NHK Learning Fair 2003

The NHK Learning Fair 2003, "Everyone's Plaza in Autumn," took place from November 1 to November 9, 2003 at the NHK Broadcasting Center in Shibuya, Tokyo. This event helps visitors experience NHK's approach of "education while having fun." The event attracted 140,000 visitors, exceeding the previous year's number.

Popular exhibits had long waiting lines. These included one that used "multi-viewpoint camera" technology to allow a participant standing in front of a camera to generate movements for a CG character by simply moving the card over a TV monitor. Another exhibit let children play with CG characters on a monitor connected to an HDTV 3D camera that picks up the distance from the camera to the subject along with an ordinary camera image. In a stage performance, an ultrahigh-speed camera captured the moment that a balloon burst. Many exhibits featuring STRL's technologies captivated the attention of adults as well as the children in attendance.

Broadcasting Services Based on Home Servers

The entry hall of the broadcast center featured many stage presentations during the day. The woman in this presentation took the audience on a tour of the envisioned home server based system with her remote control.

Ultrahigh-speed 3-CCD Color Camera

In this stage presentation under normal lighting conditions, a special camera captured the moment that a balloon burst. The camera doesn't have the significant noise problem and inadequate sensitivity of ordinary CMOS image sensors, yet is capable of ultrahigh-speed shooting.

Ultraviolet Color TV Camera: "BeeCAM"

Maybe you've wondered how a bee finds flowers with nectar. The "BeeCam" reveals the visual world of the honeybee, which sees ultraviolet light. The camera system captures the UV spectrum and displays a visible image.

Insect Microphone

This contact-type microphone is sensitive enough to pick up the sound of a caterpillar munching on a leaf. Visitors to this exhibit were treated to the calamitous cracks and pops of a melting cube of Antarctic ice.
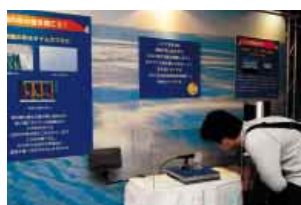
Multimedia Educational Support System

The system on display uses 550 specially prepared PICs, which are pictogram ideograms that allow children to communicate with each other regardless of language differences. Our "Antarctic School" website will allow kids from all over the world to interact with each other through PICs (see p.8).

Advanced Data Broadcasting Services on a Mobile Receiver

The prototype receiver and simulator on display are intended for mobile reception of digital terrestrial broadcasting. The simulator enables a user to experience a variety of network-linked services displayed on a screen.

Virtual Puppet

This system generates an image that appears to have been shot from a camera at an arbitrary position (virtual camera). In fact, nineteen cameras installed around the subject are used to generate the virtual image. This image was composed with images shot of children visiting the exhibit. The delighted children could play with some of their favorite TV characters (see p.9).

Virtual Reality Audio System

Kids could play hide and seek with NHK's popular animated character Ojaru Maru. Ojaru helped out a bit, calling to the children, who adjusted their views of the 3D world to follow his voice (see p.10).

3D Camera (Axi-vision Camera)

How were the kids able to dance with the Ganko chan, a baby dinosaur CG?

By sensing the distance to the subject's entire body, the Axi-vision camera can separate the subject from the background, thereby eliminating the need for a blue screen. The kids and Ganko chan could step in front of each other, but it was hard to keep up with Ganko chan's tireless pace.

The NHK Learning Fair 2003 featured exhibits of applications of the latest technologies from STRL. One of these was a presentation related to web technology, which provided educational information and a site for communications via a network. Another exhibition was based on a technology that controls video or audio data in response to a user's operations.

New Educational Broadcasting Service Using Multimedia Educational Support System

The NHK Learning Fair was the site of an experiment on a new educational broadcasting service that allows students in Japan to interact with children abroad. "Antarctica Kids," is the official homepage of NHK's educational program "Antarctica." This multimedia educational support system developed by STRL played a significant role in the experiment.

The Tokyo Nakano 7th Junior High School and the Sydney Loreto Girls Junior High School participated in the experiment. On the homepage, students exchanged opinions about the earth's environment by using a special pictogram chat and a multimedia report authoring system. The plan is for children from other countries, e.g. France and Italy, to participate in similar pictogram chats in the near future.

By using a combination of easily understood pictograms (symbols), the pictogram chat enables users to exchange opinions. The pictographic script employed in the experiment is called "PIC*," which is in use in over 20 countries.

With the help of the PIC Study Group in Japan (http://www.geocities.co.jp/NeverLand/3740/), approximately 500 pictograms were prepared, with new pictograms related to environmental issues and the Antarctic added to the existing ones. A user can express his or her opinion by combining a maximum of eight pictograms in one statement.

The multimedia report authoring system lets students edit their own video clips, for making online multimedia presentations or for sending to friends.

The "Antarctica Kids" homepage won the 30th Japan Prize (Best Web Prize in the Web Division), which was held concurrently with the Learning Fair. There were 22 other nominees in this category, including the websites of the BBC and NASA.

The judges said the "pictogram chat" feature clinched the award because it allowed users to go beyond language barriers in discussing environmental issues. Pictogram chat services for people with disabilities are anticipated in the near future.

Another feature that contributed to winning the award was the "agent search" system constructed by STRL. This is a feature wherein an agent responds to questions about Antarctica in natural-language computer-generated speech and presents related video clips.

Figure 1: Pictogram chat screen

Figure 2: Multimedia report authoring screen

Both technologies are the result of the NHK digital learning materials development effort that started in 2000, a collaboration between the School Educational Programs Division and STRL.

* Pictogram Ideogram Communication: a communication method that uses symbols (pictograms) developed in Canada.

New Virtual Reality (VR) TV Technology

Melding reality and TV

STRL has been engaged in basic research and development aimed at creating new ways to experience and enjoy TV. This exhibit at the NHK Learning Fair 2003 featured an application of "Virtual Reality (VR) TV" technology.

Conventional TV is used in a passive manner, wherein a viewer watches video and listens to audio programs that are broadcast to their home. "VR TV" is a entirely new concept, an active TV system, which will allow a user to enjoy TV in new ways. For example, a viewer/user might be able to control the movement of a CG character in a broadcast program, or move about in a virtual space displayed on the TV screen to see and hear what is there. Research is advancing on both the video and audio presentation for the "VR TV" system.

For the video system, we developed a technology through which a three-dimensional model (nicknamed a Vappet) of a moving subject can be moved around a composed screen. The Vappet is generated from multiple camera images taken from different viewing positions.

For the audio system, we constructed a prototype system (called VRAS) that is capable of controlling the perceived sound direction, distance, and reverberation, by synchronizing these in real-time with the viewing position and the CG character's movement. This gives the viewer the sensation that he or she actually exists in the virtual space on the screen.

Virtual Puppet

VRAS

Video System Vappet (Virtual Puppet)

A Vappet is a three-dimensional model of a moving subject that is generated from images taken with multiple cameras surrounding the subject (Figure1, 2). Real-time moving picture reproduction is possible while changing the Vappet's angle and position. Because the Vappet image is generated from images of an actual moving subject, such as a dancer, it is a form of video expression conveying a strong sensation of reality to the viewer.

A new tool for virtual reality presentation, Vappet Play, was also developed. This tool allows a user to freely move a Vappet in a composed image. Besides real-time presentation of a composed image combining a Vappet and a camera image, this technology makes it possible for performers on-screen to interact with the Vappet.

At the NHK Learning Fair, many children could play with a Vappet of Spoo, a character in a popular NHK children's show. The children, holding special white cards*, were displayed on a TV

Figure 1: Camera arrangement for generating a Vappet (example)

screen, and they could see themselves. When they turned over a card, Spoo or one of his friends would appear on top of it. The children watched the screen as they turned over the cards to reveal Spoo, who then danced around.

* ARTool Kit (Augmented Reality Tool Kit): a library for augmented reality system construction, developed principally by the University of Washington.

Figure 2: Experimental studio set

Figure 3: Playing with Vappets

Audio System VRAS (Virtual Reality Audio System)

The Virtual Reality Audio System VRAS generates realistic audio, giving a sensation of being at the site, by synchronizing with movements of the 3D CG characters and the viewing position. Based on spatial data including the room's size and reverberation properties, sound source and its movement, and viewing location and facial angle, this system can produce a highly immersive sound field by updating the perceived sound direction, distance, and reverberation in real-time.

This system is composed of several devices, including a special audio signal processor and mixer. By using a DSP* to integrate a series of sound signal processing functions, we could reduce the overall size of the system while enhancing the high-speed processing and sound quality. In combination with virtual reality pictures, it can generate contents that integrate the video and audio in a presentation. We also constructed software that performs all the processing with software to make it feasible for a single personal computer to reproduce simple content.

To convey the effect of this system to children, a production was made into a game that allowed a user to play hide and seek with a CG character in a virtual world by detecting only audible hints. Many children had fun with this game software.

* DSP (Digital Signal Processor): Programmable LSI capable of high-speed calculation processing.