Discussion

[Uno Takao]

Good morning everybody. Today is the last day of this symposium. Let us start general discussion.

We have been enjoying many exciting presentations for these four days. We have had the opportunity to improve our understanding of how to get spatial information in field surveys, how to predict unknown archaeological sites, how to record archaeological data in excavations, and how to reconstruct and interpret that data. We also could gain a better understanding of how geographers employ GIS in their research, and how information scientists are enhancing the environment for human studies.

I would like to ask all participants to discuss the questions, "Is there any limitation on human studies using GIS?" and "How should human studies with GIS develop in the future?" We will be very happy if Western researchers will give us advice about how to develop this discipline in the Eastern world.

[Juan A Barcelo]

Yeah well··· thank you very much for this general presentation of the contents of the conference and about the general discussion.

I think one of the most important things during all the conference has been that people from archeology, from history and even from geology are here and we are trying to exchange our experience using technology. And one very important thing from the point of view of archeology is that we should make a preliminary remark at this point because the kind of problems we have to solve are completely different. So, the first thing will be, to explore technology for making a decision in archeology and the other will be to explore technology for explanation and probably also for presentation. These specific problems for data acquisition are very specific from archeology and I think that modern GIS technology is not very well developed for that; because archeology is a very specific discipline for the kind of data we have. One example is the multi-dimensional character of archeological data. GIS technology is not very well developed for three dimensional information. In archaeology we need using solid volumes as a representation unit, more thanbthe usual bi-dimensional polylines.

Of course, the kind of problems we in archeology want to solve when explaining our data are more or less the same as historians for more contemporary times or geographers, or even geology. So, although there are many differences, we need to collaborate, and

formalize our discourse. Only be considering what we have in common, and where are the differences, we will take profit of technology.

[Philip Brown]

"I'm Philip Brown, Ohio State University. I'm not entirely sure this is related but certainly, if we're trying to find a way, as Professor Marcelo suggested, to breach disciplinary boundaries, one possibility is to at least consider whether there is value in establishing what has been developed in some sites in Europe and the United Stated as a so-called national GIS. The projects I'm most familiar with are in England and also a collaborative project with Harvard University and colleagues in China. But I'm aware there are generally other similar, kinds of projects. It may depend very much on how the national GIS is conceived. My sense, so far, is that people have been more excited about how they can represent data that they have at hand, rather than thinking about trying to provide a tool that will be broadly applicable across many disciplines. But at least establishing a national GIS has the potential to provide some fundamental frameworks that can be used by multiple disciplines and might facilitate the sharing of technology. It might also promote the sharing of a wider array of applications for technology that some people might be aware of but about which people in other disciplines might not know. And I do think that that kind of project at least offers the possibility of creating a venue that will facilitate the kind of exchange of ideas that I think Professor Marcelo is suggesting.

This is not an easy problem to solve, since it takes in broad geographic and subject areas and in some cases, the challenge even of providing something as apparently simple as a good genealogy of political boundary change over time is just astonishing. The University of Minnesota and the Newbury Library in Chicago have been working for a long time on national boundary changes at the county level for the U.S. This has been going on for 10 or 15 years and it's still not finished, even though it is such a fundamental resource. Partly that's a result of early problems in the technology they employed, but the challenges also lie at the heart of contemporary concerns about hamlet location and boundaries that I share with Professor Mizoguchi, who is not here today, and Professor Yano, who was speaking yesterday, as we think about trying to develop digital resources that will have broader applicability for research in the Japanese context. A national GIS is at least one possibility for bringing people together across disciplines and creating fundamental resources so that scholars in different disciplines don't constantly have to reinvent the wheel. Such a GIS should focus on certain fundamental processes or fundamental areas that could benefit people working on diverse projects.

[Ian Johnson]

I'm Ian Johnson from Australia. In reference to that national GIS idea, you've got at least three things in there: one is the basic framework data chronology coastlines, modern administrative structure and so on. The second is historical information and the third thing is training. Maybe we should pick those apart. You've also got the issue of how do you organize this, how do you fund it ? Do you have any ideas ? I'll throw that open to comment."

[Nick Ryan]

"Nick Ryan##, I'm certainly aware of one UK project handling··· I suppose we would say the history at the moment, concerned with the evolution of the boundaries through time. They have, again, been working for many years on putting together their available data and one of the things that concerns me about this idea of national GIS - I think maybe it came out in something Ian was hinting at - is that whilst this may be useful for like, base data, one of the problems I see is much data is collected at many different resolutions ## the larger the collection, the players in such a system, the more difficult it becomes to find one which would eventually be of use at your particular stage. Can you really get a bunch of historians to agree ? That's a question for Phil!"

[Philip Brown]

"I think I agree with both Ian and Nick that this is a considerable nexus of problems. I think that in my discussions with Professor Mizoguchi, and Professor Yano, we have tried to envision a process by which we can have a multi-scale, easily scalable kind of process. That's in part because our interests vary all the way from people who are interested in regional analyses to people who, like myself, are interested in both regional and very small scale hydrological analysis and want to be able to move between those levels. So I think the issue of scale, at least in terms of topography and digital elevation models etc. can perhaps be encompassed fairly readily. I'm not entirely sure what might be needed or possible in terms of issues of political boundaries. Colleagues who are working on China are interested in working at the county, but not the village level. They have been surprised that I am interested in working at the village level, as you saw in some of the presentations here. But for Japan, the village level is the basic unit of data acquisition for the time periods I and many of my Japanese colleagues are researching. Therefore, it makes sense to focus on the village, and there seem to be reasonable shortcuts for getting a good enough fit for village locations so that this seems reasonable in the context of Japanese history, even if such an approach may be completely unreasonable in the context of China. I think that in considering scale we have to be aware of the circumstances of data survival in each of the

historical contexts in which we are working. Nonetheless, I think the issue of scaling can be addressed fairly satisfactorily in many contexts. I'm basing my conclusion primarily on what I sense about the Japanese case."

[Peter Jablonka]

"My impression is that we have two decidedly different types of GIS application in archaeology or history; first we have the use of GIS analysis to answer specific research questions; people would take a selected area and prepare data with the purpose of answering a specific question like "why are the settlements where we find them?", and use GIS analysis methods to test a hypothesis. The other area is the assemblage of very large spatial databases, and obviously, research would greatly benefit from such databases if they already exist. If not, every researcher has to start from scratch, digitize printed sources, use whatever data are available and recompile similar datasets for his or her analysis. I think in the future it is very important to make all those databases accessible and available. I think it is most important to find ways to create a digital library of spatial data for certain fields. The technology is there and examples are there, think of Ian Johnson's work with TimeMap, for example. We have to standardize data, with no restrictions on individual researchers, but indexing datasets similar to a library catalogue, so that they become inter-operable, i.e. provide standard metadata.

Most projects will maybe put only short descriptions on the Internet or print a short summary report; the database itself will not be generally available, as it is now. But I think it will be important to make all this data available, at least for the research community. As I said, the recipes how to do it exist.

[Maurizio Tosi]

Maurizio Tosi from Bologna. GIS is not only a well known tool for scientists. In fact, we become in Italy , very lost with these questions. The collapse of the national state, which started immediately after the defeat in the second world war, has made the State rather irrelevant at a cultural level, with the rise of the regional. Consider also then cultural resource management in a country which owns probably 50% of the monuments in the world! That's a joke of course. But the concentration is gigantic. The masses of tourists that crowd our historic cities are sometimes hard to manage. So the question of GIS has been taken immediately at not a national level but on a regional level. Some of the towns in the regions have got more money than the state in the way it's been managed. Municipalities are very powerful too and they search for the protection of their monuments.

Now protecting the monuments in a country where every building is probably privately owned requires quite a complicated and constant negotiation, on how to apply the restrictions in historic cities, which in spite of the work of Mr. Berlusconi, you will not be able to destroy; these fundamental things. You own your own land and build it up to a certain point and you cannot freely handle an historical monument and you do not own anything below 10cm in the ground. So, because of this, the GIS have become a very central tool for the negotiation on cadastral property, session, so there's an enormous amount of data, not in the scholarly institutions, but in the municipalities. Most of the Italian towns have equipped themselves with a GIS office, which is a special office with very good hardware and where all the data is channeled. The universities, in most of these historical towns, have got an agreement to put all of the data, not at a scholarly level, but they go to the cities. So, this has created interesting dynamics into which we do not have to take care about classic occasions, models, national types of cards and fields that fail. 1921, we started the archeological map of Italy, 1921. By the time each sheet was published, there were estimated sites to discover and it was already updated. Now, you mentioned that by going onto the Internet, immediately. By the time we accelerate our capacities of documenting and sending the data; the data will have found more and more and you cannot oblige scholars to go the way the government wants. You can in some countries but not in Italy. You are free! Your creations are free and thank God, the computers are no more those mainframe things with ##. Now the computer is in your desktop, in your house, and you access the Internet and you don't give a damn what the government, or even the Dean and the Rector, will tell you. The creation is mine, and I'm going to run the data the way I want and this has problems.

So, in general, what I advise you, the feature of GIS as storing the data is not at university level. It should be at the level of those who manage the countryside, which by far, sorry, it's not the centre of government. It's not Brussels or anything they're trying to invent on top of that. It will be at the county level. You have to fight to have independence of data collections at the minimal level of management, because for monuments, you might not have the crowds which you have for monuments in an Italian town but let's face it, Siena, many of you know, has got 25, 000 registered monuments. India has got 7, 500. No, of course there are more in India. There's a difference you know. So, I don't know how many historical buildings you've got in Kyoto, but it looks like everybody's free to build it in the way they want it. So it's a completely different tradition and I'm sure you don't want to buy it or lend it to each other, the richest people in Japan, I heard. So, you've got to handle these things politically. I know many of you don't like the word 'politics', but if you are trying to describe and classify the territory where your people live, you are into politics.

[Qi Dongfang]

I am not a specialist on GIS, but I am deeply interested in the theme of this symposium.

There is a famous remark by Dr. Aurel Stein, made one hundred years ago: 'An archaeologist is an inspector of the human world.' Archaeology has provided a great deal of data, and also has made wonderful contributions to Natural Science. However archaeologists should also be modest about their weakness, and should acknowledge that the data available in the ancient sites are limited. The ancient remains at sites are not all of that time, and all of those remains are not to be discovered. Furthermore what can be analyzed is also limited. We should be very careful in interpreting history. Archaeologists and historians should collaborate closely with GIS specialists.

In my archaeological study I always feel that the environmental factor is very significant for the human development. The information about the environment available for archaeologists is less than the information available for GIS specialists. However, human society has particular features, and it is not dependent solely on the environment, but historical development also depends on the concepts, thought, or the forms of daily life. Furthermore it is an important point that human beings themselves select their natural environment. Through these two days' session, I learned that GIS analysis can be done by archaeological data, but the data for ancient society is sometimes casual or coincidental. Especially in analyzing the ancient society it may be more casual. So I hope to study archaeology by collaboration with GIS and GPS specialists. These fields will cast new light to illuminate archaeological study. I individually hope to be a student of the members of this symposium, as I know practically nothing about GIS analysis. However, once the data itself has emerged, we archaeologists may in turn be able to be your teachers on the interpretation of history.

Thank you very much.

[Philip Brown]

'My comments take off in a little bit of a different direction than my colleagues' most recent comments. I want to indicate that when I think about basic data that might be nationally applicable, I'm thinking of maybe two, three or four different kinds of data only. Professor Tosi's comments, I think, begin to get down to a much more intense level of data collection and use. When I think about the prospect of putting together a resource that would be fundamental, it really is limited to things -- like topography, perhaps political boundaries -- for the broadest possible use. When I think about trying to find a project to do something like that, that is the point where I think the inter-disciplinary and multi-disciplinary applicability of GIS becomes a real asset. One can seek funding for such a large project

(such as developing the village boundaries of mid-19th century Japan) and get somebody in Kyushu, who is interested in religious history, combined with somebody in Toyama prefecture, who's interested in mid-19th century conceptualizations of children and their world, combined with somebody who's a demographer in Tohoku and interested in looking at environmental impacts of population trends. All of them have to use basic topographic data, all of them have to use basic boundary data, but none of them shares a specific research interest. This is at least a strategy that several of us are trying, so that we can begin to piece together a uniform standard for basic data over a broad area of Japan - even though we do not share a consistent research problem but have in mind research agendas as just demographers, just agricultural historians, just archeologists, etc. Nonetheless, we have a need for common types of data and are trying to find a way in which people from multiple disciplines can collaborate on developing the same basic data as the device for trying to find funding and create a nation-wide data base.

There are research projects that I am attempting to get funded in the United States, involving biographers, historians, computer scientists, engineers and civil engineers. All of that expertise can be brought to bear on a single set of the most fundamental problems of data development, but it can only work if you keep the problem focused at the most fundamental level. The other issues that Professor Tosi is developing I think are all rather serious and important issues to be considered but I would hope that there's a way to generate interest in two, three or four kinds of fundamental data with the broadest applicability, even given the kinds of concerns that Professor Tosi sees as fundamental problems."

[Franco Niccolucci]

"I think this discussion is very similar to an archeological excavation. There are several layers, you understand the site if you take them all together but you have to separate each one, so my comment will not concern what Mr. ## talked about recently, I agree 90% but I will not comment on his statements because ##. Anyway, my opinion about what I think we've said this morning, is that you cannot pretend that people have enough data for research to start automatically, so it's a very complex problem. The problem at a basic level is quite complicated. From my point of view, the first problem, which, sooner or later, will come out in every investigation, is that we are using tools, which were not created for the purposes for which we are using them. We are using ##, and the ## were educated by banks to manage accounts, not to manage ##. #### but the time they mention is completely alien to the original concept, so they are using computer graphics, but the computer graphics were created for the historical engineers; not a way to explain culture to citizens. And this problem of the original theme of the tools that we're using, sooner or later comes up.

Secondly, archeology has a very specific capacity of incorporating tools. Perhaps when topography was invented, more than 100 years ago, archeology was very quick in using this new technology. So, it is, in a way, archeologists are depending on other colleagues who are supposed to contribute to their understanding. Unfortunately, things are not so simple. They are not so simple because in the end, on one side, archeologists sooner or later will close their circle and take out their uniforms of the archeological field and all the people who are not [next part is very difficult to hear] the people going there to make things go wrong with the equipment or the technology, sooner or later, will do the same. That is, we use technology, we don't care about the real archeological problem, but we want to play with our toys, with our nice computers, with our nice GIS, so in the end, an investigation has a high risk of being technology-driven. I think a great deal of useless analyses are performed because the tool is there within a "click" distance. I think there are a lot of presentations using wonderful computer graphics, but it turns out all the technological stuff is there because some engineer thought, oh look, what interesting tools I developed, where could I apply them, dentist ? Oh, there are already a lot of people doing that. Oh, there is money in cultural things so let's go there and present a nice reconstruction of ··· this happened in the past. Because the real problem is this kind, coming back to the GIS issue, which is our main issue. In this kind of research, as my colleague Professor ## said, there has to be competence, real competence, of different disciplines. And they should, in a way, merge and create something, which perhaps is starting a trend and the opportunities, allow me to take the opportunity to thank you for inviting all of us here, because it is not common to come together with colleagues and have a close vision of what is happening, in a country which is not only far - 11 hours of flight - but also having a different language which in our western countries is not so easily understood. So thank you for the warm hospitality and for being capable of understanding ##. Well, I was saying that the real problem is that you need to ##, and this is not easily achieved. So I think that a medical solution offers a ## but again in my experience, medics are like telephone directories; there is a lot of stuff there but you don't find what you need. You don't find the number. So ## are important, you cannot live without it but most of the time, it is not what you really need.

I would conclude this long comment stressing the fact that what we need are really good tools. I can quote an example, ## time may be something that was not available before, probably is not a universal solution, but I think it is a really good tool because it is something an archeologist can take himself and ## as they showed many times, they can globally use the tool to communicate, ##, so these kinds of tools are those which are really needed and to create them and to approve this role among the users, and archeologists, we need to make things closer to the real needs of archeological research. We need to make things, to create

tools, which are easier to use and we must also create the occasions for defining the ##. The latest available technology is perhaps sometimes an innovation, but we can use old technology to make new things. So, I would suggest, perhaps it is not just a thought of what we need; perhaps we can create from the river bank, a more stable, durable and tenable cooperation between us; between the people who are here and the institutions involved in these ## and work together to such a goal. Well, I want to conclude just one final thought. A long moment, but I promise it will be the only one this morning. Well, one final thought. The one person who is not present here is the citizen, the taxpayer. In the end, they are the taxpayers who allow us to be here, who allow us to carry on our research, so I have all due respect for them and we should always consider what they do. If researchers are allowed to keep their research in their drawer, it's easy because they did it with public funds. So, there's always a way to go back to the taxpayer and consider. So I apologize for being a bit long but I think that's all I have to say."

[Peter Jablonka]

I just wanted to add a short remark to Philip's long contribution. Most of the basic data is actually available right now. I think it's more a matter of legal, economic and political decisions and constraints; how far are we allowed to use it? So obviously, every national survey has base data for all the maps, in some form, in their department but maybe you're only allowed to buy printed maps and not use the actual data. Or, as we heard from Korea, you're allowed to use all base data as long as you are a Korean citizen. All others still can download satellite images down to 18 meter resolution or terrain models, which are free already, but this is a political or economic matter, not a research question.

I think it is a problem that most of the tools used where not created for archeology but for other purposes, but it is not a fundamental problem. For example, it means that we need better tools to handle three dimensional information with GIS but it doesn't mean that we can't use GIS at all, because all computer system, from a mathematical or theoretical point of view, are similar; which means that one can be transformed into another. It might take ages to do it in one way, and it might be more practical to do it in a different way, so of course, if we use databases and GIS and whatever we have we must decide where it is useful for our work and where it is not. Then we should say, okay, we have to develop new tools here. But it is not a fundamental problem, because we all use lists of objects and we all use the concept of space and represent it using similar mathematics and geometries, therefore we all can use graphics, GIS, or databases, even if they were not created for use in archaeology in the first place."

[Maurizio Tosi]

"I agree··· I agree with Professor Brown, I should leave you alone for your projects and be safe about it but let me tell you, I have a moral duty to tell you, that GIS is not a lovely little tool that you can use in your safe environments. I spoke about Italy because I didn't want to tell you about the other projects, the ones I am doing. National Geographic from Washington has asked my team to help them in the GIS of Afghanistan. Well we are supposed to give them the basic historic information behind the tribal and national territories within the country. And if you believe, then, this is a peaceful, detached work, you have great illusions. Another project I'm running since 5 years is the GIS of tribal boundaries in Eastern Arabia. If you think this is meaningless··· And now I am entering with a rather secretive team, which is preparing the divisions of Jerusalem in terms of historical buildings. And you really think this is meaningless, for an academic in a safe, detached way ?

Let me tell you a little story. Professor Ottohan, in Berlin, split the atom in May 1938 and thought it was a nice little toy. Nillsborg brought information to America then the thing was happening, and immediately the US, taking a letter from Albert Einstein to Roosevelt, put together a unique team and within a few years, the bomb was made and dropped. When the bomb was dropped on Hiroshima, the great German physicists were all held by the British in a villa filled up with microphones. Ottohan was there on the morning that 200 000 people had been killed. With this discovery, out in Japan, he went upstairs to kill himself. It was then that Eisenberg and the British, understanding what he was doing, saved his life. Now, the poor Ottohan, also felt he was doing a nice little science. GIS is a very dangerous and powerful tool. Don't think you are safe countries. Don't think it is only those countries. In other places, the past is used as a weapon. I'm not going to make the GIS of Armenia and the Turkish lands around them. It's going to be a murder. It's going to be a very difficult tool. When the British decided to quit India, in three months, they took their major geographer and asked him to draw the boundaries of Punjab. The man told them I will leave the country before you declare independence and so he did and 5 million people died on the Punjab border. Please. Geography and the capacity of proving and describing things; it's a moral issue. Now, we talk only about science. But consider the world. It's not only made up of the peaceful countries where we live at present. Sorry.

[Ian Johnson]

I think I'd like to work back a little and pick up on one of the final things that Franco mentioned. I think we saw a wonderful example yesterday, in the Kyoto project, of giving something back to the taxpayer - and I think that we can play an important role in society,

which relates to what Professor Tosi was saying. Philip initially raised some issues on the question of the national GIS. One of the things that is needed - maybe it already exists, maybe it just needs some encouragement - is the need for communication. What may be needed is a lobby group that people can use to pressure for free and easy access to basic data that everybody shares. This also raises the possibility of the need - I think it's reflected by some of the work that's been done here - for a clearinghouse. One must recognize that people are going to create things in different formats and we need to encourage people to make that data available and give them the tools to make that data available. It's not that there's anything wrong with the tools that are available now - our GIS, for all their faults, are wonderful tools for archaeology, used properly - but it's knowledge of how to use them which is needed. So in fact the important thing is training and the flow of information about how to use them, at conferences like this, and perhaps other meetings in the future. The power of GIS comes from training people to apply it.

So I think that the important thing is communication and flow of information, and I think that you obviously have a prime position that you can exploit to act as a hub for information.

[Loren Siebert]

Loren Siebert, University of Akron. I would like to return to the comments made about the taxpayer getting something out of this. I think that academics need to realize that projects do not always need to be analytical to be worthwhile. GIS can be used for recording historical conditions, for analyzing historical conditions, and for displaying historical conditions. All three functions, not just analysis, are important. We need to narrow the gap between historical GIS for academic research and popular GIS. For example, today we heard about the historical GIS project that lets tourists use their cell phones to download simulated historical views of the location they are at in Kyoto. Such "instant GIS" is very impressive as historical GIS display even if it is not inherently analytical. If GIS used for historical research can go out into the commercial world, I would say all the better.

I would also like to emphasize the importance of archiving GIS data. Government planning agencies are big users of GIS. Planning is about the future, so the temporal component of GIS is important to such agencies. Ironically, however, the historical component is often of less interest to such agencies, so some do not archive their GIS data -they just update the data to reflect current conditions and delete the old data. Those of us who are interested in history need to make sure that our local planning agencies, our local GIS agencies, are archiving their data, and keeping them for future historical analysis in subsequent years.

[Wang Zhengzhong]

I am Wang Zhengzhong from the Institute of History of the Chinese Academy of Social Sciences. Through this symposium I learned that the GIS method, originally derived from geometry, can contribute so much to history and archaeology. In China, in archaeology study and especially in the study of ancient society, we are behind in adopting GIS methods. After attending this symposium, I have come to think that archaeology, history, anthropology, and natural science can come closer to true understanding of ancient civilization only by collaborating together. Because human civilization developed by mixing many elements. I have realized that GIS is a superior method for uniting the study of these fields. GIS alone may solve many problems in the field of archaeological studies on ancient villages or cities, but the main superiority of GIS is to be marked when it links with natural science and other fields. We should think about two factors in the study of ancient village and city: one is the natural environment, and the other is an artificial factor, that is, the social factor. In the study of natural factors, we should use GIS as well as natural science. In the study of the residential factor, that is, the social factor, GIS will be superior for dealing with massive amounts of data. GIS will also be effective when applied to analysis of society or rites, in studies of the substance of settlements or the history of the family. If it is employed in collaboration with archaeology, as well as other natural sciences, anthropology, and art history, GIS analysis will be a useful method for the approach to ancient civilization. I myself hope to use GIS in my own future study of archaeology.

[Mori Hirohisa]

From the viewpoint of information science, broadly, I have two opinions about the topics we have been discussing:

First, I wonder whether various systems built by consumers are really useful in the discipline of archaeology. Second, technology does not necessarily work very well when applied to, for example, social issues or international relationships. In a sense, it can be quite harmful.

About the first problem, I myself am working at this International Research Center for Japanese Studies, an institute primarily dedicated to studies in the humanities, to build up several databases, using the methods of information sciences, and I sometimes face this problem head-on. For example, dealing with a problem related to geographic coordinates, it is very difficult to reconcile the technology with the data when the research center wants to use data from old maps that are not always drawn to scale, but GIS relies on precisely measured data from surveys. I always feel the necessity to reconstruct the system from the viewpoint of archaeologists or historians.

However, the system will be huge, and it will require a great deal of money and labor. So the building of system only for archaeology will be unprofitable. I think it is necessary to use the ideas that have been generated by archaeology or history, and to apply them to various aspects of society . . . . For example, we might turn a concept upside down and apply a database developed for on-line systems at banks to archaeology or history. Or the reverse might occur and a system using ideas from archaeology or history might be adopted by banks or local government entities. As these concepts spread, they will be easier to use. I think archaeologists and historians should express more of their ideas and opinions to society. Or they should express their ideas and opinions to systems engineers such as myself.

Regarding the second issue, whenever we build a system, a kind of system of thought inevitably enters into it. We should first think about where the system will be used and who will use it. The problems are similar to those I touched on in talking of systems constructed for consumers. For example, the concept that land has boundary lines is an extremely modern concept, but in the Edo period ("early modern" period) in Japan, the villages are only points and the boundary lines were uncertain. If the GIS specialists know that historical fact, they will not make GIS system draw lines for the boundaries of villages, or show villages as complete polygons. Because of things like this, I think it is important for archaeologists and historians to take enter into the world of information sciences, and do not allow only one party or organization to control the technology.

[Hans Kamermans]

Yes. I'm very interested, of course, in the application of predictive modeling in Japan and I'm very curious to hear anything about it. The problem during the public lecture yesterday was that there was no time for discussion afterwards, but I'm very interested in the comments of my Japanese colleagues on my presentation. So instead of me saying something which I already said, I'm inviting my Japanese and the Chinese colleagues to comment on the topic I raised yesterday, namely: their views on the problems with predictive modeling.

[Clive R. Orton]

"What I've been hearing this morning has led me to think a bit about the spread of computer technologies in general, and the way in which they have been democratized by spreading out into wider and wider populations. Take, for example, word-processing and desktop publishing. We no longer have conferences about these things because they are so much part of our environment. And then spreadsheets - again, hard to think of life without them - but not long ago, we didn't have them and now people use them very widely for all sorts

of purposes. Databases, similarly, have spread out, and this leads me to think that perhaps GIS will be the next technology which will spread and become democratized and very widely used for all sorts of personal, academic and above all business purposes. This seems to carry two specific risks that I would like to mention (there are probably many other risks, which I don't have time to mention). First, things that come from a computer always look more convincing than things that don't come from a computer, and therefore there is an inherent belief in something that comes off the machine. The second, looking at GIS in particular, as opposed to the more numeric or text-based technologies, is that the human eye is very good at seeing patterns, and I do some experiments with this with some of my students. The trouble is that we can see patterns even when they're not there. We can create apparent patterns; for example, I can generate random distributions, ask students to interpret them, and they will quite happily interpret them. Bringing these two together seems to be a big risk in GIS, one that possibly will lead to a lot of bad GIS in the future. Because the technology will be so widely available, people won't really understand the fundamentals but they will use it as a tool. We can already see this sort of thing happening in text processing, spreadsheets, statistics and databases; it all goes on already but perhaps, because the output is visual, the risks of misinterpretation and a poor use of the technology are even greater. GIS is a very valuable technology; but widely open to misuse. So I see great benefits and I also see great risks."

[Jiao Nanfeng]

As we know, GIS is a new field which has connections with computer science, statistics, information science, and diverse other fields. GIS has come to be very important in social life and also in the realm of research. However, needless to say, many people regard it as nothing more than an emergency measure. I think we in the fields of archaeology and historical research should be more positive about use this method in our work. And we should think very carefully about the target-the objects on which we use GIS-considering time and space or a synthetic combination of factors. I understand that one of you said in this symposium that GIS may give archaeologists the feeling that they have lost their role. I think, however, that we archaeologists should be glad to know this method, and incorporate it into our research.

[Sakka Kazushi]

I am Sakka from Kyoto Graduate School for Informatics. I am in the field of natural science, and this is the first time I have participated in this kind of symposium in human science. When we have a meeting for physical science, especially when the presentation is about laboratory experiments, or measurements, the speaker always first explains his

instrumentation, and when, where, and how he collected the data. For example, an astronomer first talks about his telescope and how he takes measurements. Here I have heard no such talk, and I felt it strange. I wonder if this means the method is already established and everybody knows, or only that everybody thinks the result is important. I felt strange on that point.

[Tsumura Hiroomi]

I will speak briefly. I am also studying archaeology, and I felt that In Japan, we are thirty years behind Western countries in the application of GIS methods to archaeological study. At this symposium, we felt keenly the differences in vision and technique, by comparing the presentations of foreign scholars with our own. I am afraid that GIS in Japan will progress without correcting their misunderstanding. I would like to catch up with Western scholars, following your lead, on the correct path, as soon as we can.

[Uno Takao]

I appreciate all participants' contributions to the exciting general discussion. We have been very happy to meet many researchers from around the world who have been conducting studies using GIS, and to be able to discuss these things with them.

We East Asian researchers have little experience combining human studies with GIS, compared to Western researchers, but we recognize the importance of this field. We believe that this international symposium in Kyoto will trigger rapid development of this discipline in Japan and East Asia.

Thank you very much to all participants, and I look forward to seeing you again, all around the world.