Exploring Exhibit Space in a Personal Perspective: An Interactive Photo Collage of a Folk Crafts Museum

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1. Introduction

This paper describes a research project that was an outgrowth of a Website created for the Japan Folk Crafts Museum [JFCM]. The Website was created in 1995 by Otake, et al to provide information about the museum's philosophical background, collections, and special events [Otake 2001]. User feedback from the site indicated that people who could not actually visit the museum desired a virtual experience of the museum's collections. In addition, those who had visited the museum wanted to refresh their memories, as well as discover new items. To meet these needs, the authors decided to create a virtual tour of the museum that was language-independent and self-explanatory, and thus accessible to an international audience.

We termed this principle of a language-independent and self-explanatory exploration as "nonverbal navigation." To accommodate low-end computers, we decided against using 3D walkthroughs, and opted instead to use the technique of STAMP (Spatio-Temporal Association with Multiple Photographs). STAMP provides a means of interactively exploring an architectural space, while maintaining the simplicity of photography. Our prelimi-

nary evaluation of STAMP convinced us that it would provide a useful framework for building nonverbal navigation. In this paper, we will explore this use of STAMP, as well as discuss our findings from a photo collage workshop at Japan Folk Crafts Museum.

2. The STAMP Collage

STAMP, developed by authors Tanaka, Arikawa, and Shibasaki, is a technique for constructing a pseudo-3D virtual space from digital pictures [Tanaka 2001, Tanaka 2002]. A STAMP collage consists of a set of photos and links between them, as illustrated in Figure 2. Each link is associated with a geometric transformation combining translation, rotation, and distortion. The transformation is defined such that the rectangle specified in the photo at one end of the link is mapped onto the corresponding rectangle specified in the photo at the other end of the link. As depicted in Figure 3, a collage scene consists of a key photo and the photos linked to it. The key photo is placed in the center of the display, and linked photos are placed at transformed positions. A scene transits to the next when the user clicks on one of the linked photos. In a transition to the next scene, the current key photo fades out and the next key photo moves over to the center. This animation gives the user a sense of motion to the next key photo. Because a photo may be linked to several others, scene transitions can fork into multiple paths.

A STAMP collage can be played in a STAMP viewer, or after conversion into the Shockwave format, in a Web browser.

The user interface of the STAMP viewer is straightforward; in an automatic mode, the scenes play until there is more than
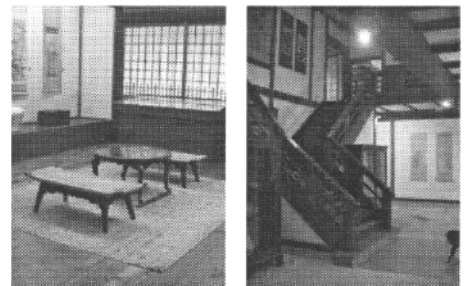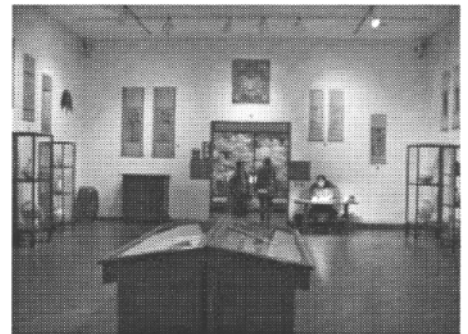

Figure 1. The Japan Folk Crafts Museum
The museum was founded in 1936 by Muneyoshi Yanagi. He valued the functional beauty of folk crafts and made a large collection of items including ceramics, furniture, textiles, and tools. The museum displays part of its over 10,000 collection items in a traditional Japanese-style building.

one path to follow. At a fork of the path, clicking on one of the linked photos triggers a transition to the next scene. In an earlier study of the design of multimedia content, we learned that some users prefer this type of minimum interaction [Kiriyama 2000]. In a manual mode, the user controls transitions to each photo in the scene, permitting the user to examine photos at his/her own pace.

To create a STAMP collage, the editor uses the STAMP editing tool to build links between photos (Figure 4). The editor loads a set of photos in a library in the Macromedia Director format. The user picks out two photos in the library, places them in the workspace side by side, and draws a rectangle around a common object in each picture to indicate areas to overlap. Based on the two rectangles, the system computes a geometric transformation such that the transformation maps the rectangle in one picture onto the other. Sometimes manual alignment is necessary for exact matching between overlapping areas.

A STAMP collage differs from video in its ability to represent multiple paths in scene transitions, including branches, loops, reverse motions, and terminals. In this sense, the STAMP collage is close to nonlinear video, but it can be created much more easily. Both STAMP and Quick-TimeVR [QTVR] use photos to construct a virtual space. QuickTimeVR, however, is limited to panoramic photos. STAMP has
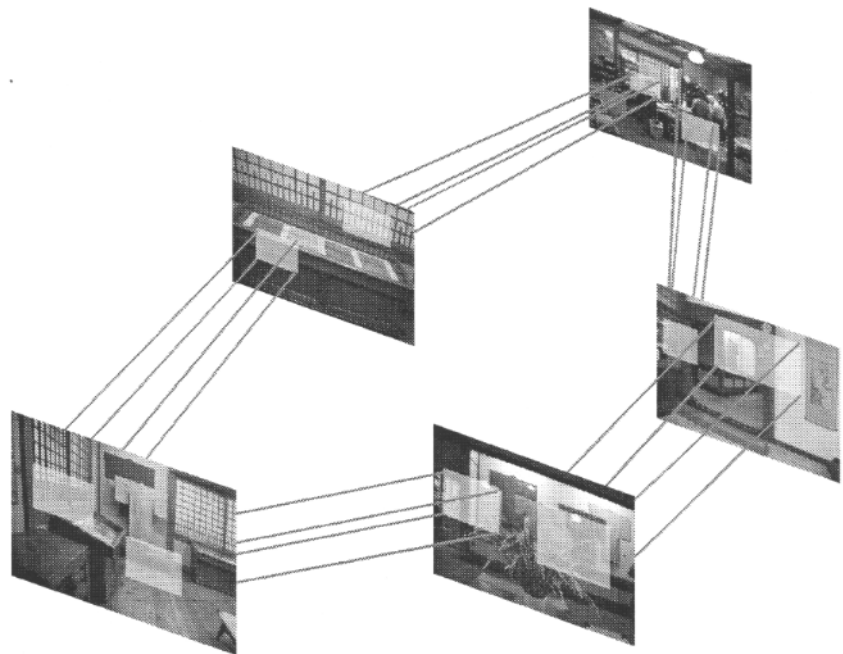

Figure 2. A STAMP photo collage
A link between two pictures is associated with a geometric transformation, which maps the rectangle marked in one picture onto the corresponding rectangle in the other picture.
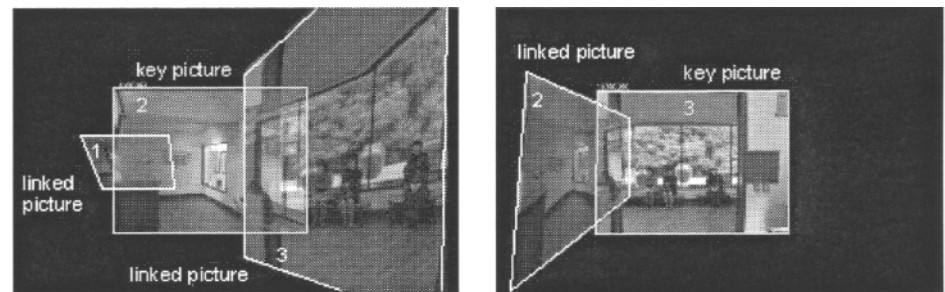

Figure 3. Scene transition
A scene consists of a key picture placed in the center of the display and linked pictures placed at transformed positions. The scene to the left transits to the next scene to the right when the user clicks on picture 3.
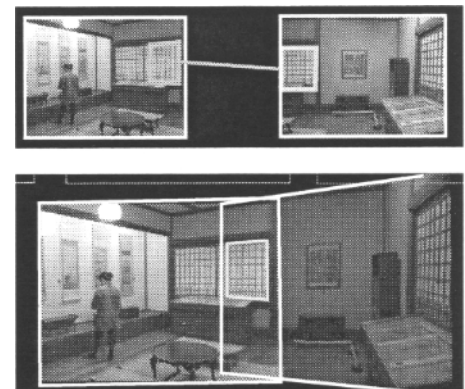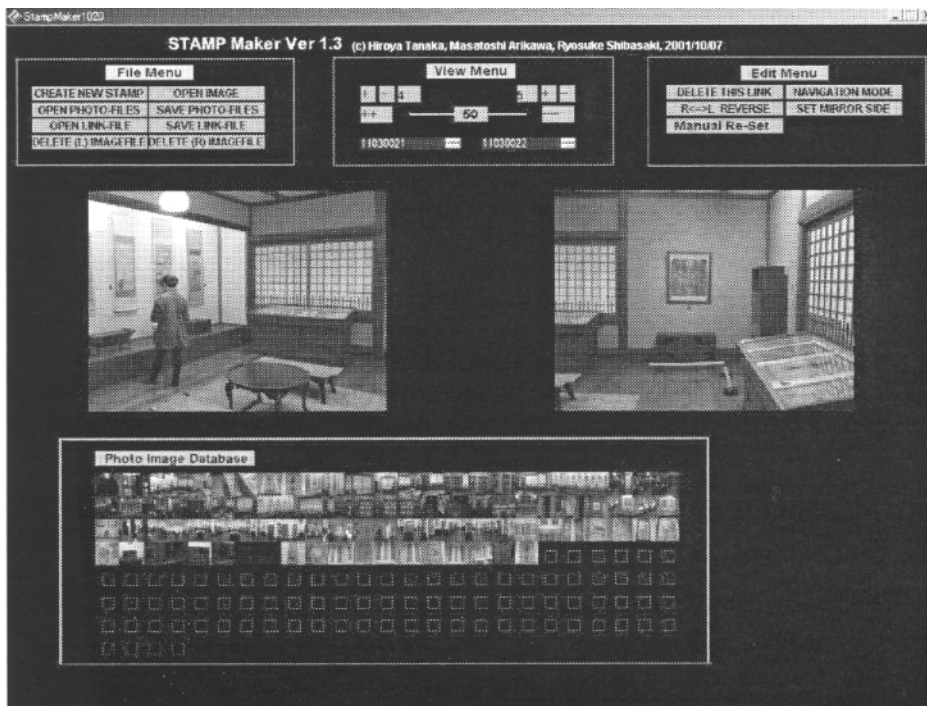

Figure 4. STAMP editing tool
The editor picks out two pictures in the cast library and places them side by side in the workspace (left). Then the editor draws a rectangle in each picture to indicate an overlapping area (above, top). The editing tool calculates a geometric transformation between the two pictures and creates a preview of the scene (above, bottom).
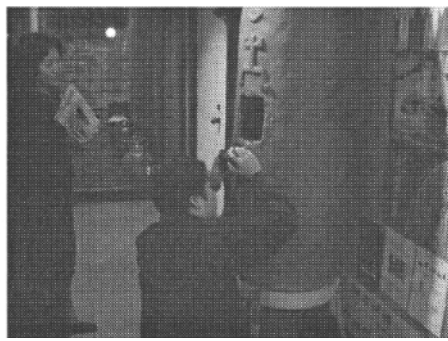
Figure 5. STAMP collage workshop at the Japan Folk Crafts Museum
Participants took pictures as they walked in the museum.

the advantage of handling depth dimension to create a virtual walkthrough. Other 3D modeling techniques for the Web, such as [Web3D] and its derivatives could be options for creating a walkthrough. So far, we find them too technically demanding in both creation and viewing. We see an advantage of STAMP in its fundamental simplicity.

3. Workshop

In November 2001, we held a workshop at the Japan Folk Crafts Museum (Figure 5). The goal of the workshop was to have participants create and compare virtual tours using STAMP. Workshop participants included seven students from the Department of Intermedia Art at the Tokyo National University of Fine Arts and Music, and four graduate students from the School of Engineering at the University of Tokyo. Prior to the workshop, they attended a seminar on STAMP. Each participant was then given a digital camera. With special permission from the museum administration, they each proceeded to take one to two hundred photographs in the museum over a ninety-minute period.

After photographing, we spent two hours discussing the participants' experiences. They were excited at the idea that their choices of photos would guide the end users. But while taking the photos, some of them experienced difficulty in conceptualizing the final product. For instance, one participant found it difficult to determine what would be effective branches in the STAMP collage. Also, most participants found the requirement to overlap photos tedious. In a large space, they tended to
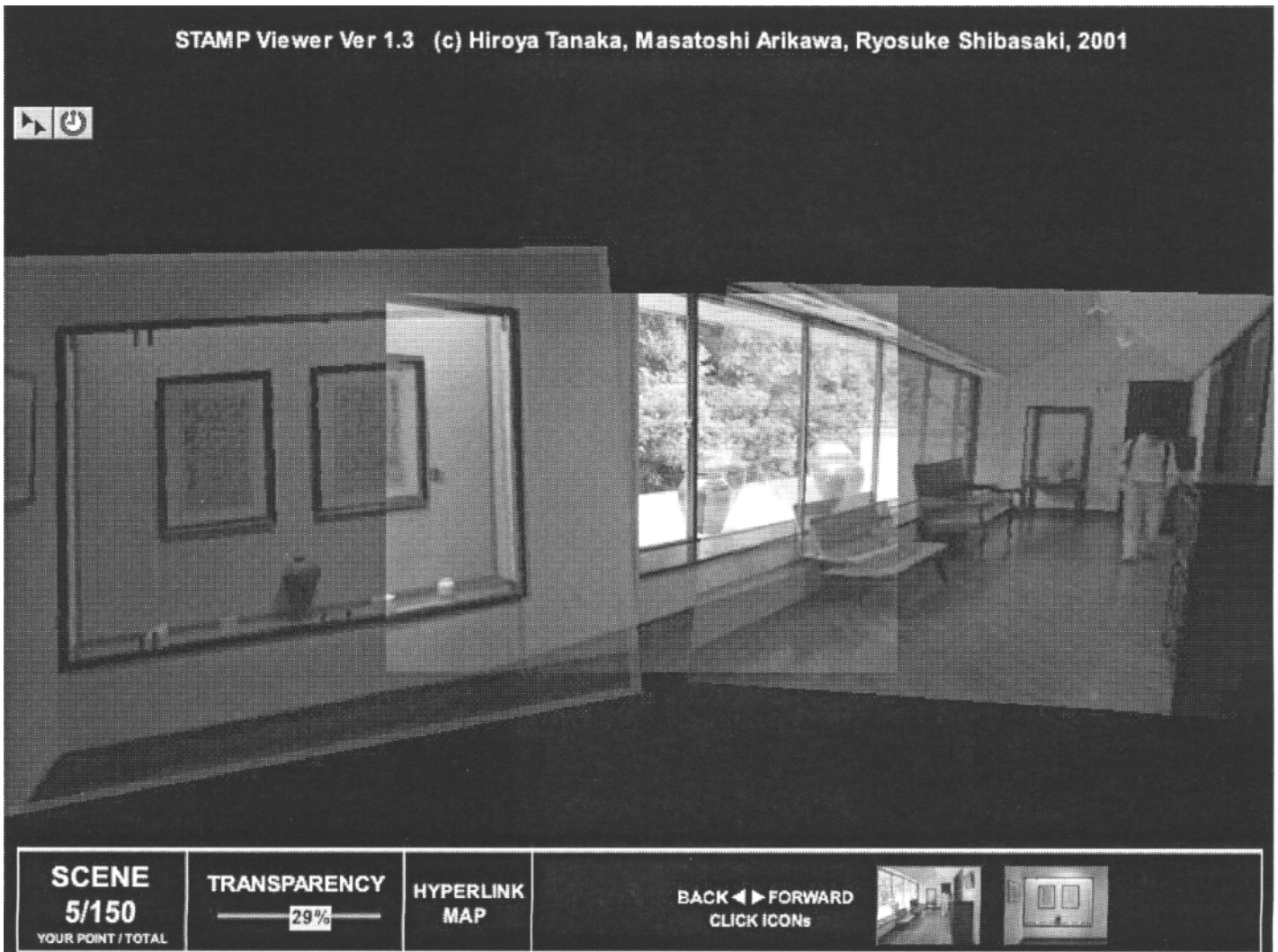

Figure 6. STAMP collage of the museum
This short corridor in the upper floor leads to the special exhibition room. The large window to the left has a view of the rooftop garden. This space is one of the landmark locations in the museum.

Figure 7. STAMP collage of an exhibition room
The STAMP viewer allows the user to set visibility of linked pictures. At a higher visibility, the linked pictures in both sides show a spatial context of the key picture in the center.

make a gap between points of interest.

One of the positive findings was that we could create novel branches, such as jumping directly from lower to upper floors. Another finding was that the STAMP collage can effectively combine pictures of various scale. Continuous media such as video are not suitable for frequent dramatic shifts between wide shots and close-ups, but a STAMP collage can comfortably connect such photos. This feature allows the editor to efficiently create spatial context between an exhibition room and the collections in it.

4. Analysis

We next compared STAMP collages created by different students. Figure 8 illustrates two approaches to showing the same exhibit space. The student who made the collage in the left hand column

directed her attention to a display table in the middle of the room. In her virtual tour, she approached the table and examined the items on display. The student who made the collage in the right hand column stood in the center of the room and scanned the walls. Such techniques were commonly used in the workshop. Other techniques used included connecting a photo of a wide area with variety of close-ups of objects in it. Awareness of these techniques is useful in planning a virtual tour.

Most often, the students created their collages by photographing the space along a random route. In editing the collage, they discovered that the path frequently intersected itself. Such a place of intersection could be identified as a landmark in the museum space. The editor could link a photo of the landmark with photos leading to different branches of the route.

The choice of landmarks was arbitrary, and depended on how the editor wanted to construct the virtual tour. Typically a photo of a landmark had just a few links, and cascading such branching links created a complex structure of the tour route. To review this structure, the STAMP viewer incorporates a hypermap that illustrates how pictures are linked to one another (Figure 9).

We then compared the virtual tours created by the students with a tour previously created by the museum curator. The STAMP collage built by the curator markedly contrasted with the collages of the students. For example, the curator tended to move directly from a distant position to a close-up of an object (Figure 10). The students' explorations, on the other hand, were much more random. This suggests that because of the curator's familiarity with the museum's collections, he knew the most significant objects to look at first. The students were impressed by the curator's approach, which clearly and dis-
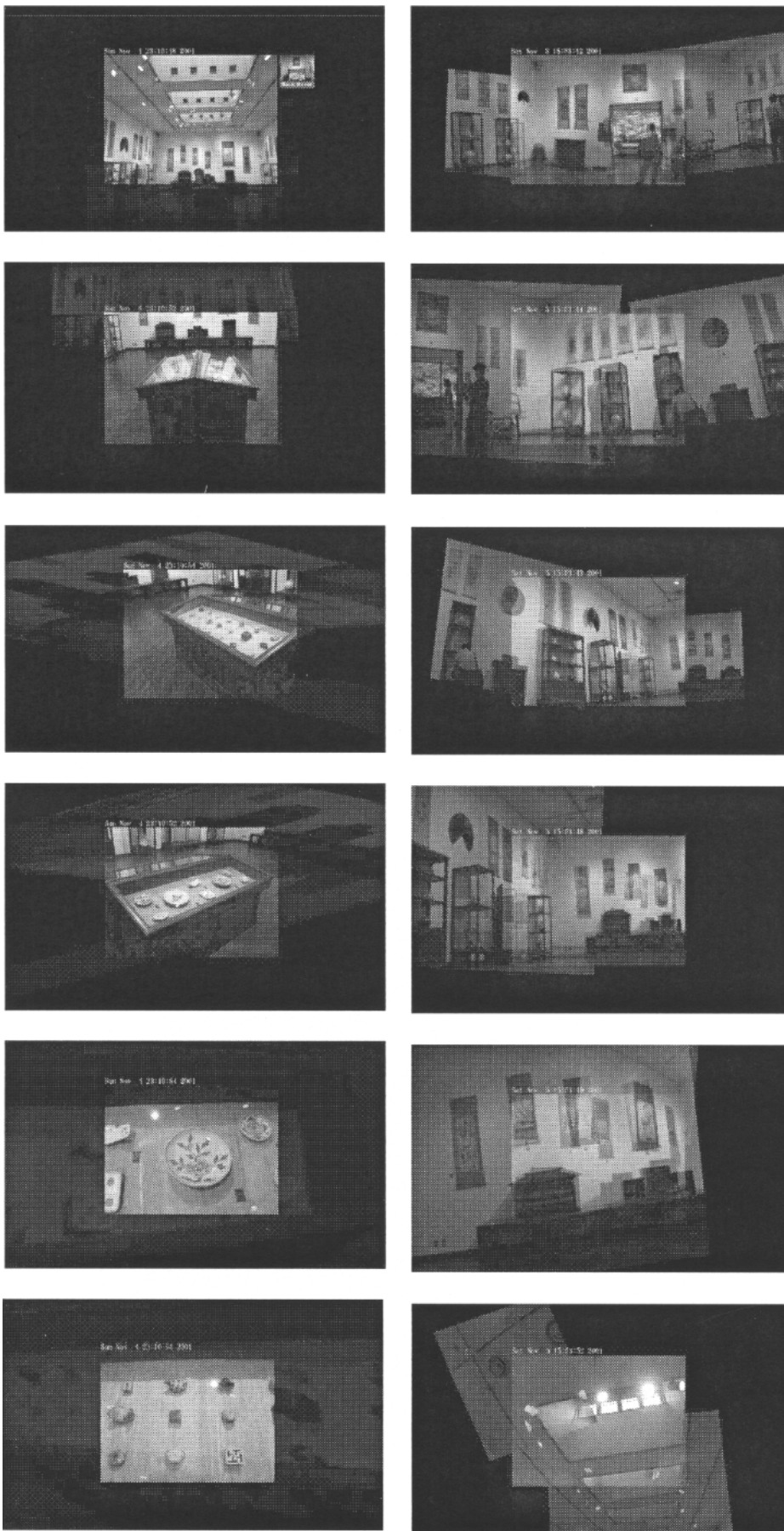
Figure 8. Navigation patterns

Students in the workshop took different approaches to navigate the user in their STAMP collages. The student who made the collage in the left hand column directed her attention to a display table in the middle of the room. In her virtual tour, she approached the table and examined the items on display. The student who made the collage in the right hand column stood in the center of the room and scanned the walls.

tinctively reflected his implicit knowledge of the collections. This indicates that the opportunity for learning is enhanced in a virtual tour created by a knowledgeable person.

The STAMP viewer illustrates the route of a virtual tour as shown in Figure 11. The route is computed from transformations between photos. The curator's route in the left hand clearly contrasts with the student's route in the right hand.

5. Conclusions

In this project, we experimentally created virtual tours of the Japan Folk Crafts Museum using STAMP. We discovered that navigation of space differs from person to person, and is influenced by the knowledge of that space. By comparing virtual tours created in the workshop, we identified navigation techniques that are useful in constructing virtual tours. As a result of this workshop, we are convinced that STAMP is useful for nonverbal navigation of a virtual tour. Examples of virtual tours created in the workshop are available at http://www.beausys.org/collage.

We are planning to hold the next workshop in Spring 2002. On the agenda is adding temporal relationships between photos, which would allow us to move between photos taken before and after upcoming renovations. Future projects with STAMP include providing the museum visitor with a digital camera so they can create their own virtual tours. Ultimately, we are hoping to build a network of virtual tours created by museum visitors, with the goal of facilitating learning from each other's tours and creating a comprehensive virtual experience of the museum.
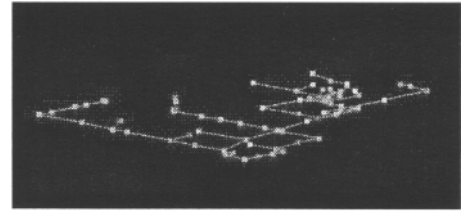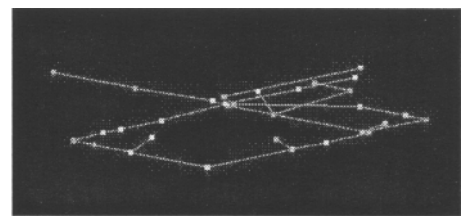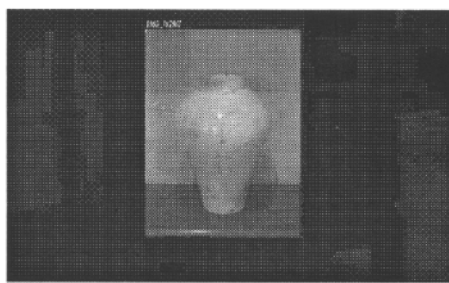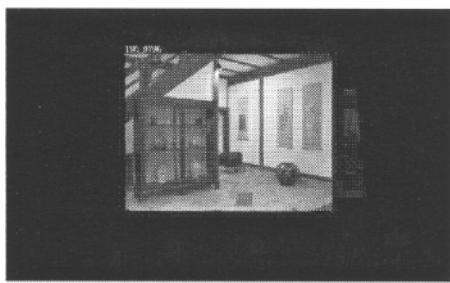
Acknowledgements

Figure 10. Navigation by the museum curator
Prior to the workshop, we asked the museum curator to take pictures for the STAMP collage. He often moved straight to important collection items, which contrasts to the collages of other workshop participants. This approach can be explained by his knowledge of the museum collections.

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Figure 11. Virtual tour routes
These routes are computed from transformations between photos. The curator's focused route (top) clearly contrasts with the student's exploratory route (bottom).

About Beausys

Beausys is a nonprofit organization for research in technically sophisticated information design. Current members include Mihoko Otake, Junichi Tokuda, Haruka Tanji, Takeshi Matsushita, and Takashi Kiriyama. http://www.beausys.org
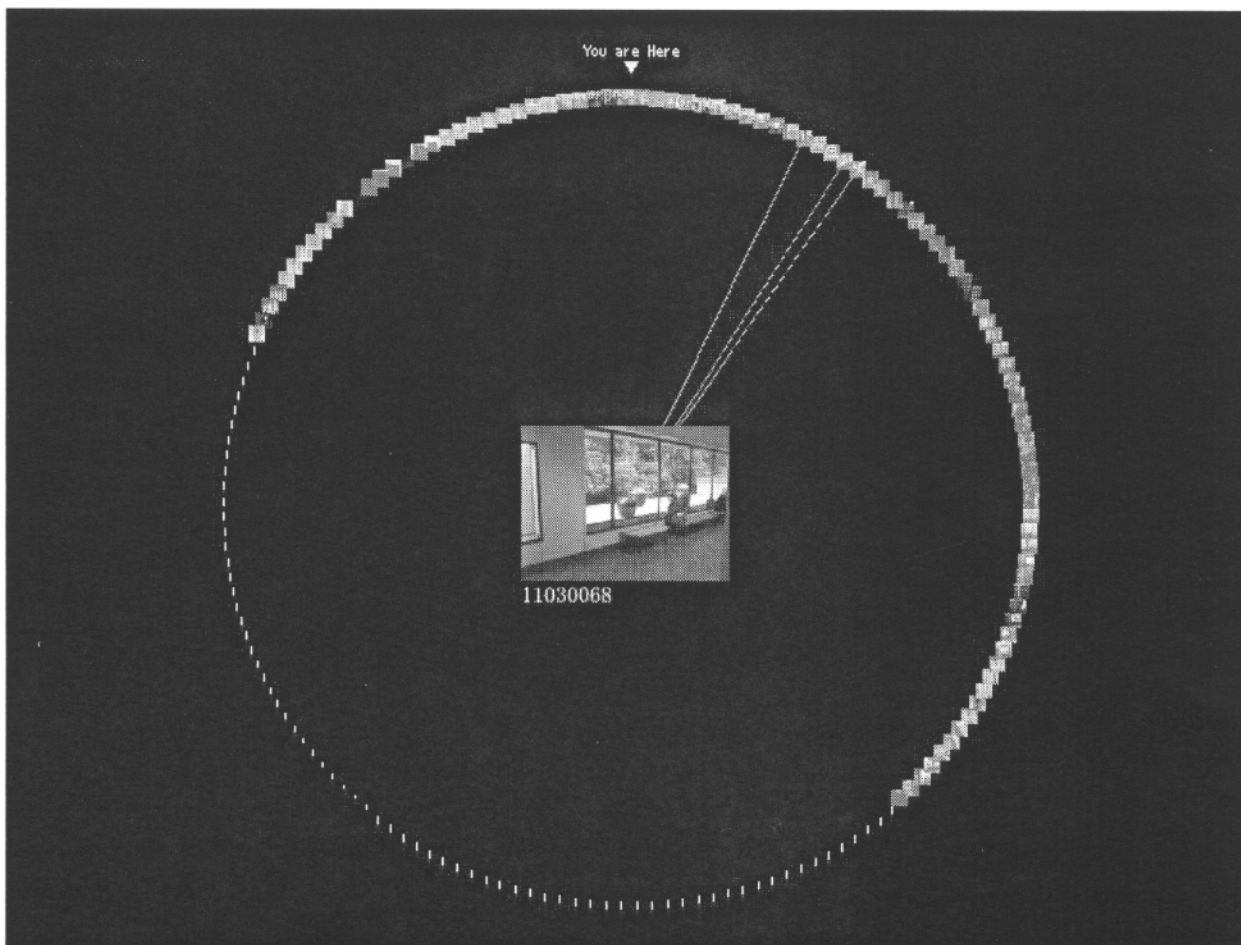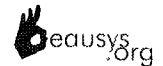
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Figure 9. Hypermap
A hypermap in the STAMP viewer visualizes how pictures are linked one another.