Use of Multiple Tools in Distance Learning
: International Distance Learning Using “HyperMirror”

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Abstract
In this paper, we describe and discuss the use of multiple tools in distance learning. We focus on HyperMirror, but also look at other tools used for video-based interactions during our HyperMirror projects.

First, we describe what HyperMirror is. Then we explain the application of HyperMirror to distance learning, especially our HyperMirror projects, and introduce previous studies of distance learning using HyperMirror. Examples of usage of HyperMirror along with other tools: standard video cameras, overhead cameras, and cameras showing a shared drawing space are provided. Finally, based on these examples, we discuss the use of HyperMirror and/or other tools.

It became clear that the choices of appropriate tools in distance learning were important. Also, we saw that multiple tools can supplement each other when used together in distance learning projects.

Keywords
HyperMirror, video conference, shared image, shared drawing

Introduction
Various tools have been designed to allow people to communicate from a distance. Some tools create ‘shared work spaces’ where participants can interact with each other doing various activities. One of these tools is HyperMirror.

HyperMirror is a tool that aims to create a shared space that facilitates collaborative activities. In contrast to traditional videoconferencing systems, HyperMirror allows local and remote participants to feel as if they are in the same room, share materials, and do collaborative activities using a single shared video image. Utilizing these unique features of HyperMirror, we have implemented various international distance learning projects using HyperMirror between Japan and countries around the world for the past several years.

However, our projects also used other tools in addition to HyperMirror: standard video cameras, overhead cameras, and cameras showing a shared drawing space.

This paper provides information about our HyperMirror projects and the use of HyperMirror with other tools, and concludes looking at the role and effectiveness of HyperMirror and other tools for distance learning.

1 What’s HyperMirror?
Morikawa et al. (1998) designed HyperMirror which is a new video image communication tool. Unlike the traditional video conferencing system, HyperMirror uses composited video image with chroma-key effect (Figure 1). For this, HyperMirror allows local and remote participants to feel as if they are in the same room, share materials, and do collaborative activities (eg. Figure 2). In addition, participants can interact naturally because their own image is reversed and appears just as if they were looking in a mirror.
2 Application to distance learning

Because HyperMirror allows participants to have more interactive activities than the traditional video conferencing system, we have tried to apply HyperMirror to distance learning. In particular, we have implemented various international distance learning projects using HyperMirror between Japan and other countries for cultural exchanges, ethics education, science education and nutritional education (Table 1).

For example, Figure 3 is the picture that Japanese and Kenyan students created a ‘joint picture’ using HyperMirror. Japanese students painted half the picture and Kenyan also painted the other half. Both students hold each piece side by side, in order to make the one completed picture. This activity promoted a greater understanding of cultural difference, i.e. physical features and cloth colors, among participants. Secondly, Figure 4 is the picture that Japanese students ‘wore’ Kenyan traditional costumes using HyperMirror, Figure 5 is the picture that Japanese students did joint experiments of testing pH of water ‘side-by-side’ with U.S. students, and Figure 6 is the picture that Japanese and Thai students played a card matching game ‘in a same room’. The cards illustrated each local fruit were laid face down on a surface, and both students picked one of them holding up it to their chest. Moreover, Figure 7 is the picture that Japanese and Thai students studied nutrition sharing information on a bulletin board using HyperMirror. Because HyperMirror enabled participating students to share the bulletin board and information on it, students could study together and enhance the contents of learning as if both participants were getting the feeling of being connected to each other and studying in the same room. These examples were unique activities taking advantage of HyperMirror.

Through these distance learning projects, some characteristics of HyperMirror became clear. One is that students can easily do body activities (Imai et al., 2002). The other one is that students can expand understanding of learning contents because HyperMirror enables participants to share video image (or share space) and compare each materials (Matsukawa et al., 2005).

As stated, HyperMirror has effect on distance learning. However, this is not to say that we use only HyperMirror in these distance learning projects. In our projects (Table 1), we tried to apply suitable tools for each single content. The next chapter provides details of these choices.

Table 1: International distance learning projects using HyperMirror

<table>
<thead>
<tr>
<th>Year</th>
<th>Location of Partner School</th>
<th>Participants</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>China university</td>
<td>elementary</td>
<td>First trial of our HyperMirror projects</td>
</tr>
<tr>
<td></td>
<td></td>
<td>school</td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>Korea elementary school</td>
<td>Cultural exchange</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ethics</td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>Afghanistan elementary school</td>
<td>Science</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Afghanistan elementary school</td>
<td>Cultural exchange</td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>Kenya elementary school</td>
<td>Cultural exchange</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kenya elementary school</td>
<td>Cultural exchange</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mongolia elementary school</td>
<td>Cultural exchange</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mongolia junior high school</td>
<td>Cultural exchange</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>U.S.A. junior high school</td>
<td>Science</td>
<td></td>
</tr>
<tr>
<td>2006</td>
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<td>Science</td>
<td></td>
</tr>
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<td></td>
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<td>Science</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thailand elementary school</td>
<td>Nutrition education</td>
<td></td>
</tr>
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<td>Thailand elementary school</td>
<td>Nutrition education</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>Thailand elementary school</td>
<td>Nutrition education</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thailand elementary school</td>
<td>Cultural exchange</td>
<td></td>
</tr>
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<td>Thailand elementary school</td>
<td>Nutrition education</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U.S.A. conference</td>
<td>Combined use trial</td>
<td></td>
</tr>
</tbody>
</table>
3 Choices of tools in distance learning using HyperMirror

In this chapter, we give details about our usage of tools in distance learning using HyperMirror.

3.1 Switching HyperMirror to other tools

3.1.1 Standard video camera

Although HyperMirror has effect on distance learning, there are two limitations. Firstly, the number of people who can participate in activities is limited, in other words, space of activity is fixed. Secondly, because the HyperMirror video image is fixed, i.e. do not move or zoom a camera of HyperMirror, so that it is difficult to zoom in a material: a poster or documentation that participants want to show, and watch details of the material.

In order to solve these problems, we switch the HyperMirror image to the standard video camera image --not composite and self image is not reversed.

For example, Figure 8 is the picture of a HyperMirror image that students were painting a picture. As stated above, it is difficult for HyperMirror to zoom in participants and/or materials. By contrast, Figure 9 is the picture of a standard video camera image. Unlike the HyperMirror video image, the standard video camera allows participants to focus on what they want to shoot. In other words, if participants want to show details of what they are working on, it is necessary to switch to the standard video camera image as necessary.

As shown in Figure 10, the picture illustrates another way of use of a standard video camera image. The picture shows students in Thailand who participated in distance learning and did their work --whole of classroom.

Thus, in case of showing details of students working on a task and a scene of the classroom, we switched HyperMirror to the standard video camera image.

Figure 3: Japanese and Kenyan students created a 'joint picture' using HyperMirror

Figure 4: Japanese students 'wore' Kenyan traditional costumes using HyperMirror

Figure 5: Japanese students did joint experiments side-by-side with U.S. students: left side is Japanese students, right side is U.S.

Figure 6: Japanese and Thai students played card matching game

Figure 7: Japanese and Thai students studied nutrition sharing information on a bulletin board using HyperMirror

Figure 8: HyperMirror image that students painted a picture
3.1.2 Overhead camera

According to contents of distance learning, there are some cases that participants want to focus on materials. In this case, we switched HyperMirror to an overhead camera that shot objects from overhead.

Figure 11 is an overhead camera image that focuses on materials used in the lesson. Because of using the overhead camera, it became possible that the materials were shown clearly.

In this case, we built up HyperMirror as well as other tool that enables participants to share work space, and both HyperMirror and shared work space were used at a time. This shared work space is not ‘HyperMirror’ because self image was not reversed.

HyperMirror helps participants understanding whom he/she is working and talking with and doing collaborative activities because participants share whole of space that they do activities. In contrast, shared work space enables participants to work together and deliver surely their working situation.

Figure 12 is the image of collaborative activities using HyperMirror. The American male and Japanese female participant tried to communicate with hand-shake and touching top of her head.

Meanwhile, Figure 13 is the close-up image of collaborative drawing using shared work space. Participants drew a picture together and finally completed their work (Figure 13). In addition, by moving their hands, it can be said that participants could communicate with each other (Figure 14).

Thus, HyperMirror was effective in physical communication and enabled participants to feel as if they are in the same room like other HyperMirror projects above. On the other hand, shared work space enabled participants to not only do collaborative work but also communicate with each other. This is because participants’ body part: i.e. each hand appears on the shared work space, and this enables a local and remote participant to start to communicate by moving one hand in response to the other hand.

Altogether, the combined use of HyperMirror and other tools can provide activities taking advantages of their features. Additionally, like this case, the combined use of tools can supplement each activity.
tools: switching HyperMirror to other tools; using both HyperMirror and other tools together. As a result, participants could do their activities that they want to do, and they could show clearly what they want to display: a picture, material and situation they are working on. Basically, it seems to be that these uses of HyperMirror and other tools were effective in the projects we implemented.

Thus, it is important to choose an appropriate tool(s) which function or feature is (are) suitable for contents, activities, and participants of distance learning.

### 4.2 Supplement each other

It seems that tools used in this paper supplement each other. This is because each tool had the characteristics and was taken advantages in each single distance learning lesson.

Particularly, in the case stated in 3.3, participants could communicate in different way: communication with every part of and a part of the body. Although such a different way of communication could have different meanings, it seems to supplement each other.

This supplement could be a significant point in planning distance learning lesson and deciding which tool is used in distance learning.

### 5 Future prospects

In this paper, it became clear that the choices of appropriate tools in distance learning were important and that these tools supplemented each other.

We want to implement more distance learning projects using HyperMirror and review the effectiveness of HyperMirror and other tools and their application to distance learning. Then, we evaluate switching tools and combining tools more fully because we could not evaluate enough in this paper.

### References

