Intelligent Cooperative Systems
Professor HIROSE, Michitaka

The domain of “expanded virtual reality” extends from space to time

Interviewers: Jun Yamashita, research associate / Ryoko Ueoka, adjunct research fellow

——Could you start by introducing the main research theme of your laboratory?

In a word, it is virtual reality (VR). VR started as screen technology and, initially, most of what you heard about VR was how viewers would feel as if they were in the screen space. More recently, however, the concept of VR has been gradually expanded to include, for instance, wearable computers, which Ms. Ueoka has taken up as her research theme, and virtual experience in ordinary space, which is being studied by Mr. Yamashita. In this regard, I would say that "expanded VR" is the research theme of our laboratory.

——Let us delve further into concrete details. In short, what you have just said is that your research theme has expanded into what may be described as the boundary area between technology and people, in which people use virtual technology as an expanded technology component to enjoy something in the real space. Am I correct?

It is just around the end of the 1980s that this technology called VR emerged. At that time, VR was a kind of technology that enables you to interact with a computer graphics (CG) object right in front of you on a real time basis, wearing special goggles and gloves called data gloves. That is how VR came into our life. In other words, VR ushered you into the world of CG, which was indeed a very novel concept.

This served as an anchoring point from which the VR technology has evolved in various directions. At first, VR was thought to be little more than a poor imitation of a computer game which would go out of fashion in a year or so. As it turned out, however, the boom did not end there. Looking back now, we can see that VR is a technology quite different from the conventional computer technologies at that time. I think that VR served as a driving force, at least in part, for the development of computers in the 1990s.

At the beginning, the virtual world was a closed world inside a box called computer. But the world inside the box soon reached its limitations, and hence, the first conceptual expansion occurred. That is, VR came out of the box. One of the new concepts thus born is mixed reality (MR), a technology that has been developed to fulfill the desire to watch the real world and a virtual world simultaneously. In practical term, you are now able to see through the special goggles you wear, thus, you can see both the real world and a virtual world. This technology started from superposing the real and virtual images.

But simply superposing the real and virtual images inside a small room is not interesting enough and you come to want to get out of the room in search of somewhere more spacious. This desire led to another major direction that is to broaden the space by combining the MR technology with mobile computing. So, in the initial stage, MR was nothing more than the superposition of double images, namely, a virtual world and the real world. But when MR was combined with other technologies such as wearable computing, the scope of virtual world expanded into the real world, or I should say that the technology itself changed in nature.

Another interesting point of the VR technology concerns the "five senses." For instance, when people see an extremely close-to-real CG image, they definitely try to touch it. This is because every human being, by nature, is not fully satisfied simply with watching things move. Instead, he or she wants to touch, smell, or taste them as well. That is, every human being

has a desire to confirm with his or her senses in perceiving the world.

Professor (Takeshi) Yoro of the Faculty of Medicine has set out the definition of "mono (goods)." According to Professor Yoro, what can be recognized through a single sense – for instance, a rainbow – is "gensho (phenomenon)" while the term "mono (goods)" can be used only for what can be recognized through all the five senses. This is a very philosophical argument but it would be interesting if we could virtually synthesize all the five senses. Philosophers would be in trouble, though.

Up until now, computer science has hardly paid attention to the physical movements of human being as you can see from how a computer keyboard or a display is structured. That is, the reach of the senses of human being has not been utilized. However, when virtual elements come into being in a large space, it opens up a new world of physical senses and computers.

Now, let me summarize what I have said up to this point. Evolution is taking place in two directions. One is the combination of mobile and wearable technologies while the other is related to the five senses of human being. It may be the case that these two directions are connected underneath the surface.

"Mobiles and wearables" and the "five senses" Two directions for VR evolution

——Within a pillar called VR, there are two sub-pillars – "mobiles and wearables" and the "five senses" – and these sub-pillars may be linked with each other. That is where you are trying to further the research.

Let me explain what is happening to the mainstream research on VR, which is to let people experience an artificial world with an extremely high realistic sensation. As you know, we have a big projection display system called CABIN at the Hongo Campus of the University of Tokyo. Using gigantic screens such as those you see at movie theaters, the system let you feel as if you were stepping into the world inside the screens. So, the mainstream of VR is moving in the direction of heavier and larger systems. At the same time, however, there emerged another direction of research in which, as I just mentioned, we use extremely small and compact computers such as wearables. These two streams of research are seemingly unrelated with each other and pointed to different directions. But I think they are actually the two sides of the same coin. A VR world you can experience using a wearable computer is far greater in scale than the size of CABIN because, for instance, the whole campus or the streets outside could be turned into a virtual world. Even though the size of the computer is small, we can probably say that the whole system is large in scale.

——The idea that these two directions are actually same is a very unique viewpoint, which I guess is of your origination.

They are linked with each other but branching out in somewhat different directions. That's the kind of image I have. And once branches grow out, each of them gets more space to expand freely, thus, a new domain begins to grow there. Our VR research project, too, was once keen on CABIN and from there new research themes, such as the one undertaken by Ms. Ueoka (life log), were born.

Content that conveys the excitement of technology

——I think that there are broadly two types of VR researchers, namely, those engaged in basic research and those working on the development of concrete systems. Professor Hirose, you seem to belong to the second group.

In the field of computer science, you used to be admired for creating something conceptual in the past. Conceptual things are things that present a new formula, for instance, a system in which you wear a special goggle and catch a three-dimensional object right in front of you or the embedding of tags. That is, let's say you have invented an airplane, for instance. As a conceptual work, it is fine and meaningful even if the airplane you have built is still in a very premature stage. It is how a conceptual thing was supposed to be in the past and has been accepted as such. But when it comes to something like the development of computer screen technology, it is not enough to create a conceptual work. For instance, even if you invent a new form of media that supersede movies, you cannot convey the excitement of the new technology simply by presenting conceptual test patterns.

——Do you mean that we need certain content in order to convey the uniqueness and excitement of the technology?

In developing information technology, we also need to develop content that is, to a certain extent, appealing and digestible. Otherwise, people would not be able to tell whether the new technology is interesting or not. This may be a challenge that we will continue to face in developing information technology. As information technology further matures, we will inevitably move into an era of content. Even if what you are to create is meant to be a mere test pattern, you must elevate it to a certain level in quality or you will not be able to convince people. We must achieve a very high quality level, that is, to an extent comparable to that of CABIN. We must show what wonderful things can be done with the technology. Being a faculty member of a university, I find this task quite tough and challenging, though.

——So, as a test case, you have been courageously undertaking various projects. For instance, as part of an exhibition featuring the Maya Civilization held at the National Science Museum, you presented a virtual image space to introduce the concept of image technology and content to the general public.

Generally speaking, people doing research at university are quite imaginative. So, explain the concept of your research

and prepare a special goggle and data gloves. Then, they would roughly grasp the whole picture of a world you are trying to build. But when you deal with ordinary people, you need to present your idea in an easier-to-understand manner. If you simply say a mixture of virtual and real, people would not understand what you are talking about. So, if we want to truly influence the society with engineering, we must properly create and incorporate content to go with it. I guess this is the way we need to be.

——Now, let me ask you about the concrete substance of your research.

We have just completed an exhibition project in which Mr. Yamashita has been engaged. The project was for the "Video Game and Digital Science" exhibition held at the National Science Museum. As part of this game exhibition, we created a new way of exhibition thereby enabling visitors to enjoy both real and virtual exhibits simultaneously as they walk around. During the past three months or so, we have been carrying out experiments for this project.

What was very good about this project is that we made the whole system compact and were able to present very interesting exhibits. Also, we let people interact with computer by means other than the sense of sight. I wonder why we had never done before. People would not watch a display while moving around. Up until now we were trying to present images on a display but that was wrong. Because people are moving around, we had to let them recognize objects by means of non-visual senses such as auditory and tactile senses. Another notable thing about this project is that we created very sophisticated content. For instance, we asked professional voice actors to do the voices. No one would listen to the mumbling voice of a student at our laboratory. But professional voice actors have a special skill and keep people tuned to their voice. In addition to developing an interesting concept, we must make its content interesting. Only then, we can convey the excitement of technology. We need both of them, concept and content. Otherwise, it would be no good.

This argument I have just made is somewhat different from the so-called content problem we have been hearing lately. We are not seeking to create content in a way to excel in presentation within the given framework of technology as is the case with movies. What we are trying to do is to create interesting content while changing the technological framework at the same time. In this sense, we are not thinking of content as a separate object. Instead, we think of technology and content as one united system. That is why we asked Professor (Toshio) Iwai to join us under special appointment.

This means that there are many things that we cannot convey simply by establishing a technological platform and developing new concept. Probably what is important is to show the feasibility, i.e. what we can do based on this platform. Information technology is now coming to a turning point. It is no longer about simply finding applications. We are entering a stage where we need to focus on what sort of interesting content we can create with new technology.

——As an example of research that we have been able to undertake thanks to being a member of the Research Center for Advanced Science and Technology (RCAST), we can cite a radio frequency identification (RFID) tag project.

Only now, we are beginning to hear people talking about embedding RFID tags in various places. We were quite ahead of time when we embedded such tags in the floors around No. 4 building of RCAST. And after we actually had them embedded, we came to realize various problems. For instance, embedding tags has tuned out to be considerable construction work. Also, they were submerged when we had extremely heavy rainfall some years ago. At the time of the game exhibition, we had to install 400 sensors in the ceilings. Although we are trying to create a virtual space, we end up doing lots of physical work just like what we would do for constructing a real, physical space. In this regard, I remember that you, Mr. Yamashita, said, "Ubiquitous means matching of physical objects."

Engineering technology has a pragmatic aspect. In order to realize certain concept, we must solve various problems that come along with that concept. Only when we find solutions to all these problems and have them incorporated into the concept, we can call it technology. Simply having a concept is not enough. We must try it out to find problems and solutions to the problems. At RCAST, research evolves quickly because we are able to start experimentation without wasting time. That is probably one of interesting features of RCAST.

Collect information with a wearable computer "Lifelog" that started from a simple idea

——Professor Hirose, about what you earlier mentioned about VR, that it did not end just as a transient phenomenon as initially thought, isn't it because this particular technology is easily linked to various aspects of human?

The recently emerging concept of transdisciplinary approach is to combine and mix things that are alien to each other. But in VR, things are mixed from the very beginning. VR is not a technical term originally and reality is something that exists in your head.

For instance, in the case of a fusion between science and the humanities, we are currently working with Professor Mikuriya and others to launch a new project. About our research on "lifelog," a tool for keeping the whole record of your life, we were simply thinking about keeping records of experience. But when Professor Mikuriya comes into play, this evolves into a very lively story. I thought this is the power of the humanities science. It is impressive how things broaden and evolve. Sometimes, they turn out to be nothing short of contents. Ms. Ueoka, you probably did not expect any association between lifelog and "oral history," did you?

——The Lifelog project started from what I wondered while doing research on wearable computers. That is, if an extremely small information device can be worn by a human, I thought

we can use the device not simply as a means to provide information but as a tool to collect various sorts of personal information. When I tried this out, my own experience in the reality has manifested itself in a way quite different from what I had expected.

That is interesting, isn't it? In the field of VR, the mainstream is research on computer displays although, in terms of interaction, some research on technology to take in information into computers has been conducted by necessity. But in research on wearable computers, this relationship is being reversed. When computers become further smaller in size and installed in various places of the world as if they were sensory organs, information siphoned through these computers becomes far more important and informative.

I think Ms. Ueoka's research must have been derived from such context. All the experience input into a computer is recorded and will stay there unless you erase the relevant data. Furthermore, the data can be viewed by others. Once taken into the media, experience of yourself or others can be shared if so wished.

Originally, experience record is something of personal interest and for keeping record on everyday life of individuals, i.e. information that normally would not surface outwardly. In this sense, this seems to be rather remote from business. But what officials of Dentsu Inc. said after taking a look at this research is that this can be used as a marketing tool. Indeed, while questionnaire surveys have been used as a means to find out an average picture of things, lifelog enables us to trace everything in someone's life. This is a very delicate way of colleting data that walks on a thin line between infringement and non-infringement of privacy. But this is very interesting and it may be possible to use this method in examining the trend of TV viewers' preference and checking living habits that lead to lifestyle-related diseases. There is lot of information which is spreading so thinly across our everyday life that we have been unable to use it. So, the question would be whether we can collect and give new life to such hitherto unused information by using this new mechanism called lifelog.

What we are trying to do in the lifelog project is to use a computer as a recording device, which is in a sense not at all strange or surprising. The reason why this kind of research has become very realistic is that we are now using e-mails in doing work whereby certain segments of our life go through computers. That is, we are living in a world where we can, if we try to, capture these segments of life at a certain point of the process of transmitting information. For instance, when people use an IC card such as SUICA, it is possible to keep records of who passed where at what time. And such information can be organized and synthesized from various viewpoints whereby a certain image will emerge. Such a thing will become possible with lifelog.

What we are trying to do with Professor Mikuriya is to create something like a photo album so that we can etch the shape of past systems. For the moment, we are trying to work out how we can create such an album. A typical shortcoming of us, researchers specialized in science, is that the way we see things is too objective to capture stories behind the things. But unless we capture both the form and story, we cannot keep complete records. We have yet to know how we can keep records on them and how the records can be synthesized. But it will be interesting to think these things.

Not only looking back to the past, we can also look to the future. Here comes in the concept of "time machine," which is so to speak a technology for traveling through time. After all, the 20th century has been an era of a spatial concept, in which our spatial ability has improved very much but we have developed little time concept. I think this concept of time is about the only major research theme left for us to work on in the 21st century. Currently, we are working on a "virtual time machine" project which was jointly launched with the National Institute of Advanced Industrial Science and Technology (AIST). The specific content of this project is coming soon (laughter).

Toward the past, for instance in case of lifelog, we trace the data back. Toward the future, we should be able to use the simulation function of computers. We are now in the era when we can somewhat travel to the future. To put it other way round, let's say we predict a situation we will be in at a certain future point of time by using a simulator. Then, when that moment actually comes, what we are doing is nothing but confirming the predicted situation. Even today, we can predict certain future events. For instance, checking with the "eki-navi (station navigation)" Internet service, you would say, "In 30 minutes from now, I will be getting there late" or "However hard I try I cannot get there on time." So, in a sense, we are already entering a new system where we use something resembling a time machine in life.

It may seem that things are moving in direction unrelated to VR. But the world of information is a virtual world, isn't it? The world of information is free to move backward or forward. What is interesting is that the real world is beginning to become virtualized with many virtual things coming into the real world and that such a thing is becoming possible in our world. An increase in the degree of freedom of the world is kind of dangerous. But it is not totally a bad thing. If we free up our imagination, we can develop many interesting things from here.

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