Training Report on Cultural Heritage Protection

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Cultural Heritage Protection Cooperation Office, Asia/Pacific Cultural Centre for UNESCO (ACCU)

Preface

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Afghanistan has had much unique cultural heritage formed by influences from Buddhism and Islam over a long history since prehistoric times. However, due to longstanding war, a considerable amount of this cultural heritage has been destroyed or threatened with destruction. While the restoration of damaged cultural heritage and the re-collection of scattered fine arts and archaeological artifacts have been carried out, as well as the reconstruction of museums after the establishment of a new government in 2002, we need to focus more on the recording and management of cultural heritage in Afghanistan. There are, however, not enough personnel for these tasks.

In Japan, in setting up the international advisory programme for the preservation and restoration of Afghan cultural properties, the Agency for Cultural Affairs and the Ministry of Foreign Affairs have established a system to advance effective and efficient cooperation at the national level and to seek close cooperation with related institutes. In this programme, the "Report on the Promotion of Cooperation for the Preservation and Restoration of Afghan Cultural Properties" was compiled on August 19, 2003, stating that the Japanese government will provide cooperation using our advanced and specialized technology and skills, and scientific knowledge on the basis of the international supporting system such as UNESCO.

Based on such a background and activities by the Agency for Cultural Affairs, ACCU Nara Office (Cultural Heritage Protection Cooperation Office, Asia/Pacific Cultural Centre for UNESCO (ACCU)) decided to invite trainees from Afghanistan and provide training mainly on photography techniques essential for the recording and management of cultural properties, in other words, "documentation", in order to contribute to fostering personnel for the preservation and restoration of cultural properties in Afghanistan.

For this training project, it was decided to establish cooperative ties with the Faculty of Fine Arts, Tokyo National University of Fine Arts & Music with respect to the proposal to execute close mutual cooperation with related institutes, as stated in the above-mentioned report. We are grateful to those persons involved in the project at Tokyo National University of Fine Arts & Music.

We also thank the National Research Institute for Cultural Properties, Nara, for facilitating training and Tokyo National Museum for giving us opportunities to browse through related materials and exchange opinions with experts.

Last but not least, we are respectful and grateful to the Agency for Cultural Affairs for its great support in realizing this training project.

USHIKAWA Yoshiyuki Director Cultural Heritage Protection Cooperation Office, Asia/Pacific Cultural Centre for UNESCO (ACCU Nara Office)

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Introduction



Introduction

1. Preservation and Restoration of Cultural Heritages in Afghanistan

As is generally known, in Afghanistan, a number of cultural heritages have been destroyed, damaged, and threatened with outflow to foreign countries, due to the war. In Japan, considering such situations, the Cultural Affairs Agency and the Ministry of Foreign Affairs had a talk for the purpose of cooperation in preservation and restoration of cultural heritages in Afghanistan. In the result, the fundamental measures for support were decided, and the policy for active cooperation was established in August 2003.

According to the report on the international advisory conference for Afghan cultural heritages, etc., in which the promotion of cooperation for the preservation and restoration of Afghan cultural heritages was discussed, international contributions should be implemented as both material and spiritual support with Japanese unique viewpoints, using our expertise and scientific knowledge, in consideration of the international support system by UNESCO, etc.

As specific fields of cooperation, the following activities have been suggested:

- 1) In the Kabul Museum, training on photographic techniques essential for recording, registering, and organizing art works and archeological artifacts, and conservation science area related to conservation and restoration technology shall be provided.
- 2) In the Archaeology Center, technology and management methods necessary for the research on sites, and technological transfer and personnel training for scientific processing to conserve unearthed artifacts shall be considered.
- 3) In Bamiyan, the research on underground sites shall be carried out.
- 4) In Kabul, the research base shall be secured.

In this report, it is required to promote cooperation, taking our own response system with the systematic linkage with related institutions, such as universities, research centers, museums, Japan Foundation, and Japan International Cooperation Agency.

2. Training Program

Cultural Heritage Protection Cooperation Office, Asia/Pacific Cultural Centre for UNESCO (ACCU Nara Office) is carrying out training projects to foster personnel, international conferences and open symposiums/seminars for enlightenment and diffusion of the awareness for cultural heritage protection, and collection and transmission of information on cultural heritages, for Asia/Pacific countries. As a link of those projects, the training in which curators are invited from the Kabul Museum in Afghanistan will be implemented this time.

At planning this project, the Cultural Affairs Agency provided the guidance that support projects by related institutions including universities, research centers, and museums should not overlap or hinder each other, respecting the framework stated in the report on the international advisory conference for Afghan cultural heritages, etc. Consequently, in concert with those institutes, it was decided to implement the training on photographic techniques.

The training of photographic techniques will be carried out in the full-scale cooperation of

Tokyo National University of Fine Arts & Music, which has been working on training projects in this field.

3. Digital Photography

The purpose of this training program is to promote the utilization of photographs of the general cultural heritages, as records including materials in possession of museums in Afghanistan. The program is aiming to study the theory and techniques necessary for effective utilization of instruments for digital photography and image processing, which can be applied in the Kabul Museum. In consideration of difficulties in procuring materials for development and print of conventional analogue photos, as well as environmental affects from waste liquid generated in those processes, the recording method using a digital camera is given a priority.

Furthermore, it is expected that the establishment of this photographic technique will promote the documentation of the general cultural heritages, for example, making photographic registers of sites and ancient artifacts. Especially in organization and storage of collections in museums, a register becomes the fundamentals of all, and can be called properties' census register. The contents concerning the management of this register, for example, retrieval and sorting with computer, are planned to include in this training.

For the publication of a museum like a graphic catalogue of the exhibits and a report, large-sized color or monochrome photographs recording mass volume precise information are sometimes needed. However, since highly precise photographs are not required for the register to manage collections, the image of digital photograph is enough. This is another reason why this training program aims at mastering digital photographic technology.

4. Contents of Training

This is the second training program in which ACCU Nara Office invites staff from Afghanistan since last year. To select personnel, a vice minister of The Ministry of Information and Culture of Afghanistan and the director of the Kabul Museum recommended staff appropriate to attend this program, and ACCU Nara Office made decision after screening. Two invited staff, Mr. Mohammad Rafiq Hafizi and Mr. Hamed Enayat, both belong to the photograph department of the Kabul Museum.

The contents of the training on the theme of digital photographic techniques are as follows:

- * Comprehension of the principle of photograph, with actually comparing digital photography and analogue camera photography
- * Essentials for photography, including how to decide the exposure and its structure, characteristics of long and short focus lenses, and aperture and depth of field
- * Fundamentals of lighting
- * Way to take photographs of artifacts and display them, in consideration of being museum collections

In addition, the processing method of photographic data, the management and the storage of photographs, the production of registers for collections using computer are added for the purpose of organization and management of collections.

Summary of Lectures



Summary of Lectures

February 21 (Sat.)

Introduction to the Course

- General explanation of the training course and stay in Japan
- · Hearing on the current situation of Afghanistan and Kabul National Museum

February 22 (Sun.)

- Continued from yesterday's hearing.
- Visit to National Science Museum and Edo-Tokyo Museum as examples of exhibition.

February 23 (Mon.)

Briefing Session on the Training Programme

< Prof. SATO Ichiro, 9:00 to 10:20>

- Prof. Sato has exercised control over workshops held in Tokyo National University of Fine Arts and Music (*Tokyo Geidai*). Briefing session on schedule and contents of the training in light of the on-site training on photograph held by *Tokyo Geidai* in 2003.
- Visit to the exhibition of graduation works and others in Conservation Course, *Tokyo Geidai* to inspect the conservational work. Explanation of repairing methods and scientific methods were done in reference to these exhibits.

Photographic Techniques for the Documentation of Artifacts (1)

- < Dr. KIJIMA Takayasu, 10:40 to 17:00>
- Photography can record and convey information that cannot be represented by writing. At each stage prior to, during and after the repair of cultural assets, it is required to record them by photographs including ultraviolet and infrared photography.



Briefing Session at the Laboratory of Prof. Sato, Tokyo Geidai



The exhibition of graduation works, *Tokyo Geidai*



Dr. Kijima giving lecture on handlimg 4x5camera



Visiting the Conservation Laboratory, Tokyo Geidai



Using the exposure meter before taking photos, Dr. Kijima's Laboratory, *Tokyo Geidai*



Taking infrared photograph, Dr. Kijima's Laboratory, *Tokyo Geidai*



Taking photos in the campus to prepare for the tomorrow's lecture

- Learn photographing by using a 4 × 5 camera, taking oil painting as a photogenic subject. Lecture on camera setting, exposure and adjustment of shutter speed.
- Practice insertion of 4×5 color and black-and-white films into the folder. Then, actually take photographs by using the folder.

Visit: Conservation Laboratory

< Prof. NAGASAWA Ichiro, 13:00 to 13:30>

 This laboratory specializes in the repair of woodcarving. Look at the actual repair work. The laboratory is currently restoring a Buddha statue entrusted by a temple in Akashi City, Hyogo Prefecture and a statue of an eighteenth century Edo period Buddhist monk.

February 24 (Tue.)

Photographic Techniques for the Documentation of Artifacts (2)

- < Dr. KIJIMA,10:00 to 12:00>
 - Continued from yesterday's lecture. Take photographs of the backside of the painting photographed yesterday.
 - Analysis by use of infrared camera. Observe the painting with infrared camera to confirm rough that cannot be seen so far.
 - Take photographs by use of ultraviolet lamp. Firstly observe the painting irradiated by ultraviolet lamp with the naked eye to confirm the repair traces, and then take photographs of them with a 4 × 5 camera. The object is a work of a professor of *Tokyo Geidai* and it has already turned out to be modified.

12:50-

Take photographs in the campus in preparation for tomorrow's training on the development of film. Training of basic photography with a 35 mm film camera (how to hold the camera and remove film).

Introduction to Conservation Science

<Dr. KIRINO Fumiyoshi, 13:30 to 17:00)

- Explanation of the organization of the Conservation Science Course.
- Lecture on conservation science.
- Actual photographing by use of optical microscope and electronic microscope. Observe cadmium sulphide used as coloring matter under optical microscope and then under electronic microscope. Receive an explanation on the principles of the electronic microscope and observe a sample. Make a chemical analysis of the sample and learn how to read the resulting data.

Visit: Japanning (urushi, Japanese lacquer) Course Laboratory

< Dr. NAKAMURA Makoto, 17:00 to 17:40>

• With Dr. NAKAMURA as a guide, inspect the drying room of works made of lacquer. Taking the works of Dr. Nakamura as examples, talk about lacquer arts and the possibility of lacquer work in Afghanistan.

February 25 (Wed.)

Techniques for Processing Photographs (1)

< Staff of Photography center, *Tokyo Geidai*, 10:00 to 17:00>

10:00-12:10(Ms. KAYAHARA Risa and Ms. NOZAWA Tomoyo)

- Dr. SATO Tokihiro, Chief of the center gave a brief explanation of the center.
- Lecture on configuration of a 35 mm camera.
- Practice in film development. Practice development and printing using 35 mm film of photographs taken by each participant yesterday.
- Explanation of chemicals necessary for development.



Dr. Kirino gave a lecture on Conservation Science, Tokyo Geidai



After the lecture, participants observed material with electronic microscope, Dr. Kirino's Laboratory, *Tokyo Geidai*



Showing examples, Dr. Nakamura explaining japanning technique, Japanning Course Laboratory, *Tokyo Geidai*



Dr. Sato giving a lecture at the Photography Centre, *Tokyo Geidai*



Learning how to handle the 35mm film to prepare for developing



Evaluation of the developing and printing technique



Learning how to use digital camera



Management of the data was demonstrated using i-Mac

12:50 -17:00 (Mr. KON Yoshinori)

- Development of 4 × 5 film, which is basically same as in 35 mm film; Printing to developing paper.
- Evaluation of developed films and printed photographs.

February 26 (Thu)

Techniques for Processing Photographs (2)

< Staff of Photography center, *Tokyo Geidai*, 10:00 to 17:00>

- Training in photograph center
- Learn how to use digital camera, printer with scanner and personal computer (Macintosh, i-book) with practical work.
- How to use personal computer, to move data in camera into the computer, to store the data into a folder of the computer, to use Photoshop7.0 (simple picture processing) and to make a CD.
- These devices and software belong to *Tokyo Geidai* have been kept by Kabul National Museum for the next training course. So, the lecture was made on the premise that they would be available immediately after returning to Afghanistan.
- Dr. Sato of the center concluded, saying "I hope that this training will contribute to restoration of Kabul National Museum".

February 27 (Fri.)

Management of materials in Tokyo National Museum

< Dr. GOTO Takeshi, Mr. TARASHIMA Satoshi, 10:00 to 12:00>

- Dr. GOTO outlined the organization of the museum.
- Mr. TARASHIMA in the Information Division introduced a picture reference system using photographic materials in the museum. Receive an explanation on history of collection of the photographic materials

and current situation on storage and management, and look at the picture reference system and a reference room.

13:30-

- Observe how to exhibit and manage the artifacts in the museum.
- Courtesy call on Dr. MIWA Karoku, Director of Kyushu National Museum, Office of the Planning and Development.

February 29 (Sat)

Visiting the World Heritage Sites in Nara

• Visit to World Heritage sites in Nara Prefecture (Horyu-ji Temple, Heijo Palace Site, and Todai-ji Temple)

March 1 (Mon.)

Fundamental Photographic Techniques

<Mr. SUGIMOTO Kazuki, Photo Studio, National Research Institute for Cultural Properties (*Nabunken*), Nara, 9:00 to17:00>

• Lecture on the fundamentals of photographic techniques, choosing three-dimensional material as subject. Learn selection of lenses used, exposure and focal depth.

March 2 (Tue)

Management of Digital Photographs and Files

<Mr. SUGIMOTO Kazuki, Photo Studio, National Research Institute for Cultural Properties, Nara (*Nabunken*), 9:00 to17:00>

- Lighting. Learn proper lighting, assuming heritage to be photographed after returning to Afghanistan.
- How to use a digital camera. Learn how to perform lighting and zoom and compare digital photos with analog photos.



Mr. Tarashima showing filing system of Tokyo National Museum at the Library of the museum



Reference system using photographic materials is introduced.



Mr. Sugimoto's lecture on lenses.



Lecture on digital camera and lighting.



Mr. Morimoto showing the database system of Nabunken



Dr. Higuchi showing photos of Afghanistan he took before and stressing the importance of keep photos in good condition

March 3 (Wed.)

Management of Digital Data

<Mr. MORIMOTO Susumu, Centre for the Archaeological Operations, *Nabunken*, Nara, 9:00 to11:00>

• Explanation by a senior researcher, Mr. MORIMOMTO about the cultural properties database managed by *Nabunken*, and compiling a database for ancient monuments, ancient architectures and heritage.

Visit: Sen-oku Hakuko Kan, Kyoto

- < Dr. HIGUCHI Takayasu, 13:30-15:00>
- Interview with Dr. HIGUCHI Takayasu, Director of the Museum. Inspection and explanation of photographs of heritage that Dr. Higuchi took more than 20 years ago, reports on Bamiyan, and image of Bamiyan restored on the screen based on the photographs.
- Advices on management of photographs.

<u>March 4 (Thu.)</u> Report writing <10:00 to 15:30>

Participants' Country Reports



Photography on Cultural Heritage in Afghanistan

Mohammad Rafiq Hafizi Director, Photography Department Kabul National Museum, Afghanistan



Afghanistan National Museum was established in Baghe Bala (meaning "the park on the hill") in 1919. At that time, arms, cloths for battle, embroideries, ancient texts, traditional folkcraft articles, etc. were exhibited. The museum was transferred to Koti Baghcha in 1924, and to the present location, Darulaman in 1931. Then, it was not called "Museum", but "Magic House" meaning the building in which rare and unique things were stored.

There are over 5,000 archeological sites (remains) all over Afghanistan. Besides Kabul, another museum was in Herat Province, but destroyed. Buildings of both museums are being restored steadily now.

Although Kabul National Museum was destroyed with long lasting wars, the first floor of the building is under restoration with aid from Greece, and the second floor with that from United States. Those are scheduled to complete by the late April 2004.

The Bamiyan Buddhist monuments are located at the center of Afghanistan. After they were destroyed by Taliban, Japan and France are cooperating to conserve them to prevent further collapse.

Valuable cultural properties stored in the museum were robbed during wars, taken out to foreign countries or lost. Under Taliban regime, many Buddhist heritages were destructed, too. Presently, 30% of collections stored in the museum have remained in Afghanistan. These collections which were protected by some brave people in Afghanistan are now under restoration. The reconstruction and restoration of the museum and the conservation of remains are steadily advancing with active support form Italy, France and Japan. In addition, training for fostering personnel has been carried out frequently.

In this training in Japan, we hope that we will become able to operate a digital camera, computer, and a printer to use in Kabul National Museum, take photos and process them by ourselves. Although we were taught how to use those instruments by staff of Tokyo National University of Fine Arts & Music in the Kabul National Museum in June 2003, we could not completely understand about many things. This time, we are aiming to perfect ourselves in them to utilize instruments effectively. As lacking the general knowledge on photographic technology, we hope to learn from the basics. Especially, we would like to know specific ways concerning digital photography and that image processing which we can utilize.

Furthermore, we would like to know future possibility how our photographic technology will be utilized effectively for conservation and restoration of cultural properties. Since we have to take photos of collections of the museum after going back to Afghanistan, we would like to learn the way to organize materials using those photos.

We express our appreciation for this training held by Cultural Heritage Protection Cooperation Office on behalf of the Kabul National Museum.

Current Status of Photography in Kabul Museum

Hamed Enayat Deputy Director, Photography Department Kabul National Museum, Afghanistan



Photography Department of Kabul National Museum was completely destructed by the last tragic war. However, Tokyo National University of Fine Arts & Music in Japan has kindly allow us free to use a digital camera, a printer, and computer which are possessed by them, and kept by us now. We are grateful for Japanese friendship and kindness to Afghanistan.

When Tokyo National University of Fine Arts & Music implemented the training in Kabul National Museum in June 2003, we could have a chance to learn photographic technology. In that training, we learn how to use those instruments. However, since the period of the training was as short as 2 weeks, we wondered if we could fully understand all about photographic technology. Therefore, hoping to have such chances frequently, we are really happy to be able to come to Japan for this training.

There are only 3 members including two of us in Photography Department of Kabul National Museum. Another one is a new face. The museum is generally lacking in not only personnel but also instruments related to photography very much. If the trainings like this are more frequently carried out in Kabul, apart from ones in Japan, more personnel can study. Therefore, we would like to have such assistance from Japan also in future.

During stay in Japan, we would like to learn about not only digital photography, but also the general knowledge of photographic technology from the basics. Soon after going back to Afghanistan, we have to take photos of archaeological artifacts including burnished and shining things such as gold. Without experience to take photos of such things, we would like to know how to shoot specifically.

In addition, we hope to learn about the way of organization such as registration of collections of the museum, and information processing such as how to use photos for organization.

We greatly appreciate for opportunity to attend the training held by Cultural Heritage Protection Cooperation Office.

Lecturers' Papers

1. Theories of Photography

Laboratory of Technique and Materials Department of Oil Painting Tokyo University of Fine Arts and Music

2. Introduction to Conservation Science (Excerpts of the Lecture)

KIRINO Fumiyoshi

3. Photographs of Cultural Properties

SUGIMOTO Kazuki

1. Theories of Photography

Written by YOKOYU H. Translated by TATEISHI T. and UETSUKI M. Laboratory of Techniques and Materials Department of Oil Painting, Tokyo University of Fine Arts and Music

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Introduction

Photography is a relatively new technique invented in the middle 19th century. Photography kept changing along with the development in science, giving strong influence not only to our sights and thoughts but also to our society, making it very hard to imagine a world without them.

However, photography did not just suddenly appear before us 150 years ago. Some device similar to photography, "a photographic way of seeing things", did exist. The knowledge and experience behind them goes back a few thousand years. There is a history of strong relationship between photography and paintings.

Learning and understanding the structure of cameras and its complex history will surely help you in creating works of art.

This textbook explains briefly the basic elements of photography. It also introduces some useful tips for recording art works.



The sketch of a glass tracing device used by Leonardo Da Vinci. 1500 A.D.



The cross section of a "Daguerro-type" camera...



Transferable camera obscura

1646 Appears in "ARS MAGANA LUCIS UMBRAE IN DECEM LIBROS DIGEST" by Athanasius Kircher



The oldest photograph remaining today. 1926-27 by Nicéphore Niépce

Taking pictures

Pictures are made up of several elements related to one another. Experience is necessary to understand the function and relationship of each element and taking pictures as you desire. Taking pictures, developing, printing, exhibiting, and publishing is a complicated work which all requires a lot of materials, techniques and cooperation with various engineers. On the contrary, pictures can be seen as a direct and simple way of expression, composed of few elements such as brightness, framing, color of light, and field of depth.













Subjects

Color of light





















Depth of field

Tone

The Mechanisms of Cameras

The word "camera" comes from the Latin word "*camera obscura*", meaning "dark room". A typical 35mm single lens reflex (SLR) camera is explained here.

The largest merit of SLR cameras is that you can picture the object exactly as it is seen through the viewfinder. In addition, various screen effects can be obtained easily by taking pictures. Also, a highly sophisticated exposure meter is built-in, enabling us to choose the right exposure. Therefore, SLR cameras are the most idealistic camera for taking photographs.



Lights passing through pentaprism

Lens

Camera lenses are usually a combination of 4,6, or 8 lenses. This is due to a fact that a singular lens can not avoid aberration. Specifications of lenses are shown by numbers for brightness and focal length. Zoom lenses which can change focal length gradually are popular for its convenience.

Lenses should be stored in dry places for it is subject to mold from humidity. Lenses turn brown through time since their surfaces are coated with films.

Aperture

The amount of light passing through the lens is controlled by changing the size of the area of lens exposed. The unit of aperture is shown with numbers such as 1.4, 2, 2.8, 4, 5.6 etc. The smaller the number, the amount of light passing through is greater.

Aperture also controls the range where focus "seems to be set" known as the "Depth Of Field".

Shutter

A camera shutter is like a tiny door that opens up for a specified length of time to allow light to hit the film. Modern shutters can be set to remain open anywhere from a few thousandths of a second to 30 seconds. A function called "bulb" leaves the shutter open while the shutter release button is depressed and closes only after the button is released.

Pentaprism

The pentaprism is a roof-like pentagon shaped prism used for 35mm SLR and medium size SLR. It is placed above finder screens and reflects the lights passing through the screen for 3 times, assembling the non-reverse image of the subject.

The view finder of 35mm SLR is said to be the most sophisticated.

Exposure meter

The exposure meter measures the light form the subject and displays the appropriate combination of aperture value and shutter speed for the given film sensitivity – the appropriate exposure. Built-in exposure meter of SLR camera is called TTL exposure meter and it measures the light passing through the lens with photocells inside the camera. With modern SLR camera, exposure is obtained automatically because shutter speed and aperture cooperates with exposure meter.

Film

There are basically 3 types of films – monochrome films, color reversal films, and color negative films. When choosing a film, it is also important to consider the different sensitivity to light and the specific characteristics.

The Actions of SLR Cameras

Before shooting (A) The aperture is open and the image on the finder screen can be seen brightly. The shutter is closed.

During shooting (B) The mirror is up. The image on the finder is invisible. The aperture is closed to a preset diameter. A thin slit passes in front of the film letting the light hit the film. The time of exposure can be changed by adjusting the width of the slit.

After shooting (C) Aperture, mirror, and shutter is all back to the position before taking picture. The viewfinder can be seen in bright condition.



Exposure

What is an Exposure?

An exposure means giving the film the appropriate amount of light by choosing the right shutter speed and aperture. However, it is not easy to decide shutter speed or choose the appropriate aperture. The picture to the right turns bright in case of overexposure and turns dark in case of underexposure. The important thing to judge here is which of these 5 pictures is appropriately exposed.

What is an Appropriate Exposure?

When the amount of light hitting the film is changed, the brightness of picture changes. This amount of light is called the amount of exposure. What then, is an appropriate exposure? Whether a picture is bright or dark depends on the opinion of the individual, therefore an appropriate exposure may not exist in a universal means. However, we generally view appropriate exposure as adjusting the aperture and the shutter speed to obtain the brightness accepted to be right -not too dark or too bright- by most people.

Appropriate Exposure Changes According to Objectives

As seen above, there is no clear standard to appropriate exposure. Therefore, grey scales are placed in the flame when recording paintings (color charts should also be placed). Gray scale enables us to give accurate instructions when printing.

When taking a picture of a photograph or recording installation landscape, appropriate exposure should be decided manually according to the type of film or the type of final output device.



Extremely over exposed





Slightly over exposed





Appropriately exposed





Slightly under exposed





Extremely under exposed

Controlling Lights

When the film is exposed to light, how is the amount of light controlled? The 3 elements which control the amount of light and their relationship is discussed here. The 3 elements are; aperture, shutter speed, and film sensitivity.

The Faucet Model

Imagine filling a cup with water. Cup will be filled with water faster when the faucet is fully opened. If the amount of water running is doubled, only half the time is needed. On the other hand, if the amount of water is reduced to half, twice the time is necessary. Replace the water with light, and their relationship can be seen as the picture on the right.

Arrow of Light

The diameter of the bundle of light hitting the aperture (faucet) is the same. However, the area of the aperture open is reduced to half from left to right. In order to fill the cups with the same amount of light, the length of time (arrow) must be doubled.

Film Sensitivity

Film sensitivity is represented as the size of cup in this picture. Under the same condition, a film with lower sensitivity requires more light. A film with lower sensitivity can be seen as a large cup and a highly sensitive film as a small cup. When the sensitivity is reduced to half, the amount of light required and the volume of cup is doubled.

Film sensitivity is indicated by a number on its package (100, 400, 800, 1600, 3200 etc.). **ISO** No. indicates that the film meets **International Standardization Organization** standards. **ISO100** is generally said to be the standard sensitivity.







Faucet=aperture Time=time of exposure Volume of cup=film sensitivity



The Combination of Aperture and Shutter Speed for Obtaining Appropriate Exposure

As explained in the previous page, the amount of light reaching the film is controlled by adjusting the amount and the time of light coming in (aperture and shutter speed). When the aperture is changed, a certain amount of exposure can still be obtained by choosing corresponding shutter speed. Therefore, there are numerous combination of aperture and shutter speed for obtaining certain exposure.

Diagonal row on the table indicates same exposure. The photographs below are arranged to

The photographs below are arranged to match the data surrounded by dotted line in the center of the table. Pictures on the upper right, center, and lower right below all are appropriately exposed although the combination of aperture and shutter speed differs. Based on this data, it is clear that the combination below indicates the same amount of exposure.

Upper right : aperture F2.8 shutter speed 1/125 sec. Center : aperture F4 shutter speed 1/60 sec Lower left : aperture F5.6 shutter speed 1/30 sec Table

Shutter speed



What is an Exposure Value (EV)?

Based on the table above, the EV for these pictures are 10. Exposure value is a combination of aperture and shutter speed expressed as a single number. The equation for calculating EV is as follows.

$$2^{EV} = \frac{aperture^2}{time of exposure}$$

EV can be calculated from aperture and shutter speed using this equation. When an EV increases by 1, it means that either the time of exposure becomes half the original time (the shutter speed is doubled) or the aperture is reduced by 1, resulting in half the exposure amount.



Measuring "Light"

In the previous page, we have learned about the relationship between shutter speed and aperture, and about exposure value (EV). How, then is exposure determined? How exposure meters work to decide exposure is explained below.

Exposure Meter

Have you ever wondered how bright the subject is when taking pictures? By "how bright", we mean shutter speed and aperture, or EV.

"With subject this bright, shutter speed should be 1/125 sec and aperture should be F5.6." If such a decision is possible by instinct, exposure meters are not necessary. However, this is not the case, and that is why we need exposure meters. Exposure meters measure the brightness of the subject for us. Let us now look at the various types of exposure meters.

Types of Exposure Meters

Measuring light is called "metering". There are two types of metering.

Incident-light Exposure Meter

An incident-light exposure meter gauges the amount of light that is actually hitting the subject. Professionals use this meter to complement the measurements obtained by a camera's built-in metering system.

Reflected-light Exposure Meter

We see objects because of the light that is reflected off their surfaces. Photography works on the same principle --- the film image becomes visible because of the light reflecting off a subject.

Therefore, if you can measure the amount of light an object reflects, then you can obtain an accurate exposure.

This is how a reflected-light exposure meter operates.

And all the exposure meters built in the camera are this type.



Testing Characteristics of Exposure Meters

Pictures above show the characteristics of both the incident-light and the reflected-light exposure meters. Each apple is placed in a same brightness setting with different backgrounds (white, grey, black). Upper 3 pictures were measured using incident-light exposure meters. The lower 3 were measured in the background using reflected-light exposure meter.

With incident-light exposure meter, same exposure value is obtained regardless of the background. Therefore, the background is pictured as it is and the main subject –the apple- is also pictured in appropriate brightness.

With reflected-light exposure meter, the subject is sensed as bright when the background is white, and dark when the background is dark. Therefore, the apple in the picture looks dark with white background and bright with black background. Background looks grey in all three pictures. This is because reflected-light exposure meters tend to picture the subject as "standard grey".

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"General Catalogue of Photography and Visual Products 2003 (2003 shashin eizou youhin sougou catalogue)"

Walter Benjamin "Illustrated History of Photography (Zusetsu shashin shoushi)"

(all in Japanese)

Text for Conservation Science 2004.02.24

2. Introduction to Conservation Science

KIRINO Fumiyoshi Tokyo University of Fine Arts and Music













? Observation Electron Scanning Microscope(SEM), Optical Microscope ...

3) Producing Process and Technique Raw materials, Materials for arts and crafts, Industrial technique ...







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- 15 16





3. Photographs of Cultural Properties

SUGIMOTO Kazuki Saidai-ji Photo Studio, Nara

1. What is photography?

Photography records light entering through a lens to display an object on a film as sensitive material or as electronic medium. A recorded photograph is a scaled-down representation of an original image entering through the lens and geometrically similar to the original image. However, since some distortion occurs when light passes through the lens, the similarity is not accurate.

It should be understood that photographs of cultural properties are different from those in other fields with respect to the following points. The below-mentioned explanation is predicated on photographs using film and developing paper.

- **1-1.** Objects (cultural properties) may disappear or deteriorate after being recorded as a form of photograph. In such cases, the photographs themselves become "cultural properties" at the time of being taken and processed. For example, an ancient monument can disappear after excavation. In this case, photographs of the monument become "records" which play an important role in objectively conveying the monument to a third party. The photograph is the only medium capable of doing this.
- **1-2.** Archeological remains can suffer damage for picture taking due to heat and ultraviolet light during transportation. We must become sufficiently aware of that. Transportation and photography of fragile remains should be minimized.
- **1-3.** We need to take photographs of ancient monuments and remains with the realization that these photographs must have content and high resolution so as to accomplish any purpose of any user.

For publication, the materials used for photography (color or black-and-white) and size vary depending on the type of publication such as museum leaflet or excavation report. Even digital photographs can be applicable to museum catalogues or photographic indexes. Such digital photographs, however, should not be stored as the above-mentioned "record" of cultural properties.

2. What is required in photographs of cultural properties

As mentioned above, photographs of cultural properties themselves become "cultural properties" at the time of being taken. Therefore, during the course of photographing and development, it is necessary to make efforts to produce a record with voluminous information, that is, to obtain an excellent and high-resolution image. For example, when taking pictures of ancient remains and architecture, selection of proper weather and time of day can contribute to desirable photos. Especially in the case of sensitive material for color prints, recordable colors are considerably limited. Even if color photographs are taken at dawn or dusk, proper color cannot be expected.

In addition, when the film obtained from photographing changes its nature, the information recorded therein degrades or deteriorates. Accordingly, films are required to be stored in environments under which such damage will not occur.

3. Basic components in photography

- 1) A light source suitable for the subject is needed.
- 2) Method of photography varies with the subject.
- 3) Differences among various cameras, lenses and their properties should be understood.
- 4) Shutter speed and aperture value relate to depth of image field.
- 5) The properties of each sensitive material (film, developing paper, charge coupled device (CCD) of digital photograph) should be understood.
- 6) Development processing by using chemicals and printing to developing paper
- 7) Environment for storage and conservation

Shutter Speed and Exposure



4. Purposes of photography

It is necessary to understand what should be recorded and reproduced, that is, expressed as a form of photograph.

What should be expressed as a record are:

- 1) Texture, or feeling of quality of material, of an object;
- 2) Shape and location of the object, as well as spatial effect and perspective of the object; and
- 3) Atmosphere and realism.

Language cannot express these effects accurately and only photograph can convey them.

Purposes unsuitable for photograph:

- 1) Accurate size of the object cannot be recorded. Since distortion occurs in the image through the lens, photograph cannot be used for measurement.
- 2) Shape such as irregularity of the object cannot be recognized.

5. Fundamentals of shooting

To obtain an excellent photograph, that is, a record with rich information, attention should be paid to the following points.

- 1) Prevention of camera shake when taking pictures with a camera held by hand.
- 2) Prevention of blurring. If the subject is out of focus, a blurred photograph is generated.
- **3**) Adequate shade is needed. Shade and shadow express the spatial effect and perspective of the object.

Basic Configuration of Lighting



- 4) A bright photograph due to overexposure or a dark photograph due to underexposure cannot represent the details of the subject.
- 5) Too high or low contrast also cannot represent details of the subject.
- 6) To narrow down purposes and concentrate on them. Lack of well-defined purpose does not create valuable photographs. Since the amount of information included in one photograph is limited, try not to include too many subjects in it.

6. Analog photograph and digital photograph

So far, I have mentioned the analog method using mainly conventional cameras and equipment. However, the digital method has recently become widespread. I would like to define the difference between the two methods and cameras.

6-1. Basic elements of digital photography

A digital camera is the same as an analog camera in that the light (image) entering through a lens is recorded. Moreover, there is no substantial difference between the lenses used for both types of cameras. In other words, both types of camera have a lens located at the front surface thereof and cause an image to form by light entering through the lens.

As in analog photography, it is necessary to take a photograph with an adequate light source and lighting conditions. Also when using the digital camera, a photograph of the ancient monument is taken under lighting conditions suited to the object. The digital photograph is more difficult to correct excess and deficiency of expression by subsequent processing than film. Therefore, digital photography can be said to be a rather difficult technique.

As a major difference, while an analog camera uses film as a recording medium, a digital camera uses a CCD (charge coupled device) instead. Furthermore, since a digital camera uses an electronic medium, it requires no process of developing a film. However, in recording on a CCD, an image is completed via a process similar to development. Thus digital photography is more difficult in control of changes in color than analog photography using film.

6-2. Features of digital photography

As the number of CCD pixels of commercial digital cameras is limited, resolution of the image is also limited. For example, while an image of postcard size is recorded in full proportion on a 4×5 inch size film, the same image is recorded much smaller than a postal stamp on a CCD. This is because the particles of emulsion of silver salt film are completely different from the recording device of a CCD in density. Thus, since photography by commercial digital cameras is inferior in resolution of image, digital cameras are not suitable for printing and reproducing images of large size or high resolution

6-3. Originality of digital image

In the case of digital photography, an electronic image is recorded on a CCD. The image is transferred to a computer for storage. In this case, since the image is a digital image from the beginning, even if the image is processed by software, the history of processing cannot be found. That is, there is a possibility that a true original photograph cannot be identified. This is a problem for photographs of cultural properties that serve as an evidential record at the time of being taken.

On the other hand, in the case of photography by film, the process of reading film with a scanner is necessary for digitalization. Accordingly, it is impossible to work on the original film, leaving both the original photograph and the processed photograph. Color saturation, brightness and contrast are adjusted on the digital image, based on the film image.

In cases where the photograph is considered as material of cultural properties, it is desirable to fully understand the above differences and plan utilization and preservation of images having each feature..

7. Conservation and storage of photographs

As mentioned above, photographs of cultural properties are considered as "cultural properties" themselves and will be utilized for various purposes in the future. Therefore, they must be conserved while maintaining their resolution and color tone at the time of being photographed.

It is essential that films are conserved and stored in an environment with constant temperature and humidity. In addition, since the emulsion side of the film may suffer damage every time it is used, adequate care should be exercised. As a method of preventing damage, it is considered useful to take two identical pictures and separate one for conservation from one for working.

For the purpose of management, it is an effective method to digitalize the photograph taken using film or to store the original digital photograph in an electronic medium such as a CD. In doing so, attention should be taken so as to store these photographs while maintaining their original resolution. Moreover, it is indispensable to select and store the photographs in Tiff format in which data is not compressed not so as to miss information of color and so on. The use of Jpg format may result in lack of information when reproduced and raise other many problems relating to color reproduction.

In the case of a CD, however, if the recording face suffers damage, readout by computer cannot be carried out. In storage and use, the closest attention must be paid. It goes without saying to provide for contingencies by making plural copies in recording data on CDs.

Participants' Final Reports



Final Report

TOKYO

Tokyo National University of Fine Arts and Music Tokyo National Museum

This time we could take training on photography in Tokyo National University of Fine Arts and Music at the invitation of Cultural Heritage Protection Cooperation Office, Asia/Pacific Cultural Centre for UNESCO (ACCU). I express my gratitude to everyone concerned.

During stay in Tokyo, I had the opportunity of visiting scenic spots, modern buildings and beautiful museums and was deeply impressed by them. I realized that there were a lot of Buddha statues and these statues played an important role in religious events in Japan. I could also understand that the Japanese respected cultural traditions and were educated to hand down them to the next generation.

I felt it excellent that exhibits were separated by age and display cases had a quake absorbing structure in some museums we visited. Further, the display method that I have never seen was so informative. I learned much from the lighting method of exhibits. From the standpoint of curator, I intend to draw upon these methods in future exhibition in the Kabul Museum.

I knew from exhibits in the Museum that Japan had been devastated as a result of war. I was deeply surprised to know that Tokyo had burnt away twice due to Great Kanto Earthquake and World War II had been reconstructed satisfactorily and society had been highly developed. I express my respect for it.

This means that we have a bright future if we strive for it. We were so encouraged and renewed our hope. If we appreciate values of cultural properties and society as well as we make efforts diligently, then a new hope generates. We were taught it from the Japanese.

1 . Photography

1-1. Actual photographing

On-the-job training was conducted on the assumption that we took pictures of an oil painting as flat object in each state before, during and after repairing work with a view camera. In the case of painting, photography includes inspection of the damaged condition. For the purpose of the inspection, infrared and ultraviolet photography are adopted. In the respect of record, the photograph is important in conveying information that cannot be expressed by language.

Thus, the photograph for recording requires an image of the largest possible size, that is, an image with plentiful information. However, even with the



Photography for large size image



Insert a film into folder

image of large size, sufficient information cannot be recorded without appropriate exposure. If the image is extremely bright or dark, contents to be recorded and represented are limited.

Both of right and reverse sides of the painting were photographed by using 4×5 inch color and black-and-white films. The work of placing films into a folder (plate folder) was conducted in a dark room. As a result of development, two images became transparent due to overexposure. I was told that probably I had opened a cover of the folder with lens opened, leading to exposure of the film. I recalled the instruction to check the lens

and the object when pressing a shutter, and reflected on the failure.

I realized that, as the object was a flat painting in this actual work, to my surprise, it was difficult to contain the object within the image screen in proper size and without distortion. Since lines are drawn vertically and horizontally on the glass surface of the viewfinder (pint glass), the image is located based on the lines. But, the painting as an object was removed from the flame and it wasn't rectangular.

In the lighting course, tungsten light was used. To reproduce the color of color photograph accurately, color temperature needs to be adjusted at 3,200 kelvin by adjusting voltage. Given the current situation of Afghanistan, it is rather difficult. However, I found that correction by use of filter was possible.

For the purpose of emphasizing irregularity of the surface of the painting, the painting was photographed with light being applied from one direction. This clarified the damaged part on the surface. When expressing the damaged part, light was experimentally applied from each direction (i.e., from right, left, up or down) to find the most appropriate direction. Exposure was measured in the center of the painting as well as on the periphery of the painting to obtain the average value.

Exposure is determined by using an actinometer. The meter must be set according to



Measurement of exposure

sensitivity of the film used. This time color film (ISO-64) and black-and-white film (ISO-100) were used and so the meter was adjusted according to them. We measured exposure at four corners of the painting and adjusted the light source so as to make the exposure uniform at each corner.

Exposure is determined depending on shutter speed and aperture. In contrast to the flat painting in this example, photographing of a three-dimensional object requires a larger aperture value. A larger aperture value deepens depth of focus with a long distance in the depth direction, thereby to produce an in-focus photograph. On the other hand, a larger aperture value takes a longer time for exposure and decreases shutter speed, and therefore a sound tripod is required to fix the camera.

In addition, in the proximal shooting

with a view camera, distance between the lens and the film surface becomes longer which lessens the amount of light reaching to the film. Accordingly, even if the value measured by the actinometer is applied as it is, there occurs no proper exposure. Coefficients for correcting it can be found in a list provided by Kodak Inc.

1-2. Enlargement and printing

In a dark room, we practiced printing by using an enlarger QE 69. This equipment is familiar in Afghanistan. We enlarged a 35mm film and printed the film on a printing paper with varying exposure time of 1 to 3 seconds for experiment. When the developed printing paper is made to be dried, attention should be paid not to adhere dust to its surface.

It seemed me to take a long time to master printing and development. However, I found that optimum condition could be obtained by conducting test developments in which exposure time varied several times. So, I felt that we could master this actually by acquiring experience.

1-3. Infrared, ultraviolet and X-ray photography

Though we didn't practice photographing in actual, we observed images through an infrared video camera. Infrared light is one type of light that is invisible to us. Since the use of this type of light enables us to see invisible lines such as underpainting and traces of repair, the light is applicable to record as well as surveillance study. Infrared video camera is a very fascinating device.

In a dark room, we scrutinized a painting illuminated by ultraviolet ray with UV glasses on. Though ultraviolet ray is originally black light, it becomes purple in the dark. It can clarify the repaired parts of the painting as absorption and reflection of the light varies



Infrared video camera

depending on the places. We photographed this with a 4×5 film. Though we used an ISO-100 film, we increased developing time for ISO-800. The push development is a method of shortening the exposure time for preventing effect of black light on eyes. Since the region of ultraviolet ray falls within a weaker region in sensitivity, appropriate photographing cannot be realized with a normal digital camera due to its CCD characteristics.

X-ray photography is effective in investigating and recording internal structure of an object. The apparatus in Tokyo National University of Fine Arts and Music is enough large to deal with paintings of large size. I am not sure, however, when such apparatus can be furnished in the Kabul Museum. For the present, I intend to keep the apparatus in mind only as a piece of information.

2 . Fundamentals of conservation science

Repair and reconstruction of cultural properties focused on painting, conducted by Tokyo National University of Fine Arts and Music, aim to investigate mechanism of deterioration and to find the used materials such as paint. This research is based on the principle of non-destruction. Based on the findings, processing of repair and conservation are carried out. Photography records the processes of various researches as images.



Electric microscope observation



Explanation of digital camera

3 . Digital Photography

We practiced photographing, image processing and printing by using the same equipments as those available in the Kabul Museum. As Nikon-100 camera can exchange its lens, it can address various types of photography. Prior to photographing, sensitivity, aperture and shutter speed must be adjusted firstly. Then, white balance (WB) is set. This enables correction of color. For example, fluorescent light looks white to human eyes, but is recorded as color with a green tone in photograph. Apart from the problem of color, auto mode may be adopted in most cases.

The photographs were recorded in a memory card (512). The camera was connected to a personal computer through a USB cable and data in the memory card was transferred to the computer. The computer (Macintosh-i-Book) was the same type as that in the Kabul Museum.

Photographic images were processed by the software Photoshop-7. Color correction was conducted with reference to a color chart in the photograph. Tiff format is desirable for the format of storing data. CD is used for storing data therein. We learned how to produce CD. Moreover, we actually printed photographs with a printer.

The digital camera, computer and printer were the same type as those available in the Kabul Museum, and so this training provided us with very useful experience. We intend to use them immediately after returning to Afghanistan. However, as we are short of consumable goods such as paper and ink, we hope you will give a support to us in this matter.

4 . Tokyo National Museum



Explanation of digital archive

items were recorded as images of high precision.

In Cultural Properties Department of Tokyo National Museum, we could see an image search system using photographic materials of stored items. In this museum, photographic records have been made since 1871. Escaped from Great Kanto earthquake and aerial attacks during World War II, these records still remain. We knew that file cards as original materials had been stored and they had been searched manually. These file cards are base materials to be input to the computer.

The photographs taken by using film are read out by a scanner and digitalized. The processing began about 10 years ago. In principle, 4×5 film is used. I found that stored

In this museum, we heard the explanation of exhibition. We learned so much from lighting method and layout according to types of remains. Color of paper or cloth placed in the background must be adjusted in conformity with color of displayed remains. Moreover, attention should be paid to light source because it may deteriorate remains. So far, we have not been concerned about this point so much.

NARA

National Research Institute for Cultural Properties, Nara Sen-Oku Hakuko Kan Museum

When I arrived at Nara, what impressed me is that a beautiful city has been conserved in Japan with old history being retained. Historic assets such as Todaiji themselves are historic cultural properties as well as an evidences telling history. The fact that these properties have been conserved until now shows how citizens and persons concerned have made efforts. In addition, these cultural properties are important as representing Japanese traditional cultures.

Methods of conserving and displaying cultural properties in Gallery of Temple Treasures of Horyuji was seemed to be very effective in showing Japanese tradition, history and culture. The displaying method here gave us curators so useful information.

1 . Photographic technology

I felt that all lecturers in National Research Institute for Cultural Properties, Nara had a deep understanding of photography and basic knowledge. We learned from philosophy and basic stance in photography of cultural properties, lighting method to the difference between digital photograph and analog photograph. In lighting practice, we could practice on light direction and how to shine light depending on distance, which was very useful.

While we learned how to photograph a painting as a flat object in Tokyo National University of Fine Arts and Music, we took pictures of three-dimensional objects such as pottery and porcelain in this Institute. This training was helpful in photography of items stored in the museum, which we need address in future.

1-1. Characteristic of lens

There are many kinds of lenses such as wide-angle lens, standard lens and telescope lens. Which to be used for photography is selected according to the objective. For example, when a vertical object of uniform width at all points like a building is photographed, with a use of a wide-angle lens, photographing at close range can be realized though width varies in the vertical direction on the photograph. On the other hand, with a telescope lens, such difference in size in the vertical direction is decreased, but photographing at distant range is required and the sense of distance between the object and others may be lost.



Introduction to photography



Explanation of camera variety

1-2. Exposure and depth of focus

To take a picture, adequate amount of light must be given to sensitive material such as film or CCD. For films, light quantity is adjusted according to its sensitivity. Light quantity is adjusted by shutter speed and aperture. Given the fixed light quantity, the aperture is opened at a faster shutter speed and the aperture is closed to be smaller at a lower shutter speed. This relates to depth of field.

When the aperture is opened at a fast shutter speed, depth of field becomes smaller. This limits the range in-focus to bring a clear image. To correct this, the aperture needs to be narrowed down. However, it should be noted that when the aperture is narrowed down too much, light diffraction occurs in the lens, thereby to lower resolving power.

Generally speaking, in the case of a deep object such as earthenware and sculpture, focus is placed on the position of one-thirds from the surface of distance between the position of the half depth and the surface of the object. The further part from the half position doesn't appear on the photograph, and therefore no needs to be considered. After focus is placed on the position of

Lighting method:Example-1



Lighting method:Example-2



Lighting method: Example-3



one-thirds from the surface of the object and then the aperture is adjusted, it is possible to check to the extent which the object is in focus. Moreover, the lens has a scale of distance in focus and the corresponding aperture value and depth of focus, the depth can be easily found with reference to the scale.

1-3. Lighting and background paper

When photographing lustrous objects, light source behind the paper placed in the periphery of the object is used. When the distance between the light source and the paper is adjusted, as the distance becomes smaller, shadow is intensified and as the distance becomes larger, shadow is softened. Color of reflection plates placed on the right and left sides (ex. white, black, etc.) is selected depending on the color of pattern of the object. Even if the paper located between the light source and the object looks like white, it may become colored on the photograph. Similarly, as cloth also absorbs and reflects light, it becomes colored.

Top light (light from above) can be set by utilizing some material at hand even without any special equipment. Specifically, a sheet of paper is spread above the object in some way so as to illuminate light from above through the paper. For example, if there is a fluorescent lamp on the ceiling of the room, the structure is made to suspend and spread a sheet of paper below the lamp. Since coloring varies depending on types of fluorescent lamp, attention should be paid in taking a color However, difference of blight-line photograph. spectrum which brings difference of change in color varies completely by each product and cannot be expected.

In photographing lustrous beads and ceramics, the light source is located behind them. In other words, a photograph is taken backlit. Then, a reflection plate receiving light is placed in front of the object to reflect light toward the object. Color of the reflection plate is selected among black, white and other colors according to the color of objects.

2 . Photography with digital camera

Firstly, white balance is set. A QP card is used for the setting. The setting is carried out in a state of readiness to photograph the object after selection of lighting. А picture taken by a digital camera is fetched into the computer. When the picture image is processed, white balance is adjusted based on the QP card. Subsequently, the adjusted amount and factor as initial setting values apply to image processing of other pictures.

In actual photographing, optical zoom may be used for a certain size of the object, but digital zoom mustn't be used because resolution of image is lowered. The method of applying light on the object, that is, lighting in digital photography is the



QP card for digital camera setting

same as lighting in analog photography using film. Rather, it is necessary to do in the method.

To compare digital photograph with analog photograph, photographs of us were taken with a 4×5 and 35 mm camera and a digital camera. They are portraits. Moreover, photographs of a colored glass bead as lustrous objects were taken at close range. Lighting is just the same as lighting in analog photography using film. The pictures were taken against light.

3 . Database of cultural properties

I understood that to store photographs as well as various information such as text and map was necessary and effective to utilize them. Especially in terms of storage of remains and photographs, I could understand the importance of digitalization. If such method can be realized also in Afghanistan, it is possible to store ancient monuments and remains as digital information and utilize them effectively.

The database of the wooden strips exemplified here was firstly made 20 years ago. At the beginning, the database contained only written information, but now it becomes searchable information including photographs. Picture images have enough precision to distinguish subsequent touchup. However, for the purpose of printing, the original plate of photograph is used.



Explanation of digital archive retrieving

4 . Sen-Oku Hakuko Kan Museum



Photography taken from Kabul National Museum collection



With Prof. HIGUCHI Takayasu

We could meet Prof. Higuchi (Director).

We could actually look at books, figures and photographs as results of research in Bamiyan. They show clearly that Japanese researchers feel deep interest in cultural properties in Afghanistan and how they have studied them. We realized that.

The stored photographic materials are old records of the region including Bamiyan and the surrounding towns. These materials are stored in a good state of preservation under excellent storage environment. I pay reverence to efforts of preservation and express an acknowledgement as an Afghani.

I was surprised that photographs taken 30 years ago were stored in a good condition without fading. All negative films are arranged by their number. We got a sample of ledger for arrangement and it is useful when we will organize and store photographs in the future. I appreciate that.

At present, there are lots of black-and-white films in the Kabul Museum and we can use them after return to Afghanistan. However, we have

no photo lab nor equipments necessary for development and enlargement of films and printing on printing paper. If necessary equipments will be provided in the future, we could make the most of results of valuable training in Japan.

In this training, we visited Japan to practice photography centered on digital camera. Nevertheless, we could learn both photographing methods of film camera and digital camera and they provided us with useful information. We had a valuable experience in practicing photography at each stage from development of negative film to printing on printing paper.

Currently, reconstruction of the Kabul Museum is on progress. Also, we are now able to use photographing-related equipments including digital cameras, computers, etc. with favor of Tokyo National University of Fine Arts and Music. This time we could develop a greater understanding about photography on the whole by learning basics and implementation of photography in Tokyo and Nara. Making the most of results of this training, we would like to use existing equipments in the Kabul Museum and take pictures of the stored items. Since we recognized the importance of photographic image in a museum through the training, we are determined to keep learning in future and engage in photographing work for the next generations.

We could learn many things apart from the training, which cannot be expressed by language, and have good memories in Japan. I thank all of you for eagerly joining this training from morning to evening and encouraging us. I express my gratitude to people in Cultural Heritage Protection Cooperation Office, Asia/Pacific Cultural Centre for UNESCO (ACCU), Tokyo National University of Fine Arts and Music and National Research Institute for Cultural Properties, Nara, who gave us lectures. Also, I render thanks for much help.

Afghanistan is short of goods in all fields other than photographing equipments. Especially, we lack in personnel who teach photography we learned this time. The lack in human resources is serious. Please give support us in the future. Afghan people believe in Islamic religion. We would like to make efforts for reconstructing Afghanistan while respecting our society and cultural "values".

Final Report

Hamed Enayat Deputy Director, Photography Department, Kabul National Museum Afghanistan

TOKYO

Tokyo National University of Fine Arts and Music Tokyo National Museum

I got the strong impression that everyone regardless of sex in Japan works diligently. I feel that this diligence has created today's highly developed Japan. We would like to reconstruct Afghanistan while capitalizing on what we learned during stay in Japan and relation with the people we met. We are determined to strive for restoration of Afghanistan partly to repay the persons who gave us guidance enthusiastically in this training for their kindness.

1 . Photographic technology

In this training on photographic technology, we learned the process ranging from shooting by use of color and black-and-white films to development as well as photographing with a digital camera and image processing.

Firstly, we studied taking a picture of painting. We learned to keep records at each stage of prior to, during and after repair of a painting. The record includes inspection of the painting's damage. Ultraviolet and infrared photography is effective in the inspection. Photograph can record and convey information that cannot be communicated by language.

As a preparation for practice work, color and black-and-white 4×5 films each were placed into 3 folders



Measuring angle for setting up film frame parallel to painting

in a darkroom. As a folder can accommodate 2 films in the right side and the back side, respectively, films bring the total to 12. We confirmed the right side and the reverse side of the film by hand depending on a notch at one end of the film. I became nervous because of the first experience, but I felt relieved at finding that I had made a correct decision from the development results and built self-confidence.

1-1. Light source

There are natural light, tungsten light and daylight-type bulb as light source in photographing. Coloring of color print varies depending on types of light source and film. Since color temperature of tungsten light is 3,200 kelvin, voltage of light source when taking a color photo needs to be adjusted to approximate the value. Alternatively, adjustment by using a filter is conducted.



Comparison of film size

1-2. Photographing technique

The sample to be photographed was a flat oil painting. We practiced taking pictures of the right and back sides of the painting by color and black-and-white films as records prior to repair. The viewcamera was used. In photographing a painting, it is necessary to contain the painting in a frame so as not to generate any distortion in both of the vertical and horizontal directions. A film of 4×5 inch or 8×10 inch is used this time for the reason of keeping a record of largest possible size. Larger size can contain more information.

There are two kinds of methods of photographing a flat painting: one is to apply light evenly and another is to apply light from one diagonal direction. The latter method can emphasize concavo-convex on the painting and record the damaged part clearly. As the painting as a shooting object was placed aslant against the wall, we need to set a film surface of camera on a parallel with the painting. We made an adjustment by using a tool for measuring degree of angle.

1-3. Exposure



Voltmeter device for adjusting light source power

1-4. Exposure time and image

We learned to adjust the relationship between shutter and aperture, that is, the amount of light incoming to the film surface. The light quantity varies depending on sensitivity of film and must be set properly with an actinometer. However, we should give attention to the following point. When we move a camera closer to an object, or try to take a picture of the object larger, the distance between a lens and a film surface becomes greater, resulting in reduction in light quantity. Accordingly, a coefficient for correcting it is required. In connection with this, a numeric chart provided by Kodak Inc. can be used.

In the case of a flat object such as painting, light source must be adjusted so as to provide a uniform light quantity with any part of the object (four corners). In the case where light is applied from only one direction, exposure is measured at four corners of the painting to use the average value. To increase light quantity for exposure, shutter speed should be reduced. In doing so, a stable tripod must be used. Moreover, a fixed concrete floor is desirable.

Smaller aperture creates a sharper image. When photographing a three-dimensional object, depth of field is increased by making the value of aperture greater, a photograph in focus on the whole is obtained. I felt that this method was very useful in taking pictures of three-dimensional objects such as archaeological remains and an attention should be paid.

1-5. Infrared video camera

We observed a painting with an infrared video camera. This is conducted as a preliminary survey prior to repair of painting and enables abbozzo or draft lines visible that cannot be seen on the surface of the painting. In painting of old age, there are cases where a completely different picture is drawn on the used canvas to save materials for drawing (canvas). This method is effective in examining such double-layered pictures.

1-6. Ultraviolet photography

This method is adopted for examining repaired parts of a painting. To avoid ultraviolet radiation from directly entering into eyes, we observed the painting When the room was with special glasses on. darkened, we could see repaired parts of the painting clearly. Then, we photographed this with a 4×5 ISO-100 color film. Though we set the exposure time at 40 seconds, underexposure occurs when developed as it is, and so the development time is tripled. When the development time is not increased in this way, that is, a sufficient exposure time is spent, exposure for a long time is required. The so-called "push development" is a method of shortening the exposure time for the prevention effect on eyes.



Ultraviolet photography equipment

1-7. X-ray photography

X-ray photography also applies to inspection of inside of a painting. When weak energy is distributed to the painting by using an imaging plate (IP), difference between pigments can be found. Tokyo National University of Fine Arts and Music adopts the method of placing an IP on radiation source of X-ray. The apparatus is enough large to deal with a painting of large size.

As in the survey by infrared ray, this method can also find the inside of the above-mentioned double-layered painting. Moreover, it can examine the technique of painters.

2 . Conservation science

Tokyo National University of Fine Arts and Music has worked on repair and reconstruction of fine arts such as painting. Prior to the processing, reasons for damage or deterioration are investigated. Types of materials including pigment and paper, structure of materials and creating technique are also examined. Based on the findings, and the method material used for conservation and repair are selected.

These preliminary surveys are based on the principle of non-destruction. Main survey methods include optical analysis by visible ray, ultraviolet ray and infrared ray, analysis of crystal structure by X-ray



Lecture of conservation science

diffraction and analysis of material composition by X-ray fluorescence, and chemical analysis.

In the survey of pigments used for painting, the painting is scrutinized under a stereo optical microscope, with the magnification being gradually raised from a low value. Then, the structure is examined in more detail with an electronic microscope. Gas chromatography is also used for analysis of organic substances as materials including hide glue, oil and so on. Through all stages of these inspections and processing, I understood that photography played an important role in recording.

3. Digital photography

We leaned the basic operating method of digital camera (Nikon D-100 type), printer with scanner and personal computer. These equipments are the same kind as those that can be used in Kabul Museum, and so this lecture was very useful as it becomes practicable soon after return to Afghanistan.

When using Nikon D-100 type camera, sensitivity must be set by ISO value as in photographing by a film camera. Further, in this camera, it is possible to exchange a lens and determine aperture and focus manually. More than likely, this camera is used in the same manner as a normal film camera and should be used that way. In the actual photographing, however, we were instructed to set shutter speed and aperture in auto mode.



Explanation of digital camera

In most cases, resolution of photographic image may be set to about 350 pixel/inch for printing of catalogues or books and about 20 pixel/inch for normal printing. For printing, we were taught to change only size such as breadth without changing resolution of the original image.

We learned the method of transferring data from camera to personal computer, the method of making a folder on the personal computer and storing data into the folder and simple image processing by using Photoshop 7.0. Moreover, we practiced storing data into a CD.

4 . Tokyo National Museum

We took the opportunity of visiting some museums in addition to Tokyo National Museum. Every museum exercises ingenuity in display and provides us with useful information. In Tokyo National Museum, photographs of stored items are digitalized so as to be searchable. We hope to construct such system in Kabul Museum.

An original main register of stored items is retained in a filing cabinet. I was so interested in the classification. This is original data to be input to the computer. We'd like to begin by making a paper register and then collate it by computer. I found it useful to affix photographs on the register and manage the whole data including the photographs by computer.

We viewed exhibits in the museum, listening to the explanation on the details. Tokyo National Museum is an old and traditional museum and it doesn't use high technology in display in contrast with other museums we visited. For that reason, we were easy to become familiar to



Explanation of digital archive

the display method and there are many good points of some help to Kabul Museum. Some exhibits require some devices in paper or cloth in the background, and due attention should be paid to how to use color. As distinct from photographing, lighting with less shade and shadow is desirable for arrangement and layout of remains.

In addition, general visitors can look at photographic images of the exhibits on computer. However, this is a just experimental exhibition and has an insufficient search function.

NARA

National Research Institute for Cultural Properties, Nara Sen-Oku Hakuko Kan Museum

Since our arrival at Nara on February 28, we visited some temples and ancient monuments. I got the impression that Nara was a beautiful and historic city. For example, during visit to Gallery of Temple Treasures of Horyuji, we watched many Buddha statues, legacies and paintings. I think that the opportunity of seeing these cultural properties was of much help to understand Japan itself as well as Japanese history and tradition.

1. Photographic technology

The following points left an impression in the lecture in Nara National Research Institute for Cultural Properties.

Firstly, everyone including Mr. Kazuki SUGIMOTO as а lecturer has comprehensive knowledge and deep of photography. understanding In particular, the major result is that we could learn the difference between digital photograph and analog photograph using a conventional film in detail.

The comment by a specialist in photographing of cultural properties was impressive, i.e. photograph carried out three functions of 1) recording, 2) memorizing and 3) measuring and these functions should not be confused. Photographs for record require the highest precision. Photographs for memorization only play a role of note in writing. Photographing for measurement or for making a drawing needs special equipment and method.

Secondly, I could understand the importance of selecting and setting proper lighting when taking pictures of ancient monuments and legacies relating to museums, which we need to work on. Furthermore, we could learn how to do it.





Lighting method: Example-2



1-1. Lighting method

We took photographs of lustrous porcelains and glass products. The method of preventing these items from gleaming was very useful because we plan to photograph metal products back in Kabul Museum. We placed light source in the rear of an object and a reflector plate for reflecting light in the front of the object, and the color of the reflector plate (black, white, etc) is selected according to the object. Luster is not necessarily got off. Moderate reflection provides texture and volume.

Preferably, the background paper used for photographing is wide as much as possible. A

distance between the object and the background paper should be kept.

A paper is placed between the light source and the object to soften and diffuse light. By adjusting the distance between the paper and the light source, shade of the photograph can be adjusted. To attain spatial effect, light from above is effective. Here again, a paper is placed between the light source and the object.

When shards of earthenware are photographed from on high, they are aligned on a glass plate. The glass plate is supported to float and a ground paper is placed below the plate. The paper is white. By keeping a distance between the background paper and the glass plate, the effect of weakening shade surrounding the object can be obtained.

2 . Digital photography



Lighting for digital camera shooting

In digital photography, it is important to reproduce color accurately. Accordingly, a QP card as a color sample of white, gray and black is photographed firstly. The image is opened on the display of the computer and adjusted in color against the QP card. The adjusted values by color are stored as setting values and other images are adjusted in color according to the setting values.

Similar to analog camera, digital camera should be also fixed by using a I found that lighting in digital tripod. photography was exactly the same as lighting in analog photography using film and proper setting was required to achieve an excellent photograph. Comparison of black-and-white photographs taken by using 4×5 and 35mm films with color photographs by digital camera showed the difference in resolution between them. It was very helpful that we could confirm the difference based on the printed pictures.

When pictures of glass beads and china vases were taken, lighting was set in the same manner that they were photographed by using film. Since texture of glass beads was expressed excellently, I could realize that there was a need to adopt the same photographing method as photography by film, as instructed.

3 . Database for cultural properties

I could understand and realize that all cultural properties such as ancient monuments, ancient structures and legacies could be managed in a database. Moreover, I could understand that database procedure, or arrangement of materials was a crucial field in surveillance study of cultural properties.

150,000 wood strips of Nara era exemplified here are valuable as character materials. The database of these wood strips was firstly made 20 years ago. At the beginning, the database contained only written information, but now it becomes searchable along with precious photographs. The database also includes records of procedure of processing such as status before and after conservative processing of wood strips. And, it further contains information relating to storage location.

36,000 of these materials are on public view and applicable. The database searched and used

for research in the Institute is managed separately and 147,000 items are input to the database, of which 75% are small chips. The open database is widespread and can be seen by a browser available to everyone. That is, no special software for looking at the database is required.

A database of photograph of cultural properties including ancient monuments, ancient structures, remains, building structures and gardens contains 1,500,000 photographs in total. These photographs are materials collected since the Institute was founded 50 years ago. The institute began to make the database 8 years ago and 112,000 items are now input to the database.



Digital archiving of wooden writing tablet

In searching the photographs, we first have a look at image index photographs of small size and then look at a large image. If needed for publication and the like, an original film is used.

4 . Sen-Oku Hakuko Kan Museum

We visited Sen-Oku Hakuko Kan Museum in Kyoto City and had the opportunity of interviewing with a chief, Prof. Takayasu HIGUCHI.

In this museum, we could actually look on photographs and survey drawings as research results in Afghanistan and I believe that all of them are very important materials globally. We can see the sight of Afghanistan in old age including cultural properties through them. Especially, photographs of the Great Buddha and a wall painting on his niche in Bamiyan have an inestimable value as materials.

From the fact the materials including color photographs collected 30 years ago are preserved in a very good condition, we may expect the similar preservation in making materials, that is, producing and storing photographic records if we make efforts. So we are hopeful about our future. Moreover, we could understand meaning and importance of photography that we are engaged in. We felt responsibility for our future activities and were motivated.

Afghanistan and Pakistan Research Team in Kyoto University was initially headed by Prof. Seiichi MIZUNO, who was later replaced with Prof. Higuchi. This team conducted a comprehensive



Scientific research report of Bamiyan



Video display for Bamiyan cave paintings

survey including excavation during 1960 to 1978 until the Soviet invaded Afghanistan. A series of the photographs of stored items taken by Prof. Higuchi who visited Kabul Museum frequently include photographs of gold remains and iron brackets for coffin that the Soviet team excavated in 1979. These photographs were taken in 1981.

I am deeply grateful to Cultural Heritage Protection Cooperation Office, Asia/Pacific Cultural Centre for UNESCO (ACCU) for holding a training course.

In Tokyo and Nara, many lecturers made enthusiastic lectures and gave us guidance on practical work. Despite of a short period, I realize substantial contents. After return to Afghanistan, I think that we can solve problems relating to photographs in the Kabul Museum. Nevertheless, because of lack in budget, we are short of printing paper and ink for photograph. We are happy to receive assistance from you. We hope that Japanese people who appreciate cultural properties will support us. We are determined to put what we learned in Japan into practice after return faithfully for reconstruction and revival of Afghanistan.



Receiving certificates

Appendix

- 1. General Information
- 2. Schedule
- 3. List of Lecturers and Staff Members

1. General Information

Training Course on Cultural Heritage Protection in Asia-Pacific Region (21 February - 4 March 2004, Tokyo and Nara)

1. Organizers

Jointly organized by: The Asia/Pacific Cultural Centre for UNESCO (ACCU); and the National Research Institute for Cultural Properties

In cooperation with: Tokyo National University of Fine Arts and Music Sponsored by: Japan's Agency for Cultural Affairs

2. Background

Afghanistan has a long history and there remains a lot of cultural heritage that reflects Buddhist and Islamic influences. However, due to a long period of war which had only ended recently, many cultural properties had been destroyed while the rest are at risk of being exported out of the country. Since the establishment of the new government in 2002, there has been a growing attention towards re-establishing museums, restoring damaged cultural properties, and gathering remaining cultural properties from around the country. As a result, much effort is being put in promoting an effective management system; however, an acute shortage of trained human resources is a serious problem at present. It is in this context that we are inviting and sponsoring participants from Afghanistan as part of our "Training Courses on Cultural Heritage Protection in the Asia-Pacific Region – Individual training". In consideration of the current needs in Afghanistan, this training course will focus on data-recording techniques, with an emphasis on photographic techniques for the purpose of obtaining information on cultural properties for databases, which are essential skills for developing an effective cultural properties management system in Afghanistan.

3. Date and Venues

Date: Saturday 21 February to Thursday 4 March, 2004

Venues: Tokyo National University of Fine Arts and Music, National Research Institute for Cultural Properties, Nara, Cultural Heritage Protection Cooperation Office, ACCU (ACCU Nara Office)

4. Objective of the Training Course

The aim of the training course is to encourage the utilization of photographs for the management of cultural properties, for example, to create an inventory for the current collection of the Kabul National Museum. The museum currently has some equipment for taking and managing digital photos, however, there is a shortage of knowledge for creating appropriate inventory systems.

In this training course, we therefore mainly focus on techniques for using digital cameras and for taking digital photographs. The training will not only focus on developing the trainees' photography skills, but will also aim to promote an understanding of how to utilize photos for documentation and creating databases on cultural properties.

5. Training Curriculum

- Practical training on digital photography techniques
- Practical training on film photography techniques (comparison with digital photography)

- Exposure
- · Focusing and use of different lens
- Controlling aperture size and shutter speed
- Lighting
- Composition of photo
- Management of digital images
- Management of photos
- Documentation

6. Participants

Mr. Mohammad Rafiq Hafizi

Director, Photography Department of Kabul National Museum

Mr. Hamed Enayat

Assistant, Photography Department of Kabul National Museum

7. Certificate

Each trainee will be awarded a certificate upon the completion of the course.

8. Language

Dari, Persian and English will be used throughout the course.

9. Expenses

Expenses for participants in the training course shall be borne by the ACCU as described in the following:

(1) Travel expenses:

Participants shall be provided an economy-class return air ticket between the international airport nearest to his residence and Narita International Airport / Kansai International Airport, and domestic transportation costs / to and from the airports and between the training venues in Japan.

(2) Living expenses:

Participants shall be provided a basic living allowance during the training course from Friday February 20 (Fri.) to Friday 5 March, 2004. Arrangements for accommodations will be made by ACCU Nara Office.

10. Correspondence

Dr. USHIKAWA Yoshiyuki, Director Cultural Heritage Protection Cooperation Office, Asia/Pacific Cultural Centre for UNESCO (ACCU Nara Office) Nara Prefectural Government Horen Office, 757 Horen-cho, Nara City 630-8113 Tel: +81-742-20-5001 Fax: +81-742-20-5701 E-mail: nara@accu.or.jp

2. Programme Proceeding

М	D	ACTIVITIES	VENUE
February	20	Arrival, Tokyo Narita Airport	Tokyo
	21	Introduction to the course	Tokyo
	22	Presentation of the current needs in Afghanistan by the participants Visiting National Science Museum and Edo-Tokyo Museum	Tokyo
	23	Lecture: Photographic Techniques for the Documentation of Cultural Artifacts (1) Investigation and photographic documentation of the artifact before restoration treatment. (Visit: Dr. WATANABE Akiyoshi, President of National Research Institute for Cultural Properties,)	Geidai
		Lecture: Photographic Techniques for the Documentation of Cultural Artifacts (2) Continuation and revision of the course contents	
	24	Lecture: Introduction to Conservation Science Using digital macro lenses and electron microscope for documentation of details Visit: Japanning (urushi, Japanese lacquer) Course Laboratory	Geidai
	25	Lecture: Techniques for Processing Photographs (1) Monochromatic photography Conventional photographic developing techniques	Geidai
	26	Lecture: Fundamental Digital Camera Photographic Techniques Techniques for Processing Photographs (2) Digital photographic developing techniques Storage of photographic prints; computer filing of digital photos (Visit: Prof. MIYATA Ryohei, Dean, Faculty of Fine Arts, TNUFAM)	Geidai
	27	Visiting Tokyo National Museum Observation of exhibition techniques, management of data, storage methods. (Visit Dr. MIWA Karoku, Director-General, Office of the Planning and Development, Kyushu National Museum)	TNM
	28	Move to Nara Meeting with Dr. Takehara, Interpretre	Tokyo Nara
	29	Visiting the World Heritage Sites in Nara Present situation of the World Heritage Sites: Horyu-ji Temple, Heijo Palace Site, Todai-ji Temple	Nara

March	1	Lecture: Fundamental Photographic Techniques	Nabunken
	2	Lecture: Management of Digital Photographs and Files	Nabunken
	2	Lecture: Management of Digital Data	Nabunken
	3	Visiting Sen-Oku Hakuko Kan, Kyoto Meeting with Dr. HIGUCHI Takayasu, Director of the Museum	Sen-Oku Hakuko Kan
	4	Report Writing Closing Ceremony	ACCU Nara Office
	5	Departure	

Geidai : Tokyo University for Fine Arts and Music

TNM : Tokyo National Museum

Nabunken : National Research Institute for Cultural Properties, Nara

3. List of Lecturers and Staffs

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