place, and actors are always relevant to events, whether one actually has information about them or not. Information about objects follows the same rules. An object always has identity, form, and role in a given event.

One event, in GENREG terminology a "grouping event", differs from the other events. A grouping event is created by the curator to organise object hierarchies, and is thus an event which may occur independently of any "real life" event. By way of the grouping event it is possible to group objects, even though the individual objects share no events within their respective lifetimes. For instance, the objects may have been excavated in different years and accessioned in different years, yet stem from individual burials located on a burial site which has been in use over a very long prehistorical time period, so that no two objects ever existed at the same time. Nonetheless it is important for an archaeologist to see the burial site in its totality.

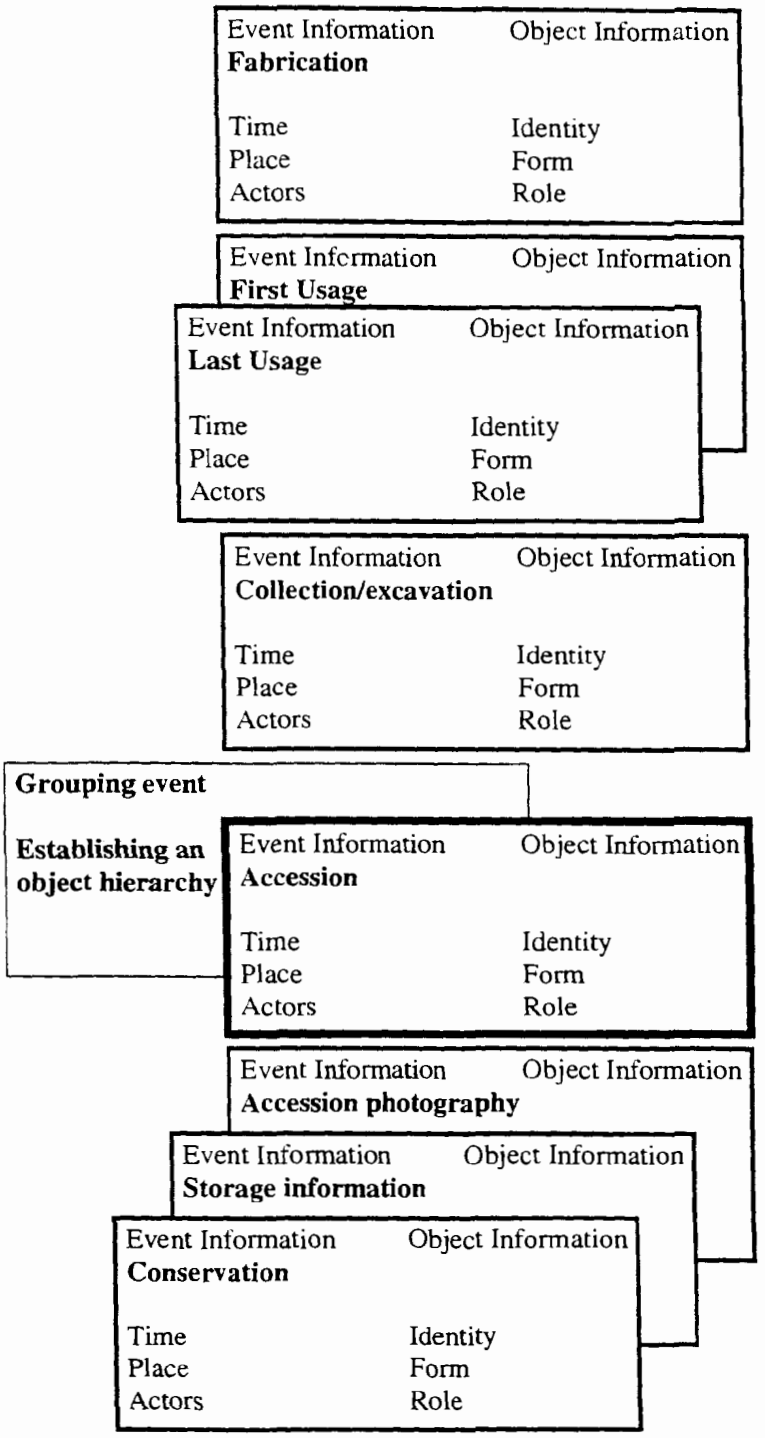

Figure 3

Figure 3: Chart showing some of the events an object may participate in during its "life cycle".

Double registration is of course undesirable and against the tenets of good database design, e.g. one should never repeat an object's measurements again and again in different events. Instead one should place such information where it logically belongs and according to a fixed registration procedure.

One thus fixes a definite procedure, for example that registration of an artefact's form and identity are associated with its accession event; this is logical since one would always measure and describe an object's state and allocate an inventory number at the time it is accessioned. One might further decide that the role of an object is associated with its last usage event. It is thus only under exceptional circumstances that one needs to register an artefact's form and role in other events e.g. only if these dimensions differ in other events.

An example could be when one can establish that an object's original form and role during its fabrication and its first usage events were different than in its last usage - for example one could describe and classify the silver table fork/bracelet as a table fork in its fabrication and/or first usage events, and as a bracelet in its last usage event (see Figure 1). One could even introduce a transformation event.

The Design of the Data Model

Even though the analysis implies that an object's life history can be long and complex, the data model resulting from the new analysis is surprisingly simple. In its most basic form it appears as follows (Figure 4).

The tables of Figure 4 are the one-to-many relation EVENT and ACTOR, which document the event's dimensions: event type, time, and place, and that actors may be involved, playing roles as for instance donor, producer, responsible for loan, etc.

The table OBJECT INFORMATION documents a given object's dimensions: identity, form, and role in the given event. An object's dimensions can be changed via the events in which it participates throughout its lifetime, as a unique event identifier is carried down to this table.

The table EVENT/OBJECT links an object to other objects and a given event. Since the table refers to itself, it is possible to link objects in a hierarchically structured relation (see Figure 2) to the same event.

In spite of appearances, the data structure is not limited to expressing hierarchical relations between objects - since the relations between the same objects can change from event to event. Thus a single object may appear in more than one hierarchy. For example, two medieval alter pieces may have been produced at the same time and place by the same workshop, and so share the same production event.

Later they may be placed in two different churches resulting in separate usage events, and still later be rejoined in an exhibition event.

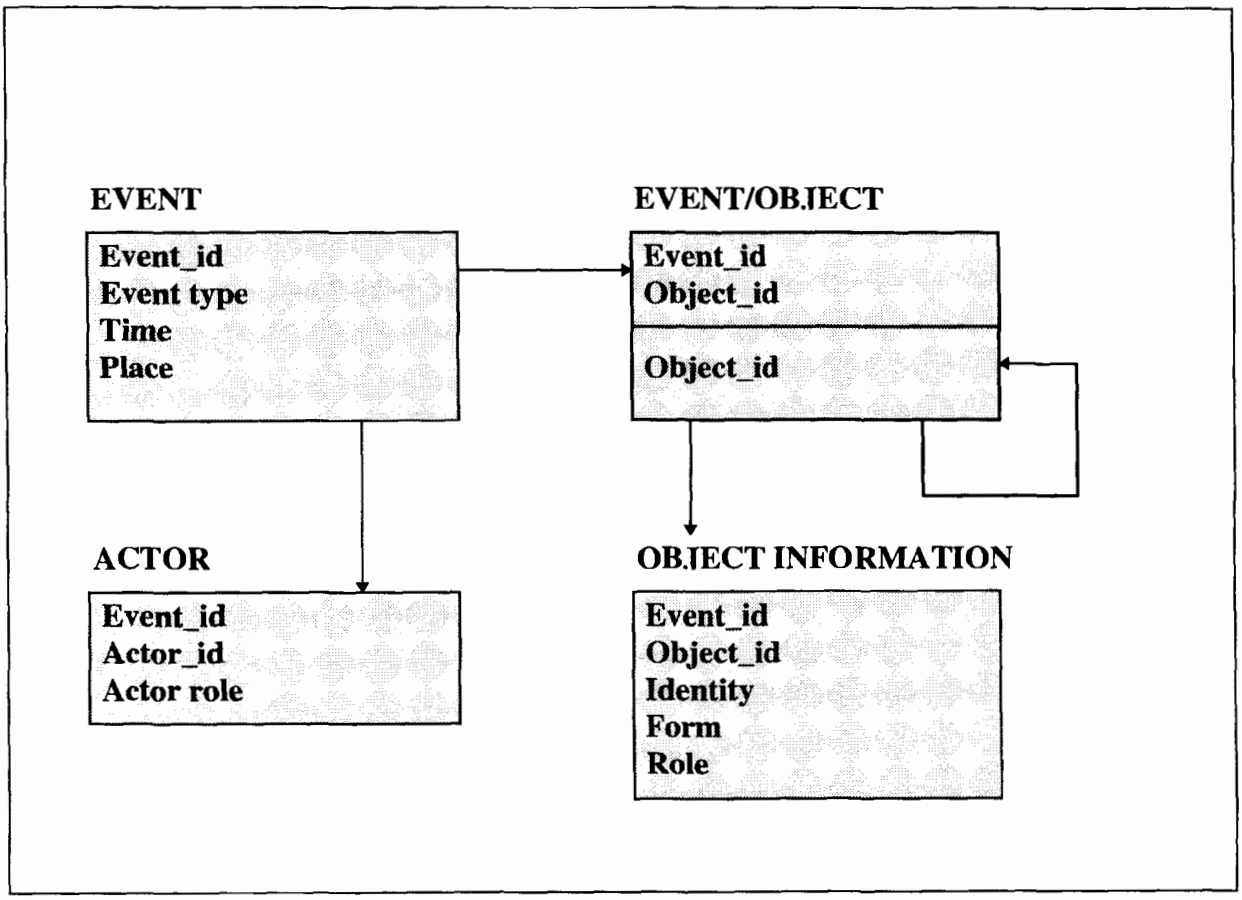

Figure 4: The simplified data model shows that only 4 tables are sufficient to solve problems of documenting changes in objects and relations of objects as they participate in different events during their life cycles. Relations between objects participating in the same event are documented by allowing the table EVENT/OBJECT to refer to itself. The arrows show one-to-many relations.

In reality the data model becomes more complex when one works through each of the various dimensions. There are in fact many ways to specify time and place, just as there exist many different classification systems building on typology, function, or a mixture of both. The individual professional fields within archaeology, history, ethnology, classic archaeology, etc. at the National Museum must of course be able to keep their own terminology, classification systems and documentation methods. On the other hand, when one speaks of more administrative events such as placement information, loans, etc., one can quite well agree on common standards for documentation and registration. Because of the many differences in terminology, classification systems, and registration routines, we decided to

implement department-specific versions of the GENREG system; it is nonetheless a good idea to strive for similarity and definitely to ensure compatibility of the various versions.

The Design of the Screens

The very simple data model gives a clue that the system's application will be simple and user-friendly. In simplified form the application consists of only a few elements (Figure 5).

- Window type 1: An event screen wherein data concerning **event type, -time, -place, -actors** and **actor roles** are grouped. Each event screen has two buttons: a button, "Event", when pushed, "pops-up" a different event screen to be placed in the area marked with a dotted line, so that two events may be visible at the same time; and a button, "Object information", when pushed, "pops-up" the screen window (window type 3) for documenting the object's identity, form and role in the current event.

- Window type 2: A screen window wherein the relations among objects are shown in a **hierarchical** relationship as declared related through the grouping event. The object hierarchy is thus independent of all real life events, however, all objects participating in the event highlighted on the screen will be marked, as objects are declared related both through the grouping event and through some of the real life events.

- Window type 3: A screen window wherein data concerning the object's **identity, form,** and **role** are grouped. One may, from any event window, "call" the window for registering the object's dimensions in the current event.

- Window type 4: a window containing **images** of the objects on the object list.

Events, objects, and images are all interrelated. When the focus is on an accession event, a set of objects which were accessioned at the same time will be highlighted; and similarly, the photographic images taken in connection with the accession will be distinguished by an extra frame. If one then shifts focus to another event, the highlighting on the object list and the images may be changed to show, for example, objects from the same burial site which have been excavated at different times over a period of years. If one focuses on one particular image, only the object or objects seen in the image will be highlighted on the object list.

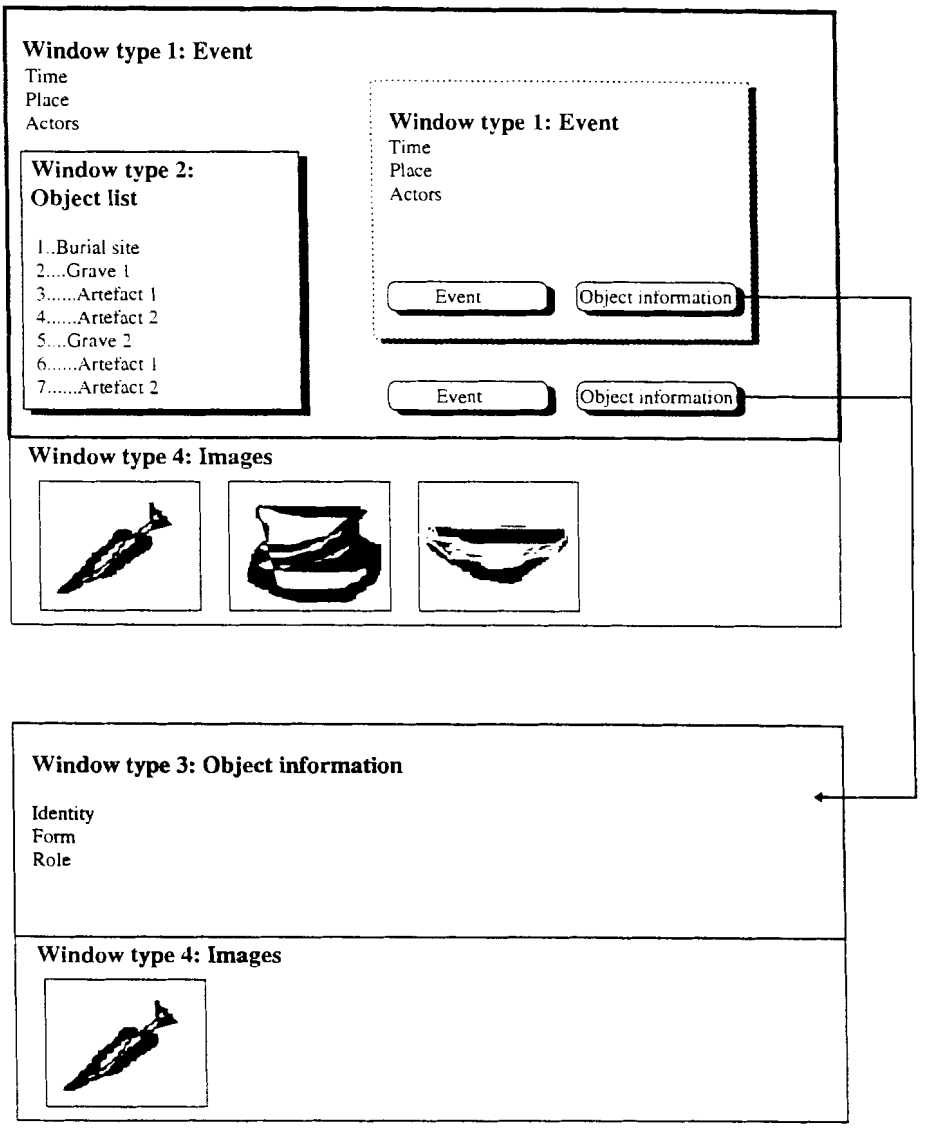

Figure 5: The basic design of all screens reflects the 4 tables of the data model. Window type 1 holds information on the dimensions of events: time, place and actors. Window type 2 holds information on the hierarchical relations between objects as they participate in events. Window type 3 holds information on objects' dimensions: identity, form and role. Window type 4 holds images of the objects.

The Application

The system was implemented in ACCESS, following the standards which have become well-known from innumerable windows application programs.

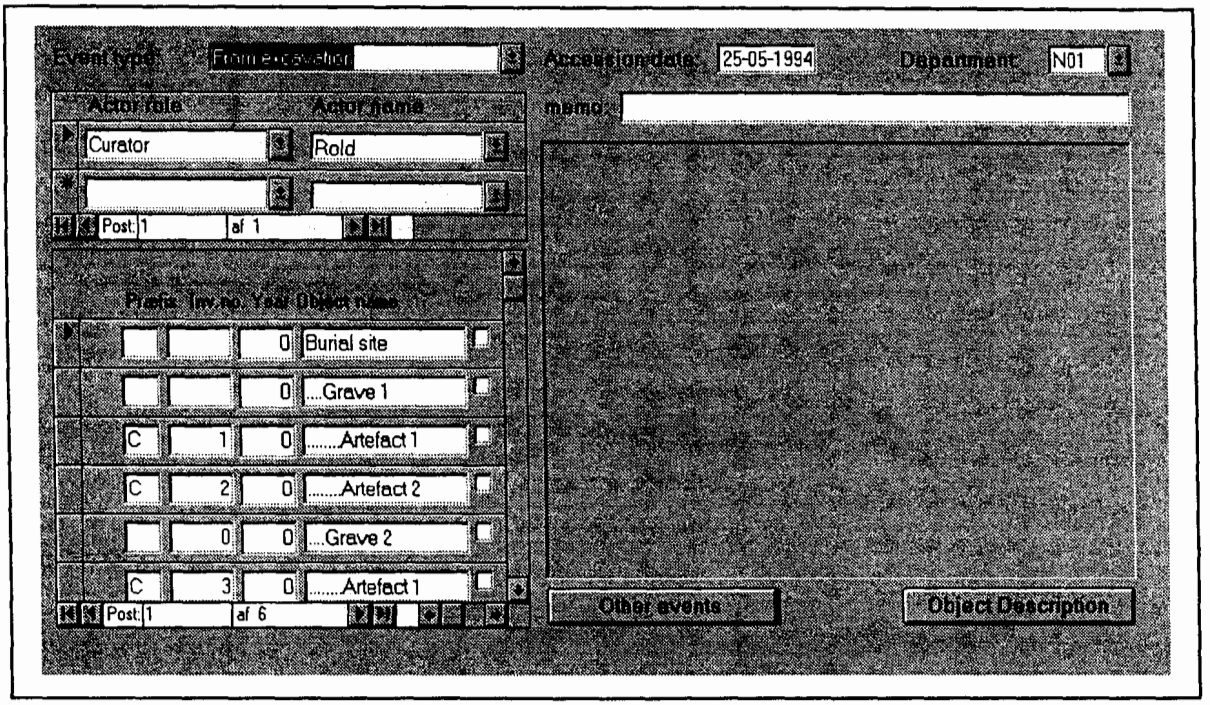

Figure 6: This screen image is a simplified version of the accession screen used by the Department of Prehistoric and Medieval Ages provided with captions in English. The sample data show the acquisition of artefacts excavated at a burial site with 2 graves. The hierarchical nature of the burial site, the graves and artefacts in the graves is reflected in the way the records are presented on the object list. In this example, both the burial site and the graves are considered as abstract objects not to be allocated inventory numbers, but they will be known to the system by their object identifier.

Figure 6 shows in simplified form the accession screen image. An accession event is the means by which new objects are entered into the database. It is necessarily complex, involving establishing the identity of the new objects by generating inventory numbers, recording the way the objects were obtained, who registered them, etc. The hierarchical relationships between objects may be established at the time the accession is registered, or it may be predeclared by the "grouping event" as described above.

Individual elements of the screen image are, as said, well-known "windows" elements. The white fields on the screen are database fields in which new documentation is stored, some relate to so-called "indexes", i.e. tables where standards are stored, for example classification systems, lists of persons/institutions, and lists of allowable values of various kinds. The index tables can be displayed on the screen so the registrator can select from them the values wished to be stored in connection with event and object information. The index tables are often shown as a field with an arrow-marked button at the field's right corner.

In the screen's upper left corner field, the "event type", one may select a subtype of the event, for example an accession event may be specified as donation, purchase, from excavation, etc.

An inset window is seen under this field where one can enter the actors who participated in the accession event together with the roles they played in this connection, e.g. the curator who is responsible for the accession, donor, etc. Persons or institutions are looked up in a list which is augmented over time as new persons/institutions are registered in the system. If one does not find on this list the person/institution that one wishes to register in connection with the event, one may ask the system to open a window where information about a new person/institution can be entered.

In the screen's upper right corner the accession time and place are automatically entered as the current date, and the Department of the National Museum which is using the system. The accession data may be changed, for example it will often happen that a registration occurs later than the actual accession. Information on the registration date and the registrator, i.e. the person who "logged in" to the system, are also stored in the system but are not visible on the screen.

The hierarchical structure relating all objects in the current accession is seen in the "Object list" below the actor window. This hierarchy may have been established immediately prior to the accession registration via a "grouping event", or can be entered directly if the accession consists of only a single object, or of several unrelated objects.

One may wish to register the new objects in relation to those of an existing object hierarchy. In this case the existing hierarchy is called up in a grouping event, so the new objects can be added where they logically belongs in the hierarchy.

Finally, when the object hierarchy is shown on the object list, the registrator marks the boxes to the right of each new object to indicate that these are to be assigned to the current accession event. Further, inventory numbers are allocated by the system through this procedure.

Once the accession is registered, pressing the button "New event" will prepare for a new event in the large window, marked by a dotted line on the screen, where documentation of, for example, find event, photography, placement, etc. can be registered.

Description of the individual objects may occur in connection with accession or any other event by marking the object on the object list, and thereafter pressing the button "Object description", after which the current event screen will vanish, making room for a new screen wherein one registers the object's form and role (Figure 7).

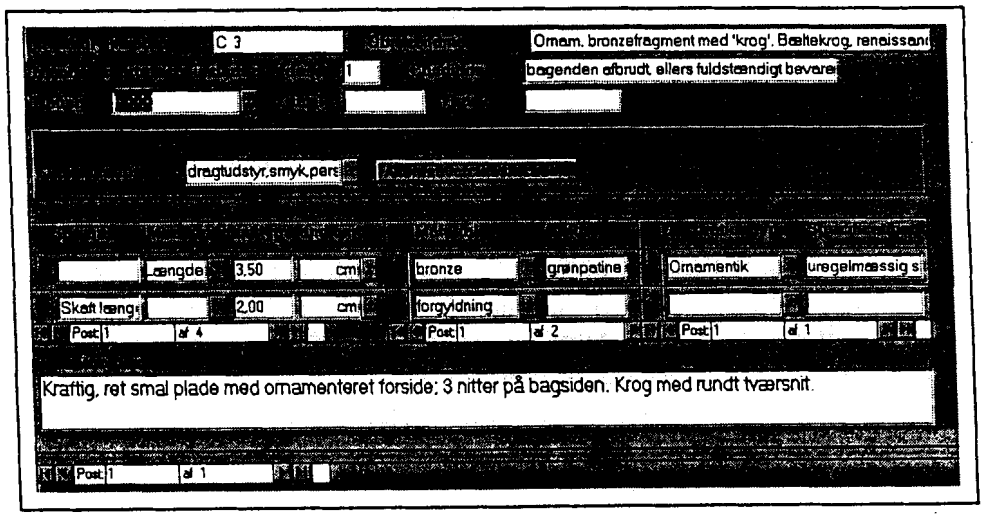

Figure 7: This figure shows the object description screen used at the Department of Prehistoric and Medieval Ages. The screen has been provided with English captions for this publication but the data themselves come from the active GENREG base and are thus in Danish. At the top of the screen "inventory number" and "object name" stem from the accession screen (see Figure 8). The object name for inventory number "C 3" is a working designation for easy identification. Below these fields one may enter the number of objects if more than one object is included in the inventory number and the age of the object(s). The "classification" field relates to a classification system and alternative classifications may be entered by pushing the button "Alternative classification". Measurements can be specified in the field "Special" and "Measurement type and unit". In these fields you may specify for instance the part of the object you want to enter the measurement of - for instance "shaft" and "axe head" if you are measuring a stone axe with a wooden shaft. Measurement type is entered as length, width, weight, etc. Measurement unit is by default in centimetres, but may be changed to meters, litres, grams, etc. The system converts the measurement units to a standard for easy access when searching. Decoration type could be "ornament" and the specification "concentric circles", or the decoration type could be "runic inscription", and the specification would be a transcription of the runic inscription, etc. The "inventory text" gives a description of the object(s) in the style that has become almost standardised and refined through close to 200 years of meticulous curatorial documentation.

As mentioned earlier, it is necessary to determine specific rules for the logical storage of objects' form, and role. For prehistoric artefacts the system automatically stores information on objects' form

in connection with the accession event and information on objects' role and age is stored in an automatically created last usage event. Following these rules the registrator does not need to bring forth usage and fabrication event screens but may enter all object information in this screen alone (see Figure 7) - unless we specifically want to distinguish between the object's form and role during the object's life cycle from its fabrication to its last usage and the duration between these two events. In the latter case the registrator needs to create such events and call the object information screen from the relevant event screens.

An "object" may be abstract, as mentioned above, this is convenient when the "object" consists of a large number of concrete objects as, for instance, stone tools and refuse from toolmaking from stone age settlements. In such cases it is undesirable to allocate inventory numbers for every artefact. In the object information screen it is therefore possible to describe the types of artefacts included in the abstract object - the settlement for instance - and also to single out particularly interesting artefacts by repetition of the object information screen.

After an object - abstract or concrete - has been registered in the system, a bar code can be written out, for reliable and automatic reading when the object is later photographed, sent to conservation, loaned out, etc.

Accession photography is done with a digital camera and the picture is thereafter accessible on the screen (see Figure 8). "Clicking" on a photograph gives a magnified image.

The image can be shown with a magnification which fills nearly the entire screen, and one can further enlarge sections of this; but beyond a certain point the individual "bits" begin to disturb the picture quality as the images available on the network are compressed to fill only 50 kilobytes (see Figure 9).

Interactive Tools for the Researcher

The range of possibilities for documentation and registration made possible by the new system is not only a researcher's dream come true - it could quite easily become a nightmare. One thing is to have the possibility to document in depth, but to do this consistently is quite another thing. It is therefore necessary to fix certain minimum requirements, standards and guidelines for registration, following the general requirements for museal documentation; but the potential of the system beyond these minimal requirements is being explored. The system can be used as an interactive working tool to carry out special research tasks - as well as a tool and data bank for exhibitions and public access. One way to achieve this has been to let the researcher work interactively with the system to structure his or her knowledge, and - if this succeeds - to expand the system with the new possibilities.

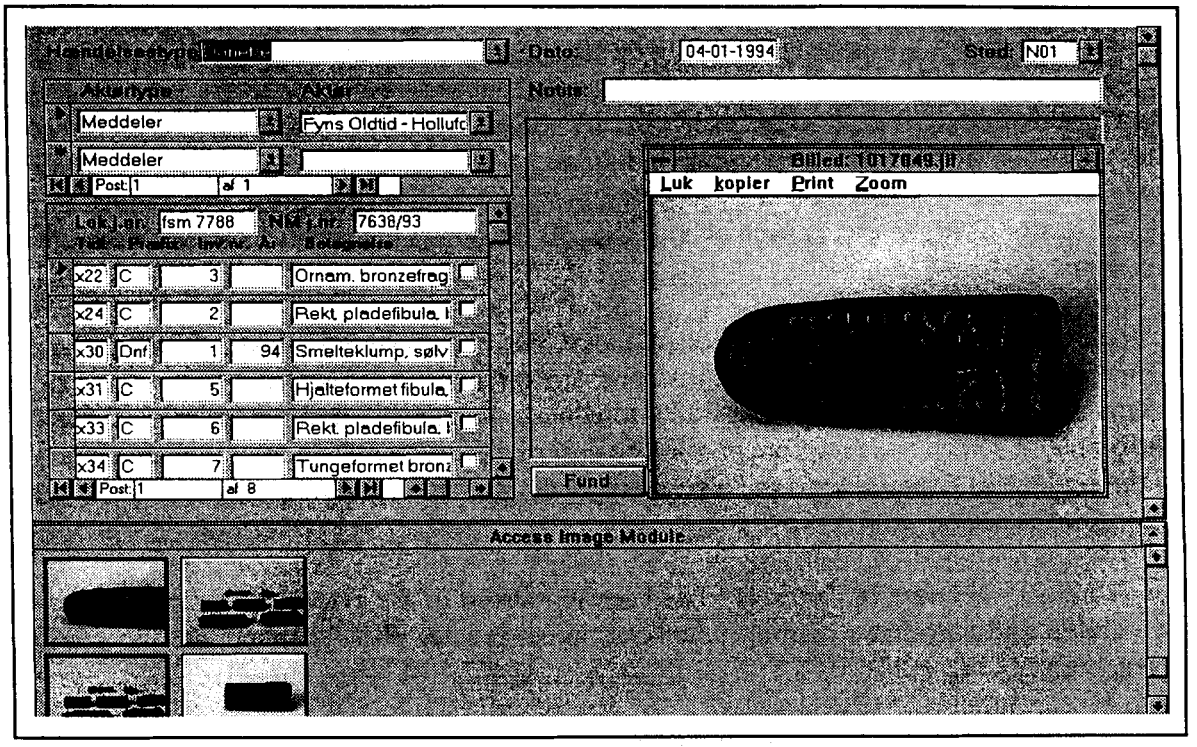

Figure 8: This screen image shows the Danish version of the screen Figure 6 with data - both textual and images - from the active GENREG base. The documentation concerns a number of metal artefacts accessioned as "Danefæ" which means treasure trove. The screen window below the object list can be scrolled to show all the photographs of the objects on the object list. The photos include both photos of the individual objects and one photo where all the objects are grouped together in a "family portrait" which appears again and again beside the photo of the individual objects. On the top of the object list an arrow points to the object "C 3". This object is thus highlighted and the photograph of "C 3" as well as the family portrait in which "C 3" also appears are both highlighted in the image window screen below. As the photograph of "C 3" has been "clicked" an enlarged image of "C 3" is shown to the right.

One example we have seen of this is a research project involving the study of bronze age objects decorated with images of ships. Such images can be found on jewellery and especially on razors. However, at the time when this research project was carried out we had not yet completed the retrospective registration of the bronze age artefacts. All the system contained was inventory numbers, find locations, a very coarse classification, storage/exhibition location - and photos of the objects. In fact we had some 10,000 photographs but lacked a refined classification of the objects, and information of decorations on the objects.

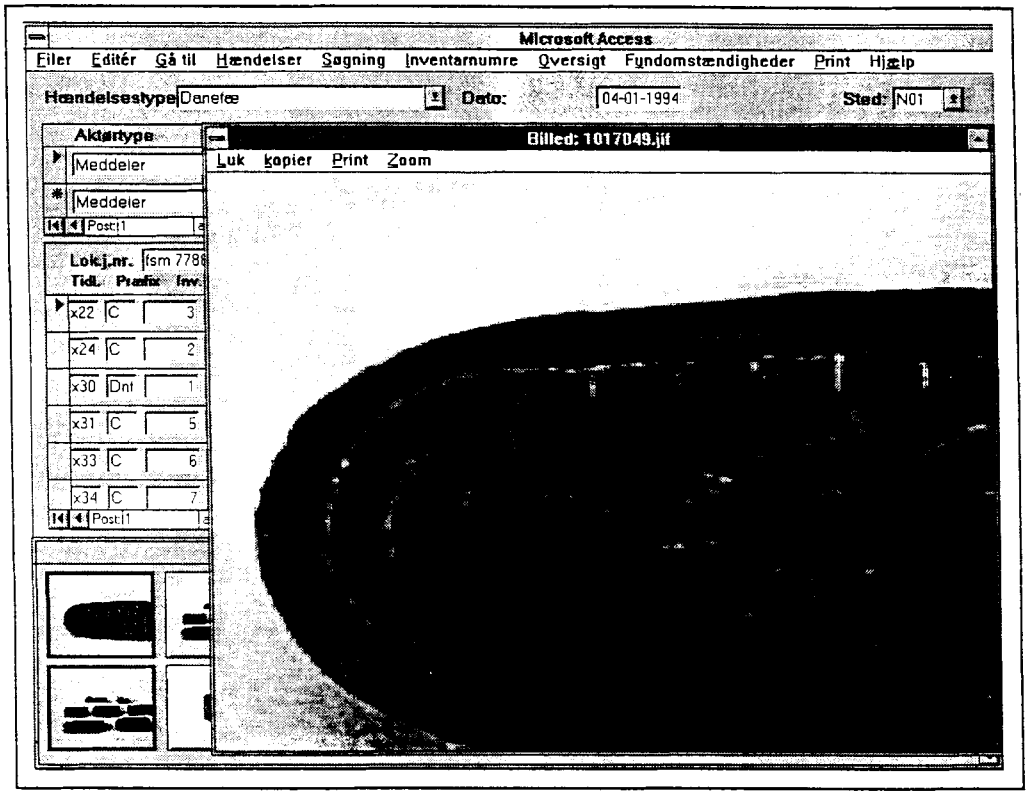

Figure 9: This figure shows the same screen as seen in Figure 8 after the photograph has been enlarged further and after zooming in on part of the photograph. When zooming in on an image the quality will eventually start showing the individual bits, thus disturbing the picture. The reason for this is that the images which are available on the computer for daily use and transmission through the internal network are compressed to fill only 50 kilobytes. The original digital photographs fills 12 - 15 megabytes and are stored on CD-ROM.

Still, it was advantageous to use the system, as the researcher could "flip" through the photographs and mark any that would be likely to hold decorations in the form of ship motives. It may sound to be a major task to look through 10,000 photographs which resulted in selecting only 400 artefacts decorated with ship motives. In fact, this part of the work was done in a very short time; especially if one compares this with the time which would have been needed to actually study the objects themselves in store rooms and exhibition halls or search information from publications.

The next step was to construct a research database in connection with the large GENREG base where the researcher, in addition to having access to the already existing data, could describe ship pictures in detail and possibly discover special motives - for example different ship types, rituals which involve ships, etc. The research result can, perhaps, result in a finer classification system, to the benefit of future designations when new objects come into the collection.

Even though such a process must be watched carefully, we begin to glimpse a documentation system which not only is changed as research develops, but from a longer perspective can be extended in the direction of a truly knowledge based system in which images will no doubt play a major role.

Unstructured search through an image base is an interesting possibility in itself. The brain can actually grasp some kind of information at the rate of skimming 26 images per second. At this rate it is possible to view our total ethnographic collection of about 120,000 objects more than once in only one day - at least technically but maybe not practically. The perspective of having such a quick access to images is still unexplored, but is bound to have a major impact on research and research methods.

References

Wanning, Tine: Ethnographic treasuries in the computer. *Proceedings of the Second International Conference on Hypermedia and Interactivity in Museums (ICHIM '93).* 1993.

Reed, Patricia Ann: CIDOC Relational Data Model. 1995.

Booch, Grady: Object Oriented Design. *The Benjamin/Cummings Publishing Company, Inc.* 1991.

Rold, Lene: Syntheses in object oriented analysis. *Proceedings of the Conference on Computer Applications and Quantitative Methods in Archaeology (CAA92).* 1993.