

materials like “artificial soil,” in which soil and stone dust are mixed with synthetic resin, or “artificial rock,” have been introduced in restoration. The research and development of repair techniques that use leading-edge science and technology, such as new restorative material will be in demand in the future.

Furthermore, in cases in which the artifacts will not be returned to the ground, preservation countermeasures for showcasing these in exhibitions must be developed. The development of a method for promptly identifying causes of the deterioration of complex intertwined cultural resources, the technological development of groundwater control to preserve cultural resources, and the development of preservation materials are all necessary.

Moreover, it is desirable to discuss two or more alternatives in the decision about the restoration policy, such as from the technological development of restoration simulations, as mentioned above, so a better decision can be made.

Presently, investigation is being conducted regarding the causes of deterioration of cultural resources; preservation countermeasures are being considered, and the restoration will be performed and recorded using digital techniques. However, records that include data regarding “sensibility” and combine information from all five senses are expected in the future.

Moreover, regarding large-scale, tangible cultural properties with a complex shape, the measurement of such objects takes considerable time and effort, and three-dimensional digitization is difficult. Yet, it is hoped to develop a system that can automatically record and save data and highly accurate three-dimensional digital images of such objects.

(5) Investigation of science and technology that supports the preservation and traditions of intangible cultural properties

The preservation and traditions of industrial art among intangible cultural properties, which are generally craftsmen's skills that were traditionally passed on from master to pupil, are essential. In former times, apprentices lived in their master's home and learned their master's technique. Nowadays, the passing on of such an industrial art is difficult; it depends on the social situation.

In situations like the abovementioned, industrial arts such as ceramics will be recorded in three-dimensional video format so that it can be transmitted to future generations, and consequently, the technique can be handed down.

The movements of the craftsman's arm and hand are measured and recorded and are reproduced as a computer image.

The development of a mechanism that would be able to measure the pressure applied by a premier craftsman's hand while he is doing his work is being pursued. Tactile and kinesthetic senses as well as the image are recorded, and the incremental increase or decrease of minute

forces can be reproduced.

If these measurements are achieved, electronic information can be sent to a robot in a remote place, and the craftsman's work can be recreated there. Moreover, a mechanism that supports craftsmanship training and the passing on of the traditions of the craftsman's skills to the next generation will hopefully be developed. Moreover, the development of a system that can record intangible cultural property, which takes considerable time and effort, is hoped for at the same time, such as the difficulty involved in three-dimensional digitization of the performing arts in which two or more people do various movements. Therefore, a system that can automatically record them and that produces extremely accurate three-dimensional digital images is required.

In the future, it is expected that not only the sense of sight and touch but also information from all five senses will be recorded.

(6) Promotion of international program (international technical cooperation)

Cultural resources are valuable possessions of the human race and emerged in the world from negotiations with various people and various countries, appearing over a long history and passed on down to today. A cultural resource is always necessary to understand history and cultural traditions in countries of the world, because it is the base of cultural evolution. Therefore, it is believed that countries aim to preserve their cultural resources and maintain their cultural base as well as to evolve within their own culture but also to contribute to various evolutions in world culture.

Japan has openly reconciled high economic growth with the protection of its unique traditions and culture. Moreover, Japan's research regarding the preservation of cultural properties and the level of Japan's preservation and restoration technology is highly acclaimed internationally. Japan is offering technical assistance in the field of the protection of cultural assets to many countries⁽⁵⁾.

Japan is expected to continue with its global view, contributing to the promotion and preservation of international cultural resources.

Furthermore, Japan continues to advance the science and technology that supports preservation and the construction of an international research base and active technical cooperation. Japan's unique cultural resource preservation restoration technology center.

5: In Japan, we are cooperating with countries from around the world through the World Culture Agency, the Ministry of Education, Culture, Sports, Science and Technology, Japanese National Commission for UNESCO, the Ministry of Foreign Affairs, The Japan Foundation, Japan International Cooperation Agency, universities, local authorities, and non-governmental organizations with regard to the preservation of their cultural properties.

1 - 2 Science and technology that supports application of cultural resources

● Preservation and exhibition of the five senses using Virtual Reality technology.

The features of Virtual Reality technology are a natural three-dimensional space for the person wherein the person interacts with the artificial environment, of which the conditions can be created, and can move freely around it. This Virtual Reality technology makes the following become possible:

- i. Cultural resources can be freely produced and used.
- ii. Cultural resources that should not be touched can be touched.
- iii. Past times and conditions can be reproduced.
- iv. Cultural resources that cannot be physically preserved can be preserved, opened to the public, and used.
- v. People can experience a different dimensional space; consequently, cultural resources are open to the public.

For instance, the opening up of genuine cultural properties is possible at museums. Not only that, but they can be accessed via the Internet by using Virtual Reality technology. Currently, in order to achieve this, programs are being conducted in each country.

Moreover, Augmented Reality technology, which creates a “space in Virtual Reality” is applied. The following become possible by applying an extension of Augmented Reality technology:

- i. Additional clarification is added to the exhibit without ruining the exhibit.
- ii. Restoration of missing parts, showing the repaired state, is possible.
- iii. Parts that are transparent and cannot be seen may be shown.
- iv. Figures and the works that they create are constructed.
- v. Exhibitions in a fixed region are possible.

In addition, application of telexistence technology, in which “people can have an advanced presence and can work and communicate as if they were actually there even though the location may be far away” can be used. The following become possible by applying telexistence technology:

- i. Such things as exhibits can be observed without actually going to the museum.
- ii. Historic sites can be viewed even without actually being on location.
- iii. Traditional performing arts can be appreciated without actually going to the theater.
- iv. Movements associated with the performing arts and craftsmanship are recorded and can be reproduced.

The following become possible by using these technologies:

- 1) Cultural resources are stored as electronic information

and will remain for easy access.

- 2) People can go to an actual site and build up three-dimensional images of the site using augmented reality technology.
- 3) People not have to go to an actual site but can get the exact same experience by using telexistence technology.

In addition, it is expected that robotics, which are the strength of Japan, will be used and that in the area of Virtual Reality technology, Japan will invent new technology before other countries.