THE NAGAS; AN EXPERIMENT IN MULTIMEDIA

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This article will describe a project in which a number of different communications media were used alongside each other in order to convey to a western audience the nature of anthropological materials. A book, a museum exhibition, a videodisc, a textual database and an information retrieval system, all focusing on the Nagas of North-East India, were devised over the period 1985-1990. (1) Before we look at some of the specific problems of undertaking this project, it is worth considering briefly some of the developments in information technology during the 1980's which made this experiment possible.

During the last few years it has become possible to combine media in new ways. Until the end of the 1970's, a computer was still a statistical and textual manipulating device. Until about 1980 the capacity of 'desk-top' computers was very limited. During the 1980's the power and storage capacity of such computers has increased exponentially. Nowadays, for instance, computers can conventionally have access to stored information on hard disc or optical disc ranging from 2O to 400 megabytes. Such quantities would only have been envisaged with the largest mainframe computers a few years ago, and even then only in special circumstances.

These desk-top, lap-top and palm-top computers are still slower than large 'mainframe' computers. But within a few years they will be more powerful and faster than any mainframe of preceding generations. Furthermore, they provide interfaces (e.g. WIMP, windows, icons, mouse, pull-down menus), which are infinitely more flexible and user-friendly than previous mainframes. Likewise the cost of storage and computational power is constantly decreasing.

These changes, with storage of hundreds of megabytes of direct-access information on optical disk storage already announced, presents the possibility of ordinary users setting up large textual and statistical databases on their own dedicated and 'user-friendly' machines.

The potentials are increased significantly when we come to the second major development. This is the increasing possibility of incorporating sound and film and linking this to the textual and statistical data. We can now begin to envisage the computer as a combined textual/visual/statistical tool for manipulating simultaneously words, numbers, images and sounds.

There are two developments which have made this possible. On the one hand the increased storage capacity allows one to 'digitize', that is to turn into digital form the images and sound (compact disc holds digital sound and it can now hold digital images). The main limitation on this at present is that a single image requires a great deal of space in such a digitized form, which precludes the use of

moving film in this format. No doubt compression methods will be found, and some have already been devised to overcome this limitation. The great advantage of having the image in digitized form is that it can be manipulated, printed out, deleted or replaced with ease. In other words, pictures and sound become like any computer files.

When the read/write combined optical and textual systems are available with the new generations of computers, we can envisage a situation when a use will have a dedicated device that can simultaneously hold hundreds of thousands of separate items of information; an item might be a piece of music, photograph, moving film, paragraph of text, index card, statistical table. To a certain extent this was achieved by the BBC in their 'Domesday Disc' in 1986, and I have described elsewhere some of the features of that experiment (2). But in the future numerous users will be able to set up their own libraries and archives, each one uniquely tailored and often the size of a moderate conventional library of today.

All this is in the near future. At present, the only way to combine large optical data sets with texts is by the use of optical disc or video-disc, using analogue rather than digital storage of data.

In this article I will describe a prototype system developed on videodisc, which is used alongside a textual database. Since many are not familiar with optical discs and their potentials, we can start by looking at their nature and potential before looking at how we transferred different types of materials into the textual and optical database and how we accessed it.

The nature and potential of videodiscs.

A videodisc or optical disc is a silver object which looks like a gramophone record. Information is engraved on its surface. The information is read off each separate track by a laser beam within a videodisc player. This provides a virtually indestructible storage format which is not damaged by dust, normal changes of temperature, electric currents, damp or insects.

A videodisc can hold a very large quantity of information. A standard disc can play moving film for 36 minutes per side in interactive mode or hold 54,000 separate pictures per side, or a combination of these. It can store at least 300 megabytes of information per side.

A videodisc can hold copies of almost all kinds of recordable information: photographs, slides, moving film, x-rays, sound recordings, graphics, manuscript sources, printed works. A disc has a visual track and two sound tracks. The sound tracks may be used for sound or for digitally encoded textual information. The discs are double-sided and once a master has been created copies may be made relatively easily and cheaply.

There are essentially three levels of videodisc sophistication, sometimes known as the Nebraska scale. The simplest home videodisc players , roughly the size and weight of a video-recorder, provide the following facilities: remote control (through a keypad) ; random access to any frame on

the disc within three seconds, each frame having an unique number; the possibility of freezing a frame for as long as needed without any damage to the disc; forward and reverse movement at full speed, half speed, or a frame at a time; the possibility of scanning very fast through the disc. The indexes to the videodisc in this case are held on a separate medium, either paper or a computer floppy disc.

The value of this new type of data store is increased if the videodisc player contains a small on-board (internal) microprocessor or an EPROM (externally-programmable, read-only memory). This enables the user to develop the interactive potential in the videodisc by linking a programmable machine with the archival potential of a videodisc.

As well as the basic features of the simple player, there are facilities for branching and for monitoring the performance of the user. A simple program can be written to guide the viewer through the material on the videodisc or to help in simple searches. Such a system, for instance, would be suitable for some demonstration purposes in teaching, displays in museums and in industrial applications.

A considerable increase in power is achieved if the videodisc is linked (via the RS232 serial port) to a more powerful external computer of the kind which is now becoming standard. This can now hold the indexes to the videodisc. This first of all enables the user to develop the ideas described in the previous paragraph. Ready-written programs can be written which will take a viewer on various 'walks' or guided tours through the material, providing tutorials on various topics and themes.

Thus a single videodisc can be made to yield hundreds of different 'films' which can not only be on different topics, but at different levels of difficulty for different audiences, and to mix visual, textual and audible information. Copies can be made onto videotape if necessary.

The second possibility is to write interactive programs. Here the viewer uses the computer to make choices in response to questions and these choices affect subsequent viewing. Through the use of 'loops', that is the repetition of sections of a program, it is possible to make sure that the message is understood. Through the idea of 'branching', or diverging tracks through the material, the viewer can control whether he or she will move in one direction or another. The level of instruction and comprehension can be altered as appropriate. This provides a learning game or computer aided instruction which is enriched by the addition of visual and sound materials.

A third possibility is for viewers to explore the videodisc themselves, using the normal searching capacities of a computer and a conventional database package. With tens of thousands of separate visual and sound records on the videodisc, it is indeed only possible to explore different themes quickly if one has some form of computerized index searching. With such a standard database package, it would be possible to build up an index of key terms and to search the descriptions of pictures and sound in order to find those which matched a query.

A new dimension is added if we consider the videodisc as only one among several databases. It may be closely associated with a textual database, thus changing the system into a mixed optical and

textual database. As with the BBC Domesday videodisc, a great deal of background textual and possibly statistical material can be accessed by the computer, either on the videodisc itself, or on some other form of large store, such as hard disc or compact disc. For instance, the detailed documentation relating to the pictures on the disc may be contained in the letters, diaries, notes and books of those who took them. These need to be made available to make the pictures meaningful, and in turn the pictures are needed to give meaning to the texts.

The addition of many thousands of pages of textual information to the tens of thousands of visual images puts new demands on the retrieval system. Unless it is powerful, fast, flexible and caters for human intuitional and associational reasoning, it will be impossible to make full use of the new possibilities emerging from this very recent union of developments in laser, video and computer technology.

Already videodiscs are being used in many different ways. Here we will merely mention three educational uses. One of these is in terms of archival storage. Because of the perishable nature of early film and photographs, as well as of old objects and manuscripts, many curators and archivists have been looking for a medium which will store representations of various materials more effectively. The durability, compactness and rapid direct access, makes a videodisc based system attractive for all those with collections of 'records' , whether photographs, films, books, manuscripts, or objects.

Among its attractions from an archival perspective is the fact that the videodisc makes access to reserve collections possible for researchers and the general public. Exchange of information between institutions will become feasible, including sending copies of the very large collections now in western countries to the Third World countries from which the collections were made. Museum security can be increased by having a photographic catalogue of the collection. The cost of reproducing visual and textual information is dramatically reduced. Just as microfiche and microfilm reduced reproduction costs by factor of over ten, this format reduces such costs again by a factor of another ten to fifty times, depending on the materials.

In relation to teaching and instruction, there are also very considerable potentials which are being explored. A videodisc system can be used at any educational level in either public displays or in schools and universities. Devising programs from the data teaches a number of skills to the program maker, and the finished product can be used in class or display. As a central resource in a school or university, for instance, it would enable teachers in a number of disciplines to make up programs for different purposes. In a museum it would be possible to provide a series of different short programs which visitors could select, as a background to the exhibits.

As far as research and the deepening of knowledge is concerned, a videodisc database makes it possible to collect together and store in an accessible way many of the materials now scattered in different locations, giving the researcher instant access to them. This makes it possible to undertake detailed research of a kind that has hitherto not been feasible. A videodisc system gives the ability to move at will, with direct access, through information of a visual, textual and audible kind. Frame by

frame analysis, enhancing images with digital programs, examining film in slow motion, the juxtaposition of visual and textual materials, now becomes possible in the context of very large collections. The limits become those of human interest and ingenuity, rather than the accidental location and availability of information.

The recording of a tribal civilization; the Nagas.

As this new technology became available in the mid 1980's, a group at Cambridge University decided to make an experimental videodisc on an anthropological theme. Although we would do this differently in some ways now, it is worth recording how this was done since a number of the lessons which we learnt could be applied to other projects which are now being considered.

The first decision concerned which group to select as the subject of the videodisc and database. One of the few areas in the world where acute observers have documented, over a period of more than a hundred years, the workings of an assembly of tribal societies is on the north- eastern frontier of India. These involve the British contacts with the so-called Naga tribes of the Assam-Burma border.

In many ways the Nagas, who numbered about half a million people at any one point in the period covered by this videodisc, are representative of the forest dwelling tribesmen who once inhabited large areas of South-east Asia, the Pacific, South America and Central Africa.

A combination of circumstances has given us a particularly rich record of Naga culture. Firstly, the precipitous mountains and thick forest, as well as the warlike head-hunting reputation of the peoples deterred outsiders from entering the area until very late. The period of contact, starting effectively in the 1840s, was unusually gradual, lasting over a century until Indian Independence in 1947.

It was only with the Second World War and the combined influence of missions, education and economic growth that the situation changed profoundly. Little research has been possible in Nagaland since 1947, and the bulk of the material on the present videodisc therefore relates to the period up to that date.

Thus we have for the Nagas a series of historical records spread over a century, each analysing aspects of a set of tribal societies sufficiently isolated to maintain much of their ancient social systems, yet with a loose attachment to the British Empire. This encouraged outsiders to try to understand the traditional ways of life in order to administer and adjudicate the expanding Empire in the north-east.

The relative lateness of the contact means that the second fifty years of documentation were within the era of photography and the last few years within that of the moving film. The involved interest of the District Officers as collectors and analysts ensured the survival of large numbers of artefacts.

All this provided the context which made study and recording possible, but only good fortune brought to the Naga Hills a series of very gifted observers. These men and women became so involved with the Nagas that they assembled large collections of all kinds of material despite linguistic and practical difficulties.

Although we are forced to look at the Nagas through alien and outsiders' eyes, over the shoulders of the observers, there is enough material to glimpse a world that has now practically vanished. Here we will try to provide a very brief description of a few of the outstanding features of Naga society as they described it. (3)

A few of the central features of Naga society.

A number of features made the Nagas particularly interesting to European observers. There was first their mysterious history. First mentioned by Ptolemy in about 15O A.D., it was clear that the Naga tribes had only coalesced recently in the patterns which the British discovered. After millennia of wandering, a number of different ethnic groups had ended up in the hills of the Eastern Himalayas.

Strange coincidences of culture and language through the Pacific led some scholars to suggest that the Nagas were an off-shoot of groups which had originally descended from the central Asian plateau. Their burial customs, ornamentation, agricultural practices and even games and crafts, linked them strongly to the tribal peoples of Borneo and the Philippines. Here was a culture which might provide clues to some of the great migrations in human history.

Equally intriguing was their contemporary material culture. Like many tribal groups who practice the labour-efficient methods of swidden (slash and burn) cultivation of rice, the Nagas had a great deal of leisure, and large surpluses of grain. They used this to develop an elaborate and beautiful world in the forests.

They were expert craftsmen and artists, making their social and cultural patterns explicit through ornamentation and display. Through colour and pattern in their material culture the Nagas revealed their social and ritual status. From the earliest period of contact, visitors were struck by the Nagas' carved and thatched houses, woven cloths and wooden carvings, distinctive hairstyles and body tattoos, and their songs and dances.

European attitudes were more mixed about other aspects of Naga society. Nakedness, youth dormitories and a relaxed attitude to sexual experimentation aroused more ambivalent reactions. Yet by the turn of the century their uninhibited way of life, their physical attractiveness, and their personal loyalty and frankness, had won the hearts of many observers and administrators.

It had not always been thus. The antipathy of the Nagas to the colonial expansion of the British resulted in an Angami Naga rebellion in 1878. The suppression of this revolt was followed by the expansion of the 'administered areas' (where Nagas paid taxes and supplied labour) in the 20th

century. But the development of British 'indirect rule' and its pragmatic tolerance perhaps explains why by 1944 many Nagas opted to help the British in repelling the Japanese advance into India.

Other features of Naga society also attracted attention, including their political systems ranging from autocratic chiefs to almost pure democracy in neighbouring tribes, and their ecological adaptation to a harsh terrain. In the elaborate terraced rice cultivation of the Angami Nagas and the shifting cultivation of most of the other Naga tribes, it was possible to see traditional systems of agriculture in undisturbed operation.

One had some picture of how men must have lived in forests over hundreds of thousands of years. Each stage of the agricultural operation and its close interweaving with ritual and taboo was noted by the observers.

Two outstanding features of the varied cultures particularly drew attention, the Naga concern with death and with the human skull. Although exuberantly alive, what gave real meaning to Naga society was death and the manner of dying. Despite the absence of written records, through myth and particularly in material memorials, the names and deeds of ancestors were to be remembered.

Most dramatically, this was done through the erection of massive stones, dragged by teams of villagers through the jungle and erected as the culmination of grand 'feasts of merit' to celebrate the power and deeds of great men. The world which was only vaguely remembered in the standing stones of Europe or the Pacific was still alive among the Nagas.

All of Naga life had its ritual aspect: all activities, from simple household and economic tasks up to dancing and feasting, had a mystical or religious significance. The spirits which controlled the realities of Naga life, disease, human and crop fertility, rain, needed constant attention. The human head, the seat of wisdom and the human soul, was the repository and conductor of power. This was true, irrespective of whether the head was that of a child, a man, a woman, alive or dead. He who owned another's head gained prosperity in this world, the esteem of his fellows, and a guaranteed happiness in the after-world. The best way to own a head was to take one by force.

Forest tribal peoples, for instance the peoples of New Guinea or the Amazon, are often very war-like. To seize the wealth and labour of other groups is a more congenial way to affluence and power than by hard work in agriculture. There is no political organization above the level of the clan or village to prevent war. In this world of a war of all against all, the Nagas added the ritual importance of head-hunting. Life was given its central purpose by the quest for heads. Boys would not become men without the ritual tattooing only to be undertaken after a successful head-hunt; girls would not be attracted to men without the splendid head-hunting dances and decorations. Success and merit in every field depended on heads.

This presented administrators and anthropologists with one of their major challenges. By the turn of the century, they were well aware of the logic of the system and could recognize that if head-hunting were rapidly abolished (as it had been in other parts of the Empire) it would be the equivalent of destroying money, markets and the profit motive in a capitalist society. There would

be little point to life any more.

Yet the western conscience could not condone the cruelty, nor was the 'pax Britannica' very plausible in a world of almost ceaseless feuding. So the observers tried to study, modify and re-shape the institution, while the Nagas tried to incorporate the observers into their world. The mutual relations between these strikingly different, yet admiring and basically tolerant points of view, run through the literature. They pose the broadest questions concerning ethical relativism, the preservation or destruction of alternative modes of thought and deed, the rights to interfere. These problems were exacerbated by the growing number of Christian missionaries in the hills who were trying to convert the Nagas from their supposedly 'heathen' religion, morality and social customs.

Out of this conflict of two civilizations based on entirely different premises there came thousands of images and descriptions of the Nagas. This videodisc gives access to many of those images. Since Independence in 1947 there have been great changes and only a part of what is represented here has survived.

The "military" phase of observation.

Since we cannot visit Nagaland and in any case the period covered by this disc is long past, we are forced to look over the shoulders of others who lived and worked in Nagaland. We see the Nagas through the necessarily distorted mirror of European visitors.

The first phase of observation (1832 to c.1880) might be termed "military", in which initial contact was dominated by an attempted pacification in the face of an unorthodox resistance by the Nagas. In this phase, where the Nagas represented an unexpected obstacle to the smooth expansion of British political power and economic interests (principally tea), the potential for ethnographic description was limited.

The Nagas, who had achieved equality with neighbouring valley Hindu kingdoms, did not always accept the British presence willingly; while their institutionalized violence and lack of over-arching political organization, made British control difficult to effect. Yet by the end of this phase a significant body of descriptive writing by surveyors, soldiers and administrators had been built up.

The writing was on occasion patronizing and, to the modern eye, racist, and it emphasized the obviously exotic features of Naga society, such as head-taking. But its descriptive thoroughness, in questions of dress, ornamentation, and house-building (features which seemed to make it possible to identify different groups or even tribes), raised the key question which still informs Naga studies: are the Nagas one people or many ?

The "administrative" phase of observation.

The second phase, which we might call "administrative", saw overt military control largely replaced by a policy of indirect rule through administration. Within the (ever-expanding)

administered area, the British guaranteed peace, while setting up structures of courts, schools, taxes, headmen and labour obligations; outside the administered area the British practised non-interference, except where raiding threatened administered villages or valley tea estates.

This policy of non-interference necessitated a need for the most thorough knowledge of the people concerned: their indigenous laws and kinship systems, the demands of their ritual observances, their understanding of social status, their relations with their neighbours, their economy and systems of ownership. The variations in these matters between groups of villages, were studied intensively, often under the influence of the then current theories about migration and social evolution.

It is for this reason that the administrative and ethnographic projects were parallel, and indeed the ethnographic monographs of the 1920s doubled as administrators handbooks. The naming of the separate Naga "tribes" (largely on the basis of material culture and language) was effected by this stage: although a British way of seeing things rather than a Naga one, this classification continues to be important in Nagaland, which since 1962 has been a state within the Republic of India.

General principles of selection.

We now have media (videodisc, compact disc, hard disc) which will hold hitherto inconceivably large sets of visual, aural and textual information. Nevertheless, in practice there is always too little space, time, energy or interest, so that only part of the materials that have survived can be transferred.

We have already described in a preliminary way how the minds and interests of the observers absorbed only a small part of the Naga world into their camera lenses and writings. A second distortion then occurs by the action of history and accidents of storage; a great deal has been lost, or is buried in private or public collections in such a way that we were unable to use it.

Nevertheless, even with these two filters, a very great deal has survived and this has meant that we have had to make some selections from what we have found. Since such a selection is inevitable in any project of this nature and affects the meaning and value of what is available, we may briefly describe the principles of selection in each major type of material.

Photographs

Since there are a finite number of photographs of the Naga and they are of great value we have tried to include practically all the photographs we have located. Only a few hundred out of the roughly seven thousand black and white photographs we discovered have been omitted. These were left out on the following grounds: they were duplicates of, or very similar to, other images; their quality was poor; they were outside the delimited geographical area; they were outside our time span; or they fell on the side of "private experience" as opposed to "public experience", in the sense meant by John Berger (**About Looking**, 1980, p.51).

We did not "censor" any photographs because their content was embarrassing or shocking in any way, or might do damage to the reputation of individuals, the British, anthropology as a discipline, or for other such reasons.

This latitude obviously raises important issues, given that the videodisc system is intended for use in a variety of educational contexts. Many of the images from the colonial era do, after all, portray the people concerned in a way which is objectifying, de-contextualizing, or exoticizing. It is undeniably the case that the camera did contribute to the "normalising gaze", in Foucault's terms, by which a subtle form of power was exercised over others by classifying them and making them visible. The Naga videodisc does not attempt to avoid these issues, but, rather, hopes through the associated book and introductions to the videodisc, to encourage a critical attitude on the part of users to the historical interaction of anthropology and administration.

It must also be said that the antithesis to de-contextualized images is also contained on the disc itself, in the shape of some of the earliest, and best, examples of a recognizably "modern" era of empathetic and contextualized anthropological photography.

Moving film

There were two problems here. First, we found very little film before 1947 (the end of the period the videodisc was to cover), but since film is so important, we decided to break the temporal boundaries and include movie film taken on two visits to Nagaland in 1963 and 197O by an anthropologist who had worked in the area in 1936-7. When we included these, we now had some six hours of film. One side of a videodisc will hold only 36 minutes of moving film (in interactive mode), and since we needed to allocate at least six minutes to the photographs, we only had about thirty minutes free. This meant that we had to reduce the film at a ratio of 1:12.

We spent many weeks going through again and again, whittling away material, trying to minimize the loss of valuable archival footage. The principles we evolved and acted on were as follows.

The first consideration was the content of the moving images. We tried to include that material which was most intellectually and academically interesting. This is a subjective matter, our criteria being that material which portrayed events and processes which were most representative, most revealing, most unusual, and illuminated the other still images and texts in the most significant way should be included. The visual images which were unusual included those which were only preserved in this medium, for instance the eating of dried rats, or a shared joke between anthropologist and Naga. We concentrated on subjects where movement and action were important, for instance dance, games, postures and gestures, rituals, agricultural labour. If long and repeated sequences of film on the same subject were present, we selected only one or two sequences.

The second set of principles was concerned with form. Taking into account the interest of the content, we rejected badly filmed sequences, that is to say the few sequences which were out of

focus, badly composed, unsteady, from too great a distance and so on. We rejected film that was damaged, the colour fading, or otherwise unsatisfactory, unless it was particularly interesting. We preferred close-up shots of detail in most cases to the wider shots of a more static kind, which could be preserved with one or two selected stills. Close-ups are more effective on the intimate television screen.

In considering the selection for the videodisc, there was one set of factors which gave us a considerable advantage over the person who is undertaking normal editing down from raw film. These are connected to the absolute precise controllability of this new medium. With normal film, one is constrained to save and knit together reasonably long sequences, five seconds at least, and often three times that length, just to capture the run up to something important happening, for instance an immobile man before he starts to run up to do a jump. Action itself, if it is to be appreciated by the viewer and happens rapidly, may need to be shown at some length, or from several different angles. In other words, a great deal of redundancy has to be built in to normal editing, since the viewer will only see the images flashing past once. With videodisc the user becomes the editor, master of the medium. One effect of this is that one is not constrained in selecting shots for inclusion on the disc by the usual film conventions, such as keeping the stage line or matching shots.

Another important principle is that with videodisc, there is a sense in which film that has been shrunk or contracted in the editing process can be expanded again at the viewing stage. It is as if it had been dehydrated. This is because it is possible to treat each frame in a precise way. One can take just one shot of a view, or non-moving group of people, and hold it as an establishing shot for a number of seconds; if necessary one can easily go back to the start of the sequence and play through in slow motion to explain in detail what is happening, and so on. In other words, instead of merely cutting a long set of moving sequences into shorter pieces and sticking them in a precise order, one is creating a set of images, some of them still frames, some of them sequences of still frames taken every few seconds, some of them moving sequences.

The boundaries between still and moving films blur, and one is able to abstract precisely a great deal of the visual information without apparently losing much. It should be stressed, however, that there is a different 'feel' as between a frozen frame and a 'still' filmed sequence. In this way we created out of six hours of film approximately one hundred and fifty moving sequences, each lasting between three and about twenty-five seconds, the average being about eight seconds. We also abstracted about one thousand "stills" taken out of moving sequences where there was little movement, or randomly every few seconds to capture a series of events, for instance transactions in the market.

Having made a preliminary selection so that it would fit within 30 minutes, we tested the selection by the following method. One team member made the selections, and then a panel of other people watched the film through, both film experts and people knowledgeable about the other Naga materials. As it proceeded, they were told what was being included and what excluded and asked to comment if they felt that anything important and interesting was being omitted, or anything

unnecessary was being included. Somewhat to our surprise and relief, we discovered that there was hardly anything that the panel could find to disagree with. Thus, while there is inevitably some loss of information, it seems tolerably limited. Since videodisc (and related optical media) may well become a very important archival medium, this is of some general importance.

Artefacts

Here there is again a problem of selection. There are known to be well over 15,000 Naga artefacts in European museums and private collections, at least 12,000 of them in Britain. To have located and photographed them all would not only have absorbed much of the effort of the team, but the final photographs would have used up over a quarter of the total space for visual images on the videodisc. It would also have given, in some artefacts, hundreds of almost exact duplicates.

One general criterion was accessibility. That is to say we confined our work to certain major private and public collections in England, though we knew of others in other parts of the British Isles and Europe, not to mention America and, of course, India and Nagaland itself. From the brief descriptions of other collections, it did appear that we were able to see and select a fairly representative sample of artefacts.

Within the ten thousand or so artefacts which we either examined in themselves, or through catalogue descriptions, we used a number of criteria. We sought a representative selection, in terms of the types and functions of artefacts and their origins in different Naga groups. We attempted to use Naga criteria of significance rather than our own-that is, to ensure the chosen artefacts did reveal the key features of Naga social structure and belief (status, head-taking, kinship organization and so on).

Where there was duplication, we tended to choose artefacts with superior documentation, and left out those where the condition of the artefact was very poor. We sought to photograph as many nineteenth century artefacts as possible, on the grounds of their rarity. Such artefacts also were crucial in throwing light on a key research interest - the colonial encounter. What can we learn from the types of artefacts collected, about how the Nagas were perceived and classified as the colonial era developed?

We also bore in mind the need to photograph artefacts which would be interesting from a comparative perspective - for example, artefacts indicative of trade amongst Naga groups or between Nagas and neighbouring peoples; artefacts bearing strong resemblances to other South East Asian hill tribes; artefacts which, when compared with others, revealed continuity or change over time. We emphasized artefacts which we knew would tie in well with other material on the disc, such as artefacts collected by administrators or ethnographers whose writings feature prominently in the textual database. We sought to ensure that mundane, everyday items were as well represented as the more exotic and aesthetically exciting artefacts. Where there was obvious interest, we photographed from two angles, but constraints of time and difficulty in placing artefacts left this task incomplete.

Paintings and sketches

Here there was relatively little difficulty with selection. Since the absolute number was not great, in the hundreds, we included all those pictures which we thought could possibly be of some interest. Many very simple line drawings were included when they tied up with textual descriptions, and only very occasionally did we leave out an illustration because it duplicated something else or was so minor and badly documented that it seemed confusing to include it.

Sound

The 72 minutes of sound data included on the two tracks of the disc, are an attempt to provide very different kinds of data. We sought to combine recordings of a time breadth to match the photographs. Thus we included early wax cylinder recordings (1919) and present-day (1987) recordings of songs, with their considerable Christian influence. Examples of several kinds of instruments have been included, such as drums, jew's-harps, stringed instruments, as well as singing. Field recordings of conversation (1970) have also been included. This is referred to as 'sound' in the indexes.

Maps

We had hoped that we would merely have to photograph the various maps of Nagaland from the earliest times up to 1947, including the very detailed Survey Of India maps of c.1910-1945. However, when we experimented with the maps by looking at photographs of the ordnance survey maps on the screen, we discovered that this was impossible. However much we magnified the maps by photographing them in tiny sections, the mountainous nature of Nagaland meant that all we could see were blurry pictures of contour lines, with the odd village name, almost unreadable, dotted among them.

We found therefore that we had to re-draw the maps, ending up with 165 sketch maps on the videodisc. All contours were left off, but otherwise they included rivers, major mountains, borders and the location and names of some 1400 villages and towns which were mentioned in one or more of our photographic or textual sources. The maps were mainly based on the 1:2 Survey of India maps of the area. All maps and mapping were subject to considerable errors, compounded in this case by the difficult terrain, the shifting character of many Naga villages and the immense complexity of village names, which can vary radically from author to author, or even within the same author. The maps are therefore, very much to be thought of as sketch maps. They form the basis of "map-walking" software, developed for the project, which allows the user to move north or west to the next map.

General principles in selecting texts.

The selection of texts was done with two overall considerations in mind, which relate to the nature of the new technology.

The system can be thought of as essentially an archive, in which case one would probably wish to exercise fairly limited editorial control; on the other hand, it is also a teaching resource, and in this sense does require some attention to including material which is likely to be of use in diverse educational contexts. The main problem here is not so much one of total available space, but of the effort of data entry.

It will not be long before standard microcomputers have hundreds of megabytes of storage available, so there is unlikely to be a long-term difficulty in holding materials. Yet if we consider the labour not only of inputting material, but then of checking it and indexing it very precisely to make it useful, it becomes clear that unless one has very large funds and a team of workers over a long period, one is bound to reach the limit of what can be fed into the computer. In effect, if we add up all the different parts of people's lives that have gone into this project, it is probable that we had the equivalent of five or six person-years of human labour available.

Thus one has to select from the surviving materials. A few of the broader principles of such selection need to be mentioned. Firstly, we have concentrated, with the major exception of one very long diary in German, entirely on texts in English. Perhaps a tenth of the writings on the Nagas before 1947 has thus been excluded for consideration. Secondly, we have tended to concentrate our efforts mainly on the period between about 191O and 1947, leaving the nineteenth century more selectively treated. Thirdly, we have directed much of our efforts to the more intimate and detailed accounts by specific individuals whose visual materials are available on the videodisc.

Major textual collections in the database.

Thus we have attempted to collect and put into the computer all the relevant surviving materials of R.G.Woodthorpe, J.H.Hutton, J.P.Mills, C. von Furer-Haimendorf, Ursula Graham Bower and W.G.Archer. Added to these are smaller collections from other twentieth century authors.

For the nineteenth century we have only selected a few texts, for instance part of the ethnographic survey by Dalton, the diary of Godwin-Austen, Woodthorpe's papers and some manuscripts of Colonel J.Butler. At present, the gaps are as follows. Of the several hundred articles written about the Nagas between 1832 and 1947, we have only included a few. Secondly, as far as the official records are concerned, we have only sampled a few of the very extensive files. We have included a file on a military expedition, a gazetteer, some official reports.

As well as the gross decisions described above, there are more subtle ways in which one is forced

to edit documents, however.

As far as internal editing of texts is concerned, we have only applied two rules. If the material is likely to cause personal offence or political embarrassment to living persons, we have omitted it. In all the files we have included, this has led us to omit probably less than a couple of pages of material. Secondly, if the material is repetitive or apparently trivial and of only personal interest, we have omitted this. With regard to the actual materials, we have occasionally corrected spelling or minor grammatical errors which obscure the meaning, but otherwise we have not changed the documents.

Methods used to transfer the visual material to a videodisc

Film.

We reckoned that about 6 of 8 available hours of film would be of interest, and should be included on the disc in full or in "compressed" form. The original film was copied to high quality videotape, in the process one copy receiving a burnt-in "time code", which allowed us to watch the tape and decide exactly which parts we wanted to include on the edit master video-tape.

In addition to making time-coded versions for our editing use, the production centre provided the professional skills of edit suite operators to do the editing work of putting the desired clips onto the Edit Master videotape. In our case this was extremely complicated, because it involved not only relatively long sequences of film, but also up to a thousand "random" edits (taking, say, one frame in every 25, to give an idea of what was going on in a sequence without including it in full). If very complicated editing is being done, extra care must be taken to ensure that the field dominance selected is absolutely consistent throughout or else the possibility will occur of "jumping" frames appearing on the videodisc.

Sound.

This came in various forms, old 78 r.p.m. gramophone records, wax cylinders, reel to reel magnetic tape, modern cassettes and high quality quarter inch magnetic tape. All had to be transferred onto the quarter inch tape. Most of this was done within the Audio Visual Aids Unit in Cambridge, though the wax cylinders had to be copied at the National Sound Archive, London. There are two sound tracks on the videodisc so it was necessary to be selective, but there were few technical problems. There was no usable synchronised sound and film so there was no need to plan the sound with this constraint in mind.

Original photographs.

As is common with many historical photographic projects, the images we identified in various

collections existed in diverse forms; from glass-plate negatives to modern colour prints. These all had to be transferred to a single medium. In the case of negatives, we decided that re-photographing as transparencies would be far too expensive at the tele-cine transfer stage (given that there were 8000 or so individual images). One option considered was to use a 16mm film camera, mounted on a copy stand above a flash light source, through which negatives could be fed. This arrangement was mechanically quite complicated, and it proved difficult to focus adequately on the image.

We decided instead to use a half-frame camera mounted on a Bowens "Illumitrans" copier. The Illumitrans allowed for some correction of light balance with each negative, in some cases making it possible not only to copy but also to improve on the quality of the originals. The half-frame camera altered the direction of the images. Instead of producing images on the film lying lengthwise, they were inverted through 90 degrees, to lie across the film and were reduced to about two-thirds of the usual size. In effect, this produced a short roll of film which had the images lying in exactly the same way as a movie film. Indeed, one could produce short strips, of usually about 6O exposures, of 35mm movie film.

These strips could then be spliced together to create a single reel of 35mm film, with the images of roughly TV-aspect ratio, easily transferable to video-tape. We used reversal film to copy negatives, which produced high grade positive images when developed. We were able to do our own developing of these films, substantially reducing the costs.

In the case of positive images (in our case, photographic prints, pencil sketches, sketch maps), we used the half-frame camera (with ordinary transparency film) mounted on a regular copy-stand, using either an electric light source or daylight. The strips could then be spliced together, as described above.

A specific problem which it is impossible to overcome arises from the shape of the television screen, that is, its 3:4 aspect ratio of height to width. 'Landscape' negatives are close enough to the aspect ratios of television to need only a little pruning at the edges. But 'portrait' or upright originals are bound to come out oddly on the TV screen. Here we exercised our judgment in the re-photography. If only a part of the portrait is relevant, one can go up close and fill the screen. But in many cases it was impossible to take off much at the top or bottom, and consequently the image will only occupy the central two thirds of the screen, with subsequent loss of detail. We decided to leave roughly equal (white) borders on each side.

As for reframing the landscape photographs, we did a certain amount of this if there appeared to be parts of the picture which contained most of the visual information. In general, however, we tried to be careful not to change the image too much, since the original composition in itself may be important for future analysts. It was important to bear in mind, however, that TV will always tend to crop images, unless they are very carefully taken within the viewfinder's "safe" area. On occasions we bracketed two shots together, as "whole" and "detail". Where we were unsure about the copying of very old or otherwise difficult images, we shot two or three times, at different exposures; but (as explained below) it may prove impractical to edit out the unwanted versions.

The half-frame method has a number of advantages. But there are three potential hazards. One is that if a single mistake is made in the splicing, the entire reel after that point will be "out" by that amount, and the resultant videotape master will be useless. The second arises from this need for care with splicing. For non-specialists, the less splicing, the better. Therefore, it becomes inadvisable to think about "splicing out" all your faulty images, which will doubtless figure here and there in the half-frame film strips. The resulting videotape will, therefore, include your "mistakes" and indeed your codes for where the constituent strips begin and end (without these, it may be difficult to relate any individual picture to its index record when it appears on videotape and ultimately on videodisc). "Mistakes" will of course be "edited out" to some extent in the system software (that is, query-based searching will never take the viewer to a faulty image); but random flicking through the disc with a keypad will mean that users will see mistakes from time to time.

Third, attention must be given to accurate centring of the images. In many cases (e.g. landscapes), this may not be important, but where single objects or portraits are concerned, it is as well to anticipate a possible slight "left bias" in the tele-cine process. That is to say, the tele-cine process expects the left side of any film strip to contain a sound track. This will of course not be the case with half-frame film. But potentially this means that the tele-cine process only scans 90 per cent of the film width, missing out the 10 per cent of "audio" to the left, which in our case is very much part of the picture. The effect is that, as is visible in our disc, the "true" centre of the original film appears to be shifted by ten per cent to the left on the videotape (and therefore on the videodisc). To anticipate and correct this possible bias, it is essential either to ensure that full-width scanning will be available to you, or else to centre the original photographs ten per cent to the right of true centre, when you look through the view-finder, and to ensure that nothing of value remains within the left ten per cent area.

Artefacts.

Our project first concentrated on material culture objects from the Naga Hills. This is the only part of the disc featuring original new material photographed by the project. Some of the earlier images on the disc relate to the period when we were developing the technique and remain somewhat unsatisfactory.

We were advised to use natural daylight as far as possible, and we did so in almost all cases. The exception were a few very large artefacts which could not be moved outside or properly lit by daylight. We also decided that, since our aim was mainly to provide a neutral and precise record of the artefacts, we should try to take them all from a uniform angle. This was almost always from above, using a copy-stand set-up. The exceptions were the few artefacts which because of their shape or size could not be photographed thus. We photographed against a variety of backdrops which we made. It is essential to anticipate cut-off during later stages of the transferring process, and therefore to frame the object in the view-finder within the "safe area", leaving a generous border.

We tried to take a photograph of the whole artefacts from the top or front, as appropriate, with extra photographs of other angles or details or close-ups using a macro lens, if this seemed necessary. We decided to keep out measurement rulers, but measured each object so that the information could be available in the index entry about the image.

These colour slides were then transferred by the process described below, with "tariffing" (colour balancing), to videotape. Depending on the nature of the objects, the logistical problems in the museum or archives we were working in and the number of persons working, it is probably roughly the case that with some help from the curators in searching for and getting hold of the artefacts, two people working together could photograph and index between twenty-five and fifty objects in a full working day. (This was working under pressure, with relatively portable objects, and assuming no hitches. The desired quality of the end product will of course also affect this calculation.) These colour photographs were developed by the University of Cambridge Audio Visual Aids Unit, while the black and white half-frame photographs were developed by one of our team.

Transferring black and white photographs to master tape.

At the BBC Enterprises Centre, we arranged to have our long reel of half-frame film transferred to c-format videotape. A trade-off had to be made, between target quality and cost. It is perfectly possible to have each frame checked ("tariffed") for colour and contrast and for considerable changes to be effected, improving the quality of the originals. But this would cost a very great deal of operator's time. Instead, we opted for "batch" control, by which a certain amount of checking for colour and contrast was done for a series of photographs at a time.

It is at this point that the original quality of half-frame photography matters. Batch monitoring will only be of much use if the half-frame photography is done carefully enough to produce a fairly uniform standard of image, without wide variations of brightness and contrast. If there is little tariffing to be done, this process is remarkably fast: transferring from film to videotape at 25 frames per second (standard moving film speed) means that 8000 frames will take about 6 minutes. It also appears to be the case that relatively minor adjustments in exposure in the tele-cine process for colour images produce a larger difference in the final videotape rendition than is the case with black and white images.

Transferring colour slides to master tape.

By choosing slide transparency for our photography of museum artefacts, we allowed ourselves the option of slide-by-slide colour monitoring to improve quality during the process of transferring to 1-inch c-format tape. This process involved some very time-consuming mounting of slides (in our case, about 1000) in special individual mounts and racks, and was also expensive in terms of an operator's time. A slightly less expensive version of this process is available, in which the transparency film is fed in as continuous strips (i.e. not individually mounted), but this does not allow individual frame colour control.

Pressing the videodisc.

The production centre not only assembles the above material onto the Edit Master tape, but also includes credits and title (if any) and standard audio and video test signals and lead-in and lead-out tape, after which the Edit Master tape can be sent to the disc pressing plant. At this stage, we opted to produce a "check disc" made in essentially the same way (i.e. an acrylic, PMMA, coated with a layer of aluminium) but with slightly cheaper materials, and most suitable to one-off production rather than large numbers. It is much less robust than standard laservision videodiscs.

This allowed us to check the disc and determine if there were any errors. This proved a valuable exercise, since certain errors were indeed discovered, which we could then correct, and it allowed some new material to be inserted at the end of the disc. The quality is undoubtedly inferior, particularly on the first part of the disc, and users thinking of using only this cheaper process should try and ensure that moving film rather than stills appear on the first part of the disc, so the loss of quality will be less obvious. Once satisfied that corrections to our edit master had been made properly, we then pressed 100 copies of the disc (in the PAL format).

Inputting textual materials.

The transfer of the textual information is a very long and time-consuming business but compared to the videodisc transfer the methods are relatively simple and well-known. The printed books which were of sufficiently high quality to be scanned by a computer were fed in by optical character recognition methods. It was a relatively slow process to input about 3000 pages of text, which all had to be carefully checked, since the computer found it difficult to distinguish certain letters, for instance i and l. Nevertheless, it was much less of an effort, and much cheaper, than typing in the material.

The rest of the material was either in manuscript form, or the printing was too poor for present scanning devices. This was typed in using conventional word-processing packages and data entry methods, over a three year period. Often the manuscripts were very faded, sometimes jumbled in content, excruciatingly badly written, or presented other difficulties. One key text of over 15O,000 words had to be translated from the German. The texts were then held for editing, indexing and later dissemination on the Cambridge University Mainframe computer, both on disc and backed-up onto tape. This constitutes a textual database of about six thousand pages of information, including indexes; twenty-five megabytes of information on the computer hard disk.

An overview of the visual contents of the videodisc.

The videodisc contains a selection of images of different kinds. There are some 135O colour photographs of selected ethnographic artefacts from the Pitt Rivers Museum in Oxford, the Museum of Mankind, London, the Museum of Archaeology and Anthropology in Cambridge and other public and private collections. These include photographs of a selection of weapons, tools, ornaments and textiles.

There are copies of some 4OO drawings and paintings between the 1847 and 1947 taken from diaries, fieldnotes, printed and other sources, varying from full colour portraits to small sketches of a decorative pattern. They include designs, patterns, human faces, house types, flora and fauna. There are 165 maps specially re-drawn for the videodisc. These indicate the position of more than a thousand villages, towns, rivers and mountains in the Naga area which are referred to in texts and pictures.

There are about 7OOO black and white, and a few colour, photographs from the 188O's to 1948. These cover all aspects of Naga life, art, architecture, crafts, rituals, sport, family life, marriage, war, head-hunting, agriculture, fishing, colonialism and many others. All major sub-groups of the Nagas are covered. They come from public archives and private collections.

There are over 15O sequences of moving film and another thousand or so still frames extracted from 16mm colour and black and white moving film shot between 1938 and 1970. These cover music and dancing, war and head-hunting, the agricultural cycle, fishing, arts and crafts, body decoration and tattooing and many other topics. They are referred to as 'film'.

Finally, there are 72 minutes of recorded sounds from Nagaland, from wax cylinder recordings made in 1916 to some contemporary devotional music. The sound of various instruments, such as drums, jew's-harps, primitive string instruments, as well as solo and communal singing by men and women, illustrate some features of the musical culture of the Nagas.

An overview of the textual contents of the disc.

There are a number of different classes of written records which provide the background documentation for the visual images and are of value in their own right. They make it possible to trace the process of documentation of Naga culture from the first, fairly random, fieldnotes or diary jottings, up to the final, polished, published book.

There are a number of manuscript daily diaries kept by soldiers, surveyors, colonial officials, anthropologists and interested observers. From the earliest mid-19th century reports and diaries of Woodthorpe, McCulloch, Butler and Godwin-Austen through the illustrated museum curator's diary of Henry Balfour in 1922, and the detailed anthropological diary of von Furer-Haimendorf in 1936-7, to that of Mrs.M.Archer in 1947, there are the equivalent of over a thousand printed pages of diary material. These provide the most intimate and revealing reactions of the visitors to the Naga Hills.

There are extensive fieldnotes made by anthropologists and colonial officers, describing every aspect of Naga life, from rituals and myths, to genealogies and house lists. These can be cross-referred to the diaries and provide a solid body of ethnographic description and preliminary analysis. The fieldnotes constitute the equivalent of over 75O pages of printed material.

A number of those who visited and worked in this area wrote letters to their family and friends in England. A selection of these letters, for instance those exchanged between J.P.Mills, J.H.Hutton and Henry Balfour, have been included. They describe some of the practical and theoretical problems that lay behind observing and collecting materials.

Colonial officers were required to make detailed reports on their tours of duty through Nagaland. These were then used by the government to provide the background for administration. Over one hundred such tour diaries made by J.H.Hutton, J.P.Mills and others have been transcribed, giving insights into colonial administration and the mentality of the observers. They constitute the equivalent of some 400 pages of printed materials.

A considerable quantity of reports, surveys, gazetteers, and other official records were published by the British administration over this period. Much of this is in the India Office Library, and selections relating to the Nagas have been transcribed and included. This gives a strong impression of the official and secret activities of the British Empire in this corner of its territory. There are also several articles and three books written about the Nagas.

Searching and displaying the materials.

Taking each paragraph of text or 'image' (a photograph, film sequence etc.) as one 'record', approximately 25000 records of textual and visual materials are held in the computer. This is an early example of what will be a growing problem, namely information retrieval from large multimedia databases.

Of course it is always possible to search through visual or textual databases sequentially, or using a hand index. Or one can create a computer indexing system, using a commercial package, such as the DBase series. But we early realized that we would need a more powerful and flexible way of searching the images and texts for our project and a good deal of work during the project was devoted to developing what we have termed the Cambridge Database System (CDS). The following is a brief overview of an alternative information retrieval system, for use with large sets of material on optical, compact or computer discs.

The system is based on the earlier 'Muscat' (Museum Cataloguing System) written by Dr. Martin Porter. It has been developed specifically for use with the large set of visual and textual materials concerning the Naga peoples of Assam. But since it works on IBM-compatible microcomputers and is a powerful and general system, it will have other applications.

The descriptions of the visual images and sounds, as well as texts, are divided into 'records'. Each record can contain a number of fields, which contains a 'code' part and a piece of text giving information. Each field may contain a group of sub-fields. There is no fixed format to the records and fields can be of any length, provided that no single record has more than 64,000 characters. The number of records is not limited.

This is a system which allows the user to describe photographs, film sequences, music, museum objects, manuscript sources and printed books, making it possible to move from one to the other without difficulty. This is unusual, since it has not previously been possible or necessary to jump between such different media. Furthermore it includes 'relevance feedback and query expansion', features which enable the user and computer system to unite in setting up better enquiries, as explained briefly below.

Indexing and captioning

The division of the information can be made according to one's needs. One obvious way to divide information is into substantive and administrative fields. The substantive part includes a caption, a text field, and various keyword fields. The keyword fields allow the user to record details of people, places, ethnic groups, dates, subjects and themes.

Index terms in the database are extracted from words in caption and keyword fields and can thus be searched. But index terms are not extracted from the pure text field. For this reason, important information in the text field should be identified and inserted into the keyword fields. The information does not have to be assigned to any pre-planned hierarchical ordering of categories.

Administrative information concerns the medium (photograph, object), the present location and significant details of acquisition; it could also include, in a library or museum, the shelf location of the item concerned. The information in these fields also enters the index of terms and can be searched for.

The captioning of visual images, including museum objects, is necessarily a very subjective matter. Although many attempts have been made to standardize this by providing a check-list of what should be noted, none of these can provide more than a preliminary set of categories. After a large amount of testing, we have decided on a relatively simple selection as follows.

In the captions to photographs, we have broadly described what is happening, if there is action, or what the nature of the subject matter appears to be. Any particularly striking details may be noted, for instance a particularly fine piece of ornamentation. We have tested this procedure and found that several different people looking at the same photograph independently will describe it in roughly the same way. Yet there can be little doubt that people from a different culture and with different interests would describe the photographs in different ways.

The captions can only thus be a first approximation, and users will have to add further details (often contained in other fields) after searching and analysing images. Captions are necessary, however, since database searches can only be made by presenting the user with a set of relevant answers identified by their short captions.

In the case of objects we have tried to include something on the size, materials, functions, colours, motifs of each object. But when dealing with a complex three dimensional object, it is obvious that

one can only capture a little of its complex character in words. That is why we also have a picture.

Likewise in the case of moving film, a sequence lasting twenty seconds, involving several people, could generate several pages of textual description if one noted each gesture, posture, interaction, all the material objects present. We have merely simplified this in most cases to one line, for instance "group of men and boys catching fish". Again, it will be up to users to refine what can only be a preliminary index.

The same simplification is clearly necessary with texts. Often there is a paragraph which contains information on many different topics, for instance marriage payments, political alliances, economic transactions, the interrelations of chiefs and subjects. In the short caption one can merely take out what appear to be some of the more central themes. We are now starting to experiment with indexing the whole of the text, not just the caption, and this is proving successful and may be a better strategy in the future.

Free text and structured queries in general.

In order to find a particular record and its attached visual or textual information, there are two main methods of searching. These are 'free text' and 'structured' (Boolean) searches. The two can be combined in the CDS system. Structured queries (of the 'and' 'or' 'not' variety) are fairly standard in databases. However, they have certain inherent weaknesses. The number of answers retrieved is usually too large or too small; users often require an expert to compose boolean expressions of any complexity for them; the retrieved set of answers is usually not ranked in any way, and so it is necessary to inspect the entire list in the search for relevance.

The powerful feature of the CDS system lies in the fact that it works in a way that makes it possible to interact with the computer. Thus it is possible to use human insight alongside computational power to improve the quality of the questions and hence the answers.

For instance, one may ask a specific question, to which the best matching answer is given, then the next best answer and so on in order of declining relevance. The user is asked whether each answer is what he or she was looking for or not. Those marked as 'relevant' are then stored by the computer. The computer then presents to the user a list of the terms which appear to have been most significant in those answers marked as 'relevant'. This list will include other, associated, terms in the answers which the user had not realized were of importance. The user is then asked to add in whichever of these new terms might be used in re-phrasing the question in a more precise form. Then a better and more powerful query is re-run, bringing out further new answers and revealing further unexpected connections.

In effect the computer is helping the user to find associations which were not originally anticipated. This system is therefore a powerful tool for expanding queries and for making links between hitherto unconnected facts. The software for the system has been developed to deal with materials in museums, libraries, archives and elsewhere. It will deal with databases of any size,

including visual and non-visual materials, and works on a range of desk-top and smaller microcomputers, using less than 300k of RAM within which to run.

Databases

As with most structured databases systems, the material needs to be broken up into meaningful units. This can be conceived of as follows:

System --- database 1 --- database 2 --- database 3 and so on.

That is to say, it is possible, by choosing the appropriate names for the databases, to have several different ones held in one computer, any one of which can be made active as needed.

Files of data

Each specific database may include a number of separate files. For instance, our Naga videodisc includes files of indexes to moving films, photographs, objects and other materials. Thus one has the structure:

Database --- file 1 --- file 2 --- file 3 and others.

These files can be added to the database one at a time, as they are ready. There is no limit to the number of files in the database. The only constraint is the over-all size of the database. Once inside the database these files lose their identity. The database contains records, but not files. Files are just the unit by which records are added into the database.

Records and their structure

Moving down one level, each file consists of a number of records. There is no limit to the number of records in a file. Individual records can contain up to 64,000 characters. Since it is the records which tend to be shown on the computer screen, it is sensible to keep them to roughly what will fit on one or two screens, in other words a paragraph of text. Thus one has:

files --- record 1 ---- record 2 ---- record 3 and onwards.

Each record is a separate entity; it is the most important unit in data organization.

There are, in fact, three types of records. The R-records, are those which are indexed and are either complete in themselves, or cross-refer to images or texts. The T-records are text records, which are reached by means of an index. The A-records are 'control' records which can be used to set up the user interface, pages of help and for other purposes.

Fields within records, maximum number and length.

Each record in turn consists of a number of fields. Records are likely to have information within them which appears to fall into discrete fields, often in answer to the well-known questions "Who, what, when, where, how and why". These fields are indicated by a code or tag. There can be up to 255 separate codes per record. Since the codes can be repeated and used in many combinations, in effect the number of fields is unlimited. Thus we have the structure:

record --- field 1 --- field 2 --- field 3

Code and data parts of the fields.

Each of these fields in our conventions has two parts. A code part at the start, is indicated by an asterisk (*), to indicate that a new field in the record is being defined. This is followed by a letter or number or combination of these, which indicates what type of field the computer is to expect. For instance, we have decided that *t means a 'text' field, while *k means a 'keyword' field.

The information part of a record field; maximum field size.

The second part of the field consists of the actual information or data. Thus '*k fishes' would indicate a keyword field with the information or text word 'fishes'. Apart from the general upper limit of 64,000 characters per record, the information in the field can be of any length.

Group fields and their use.

The normal field contains only one type of information. But it is often the case that one will be dealing with material where some of the information applies to the whole record, while there are some sub-parts which have specific information relevant to that part only.

For instance, when a sequence of photographs have been taken rapidly of a particular event, say a dance, or there are several shots of movie film made in quick succession from different angles, it is unsatisfactory to separate them entirely as different records. On the other hand, each photograph or shot may need a special description, as well as the general description for the whole sequence. This can be represented thus:

record --- shot 1 --- shot 2 --- shot 3

In this type of record, the general heading is put at the top, and this will apply to all the records. But each sub-field may also have both a specific frame number and caption.

Sub-fields within fields.

Any field may contain within itself further sub-fields, in other words fields within fields. For instance, one can deal with the fore/surname problem by defining a structure which had a general name field (*name) which continued the two sub-fields (*forename *surname). In practice we have done this extensively only in relation to the production, collection and acquisition of artefacts. Each of these fields has to contain some other information, for instance the date, person, or place of collection of the object.

Thus we have a system that within one size constraint, that of a maximum of 64000 characters per record (about l5 pages of typed information on standard A4 paper) is otherwise very flexible. It can be used to index most kinds of material.

It is relatively fast. Currently, searching the 25 megabyte Naga database with its twenty-five thousand records on a medium speed 386 IBM-compatible we find the following search times. If one asks for all the records indexed by a specific date, they are retrieved in less than a second; likewise all the records with a certain person or place mentioned will be found within two seconds. If one asked a structured (boolean) query, which asked for all the records containing the intersection of a person's name, a place name and a date, the records would be found again within two seconds.

'Free text' retrieval can take longer, because the records are ranked in order of the probability of their matching the query. Thus a query with three terms, each occurring about 15O times, will produce the best hundred answers in order of likelihood in less than three seconds. With ten terms, each with several hundred occurrences in the database, the query might take up ten seconds.

The speed is increased considerably by being able to combine structured and free text searching. The machine will only take a second or two to find all the records mentioning a place name, and only a few seconds to find and order the records which match the terms in the free text part of the query. Since the system contains a sophisticated suffix-stripping or 'stemming' algorithm, it is possible to type in a word like 'marry' and get all the variants (marriage, married, marrying etc.).

The system is an open one. The images on the videodisc in our system are fixed, but the indexes to them and all the subsidiary texts are held on a read/write medium (a hard disc). It is possible to delete records, change records, or continuously to add further records and texts to the database. It is also possible to extend the size of the database if it is too small.

Finally, in this application, the computer is linked to a videodisc player. Having found the record describing an image, it is possible to ask to be shown the image, whether still or moving film, on the computer screen. It is then possible to play the sound, step through the film frame by frame, in slow motion or at full speed, or examine the photographs one by one. In the near future, of course, it will be possible to digitize and print out the images or text, to manipulate and compare them within 'Windows' etc. We are really only at the beginning of a new era of multi-media work. The Naga

videodisc, with the associated book, museum exhibition and textual files, is an early example of what lies ahead.

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(1) The book is Julian Jacobs **et al**, **The Nagas; Hill Peoples of Northeast India** (Thames and Hudson, London and New York, 1989); the exhibition is described in Anita Herle (article in Vis. Anth. XXX). The videodisc , textual database retrieval software are being marketed by Cambridge Multimedia, XXXX, to whom all enquiries should be made.

(2) For an account of this, see Alan Macfarlane, 'BBC Domesday: The Social Construction of Britain on Videodisc', **Society for Visual Anthropology Review',** xxx.

(3) For a fuller description see Jacobs, op. cit.