iaSU 2016

JAPAN

Archi-Cultural Interactions through the Silk Road

4th International Conference

Mukogawa Women's University

Nishinomiya, Japan

July 16 - 18, 2016

International Association of SILKROAD UNIVERSITIES

ISBN 978-4-907594-04-6

Proceedings

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Archi-Cultural Interactions through the Silk Road

4th International Conference, Mukogawa Women's University, Nishinomiya, Japan, July 16-18, 2016, Proceedings

Edited by iaSU2016 JAPAN Publication Committee

Mukogawa Women's University Press

This proceedings includes 1 invited talk extended abstract and 54 refereed extended abstracts submitted to the 4th International Conference on Archi-Cultural Interactions through the Silk Road (iaSU2016 JAPAN), held on July 16-18, 2016, at Kami-Koshien Campus of Mukogawa Women's University, Nishinomiya, Japan.

First published 2016 by Mukogawa Women's University Press

Mukogawa Women's University Press
6-46 Ikebiraki-cho, Nishinomiya, Hyogo, 663-8558, Japan

Printed in Japan
ISBN 978-4-907594-04-6

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Invited talk

MORE ROBUST BUILDING TO PROTECT OUR CHILDREN IN THE SEISMICALLY ACTIVE COUNTRY, JAPAN

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Earthquake Disasters Will Not Stop Even In the 21st Century

Many technologies have been developed in the 20th century and researches on seismic engineering also had notable progress. However, painful and terrible earthquake disasters do not stop even in the 21st century. There is no meaning of doing research or writing papers if these do not strengthen our house, school, hospital, and company. I regret not being able to spread out simple messages; not to live in a weak building and housing, and not to live in tsunami hazard zones.

Building is one of the basic human needs. Building needs sufficient toughness and weight to act as a shelter and protect privacy of weak and soft human. If we truly try to mitigate damages from earthquake, the shelter should not collapse.

Seismic Design Standard in Kumamoto Prefecture

The zone factor that represents the risk of earthquake used for seismic design defined in the Building Standard Law is 1.0 for Tokyo and Osaka. 0.8 is the zone factor of Fukuoka, Saga and Nagasaki prefectures in Kyushu region, while Kumamoto uses the factor of 0.9, and this suggest that Kumamoto has relatively high risk of earthquake amongst other Kyushu prefectures.

By looking at the damages from the recent Kumamoto earthquake in Mashiki City, the destructive force of the main shock was equivalent or large to the one of Great Hanshin/Awaji Earthquake. Therefore, the actual power of earthquake in Kyushu is not any smaller than Tokyo or Osaka. Only the difference is the frequency of earthquake occurrence is lower. It is questionable that if it is correct to construct a building that is relatively weaker only because the frequency is lower.

In California State, there are certain areas on the faults where buildings are prohibited to be constructed. Seismic design level changes with respect to the distance to the nearest faults. These design concepts should be introduced to Japanese Building Standard Law, considering local disaster from the recent earthquake in Mashiki-cho, Kumamoto.

Building Standard Law Is a Minimum Standard

Building Standard Law is a minimum standard that is based on the sentence “The right to own or to hold property is inviolable” from The Constitution of Japan. Hence, the national standard cannot impose to the citizens excessively regarding the enough strength of the buildings against biggest earthquake expected in construction site. The aim of the standard is for building to withstand against one big shake such as the recent Kumamoto earthquake event, and under this standard, the building is allowed to have permanent large deformation

and end up being demolished after the earthquake, as long as it does not collapse instantly. Japan is located in a very active seismic zone, there are chances of having the next big earthquake once in hundreds or even thousands of years anywhere. The number of partially or completely collapsed houses suggested that the buildings are required to be built stronger, and evaluation of building seismic capacity and seismic retrofitting of old buildings and houses should be carried out and completed.

Consecutive Earthquakes

Kumamoto earthquake began at the night of 14th April, followed by a series of aftershocks. The main shock occurred only 2 days later in the early morning of 16th April, and more aftershocks continued on. These consecutive earthquakes are not being considered in current seismic design procedures.

Such consecutive earthquakes progressively weakened the ground, foundations and even causes partially collapsed buildings to fully collapsed. If second earthquake was to strike next day, there will be no time for emergency safety inspection on many buildings or housings. As a building is a place for people to live-in, it is natural for residents to return to their houses after the earthquake. It is a big problem that ordinary residents return to their houses without knowing that severe structural damages had occurred to their houses.

Loss of Trust in Building Structure and Persistent Effort by the Structural Engineers

It was very disappointed that while building structures are being built to protect people's lives, it turnout to be what people fear the most, because buildings are vibrated, deformed and even collapsed after a series of attacks from each round of earthquake.

The earthquake-resistant technology is slowly developed by structural researchers and engineers. Base isolation and passive controlled buildings are becoming more common. There are 22 base isolated buildings in Kumamoto, and the isolation layer have moved a lot during the earthquake, but there were no damage to the buildings. There was also no loss of trust to the buildings.

We should not get lost in the middle of a large natural disaster, but we need to develop better technologies and spread to the world.

1

Religion, art and cross-cultural interactions along the Silk Road

PEOPLED VINE SCROLL IN GANDHARAN SCULPTURE

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Keywords: peopled vine scroll, peopled acanthus scroll, Gandharan art, Roman art

Introduction

In Gandhara, north of Pakistan, flourished Buddhist art which was influenced by Greek, Hellenistic, Roman, Iranian and Indian arts. A good example of Roman influence upon Gandharan Buddhist art, is a motif that is called 'peopled vine scroll' composed of vine stems inhabited by human figures and wild animals[1].

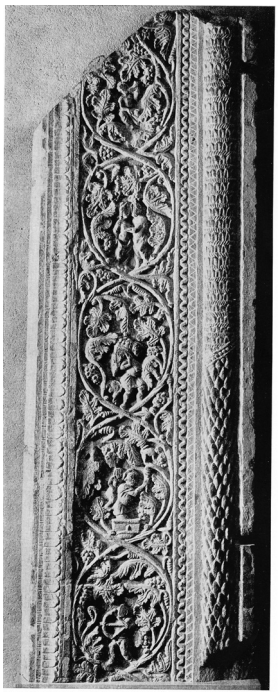
Fig.1 door jam

It is B. Rowland,who made a research of Gandharan peopled vine scroll for the first time,that is depicted on a vertical relief panel (fig.1) in the collection of the Museum of Fine Arts, Boston [2]. He identified this panel as door jamb which probably decorated a niche enclosing a Buddha statue in a Buddhist temple. He also pointed out that several images of this panel is related to Dionysus and his *thiasos,* and correctly remarked that they are similar to those depicted on pilasters found in the Roman East. Consequently, he maintained that Gandharan peopled vine scroll had been diffused from the Roman East from the middle of the second to the late third century A. D.

However, the problem with Rowland's view is his insufficient survey of Gandharan types of peopled vine scroll and also of Roman types of peopled scroll. As he did not take into consideration Roman 'peopled acanthus scroll', he could not explain the reason why peopled vine scroll was exclusively adopted in Gandharan art.

In this presentation, therefore, first of all, I will show several new Gandharan relief panels depicting peopled vine scroll that Rowland did not quote. Secondly, I will show that both peopled vine scroll and peopled acanthus scroll are attested in the art of the Roman East. Thirdly, I will clarify the reason why only peopled vine scroll motif was transmitted to Gandhara.

1 Gandharan Peopled Vine Scroll Motif

Gandharan types of peopled vine scroll are almost divided into four according to the form of vine stem.

Type I is composed of a vine stem with leaves running horizontally making a wavy scroll inhabited by human and animal figures. On the relief panel (Fig.2) in the collection of the Hirayama-Ikuo Silk Road Museum in Japan, two male figures picking grapes and two monkeys are depicted in a wavy vine scroll. On the other hand, on the panel in the collection of the Peshawar Museum, a monkey, a deer, a male figure shooting an arrow, and a male figure having a schield are depicted [3].

Fig. 2 peopled vine scroll

Type II is that of the door jamb in the collection of Museum of Fine Art, Boston (Fig.1). On this panel five medallions are formed by the symmetrical intertwist of two vine stems. These medallions enclose a male figure drinking, a fraternizing male and female couple, a male figure picking grapes, a male figure stamping grapes and a male shooting an arrow.

Type III is composed of two vine stems knotted into five medallions. In these medallions boys plucking grapes or struggling for a bunch?, and a goat nibbling the vine are depicted [4].

Type IV is also composed of medallions made by two vine stems but tied by the Heracles Knot. On a broken door jamb owned by a private collector in Tokyo, are depicted a goat, a bird and a peacock.

Human, animal and bird figures depicted in the above-mentioned Gandharan four types of peopled vine scroll are related to Dionysus and his *thiasos* [5]. For example, a drinking male figure is modeled on Silenus drinking wine, a fraternizing male and female couple modeled on amorous Satyr and Maenad, a male figure picking grapes modeled on Eros harvesting grapes, and a hunter shooting an arrow modeled on Eros the hunter. All the wild animals and birds are regarded to be under the control of Dionysus.

2 Peopled Scroll Motifs in the Roman East

In the art of Roman East, peopled scroll motif is divided into two types. The first type is peopled vine scroll, and the second is peopled acanthus scroll. These types are carved on the pilasters found at Leptis Magna in Libya, Aphrodisias in Turkey, Baalbek in Lebanon, Palmyra in Syria, and Beth-Shian in Israel [6] [7] [8] [9] .

On a pilaster of the tetrapylon at Leptis Magna, peopled vine scroll is depicted. The type of this vine scroll is the same as the second type above mentioned. In the medallions are depicted human figures related to Dionysus and the Greek Gods such as Heracles. What is more, peopled acanthus scroll is depicted on pilasters of

Fig. 3 Pilaster from Aphrodisias

the Basilica of Leptis Magna. Acanthus is a auspicous plant symbolizing immortality.

On a pilaster (Fig. 3) from Aphrodisias, peopled acanthus scroll is vertically depicted. In spaces formed by the stems arranged into wavy form, human figures like a hunting Eros and animals like a lion are seen.

On a beam from Palmyra, vine scroll motif is depicted. In the medallions, two vine stems are seen. On the other hand, there is a sarcophagus which depicts a Palmyran aristocrat lying on a couch(Fig. 4). He wears a tunic. The front of the tunic is decorated with peopled vine scroll. In the two medallions an Eros picking grapes is seen. This medallion is connected by the Heracles Knot.

Fig. 4 peopled vine scroll from Palmyra

Among the pilasters found in the Roman East, are observed both peopled vine scroll and peopled acanthus scroll. There are also two types of medallions: one is formed by simply intersecting stems and the other by Heracles Knot. What is more, in the medallion of peopled vine scroll, not only Dionysus and his *thiasos* but also the Greek Gods such as Heracles appear.

3 Gandharan peopled vine scroll and the Paradise of Dionysus

As stated above, there are both peopled vine scroll and peopled acanthus scroll motifs in the architecture of the Roman East. As regards the human figures depicted in medallions of architecture of this region, not only Dionysus and his *thiasos* but also Greek Gods are attested. However, in Gandharan architecture, only peopled vine scroll is observed, and human figures related to Dionysus and his *thiasos* are depicted in medallions of this kind of scroll. This fact means that Gandharan sculptors intentionally chose only those motifs that are intimately related to Dionysus and his *thiasos* among a lot of decorative motifs transmitted from the West.

Why did they not choose peopled acanthus scroll but select only peopled vine scroll motif? I believe that it is because they needed only the paradisiacal imagery of Dionysus and his *thiasos*.

Dionysus is generally regarded as the god of wine, grapes, winemaking, birth and rebirth, and fertility. He is also the god of the luxuriant growth of plants. Plants die in winter and are reborn in spring. Therefore Dionysus is related to resurrection and rebirth of beings. The dead is thought to be reborn after death in Dionysiac Paradise and to be able to enjoy the pleasure given by Maenads forever there. The Dionysiac figures represented in Gandharan art is also related to the resurrection and rebirth in paradise of afterlife. As a result, Gandharan sculptors chose only the Dionysiac peopled vine scroll motif. This is the most appropriate motif to show concretely and vividly a blissful scene of paradise to the Buddhists in Gandhara.

Conclusion

This presentation makes it clear that peopled vine scroll motif in Gandharan art symbolizes a paradise of afterlife. All the four types of Gandharan peopled vine scroll decorated the Buddhist temples. Therefore, this motif must have been related to Gandharan Buddhism and the faith of the Buddhists. This motif should be interpreted in the Buddhist context, that is to say, it might symbolize the afterlife that the Buddhists in Gandhara imagined and aspired to attain. I am ready for discussing what it concretely and particularly means, in another forthcoming paper.

Sources of Figures

Fig. 1 Rowland 1956, fig. 1.

Fig. 2 K. Tanabe, *Gandhāran Art from the Hirayama Collection*, Tokyo, 2007, fig. I-71.

Fig. 3 Author's photo.

Fig. 4 Schmidt-Colinet, A, T. *Palmyra, Kulturbegegnung im Grenzbereich*, Mainz, 1994, Figs. 48, 49.

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IN PURSUIT OF THE TANG OUTPOST *SUYAB*: AN ARCHAEOLOGICAL EXPEDITION AT AK-BESHIM SITE, 2015 AUTUMN SEASON

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Keywords: Silk Roads, Ak-Beshim/Suyab, Tang dynasty

1. Introduction

The Kyrgyz-Japan Joint Expedition aims at cultural and historical reconstruction in the Chuy valley through excavation at Ak-Beshim site. In 2015 autumn, a new expedition was launched in the eastern part (*Rabat*) with the purpose of archaeological identification of *Suyab* established by the Tang dynasty. This long-standing theme since the first excavation by V. V. Bartol'd in mid of the 19th century AD has been challenged with not only results of the previous studies which had actually failed to prove the expansion of the Tang dynasty, but also high-precision measurement and excavation methods/techniques newly introduced. This presentation will yield results of the autumn season as well as its basic information.

2. Site Description

Ak-Beshim site is located in the eastern part of the Chuy valley, ca. 50 km East of Bishkek city, the capital of Kyrgyz Republic. Situated on the lower terrace of the southern bank and at the western edge of an alluvial fan formed by a mountain stream toward the Chuy river, the site occupies a strategic position on the Tian Shan route of the Silk Roads, controlling trade between East and West. At the present time, it is reasonable to identify the site with *Suyab* (碎葉城), based on historical sources from Islam and China and a newly found stone marker with Chinese inscription including a name of *Suyab*.
The site consists of four parts: the *Shakhristan*, *Rabat* (or the second *Shakhristan*), *Citadel* and outer settlement surrounded with perimeter wall. The mostly trapezoidal *Shakhristan* measures ca. 740 m E-W by ca. 530 m N-S, covering ca. 35 ha. Attached to eastern side of the *Shakhristan*, the distorted pentagonal *Rabat* is located, measuring ca. 720 m E-W by ca. 1200 m N-S, ca. 60 ha. The land is utilized for agricultural activities at the present time. The *Citadel* is situated at the southwestern corner of the fortification of the *Shakhristan*. Furthermore, its perimeter was surrounded by earthen walls, except for the eastern side, in which a natural ditch running almost north to south was useful for defensive purpose.
The history of the site would go back to the fifth century AD, when established by Sogdian immigrants as a trading post. While increasingly flourished in later centuries, the city was subordinated to the Onoq Western Turkic Khaganate founded after the beginning of the seventh century AD. The famous "*Great Tang Records on the Western Regions* (大唐西域記)" referred to Xuanzang's visit to *Suyab* on the way to India in 630 AD, where a number of merchants from various regions and countries resided for international trade.

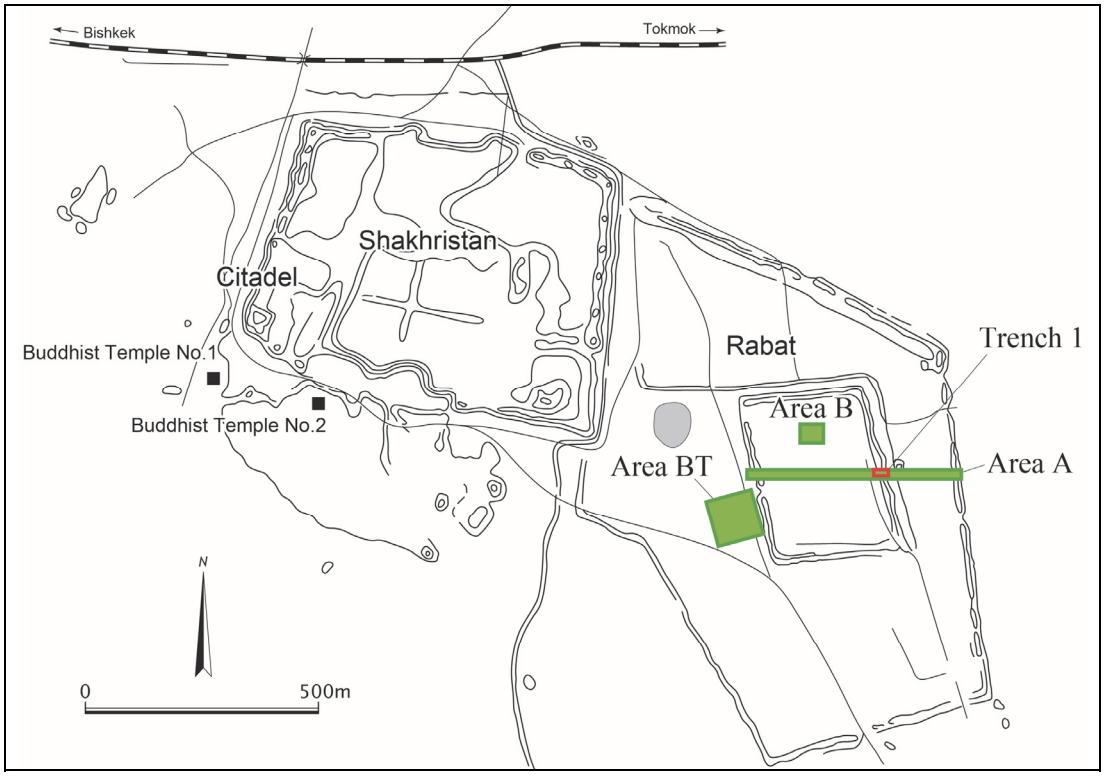

Fig. 1: Plan of Ak-Beshim site (after Kenjeahmet 2009)

In 648 AD, the Tang dynasty established the Protectorate General to Pacify the West to control the Tarim Basin including four main cities. *Suyab* as one of them had been controlled by the Tang dynasty, though taken over by the Tibetan Empire in a few times. A historical record "*Old Book of Tang* (旧唐書)" referring to newly construction of the *Rabat* in 679 AD eastwards from the *Shakhristan* implies how important role was played by the city on the Silk Roads in those days.

After the Tang dynasty retreated from the region in 719 AD, several polities ruled the city one after the other. Finally, the Kala-Khanid dynasty decided to place their capital there around the tenth century AD, as a part of Islamic expansion to the east. In the eleventh century AD, the city was abandoned at last and Balasagun (the present Burana) was established as a new capital of the dynasty at the same time.

3. Results of Excavation

Trace of outer and inner fortifications surrounding the *Rabat* was clearly visible on a satellite image taken by Corona in the 1960s, although the latter was completely vanished soon later, probably due to cultivation. Since this season aimed at yielding cultural evidence related to the Tang dynasty, Trench 1, measuring 20 m E-W by 2 m N-S, was opened across estimated location of the inner fortification (eastern side).

Trench 1 was excavated depending on artificial depth (ca. 0.2 m per each investigation). Consequently, probable inner fortification was unearthed 0.2 m below the present surface, measuring ca. 6.5 m in width. The fortification seemed to be built to pile up compact clay lamps like *pakhsa*, because it did not yield any trace of rammed earth as Chinese construction way. The excavation produced another impressive result: construction remains

discovered in the west and east of the fortification would imply different characters and functions individually.

Fig. 2: Western part of Trench 1, looking SE

In the west of the fortification, there was a somehow hardened construction layer 0.8 m below the present surface (Fig. 2). Grayish burnt bricks were arranged in a line running almost east to west and amount of grayish roof tiles were accumulated in several spots on the surface, though they did not represent any clear plans of buildings. In addition, another concentration of large amount of grayish roof tiles was detected in a small test trench 1.1 m by 0.65 m dug into the originally recognized western side of the unearthed fortification, as a result of further investigation on this layer in order to check the eastern end of a lined grayish burnt bricks attached to the fortification.

Irregular-shaped walls built with mud bricks were confirmed in the eastern adjacent of the fortification, where seems to be outside of the inner 'palace' (Fig. 3). Located on the layer 0.8~1.2 m below the present surface, it included not only two ovens ca. 0.4 m in diameter but also blackened floor inside the eastern space segmented by the irregular-shaped wall.

Fig. 3: Eastern part of Trench 1, looking W

The most remarkable finds in this season are no doubt amount of grayish clay tiles possibly put on building roofs, especially in the west of the fortification. Characteristically, most of them have imprint of close texture on concave side, though some were burnished or scraped on convex side. Furthermore, the grayish color of the tiles indicates reduced firing in kiln. These production techniques imply they belong to the Tang tradition dated back to the eighth century AD.

At least, thirteen burnt bricks were found on the layer in the western area, measuring ca. 14~34 cm in length, ca. 16 cm in width and ca. 5 cm in thickness. All of them are greenish gray in color indicating that they were fired under reduced condition. No pottery sherds were collected on the surface. On the other hand, some pottery sherds were found from fill of the eastern building remain. These include a cup with a loop handle, sherds of cooking vessel and so forth, which could be dated to the Kara-Khanid period, around the tenth to eleventh century AD.

In any case, accurate dates for the both areas must be determined through analyses of artifacts found on the floors and two collected samples for ^{14}C dating in future.

4. Systematic Surface Collection

A total of three areas were traversed for comprehensive surface collection of archaeological materials in the *Rabat*. The survey took place by ten people in average during two days, taking around seven hours per day. The surveyed areas were individually divided into small grids measuring 10 m square or 20 m square.
The first area (Area A) extended along a modern agricultural channel in the east-west direction were divided into a total of 26 grids measuring 20 m square, 23 of which were surveyed except for easternmost and westernmost grids. A total of the collected artifacts reach ca. 23 kg, especially including amount of roof tiles, grayish ('Chinese'?) burnt bricks and pottery sherds.
The second area, designated in the western part of the *Rabat*, was called Area BT ("Buddhist Temple"). This area measures 100 m square and consists of 100 grids, each of which was 10 m square. As a result, total artifacts of ca. 321 kg were collected. The most significant one was roof tile, a total of which reach ca. 150 kg. It indicates clear tendency of concentration on central part of northern half of Area BT. Given that this tendency is mostly same as of pottery sherds, it is expected some rectangular building could have existed in the north.
Furthermore, the third one (Area B), measuring 50 m E-W by 40 m N-S, was located in the northern vicinity of the first one. It was divided into 20 grids measuring 10 m square individually to collect artifacts on each. Consequently, total artifacts of ca. 139 kg were collected, including ca. 66 kg of roof tiles which account for ca. 50% of all collected artifacts. Roof tiles intensively distributed in the southwestern part. Following roof tiles, collected pottery sherds weigh ca. 33 kg, distribution of which overlapped with roof tiles. In the case of grayish burnt bricks, which weigh ca. 26 kg totally, it concentrated in the eastern part.

5. Concluding Remarks

Locating on the Silk Roads, Ak-Beshim site has played historically important role in the transregional trade network through the Tien Shan region. In this context, the 2015 autumn season have been able to corroborate the importance through the following accomplished points:

1) Excavation in the *Rabat* revealed possibility that some "Chinese-style" roofed building might have ever existed. The building is considered as remain of administrative section probably situated in the inner fortification.
2) Results of intensive surface collection imply that extensive building activities had taken place in the *Rabat* before the present cultivation, probably during the Middle Age, in view of amount of collected artifacts.

Based on the above results, the next season will aim at a greater understanding of the historical and cultural importance of the site through archaeological research, in cooperation with other various disciplines.

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A BYZANTINE CHURCH AT BEITIN, PALESTINE

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Keywords: Burj Beitin, Palestine, church, Byzantine Period.

Introduction

Beitin is the village name in the West Bank, Palestine Territory. The village has some archaeological sites such as a *tell* (artificial mound) and Roman necropolis. Burj Beitin is the one of the sites located on the southeastern hill of Beitin. Nowadays, the area of approximately fifty meters by fifty meters is preserved as an archaeological site, where many fragments of former limestone building materials are scattered. At the southeastern part of the site, a partially collapsed "tower" six meres high remains, which is the origin of this site's name.[1] Keio University conducted excavations there twice, in 2013 and 2015, and some parts of the ancient church were revealed.

Beitin is thought to be "Bethel" in the Old Testament, where Abraham encamped on the way from Mesopotamia to Egypt (Gen 12: 8), and Jacob dreamed of a ladder from the heaven (Gen 28: 11–23; 35: 1–15). Therefore, Beitin has attracted attention of many scholars and theologians during the 19th century, and some of them visited Burj Beitin and pointed out the existence of the ancient church preceding the "tower" ([1], [2], [3], [4], [5]), although no excavations had been conducted there. It is therefore necessary to excavate Burj Beitin to understand the whole picture of the church and the relationship between it and the "tower."

Measurement and Surface Survey

Preceding the excavation, measurement of structures and a collection of materials on the surface were conducted. The results of the measurement (Fig. 1) show that the "tower" is standing in the southern part of a courtyard-like space with surrounding structures and walls. Remarkably, surrounding structures vary between the eastern part and the western part, by the method of construction and the directions of walls: the eastern structures are made with single walls, while the western ones are constructed with small chambers between double walls. Furthermore the result may indicate the difference of the construction date of them.

Moreover, a result of a collection of materials indicated that the site's origin was

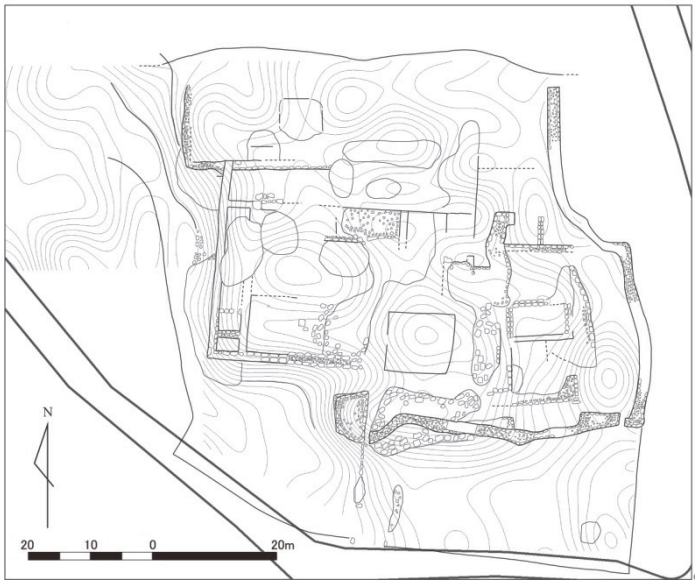

Fig. 1: Map of the Burj Beitin

mainly Byzantine period, and small residences were constructed in the Islamic period

Results of the Excavations

Four areas were selected for excavation: inside the “tower” (Area A); west of the “tower” (Area B); east of the “tower” (Area C); and north of the “tower” (Area D).

In Area D, a semi-circular line of stones was unearthed just below the surface and as expected, the apse was discovered (Fig. 2). The size of the apse was about seven meters in diameter and 120 cm high at the highest point from the floor. The southern edge of the wall adjoined the northern wall of the “tower,” which complicated the excavation. However, the apse’s semi-circular shape remained unbroken by the “tower.” Furthermore, a mosaic floor was revealed in the apse, although it was badly preserved and had been destroyed by later activities and collapse.

A stone slab floor was unearthed about seven meters west of the apse. Although the whole picture of the floor was still unclear because it was revealed by a trench of only 1.5 m wide, large stones more than one meter long were used. This floor is thought to be a nave of the church.

Fig. 2: The apse in the Area D

At the west of the “tower” (Area B), a line of rectangular stones was revealed, which was about 75 cm wide and parallel with the southern surrounding wall. Finally, the line extended for about 18 m from the small chamber of the western wall to the “tower.” Moreover, another mosaic floor was revealed at the space between the southern surrounding wall and the stone line (Fig. 3). While at the other side of the stone line, the stone slab floor was unearthed, which was the same elevation as that of Area D.

Fig. 3: The mosaic floor in the Area B

Fig. 4: The gate in the Area B

At the western edge of the site, the gate with two pillar bases was found in the middle of the western surrounding wall (Fig. 4). The interval between the bases was about 1.7 m, and the apse was located on the line that extends to the east, which should mean this was the main entrance of the church. Moreover, in the chamber south of the gate, the floor with stone slabs was uncovered. Considering the state of the floor, it is very likely that the floor extended to the whole area around the entrance room.

In the chamber at the southwestern corner of the surrounding wall, mosaic floors were partially revealed. Although these floors also had been extensively destroyed in later periods, some decorations (guilloche, wavy lines, and grapes, for example) were found.

Summary

As a result of the excavations, a great church was unearthed at Burj Beitin, about 40 m from east to west and 28 m from north to south (Fig. 5). This is as large as the Church of the Nativity in Bethlehem, and enough to say it was one of the chief churches around the area.

However, many points are still unclear about the aisle, especially the character of the stone line. Stone pillars cannot have been set on it, because no pillar bases were found there. Therefore, wooden pillars or mudbrick walls may have been used. If wooden pillars were used, this church had four aisles. The Holy Sepulchre in Jerusalem and the Church of the Nativity in Bethlehem are known as the only churches of this type in Israel–Palestine, and both are large churches constructed in the fourth century. Therefore, the church of Burj Beitin would be an important example. On the other hand if mudbrick walls were constructed on the stone line, the mosaic floor would be a part of a small room adjoining the south of the church.

To solve the questions, further excavations should be continued, especially in the

aisle area, while it would be important to identify the construction date through analyzing pottery remnants.

Fig. 5: The entire picture of Burj Beitin

Notes

1. *burj* means “tower” in Arabic.

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STUDY OF THE THERMAL BATH WITHIN HISHAM'S PALACE BY UTILIZING A RECONSTRUCTED MODEL AND A SIMULATION OF THE INTERNAL SPACE

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Keywords: Hisham's Palace, Khirbat al Mafjar (Qasr Hisham), Reconstructed Model, Simulation, Islamic Architecture, Mosaic Tile Floor

Introduction

The ruins of Hisham's Palace are located on the northern bank of Wadi Nueima, 2 km north of Jericho in the Jordan Valley. The palace was believed to have been constructed in the 8th century as the winter resort of al-Walid II, successor to Caliph Hisham bin Abd al-Malik. The complex consists of the palace, a thermal bath (including the audience hall), a mosque, and a fountain pavilion[6]. Apart from the thermal bath, all the buildings (including the superstructure) were destroyed in an earthquake in 747 A.D[7] While the floor of the thermal bath (with an area of approximately 850 m²) is lined with elaborate mosaic tiles (originals from the era), being super structure collapsed poses a threat to the tiles because of lack of adequate protection. Thus, a simulation of the original space was used to produce a reconstructed model, which in turn would be used to design a shed capable of protecting the entire mosaic tile floor.

Method

1) The literature reviews (prior research) of the thermal bath within Hisham's Palace was conducted.
2) The integrity of existing plan drawings[5] were checked and they were modified as required.
3) It was attempted to recreate the model based on the modified plans. Reconsidered areas where construction was not possible due to a contradiction in the drawings were reworked on the plan section. A 1:50 scale model based on the final plan was reconstructed.
4) The model was positioned in its actual orientation under the daylight. The interior of model was cross-checked according to the original by using photos and videos[8] of the model.

Corrected Points of the Drawings

① The plan drawings were modified to ensure that the base line and center line of the walls are parallel or perpendicular to each other.
② Since the dimensions of the existing plans[5] were not defined, they were modified according to the amended base lines and center lines.
③ The irregular heights of the pillars were aligned and positioned along the base lines.
④ Since the previous studies did not include any elevation drawings, the size, height, and position of the openings were set by using the existing cross-sectional view (and

development view) as a reference[5]. Additionally, as the shapes of the openings in the existing drawings[5] were not applicable for the building structure, the openings were altered to a more feasible shape.

⑤ The height of the niches were estimated and set using photos[4] of the current state of the ruins.

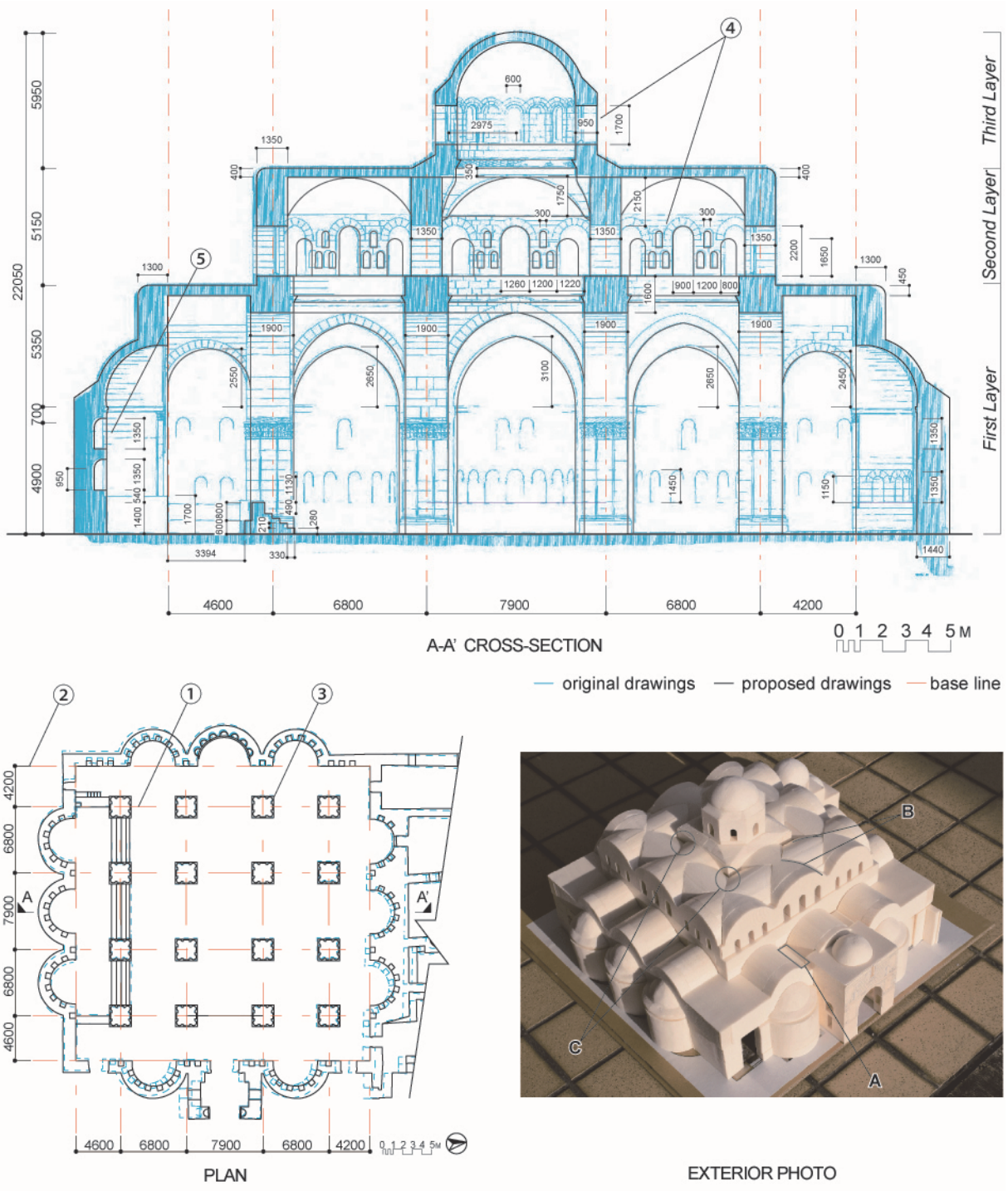

Fig. 1: Drawing Correction

Corrected Points of the Model

From the modified plans and existing axonometric drawings[3], it was determined that the center vault of the second tier was larger than the lateral vaults. The model was corrected accordingly.
Further, using the existing axonometric drawings[3], it was determined that flashing was required to cover the grooves in the following sections: the junction point between the vaults on the first tier (A), the intersection between the vaults on the second tier, (B), and the junction point between vault edge and the vertical wall (C). The model was corrected to indicate these points (Fig. 1).

Simulation of Interior

The interior space was cross-checked using photos and videos[8] of the model. The findings were as follows (Fig. 2):

There was a minimum number of gaps, but due to the opening in the drum wall that supported the dome, the interior appeared as a dramatic space lit by dim light.
Additionally, the daylight admitted through the main dome lightened even the thermal bath space. Statues of angels adorned the niche of the drum wall and the pendentive below it. Thus, the light from the openings illuminated the statues and sculptures brightly, and it is believed that during the building's period the angel statues appeared to be floating from the Heavens.
Besides, the light coming through the second tier openings illuminated the mosaic tile floor in a consecutive pattern of the shape of the openings. Additionally, depending on the time of day, the pillar surfaces are brilliantly lighted in a way that emphasizes their three-dimensional structure.

Fig. 2: Model Photo

Conclusion

This study includes literature reviews of the thermal bath of Hisham's Palace. Through the modification of existing plan drawings[5] and the creation of the reconstructed model, the followings were clarified:

1) The existing plans[5] were insufficient to produce the reconstructed model, thus it required additional modifications. The modifications and corrections are listed as follows: The base lines and center lines were modified so that they could be parallel or perpendicular to

each other. The drawings were dimensioned according to the modified base and center lines. The irregular pillars were realigned and repositioned along the base lines. The size, height, and position of the openings were made more feasible from an architectural standpoint. The height of the niche was set based on current photos[4] of the ruins.
2) The central vault of the second tier had to be rebuilt as it was larger than the lateral vaults.
3) While constructing the model using existing axonometric drawings[3], grooves were formed in the following sections: the junction point between the vaults on the first tier (A), the intersection between the vaults in the second tier (B), and the junction point between vault edge and the vertical wall (C). These grooves required flashing for protection against rain (Fig. 2).

Furthermore, the interior space was verified by using photos and videos[8] of the model. This helped in clarifying the following:

1) Although the number of openings is minimal, the opening of the drum wall results with the interior to appear as a dramatic space lit by dim light.
2) The drum wall around the dome is an iconic space for the thermal bath and has a recess above the pendentive with a decorative statue of an angel. Due to this, the light from the opening effectively illuminates the statues and sculptures, giving the impression of an angel's descent.
3) The light coming through the openings of the second tier illuminates the mosaic tiles on the floor, thus causing different areas of the floor to be illuminated in the shape of the openings. Additionally, the three-dimensional effect of the pillars' surface is highlighted more and brilliantly lighted.

Funding

The contributors of model creation: Mimiko KIJIMA, Saya NAKANO, Yuriko MURAKAMI, Yasue IMAGAWA, Komika IMAJI, Hiromi SUZUKI

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Archi-Cultural Interactions through the Silk Road
4th International Conference, Mukogawa Women's Univ., Nishinomiya, Japan, July 16-18,2016
Proceedings

TYPES OF THE CEILINGS AND ITS DECORATIONS AT ANCIENT EGYPTIAN ARCHITECTURE

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Keywords: Residential architecture, Religious architecture, Royal architecture, Divine architecture, The flat ceiling, The vaulted ceiling, Ceiling ornament, The corbelled vaulted Ceiling, The gabled Ceiling

Introduction

Two types of the ceiling architecture had been known at the ancient Egyptian architecture, (the domestic one) and (the religious one), the latter also divided into two sections (divine one, which designated to the mansions (temples) of the gods and goddesses & the second one (the funerary architecture) which dedicated to their dead.

It is agreed to call the first one (the residential architecture) as the mud-brick architecture, whereas the second one (the religious architecture) as to be the stone architecture.

Several types of ceilings were found at both architectures.

A. Ceilings of the domestic/residential architecture (living houses)

A.1 Pre-historic periods

A.1.1 The flat ceiling (fig.1)

The typical settler at the pre-dynastic periods, lived in a rectangular one-room peasant hut of sun-dried Nile mud, the roof has not survived, but it was (flat) and may originally have consisted of papyrus and plants reeds, as long as covered with the animal's skins.

A.1.2 The vaulted ceiling (fig.2)

The second type of the roof (ceiling) at the early times, the (vaulted ceiling), A hut with a semicircular roof, above which two corner posts appear to project, must be interpreted as a structure consisting of bundled reeds and matting on the base. A building with a roof vaulted longitudinally, between elevated transverse walls.

A.2 Ceiling types at the historical times

At the first dynasty establishment (ca. 3300 B.C.), the royal palaces, houses of high elite ones, built of reed matting, but it was now constructed of solid brick and timber, trees trunks (especially palm trunks), after cutting, also used and laid side by side to support the ceiling.

This technique of ceiling architecture type and design became ideal in use through ages at ancient Egypt for all segments of the society (kings, high official “great ones” and public people) (keeping at our minds the social inequality at the operation of building performance) : this type of roof still used (till now) at several villages at Egypt, which suitable for the dry scorching summer heat.

A.2.1 Mud-brick ceiling ornament (fig.3)

Ancient Egyptians covered the internal parts of their houses (walls & ceilings) with plaster material for two reasons, 1st to protect it from corrosion, 2nd to decorate it with the differ natural scenes (land scape, fishes & bird’s images, flowers ….)

So we have a lot of examples of different ceiling decorations from ancient Egyptians palaces and houses, which most of it painted with white color as background of the scenes depicted upon it.

B. Ceilings of the religious architecture (Divine temples & funerary tombs)

B.1 Ceilings of the Divine temples

B.1.1 The vaulted awning

A hut beneath an awning supported on wooden posts. In monumental architecture this form became the prototype of the later "baldachin temple," erected for the celebration of special rites and as a "way station" or resting-place for the images of the gods and their sacred barge during the processions through the precincts of large temple complexes. The "birth houses" of the late temples were also modeled after the hut shaded by an awning.

B.1.2 The flat ceiling (fig.4)

This is the typical ceiling which formed the temples ceiling, it was made of stone (lime stone-sandstone), or hard stone (like Basalt, Granite and Diorite) at the large temples.

These kinds of ceiling usually decorated with the sky shape, sky stars, or the zodiac, as the temples of the gods considered to be the horizon home of the gods at earth.

B.2 Ceiling at the funerary tombs

B.2.1 Ceiling at the royal tombs (the Pyramids)

We have several kinds of the royal Ceiling found at their tombs

B.2.1.1 The vaulted ceiling (fig.5)

At the archaic period (the 1st & 2nd dynasty), the kings buried themselves at a huge rectangular tomb made of mud-brick, called (Mastaba), which contain two parts, super-structure & sub-structure, the latter part contained stretched corridors and large chambers

had the vaulted mud-brick ceilings (usually lack of decorations), these kinds of ceiling used to support the heap of sands (tumuli) above it.

B.2.1.2 The flat Ceiling

Since the ancient Egyptian kings Abandoned the internal mud-brick building to be stone building, the ancient Egyptians designed the ceilings of their chambers inside the pyramids, at (the flat stone ceiling type), but because of cracking (especially inside the pyramids) occurred as a result of hundred thousands of stones tons above it, they abandoned these types of ceilings.

B.2.1.3 The corbelled vaulted Ceiling (fig.6)

This kind of ceilings was the most hard one amongst the ceiling types of ancient Egyptian architecture, which the method of its erecting to avoid any flat space under the hundred thousand of stone tons, by offsetting successive courses of stone (or brick) at the spring line of the walls so that they project towards the archway's center from each supporting side, until the courses meet at the apex of the archway, as inside the burial chambers of Meidum and Dahshour pyramids (4th dynasty- old kingdom)

B.2.1.4 The gabled Ceiling (fig.7)

Which the stones (slabs) of the ceiling rest at two sides only of the walls, taking a triangle shape.

Conclusion

Through these last examples of the ancient Egyptian ceilings types, we can say that ancient Egyptian architecture had different types of ceiling; each one had a specific use, which the research will reveal that in detail.

Fig. 1

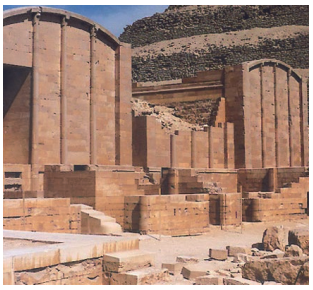

Fig. 2

Fig. 3

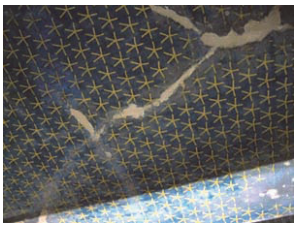

Fig. 4

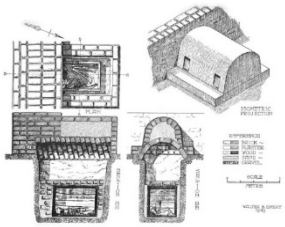

Fig. 5

Fig. 6

Fig. 7

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SPACIAL COMPOSITION OF CHRISTIAN PAINTINGS IN THE CAVE CHURCHES OF IHLARA VALLEY, CAPPADOCIA

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Keywords: Cappadocia, Ihlara valley, Christian paintings, window, tomb

Introduction

In this study, we examine the spatial composition of the cave churches in the Ihlara valley of Cappadocia, Turkey with specific focus on their arrangement of rooms, location of windows and tombs, and the theme and layout of paintings. We describe herein how the layout of the paintings ascribes meaning to the architectural space. These churches have enormous implications for determining how a holy space was created.

In studies on the iconography of paintings, an iconographic image is compared to similar images or the relevant historiography. However, many Byzantine churches have been lost, some existing churches have almost no remaining iconographical materials, and almost no historiography refers directly to the original paintings. We found drawings and photos from previous studies and websites, created interior elevations using the paintings in the cave churches of Ihlara valley and analyzed the spatial composition with the theme and layout of the paintings. In this paper the five cave churches are single-naved and the three ones are cruciform in plan of the eight ones that we analyzed. Because of space limitations, we described below the two cave churches, that is to say, the Kokar Kilise church of a single-nave plan with a burial chapel and the Yilanli Kilise church of a cruciform plan with a burial chamber.

Kokar Kilise

The Kokar Kilise church is located on the second story of the monastery, and consists of a single nave with an apse in the east portion and a burial chapel that is assumed to have been added to the west portion of the church (Fig. 1). The entrance is located on the western edge of the nave's northern wall. The chapel has an aisle with a bench on the west side and a room on the north side. The chapel's nave and aisle have an apse on their south side. Grave pits are located on the north side of the chapel's nave and in the aisle, found notably as one passes around the entrance, but no grave pits are found in front of the apse of the chapel's nave.

The walls of the church and chapel are resurfaced smoothly, and their walls and piers are decorated with cornices. Christian paintings of many colors are drawn on the plaster throughout the church and decorative red iron oxide patterns are painted partially in the chapel directly on the smoothly resurfaced ceilings and walls. It is generally accepted that Christian paintings are placed exclusively in important spaces within a monastery.

In the church, there are no paintings of the "Ministry of Jesus," but paintings of the "Incarnation," "Passion," and "Resurrection" are positioned clockwise from the east side of

the southern wall (Fig. 2). The "Deesis" is painted widely throughout the upper part of the church's western wall, which adjoins the chapel, signifying the "Salvation" of souls. Through the doorway of the lower part of the western wall, a bird eating a snake, which illustrates victory of souls over sin, and foliage patterns that represent eternal life are located in the chapel. There are many grave pits in the chapel in the church's west side and, in the aisle in the chapel's west side, the chapel apparently also served as a burial chamber.

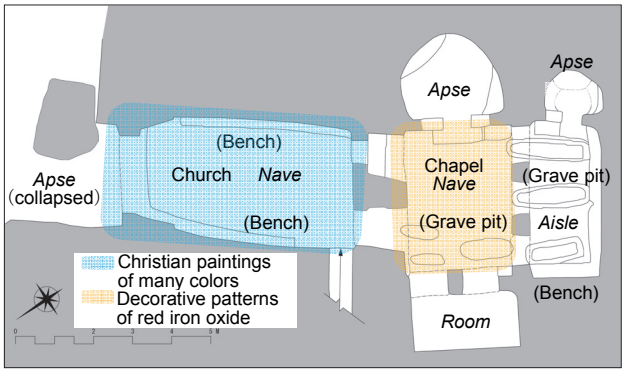

Fig. 1: Plan of Kokar Kilise (redrawn after [3])

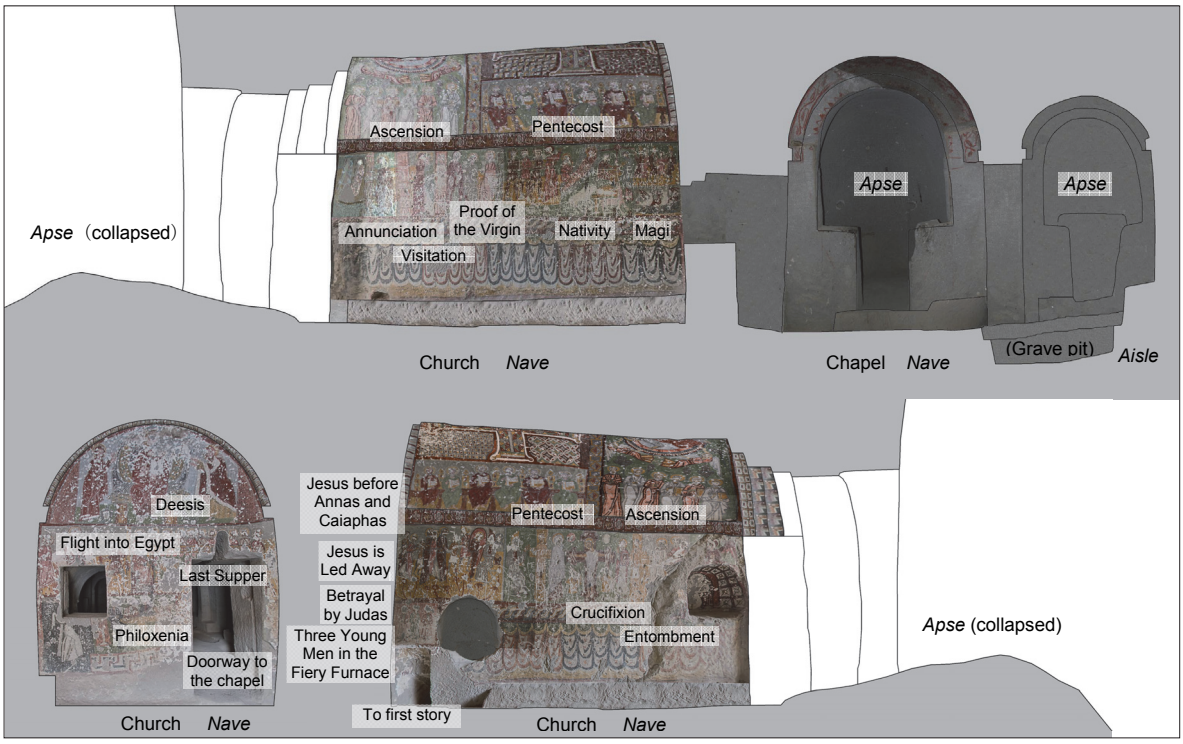

Fig. 2: Interior elevation of Kokar Kilise (photo by [5])

Yılanlı Kilise

The Yilanli Kilise church is located on the second story of the monastery. It follows a cruciform plan and has a front chamber and burial chamber (Fig. 3). The church has an apse in the eastern portion, the southern transept has a window, and the outside of the window and front chamber are decorated. The burial chamber also has an apse on the east side, an

arcosolium on the north side, and some grave pits on the floor. In the burial chamber, the surface of the walls and ceiling are rough with only the northern wall of the arcosolium smoothly resurfaced. The front chamber also contains an arcosolium on the west side, but there are no arcosolia or grave pits in the church. Christian paintings are painted on the walls and ceiling throughout the church, but are painted only on the walls in the front chamber and the northern wall of the arcosolium in the burial chamber. All of the paintings consist of many colors.

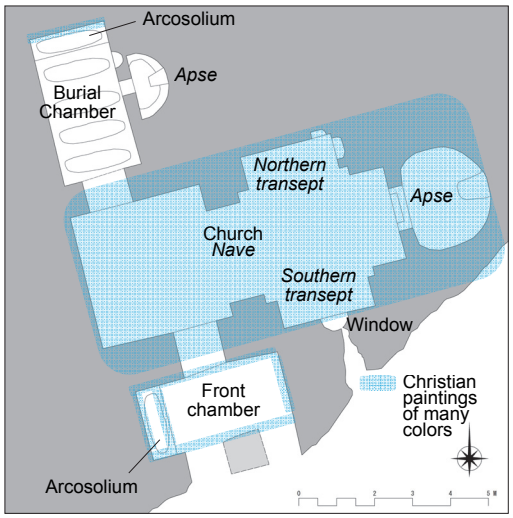

Fig. 3: Plan of Yılanlı Kilise (redrawn after [4])

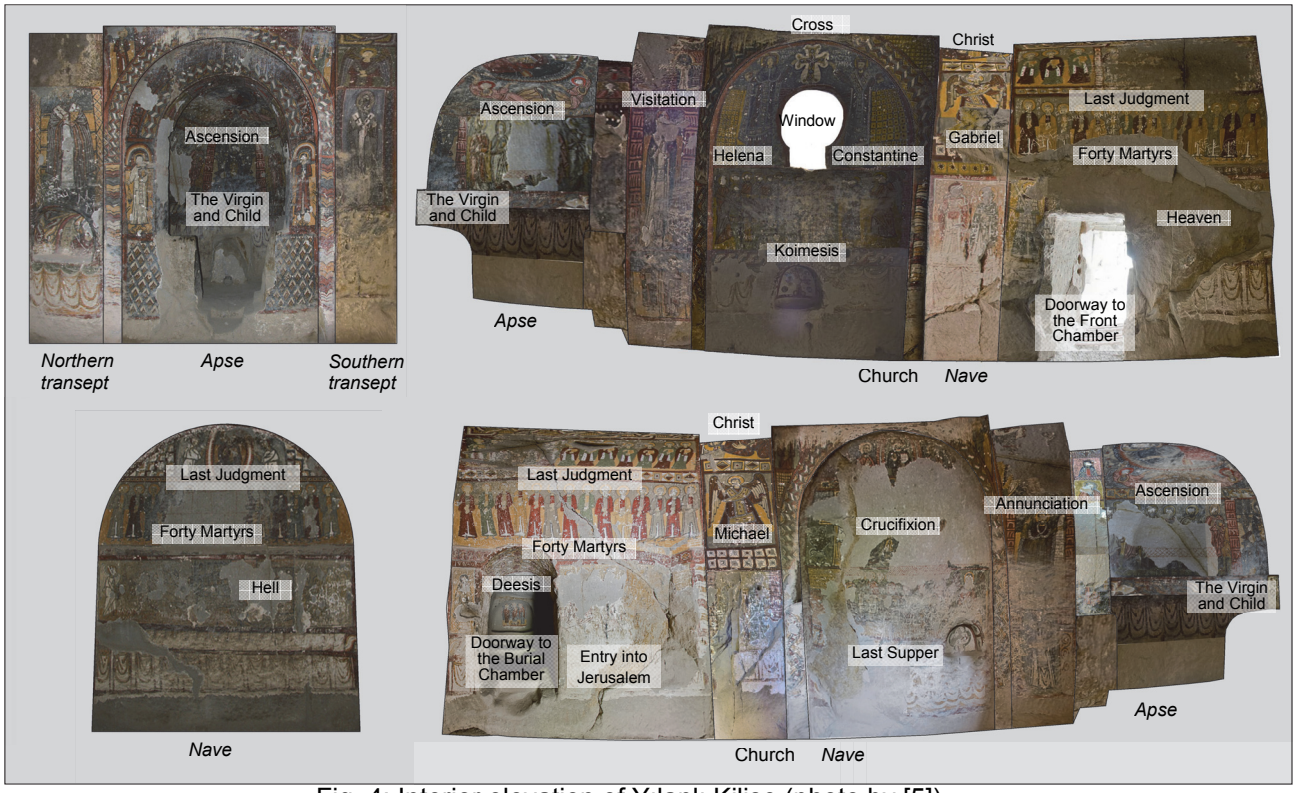

Fig. 4: Interior elevation of Yılanlı Kilise (photo by [5])

Paintings of Constantine and Helena flank each side of the window in the southern transept of the church, extending their hands for the cross, which symbolizes Christ, in the upper part of the window. The center of the painting is illuminated by the window (Fig. 4). The window is not meant to light up the painting on the opposite wall, but does associate the window with the painting, emphasizing its meaning of the "Glory of Christ." There are no "Ministry of Jesus" paintings inside the church, but there are many paintings of the "Passion," "Forty Martyrs," which implicates "Death," and the "Last Judgment" distributed throughout the entire church.

The northern wall of the arcosolium in the burial chamber is resurfaced smoothly and painted, indicating that this is a place of importance. The burial chamber has an apse and a painting of the "Deesis," accentuating the "Salvation" of dead souls. In addition, the front chamber also contains an arcosolium and paintings of "Mary of Egypt" and "Daniel in the Lions' Den," which also represents the "Salvation" of souls.

We now understand that paintings that symbolize "Death" and "Salvation from Death" are found in the church's west side and in the front and burial chambers that connect to it.

Conclusion

In this study, we created interior elevations using paintings and examined the spatial composition of the cave churches found in the Ihlara valley of Cappadocia, Turkey, focusing particularly on room arrangement, location of windows and tombs, and the theme and layout of the paintings. Many tombs are found in the cave churches of Ihlara valley, but few are found in the naves and none are located in front of the alters. All walls in the naves are painted, but the walls in other rooms are partially painted. Furthermore, many of the churches contain paintings signifying "Death" or "Salvation." These factors, based on the arrangement of rooms, location of tombs, and the theme and layout of the paintings, indicate that, for the cave churches of Ihlara valley, churches with an apse and burial chambers are important.

The cave churches of Ihlara valley establish a space that means "Death" and emphasize "Salvation" of souls with the theme and layout of the Christian paintings, focused particularly on the church and burial chamber. The burial chamber is especially significant, bolstered by the many paintings signifying "Death" and "Salvation" that are drawn in the church, giving a meaning to the holy religious space that is unique to the Ihlara valley.

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DEVELOPMENT TYPES OF BUDDHIST TEMPLES: CENTRAL ASIA AND XINJIANG UIGHUR

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Keywords: Buddhist Temples, Cave Temples, Central Asia, Xinjiang Uighur, Spatial Composition

Introduction

This paper elucidates the development types of Buddhist temples in Central Asia and Xinjiang Uighur area through bibliographic surveys[1]. Although there have been many smaller studies of Buddhist temples in these areas, no other study has focused on the entire region. "Development type" is defined as the type of development process with common spatial composition.

Method

Based on a collected database of place (area), construction year (century), religion, dynasty, culture, drawings, and photos, and an outline of Buddhist temples, spatial compositions are presented in three dimensional (3D) diagrams to investigate and to classify into characteristic patterns, specifically regarding the stupa, shrine (chaitya), and monastery (vihara), and their mutual relationships. We used our diagrams to examine the development of the Buddhist temples and classified characteristic patterns through our analysis.

Typification and Development of Buddhist Temples

Ground Temples[2]

(1) Sanchi, Dharmarajika (2) Qol-i-Nāder, Kalawan, Jaulian, Karatepa (3) Miran (4) Shankar-dar (5, 31) Gul-Darrah (6, 7) Bhamala, Ahim Posh, Shah ji ki Dheri (8, 14, 15, 17) Qocho City (9) Rawak, Parihasapura (10) Yar City (11, 16) Ak-Beshim (12) Dharmarajika, Kalawan (13) Fayaz Tepe (18, 33) Dharmarajika (19, 20, 35) Takht-i-Bahi (21, 22) Jaulian, Ranigat, Tapa Shotor, Bagh Gai (23) Tapa Sardar (24) Ranigat (25) Gumbat (26) Dharmarajika (27) Ranigat, Mekhasanda, Thareli (28, 29) Kalawan, Jaulian, Takht-i-Bahi, Bagh Gai (30) Karatepa (32) Qol-i-Nader, Gul-Darrah (34) Jaulian, Tapa Shotor, Bagh Gai (36) Ajina tepa

Cave Temples[2]

(A) Junnar (B) Guntupalle (C) Kondivte (D) Bhaja 12 (a)Ajanta 12, Nasik 3 (b)Nasik (c)Ajanta 2, Ajanta 6 (d)Aurangabad 6, 7 (1) Bamiyan B(d) (2) Bamiyan D (3) Bamiyan A_under (a) Haibak 3 (4) Bamiyan 35-Ⅲ, Kizil 135, Toyuk K50 (5) Bezeklik 3 (6) Bamiyan C(a), Haibak 1 (7) Bamiyan F(a) (8) Kumtura 5 (9) Bamiyan A_top(a) (10) Bamiyan F(c), Kizil 132 (11) Bamiyan V(d) (12) Basawal 1, 36, 38 (13) Bamiyan 53-Ⅴ(14) Bamiyan XⅤ(b) (15) Kizil 117, Toyuk 42 (16) Kizil 225 (17) Bamiyan E(c) (18) Kizil 48 (19) Kizil 8, 38 (20) Kizil 175 (21) Kizil 116 (22) Bamiyan K3, Kizil 110, Bezeklik 19 (23)Kizil 14, BezeklikⅡ (24) Kizil 118 (25) Kizil 6 (26) Kizil 77 (27) Bamiyan XⅣ(a) (28) Bamiyan M, Kizil 119 (29) Bamiyan XⅢ1(a) (30) Basawal 8, 14 (31) Fil Khana (32) Bezeklik 8 (33) Kizil 99 (34) Kizil 27 (35) Kizil 207 (36) Kizil 123

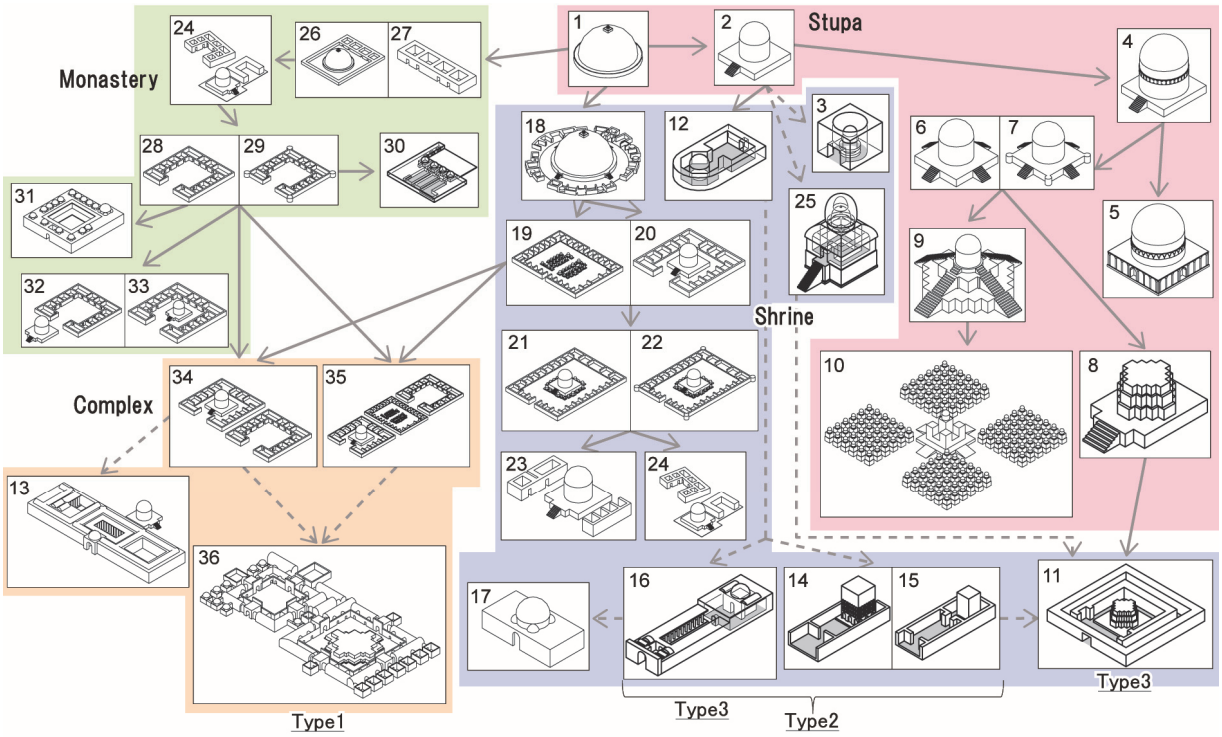

Fig. 1: Development of Buddhist Ground Temples

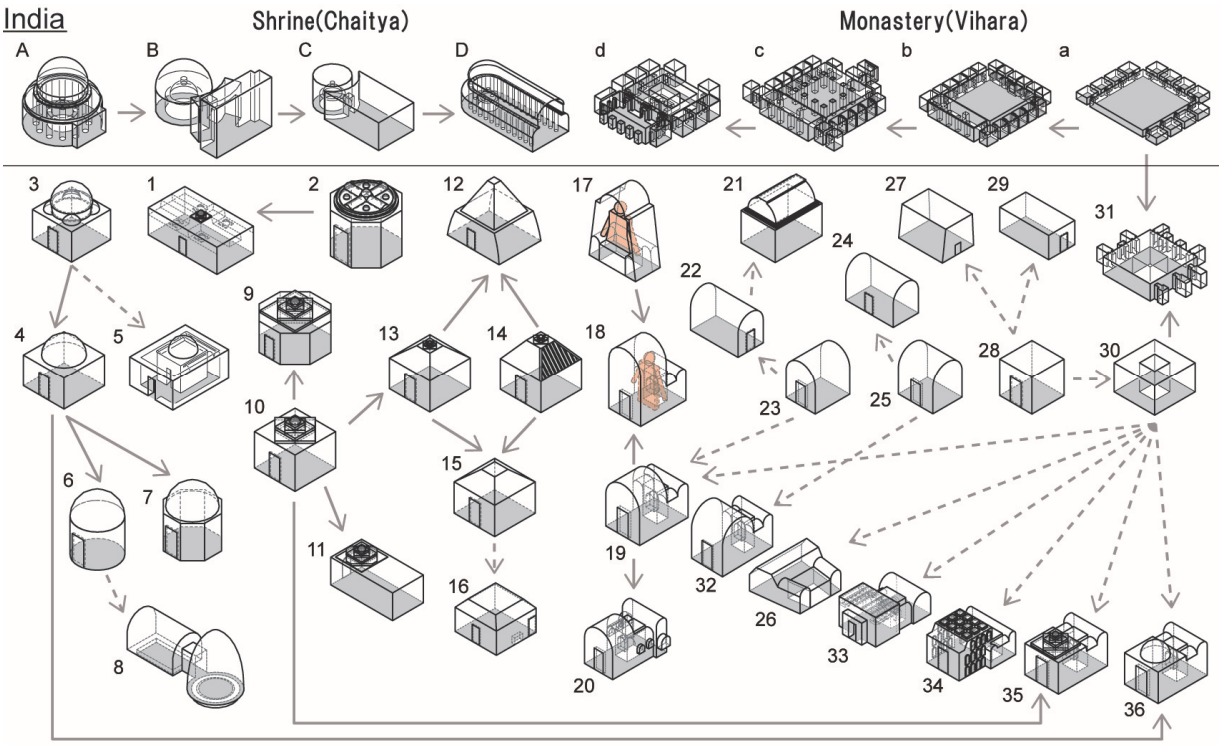

Fig. 2: Development of Buddhist Cave Temples [3]

The arrow means a "development" of spatial composition.

from literatures searching — our consideration

Results & Discussion

Our 3D diagrams enabled us to classify the spatial composition of the Buddhist ground temples in Central Asia and Xinjiang Uighur into roughly three development types:

1. Spatial composition with the courtyard in the center of the C-shaped shrine or main stupa in the center of the C-shaped monastery: (20, 21, 22, 28, 29 and 33 in Fig. 1)
   We found a small difference between the spatial composition of the stupa area and the monastery area. We also noted differences of placing the stupa in the center and having the courtyard. Otherwise, this type of temple encloses small cells, which resembles the Indian cave temples.
2. Spatial composition with the front chamber (or front yard) and the shrine with the stupa forming a line in the going straight direction: (11, 12, 14, 15, and 16 in Fig. 1)
   The front chamber (or front yard) is placed in front of the worship object.
3. Spatial composition in which the worship object is enclosed within double walls: (11, 16, and 25 in Fig. 1)
   The chancel is surrounded by a wall with the additional surrounding corridor going around to the right.

※ Type 3 can be considered the complex of Type 1 and Type 2. Type 3 often has a front chamber (or front yard).

The 3D diagrams enabled us to classify the spatial composition of the Buddhist cave temples into roughly five development types:

1. Spatial composition with the stupa or the Buddhist statue in the center of the shrine: (4, 10, and 22 in Fig. 2)
2. Spatial composition with the front chamber (or front yard) and the stupa or the Buddhist statue forming a line in the going-straight direction: (18, 19, 20, 32, 33, 34, and 35 in Fig. 2)
3. Spatial composition with the worship object (Buddhist statue) placed deep within the shrine: (1, 3, 4, 11, 21, 22, and 27 in Fig. 2)
4. Spatial composition with Buddhist statues which face inwards along the side walls of the cave, and without the worship object enshrined in the center of the cave: (2, 3, 4, 6, 7, 9, and 13 in Fig. 2)
5. Spatial composition with the front chamber and the Buddhist statue forming a line in the going-straight direction. The Buddhist statue is in the centered-pillar of the cave. It is surrounded by the corridor going around to the right: (18, 19, 20, 32, 33, 34, 35, and 36 in Fig. 2)

※ Type 5 is regarded as the development-shape of type 2. It is found only in the Bamiyan Buddhist cave temples near type 4.

Conclusion

We classified Buddhist temples in the study area into patterns and suggested the development types of Buddhist temples based on the following elements: stupa, monastery, shrine, shrine with the front chamber (or front yard), shrine with the corridor circling to the right, and complex with the monastery area and the stupa area. As a result, it is clear that in Central Asia and Xinjiang Uighur, ground temples can be roughly divided into 3 types and cave temples can be divided into 5 types.

Notes

1. Some of quoted Buddhist sites are located in the land of Pakistan.
2. Names of the diagramed Buddhist temples in Figs. 1 and 2. Some of these temples are examples of strictly one development type, while others are examples of two or more types. We did not record all of the Buddhist temples in our study area.
3. We did not consider cornices or tambours in our classification or describe differences in the junctions in the typification of the cave temples. Only the floor plan and the form of the ceiling were considered. In addition, it is difficult to show five types in the figure same as Fig.1 because development of caves temple is complicated.

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HEALTHCARE ARCHITECTURE ON THE SILK ROAD: DARÜŞŞİFAS BUILT BY THE SELJUK AND OTTOMAN EMPIRES ON THE ANATOLIAN TRADE ROUTES

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Keywords: Darüşşifa, Silk Road, Anatolia, healing, healing spaces, healthcare

Introduction

"The Silk Road" is an extensive intercontinental network of trade routes across the Asian continent connecting East, South, and Western Asia with the Mediterranean world, as well as North and Northeast Africa and Europe. This route served as the primary path of commerce for the states from the 2nd century BC to the 15th century AD. Even though the sea routes between Europe and Asia were established, caravan trade continued along the Silk Road until the 17th century and later. While commerce was the primary intention for the establishment of this intercontinental network, Silk Road played a significant role in the exchange of knowledge, culture, religion, and technology between the East and West. Various belief systems extended along the route such as, Buddhism, Islam, Christianity, Manichaeism, and Zoroastrianism. Algebra, astronomy, Arabic numerals, medical developments and techniques, architectural styles spread from East to West, while various construction techniques, seafaring methods, medicinal plants, and cotton cultivation spread from West to East [1].

Fig.1: Major trade centers in North, South and Central Anatolia routes and locations of *darüşşifa*

Since ancient times Anatolia has been a bridge between East and West where 3 routes stretching from Central Asia to Anatolia and then from Thrace to Europe. Additionally, on the Aegean coast the ports of Ephesus and Miletus, in the Black Sea Region the ports of Trabzon and Sinop, in the Mediterranean the ports of Alanya and Antalya were used in order to reach Europe from sea. Among the 3 routes in Anatolia mentioned, North route included

Trabzon, Gümüşhane, Erzurum, Sivas, Tokat, Amasya, Kastamonu, Adapazarı, Izmit, Istanbul and Edirne; South route included Mardin, Diyarbakır, Adıyaman, Malatya, Kahramanmaraş, Kayseri, Nevşehir, Aksaray, Konya, Isparta, Denizli, Antalya in the South. In between these two, Central Anatolia route connected Erzurum, Malatya, Kayseri, Ankara, Bilecik, Bursa, İznik, İzmit, İstanbul [2].

Similar to caravanserais on trade routes to sustain commercial activities [3], Seljuks and Ottomans built *darüşşifa* to provide healthcare for the public varying in language, religion or race. In fact, *darüşşifas* existed since early Islamic civilizations in order to fulfill the function of a hospital. These facilities were understood and defined as the places of health and were given various names such as *bimarhane, maristan, darülmerza, darülafiye, darülsıhha* and *darüşşifa*. The fundamental mind-set and aspire was to provide care for everyone, free of charge. Seljuks was very sensitive about health services, therefore contributed to the development of modern medicine by building health buildings. During the Seljuk Empire many *darüşşifas* were intentionally established on the major trade centers in Anatolia and Mesopotamia in order to provide healthcare and shelter for travelers who fell out of their hometowns for trade purposes [4] [5]. During the Ottoman Empire on the other hand, *darüşşifas* were mostly located in Istanbul and rarely connected to the trade routes. They were built as a part of a large complex (külliye) consisting of a mosque, a caravanserai, a madrasa, and constructed with the order of Sultan [4]. This organization improved the functioning of *darüşşifas* and prevented the feeling of isolation from the public, patients use to experience in *darüşşifas* (Fig1) [6].

Darüşşifas in trade centers admitted inpatients and delivered ambulatory care services for the locals. *Darüşşifas* in Istanbul acted as both hospitals and medical schools. They provided both medical and spiritual treatments [6]. Medical treatments included careful diagnosis of the illness by using some basic, even modern methods such as urinalysis, checking pulse, applying appropriate diet, cleaning the body before medical treatment, preparation and application of appropriate medicine and surgical interventions [4] [5]. Spiritual treatments included consciously planned and designed physical environment. Especially sensory experiences of patients were addressed through natural features in the space, light and music [7] [8].

Major trade centers of Anatolia on the Silk Road were listed in the previous paragraphs, however not all *darüşşifas* located in these centers have survived. Names, locations and construction dates of all *darüşşifas* in Anatolian and Mesopotamia trade centers, which are active between 13. and 19th Centuries by Seljuk and Ottoman Empires [5] are given in Table 1, below. This paper aims at focusing on the well-documented examples of *darüşşifas* by Seljuk and Ottoman Empires, built at the Anatolian trade centers of the major intercontinental network of trade, science and medicine. The architectural characteristics, spatial healing features and the role of architectural space design in healing will be discussed by looking these early examples of hospitals in Anatolia.

Method

Existing *darüşşifas* constitute the heart of this study. Buildings will be analyzed with reference to the previously completed documentation and sources, in terms of plans and volumetric characteristics chronologically. Above and beyond these analyses, documentation putting emphasis on spatial design and features that have impact on health and healing processes will be discussed.

Table 1. *Darüşşifas* built by the Seljuk and Ottoman Empires in the significant trade centers of Anatolia

	Anatolian Centers with Daruşşifa	Daruşşifa by Seljuks	Daruşşifa by Ottomans	Date of Construction
North Route				
1	Trabzon	-	-	
2	Gümüşhane	-	-	
3	Erzurum	-	-	
4	Sivas	Sivas Darüssıhhasssı	-	1217
		Divriği Turan Melik Darüşşifasıve Ulu Camii		1228
5	Tokat	Tokat Muinüddin Süleyman Darülşşifası	-	1255-1275
6	Amasya	Amasya Darülşşifası	-	1222-1232
7	Kastamonu	Kastamonu Ali b. Süleyman Maristanı	-	1272
8	Adapazarı	-	-	
9	İzmit	-	-	
	İstanbul	-	*	
11	Çankırı	Çankırı Cemaleddin Ferruh Düllafiyesi	-	1235
12	Edirne	-	Edirne Sultan II Bayezid Darüşşifası	1488
South Route				
1	Mardin	Mardin Eminüddin Maristanı	-	1108-1112
2	Diyarbakır	-	-	
3	Adıyaman	-	-	
4	Malatya	-	-	
5	Kahramanmaraş	-	-	
6	Kayseri	Kayseri Gevher Neshibe Şifahanesi ve Tıp Medresesi	-	1206
7	Nevşehir	-	-	
8	Konya	Konya Darüşşifası	-	Unknown
9	Isparta	-	-	
10	Antalya	-	-	
11	Denizli	-	-	
Middle Route				
1	Erzurum*	-	-	
2	Malatya*	-	-	
3	Kayseri*	*	-	
4	Manisa		Manisa Hafsa Sultan Darüşşifası	1539
5	Kırşehir	-	-	
6	Ankara	-	-	
7	Bilecik	-	-	
8	Bursa	-	Bursa Yıldırım Bayezid Darüşşifası	1400
9	İznik	-	-	
10	İstanbul	-	Fatih Darüşşifası	1470
			Osmanlı Cüzzamhaneleri ve Üsküdar Miskinler Tekkesi	1514
			Haseki Darüşşifası	1550
			Süleymaniye Darüşşifası ve Tıp Medresesi	1559
			Topkapı Sarayı'ndaki Hastaneve	
			Atik Valide Darüşşifası	1582
			Sultan Ahmed Darüşşifası	1617
			Bezmialem Gureba-I Müslimin Hastanesi	1847
In Other Countries (Darüşşifa/Şifahane buildings that do not exist today)				
1	Musul	Erbil Atabeyi Gökbürü Hastanesi ve Ziyafethanesi		
2	Şam	Nureddin Zengi Hastanesi		
3	Halep	Maristan-ı Atik		
4	Trablusşam	Nureddin Şehid Bimarhanesi		
5	Kahire	Bimaristan-ı Atik		
6		Kalavun (Mansure) Hastahanesi		1284
7	Şam	Kaymeri Hastahanesi		1248
8	Konya (Aksaray)	Darüşşifa		XIII. yüzyıl
9	Konya (Akşehir)	Akşehir Hastanesi		XIII. yüzyıl
10	Konya	Cüzzamhane		
11	Erzurum	Erzurum Darüşşifası		
12	Erzincan	Erzincan Darüşşifası		

"*" refers to trade centers active in two or all branches of the trade routes

Results

The ongoing study puts forth some similarities between *darüşşifa* and madrasa architecture. Both were observed to have large, rectangular open courtyards acting as inner gardens surrounded by arched porticos on four sides that leads to closed rooms. Spacious entrances with large doors and connection to a large "eyvan" to create a gathering space, was a common approach observed. *Darüşşifas* consisted of a hamam for the patients, a room to prepare and store medicine, patient rooms, and doctors' rooms [4] [5]. A further remarkable issue is the special approach in design of *darüşşifas* that addressed sensory experiences of patients. Designs were observed to concentrate on triggering 5 senses with features integrated into the design of the environment such as creation of natural scenes and play of light/shadow in the inner gardens; visual/tactile textures and patterns on interior surfaces; fragrances of aromas and fresh breeze in ventilation of closed spaces; and sounds from nature and music therapy [8]. Study will be completed with detailed and organized data related to the plan organizations, volumetric characteristics given in tables. Spatial features that trigger sensory experience and contribute to health and healing processes will be presented with examples.

Discussions and Concluding Remarks

Early examples of hospitals, Darüşşifas, with architectural and medical programs, and spatial qualities are considered to have a role in the healing process. They are considered as the indicators of the exchange of knowledge (medicine and medical techniques), culture, religion, and technology between the East and West. As a conclusion, discussions on spatial characteristics and qualities of *darüşşifas* will be made to trace and pin the origins of healthcare design and healing by design approach through the Anatolian trade routes.

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LEARNING FROM NATURE, SPRIT OF ARCHITECTURAL DESIGN THROUGH SILK ROAD

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Keywords: Nature, Oriental architecture, Eastern philosophies, Biophilia, Silk Road

Abstract

The interaction between men and nature as one of the most important architecture's guidelines presenting in designing process especially in oriental architecture emanating from Eastern philosophies. The five great religions of Islam, Zoroastrianism, Hinduism, Buddhism and Confucius emphasized the unification concept between men and nature in many different ways. Following the review, in this field, the major question is how to realize the unity between men and nature by observing the special architecture of silk road countries? To answer the question , the used research method is logical argumentation with librarical searching and physical studies with literature survey as the basis of all studies. Twenty survived samples of architecture effecting by nature are selected to study on. As the result, there is a correlation between nature and architecture in fields of colors, materials and contextualism. Accordingly nature and architecture are the key to unity between architects in silk road countries.

1.Introduction

The environmental connection between human and nature, is based on an intrinsic agent that is substance. Nature, knows the architecture space as one of the most important guidelines among different spreads in forming process and its main meaning, will be important and understandable when it is in humans understanding. The architecture is of the categories that has made the meaning of nature understandable for men.The studies show that during the history, the architects, have always been seeking for an order based on using the natural gifts that are set to the order existing on nature. By revising the relation between nature and architecture in eastern culture, this result is given that a respect has caused that the human tries his best in keeping it. It's not possible to study all of religions because of the multiplicity of them ,in this research we study about the religions that possess valuable works in the field of architecture such as Islam, Zoroastrian, Hindu, Buddhist and Confucius. [1]

2.The nature of the point of view of religions

One of the basic aspects of art, is internalizing the artists beliefs. For this reason, the architecture, is not exceptional as a part of art is in relation with environment more than other factors and it is always affected by the ideologies that have formed it. Observing the common viewpoints about nature, will show this point that a different variety of beliefs have been existed in different religions rather than nature that has caused that we see the natural environment in facing with artificial environment. The religions, choose the proper pattern

with these viewpoints in organizing the artificial environment and we can point to the nature-making, nature-fighting, nature-escaping, naturist and unity with nature. Despite there being common points in the way of looking of religions to nature, this is note-worthy that different viewpoints, have caused differences in how architecture behaves with the natural environment. These differences are in a way that the degree of nature has been variable rather than the degree of god-believing till the evils living place. Different viewpoints such as 1) all gods-believing, 2) the natural elements as gods, 3) the nature as god's living place, 4) the holiness of natural elements and their godly-being symbols, 5)the nature as a sign, 6) the nature, as the evils living place.[2]

Table 1: Nature of the point of view of religions ,designed by authors

	All Gods believing	Natural elements as Gods	Nature as God's living place	Holiness of Natural elements	Nature as a sign
Islam					✓
Hindu	✓	✓			
Zoroastrian				✓	
Buddha				✓	
Confucius				✓	

Islam: In Islamic belief, the nature is clear as a manifestation of God. It is created for human, but the human, can't use it in every way that he wants. It is a symbol of laws ruling the world.

Hindu: In Hinduism, the nature is the god and in this religion, a kind of god-believing is observable, as all the world is a part of Brahma and a big part of Hindu, knows the order of nature as the symbol of gods order. In this religion, in addition to god-believing, we see the worship of natural elements as different gods and in real, the gods, are the symbol of nature.

Zoroastrian: The Zoroastrian religion, entitles the worship of Ahura Mazda and in the Zoroaster message, the nature and respect to land and water, soil and plants is seen. In this religion the fire is a symbol of Ahura Mazda and polluting the nature and its elements like water, wind, soil and fire, is a big fault.

Buddha: The Buddha, is a moral religion that has practical concerns rather than theoretic. Buddhism has been the most important source of inspiration and will of Chinese art. The teachings of Buddha recommends the respectful and non-violating view rather than all the living-beings and with more emphasis to the tree. The Buddha, looks at the living-beings and the nature respectfully and tries to prevent the destruction as far as after the appearance of Buddha in china, most of gardens were made naturally and freely and it is tried to imitate the nature and totally, they made a natural landslide in a smaller scale, again.

Confucius: The special feature of Confucius, is the humanistic element. This system, is a human-believingly system and its most important concept is humanity. This religion has changed the concept of higher man radically with this belief that all the humans can reach completeness. Totally, the Chinese philosophy, is emphasized in Confucius system till Buddha and the human feels this world as his home completely and also, supposes him as a complete part of his environment.(e.g.,[2], [3], [4], [5]).

3.Research question and method

The major question is how to realize the unity between men and nature by observing the special architecture of silkroad countries?

The used research method is logical argumentation with librarical searching and physical studies with literature survey as the basis of all studies. The first step is to analyze literature and other related documents. The second step is to rethinking about architecture monuments based on location, culture , religion and the relationship with nature. The third step is to show that architectural monuments beside Silk Road have a lot to do with nature.[6]

4.Case Studies

The following paper, shows the interaction among humans and nature in eastern culture. To reach the answer of how much the nature has been affective in architecture, 20 samples of the remarkable architecture, have been selected and all the cases of the architectural monuments of the countries beside the silk road that the eastern culture has had a resounding role in forming them. Following table show some of these samples.

Table 2: Nature inspiration in architecture, designed by authors

Construction Information									Contextualism (Inspired by Nature)						
Pictures	Name	Location	Architectural Style	Religion					Nature Elements	Architecture In Nature	Nature In Architecture	Conceptual Naturalism	Integrating with Nature	Colors Inspiration	Vernacular Materials
				Islam	Hindu	Zoroastrian	Buddha	Confucius							
	Persepolis	Iran (Fars)	Persian Architecture			✓			✓	✓		✓	✓	✓	✓
	Akshardham	India (Delhi)	Hindu Architecture		✓				✓	✓		✓	✓	✓	✓
	Taj Mahal	India (Agra)	Persian & Hindu Architecture	✓					✓	✓		✓		✓	✓
	Mogao Caves	China	Rock-Cut Architecture				✓		✓				✓	✓	✓
	Shaolin Monastery	China	Buddhist Architecture				✓		✓	✓		✓			✓

5.Discussion and Conclusion

Twenty survived samples of architecture effecting by nature are selected to study on. These study shows that the nature has always been the best source of inspiration for architects.It seems that considerable amounts of architectural monuments through the Silk Road inspired by nature,in the other hand nature can be manifested as the main concept for architectural design through Silk Road.

As the most important result, there is a correlation between nature and architecture in fields of colors, materials and contextualism. Accordingly nature and architecture are the key to unity between architects in silk road countries. we could call the nature as the main stream in understanding concept of Silk Road countries in architecture , art and etc . Finally it could be the main idea for rethinking about culture and it's interaction with architecture.

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FEATURES OF THE EARTH IN THE QUR'AN: FOCUSING ON THE RELATIONSHIP BETWEEN GOD AND HUMAN BEINGS

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Keywords: Islam, Qur'an, Types, Earth, God, Human Beings

1. Introduction

In this paper, we consider the view of nature in the Islamic world. Islam was born in the arid and semi-arid regions of the Arabian Peninsula, and is a widely practiced faith centered on the Middle East. While the natural environment in this region is harsh, it is also a beautiful and comfortable environment overflowing with nature, with an abundance of flowers, fruit trees, and fountains in both public and domestic spaces.

Therefore, we analyze and clarify the features of the Earth described in the Qur'an, which plays a decisive role in the formation of the Islamic worldview. Choosing from among the elements of nature, this paper focuses on the Earth: this is where human beings live and is a foundation comprising a variety of natural elements, including mountains, rivers, and trees. Moreover, even among the creations of God, the creation of the heavens and the Earth are considered to be special. This paper will clarify the relations between God and human beings, and to consider how this relationship is understood.

2. Research text and Methodology

Research text: 451 Arabic verses were analyzed, including ارض (الارض), which literally means "the Earth," but which we translate hereinafter to mean "the Earth verses." When analyzing the Earth verses, we used "The Meaning of the Holy Qur'an" [1]. The Qur'an comprises 114 chapters known with each chapter comprising multiple verses. In listing each of the Qur'an verses, the numbers of the chapter and the verse are written in the form "chapter: verse."

Method of analysis:

1) Extraction of the descriptions indicating the Earth "E", God "G", Human beings "H" and the following 4 themes from the descriptions of the Earth verses. The 4 themes are :

- Relationship between the Earth and God is R(E,G) ;
- Relationship between the Earth and human beings is R(E,H) ;
- Relationship of the Earth as the place where God and human beings act is R(E(G, H)) ; and
- State of the Earth is S(E).

The how to extract is illustrated by examples (Fig. 1, 2).

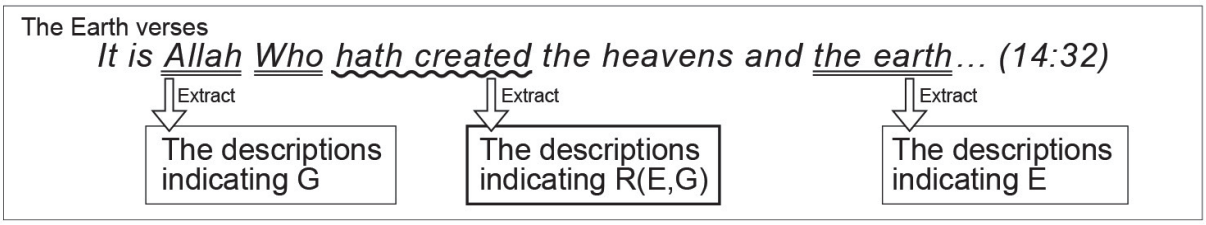

Fig. 1: An Example: Extraction of the descriptions indicating G, E and R(E,G)

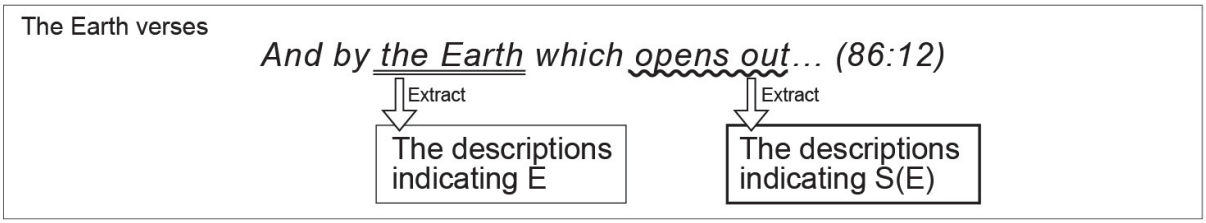

Fig. 2: An Example: Extraction of the descriptions indicating E and S(E)

2) According to the descriptions were extracted, The Earth verses that were similar in content of descriptions to one of 4 themes were summarized and called the “Types of Earth”.

3) In each of 4 themes, features of the Earth are discussed and clarified on the basis of the “Types of Earth”.

3. Type of Earth

From the results of the analysis, the “Types of Earth” were extracted. The content of each of the “Types of Earth” and the Earth verses belonging to each of the “Types of Earth” are as shown below (Table 1).

The “Types of Earth” that are similar in content to R(E,G) were the following 16 types:

(1) the Earth that God created;
(2) the Earth that God has dominion over;
(3) the Earth that God is the Lord of;
(4) the Earth that God spreads out over;
(5) the Earth that God sends down rain onto;
(6) the Earth that God gives life to;
(7) the Earth on which God sets firm mountains;
(8) the Earth that God blesses;
(9) the Earth that God destroys;
(10) the Earth that God made the resting place for human beings;
(11) the Earth where God exists;
(12) those on the Earth belong to God;
(13) those on the Earth are known by God;
(14) those on the Earth praise the Glory of God;
(15) those on the Earth bow down to God; and
(16) those on the Earth are produced by God.

Table 1: The list that shows the "Types of Earth", the Earth verses belonging to the "Types of Earth" and the numbers of the Earth verses in each of 4 themes.

Themes	Types of Earth	The descriptions indicating each theme with similar contents	The Earth verses belonging to the Types of Earth	Number of verses
R(E,G)	(1)	created, hath created, has created, Creator, the creation, Maker	2:29, 2:117, 2:164, 6:1, 6:101, 6:14, 6:73, 6:79, 7:54, 9:36, 10:3, 10:6, 11:7, 12:101, 14:10, 14:19, 14:32, 15:85, 16:3, 17:99, 20:4, 21:16, 21:56, 25:59, 27:60, 29:44, 29:61, 30:22, 30:8, 31:25, 32:4, 35:1, 38:27, 39:38, 39:46, 39:5, 40:57, 41:9, 42:11, 42:29, 43:9, 44:38, 44:39, 45:22, 46:3, 46:33, 50:38, 57:4, 64:3, 65:12	50
	(2)	belongth the dominion, doth belong the dominion, belongs the dominion	2:107, 3:189, 5:17, 5:18, 5:40, 5:120, 7:158, 9:116, 24:42, 25:2, 39:44, 42:49, 43:85, 45:27, 48:14, 57:2, 57:5, 85:9	18
	(3)	the Lord of …the earth	13:16, 17:102, 18:14, 19:65, 21:56, 26:24, 37:5, 38:66, 43:82, 44:7, 45:36, 51:23, 78:37	13
	(4)	spread out, flatted out, expanse, has made…as a carpet	13:3, 15:19, 50:7, 51:48, 55:10, 67:15, 71:19, 77:25, 78:6, 79:30, 84:3, 88:20, 91:6	13
	(5)	sends down rain, send down rain, pour down rain, do drive rain	2:164, 16:65, 18:45, 22:5, 22:63, 23:18, 29:63, 30:24, 31:10, 32:27, 39:21, 41:39, 43:11	13
	(6)	gives life, revive, raise to life	2:164, 16:65, 29:63, 30:19, 30:24, 30:50, 35:9, 36:33, 43:11, 45:5, 57:17	11
	(7)	set up on the earth mountains, has make the earth firm	16:15, 21:31, 31:10, 27:61	4
	(8)	sent down Our blessings, have blessed, had blessed, bestowed blessings on	7:137, 21:71, 21:81, 41:10	4
	(9)	gradually reduce, will be but His handful, split the earth in fragments	13:41, 39:67, 80:26	3
	(10)	has made the earth your couch, has made as a resting place	2:22, 40:64	2
	(11)	is…on	6:3, 43:84	2
	(12)	belong, belongs, belongth, do belong, doth belong	2:116, 2:255, 2:284, 3:109, 3:129, 3:180, 4:126, 4:131, 4:132, 4:171, 6:12, 7:128, 10:55, 10:66, 10:68, 11:123, 14:2, 16:52, 16:77, 20:6, 21:19, 22:64, 24:64, 30:26, 30:27, 31:26, 34:1, 39:63, 42:4, 42:12, 42:53, 48:7, 53:31, 57:10, 63:7	35
	(13)	know, knows,hath knowledge, nothing is hidden, doth know	2:33, 3:5, 3:29, 5:97, 6:59, 10:18, 14:38, 17:55, 18:26, 22:70, 25:6, 27:65, 29:52, 34:2, 35:38, 49:16, 49:18, 50:4, 58:7, 64:4	20
	(14)	declare, do celebrate, let it declare, doth declare	17:44, 24:41, 57:1, 59:1, 59:24, 61:1, 62:1, 64:1	8
	(15)	bow down in worship, doth obeisance, do prostrate	3:83, 13:15, 16:49, 22:18	4
	(16)	have produced, has multiplied	2:267, 16:13, 26:7	3
R(E,H)	(17)	inherit, inheriors of, heirs of	6:165, 7:100, 7:137, 21:105, 27:62, 33:27	6
	(18)	produced…from, multiplied… through, bring…out of	11:61, 23:79, 53:32, 67:24, 71:17	5
	(19)	sustains, sustenance depenth, gives you sustenance, gives you sustenance,	10:31, 11:6, 27:64, 34:24, 35:3	5
	(20)	are signs	45:3, 51:20	2
	(21)	see, behold	7:185, 10:101	2
	(22)	work mischief, make mischief, do mischief, behaved with insolence, walk in insolence, wrong-doing, arrogance, were arrogantly, do evil	2:11, 2:27, 2:60, 2:205, 3:196, 5:32, 5:33, 5:64, 7:56, 7:74, 7:85, 7:127, 7:146, 10:23, 10:83, 11:64, 11:85, 11:116, 12:73, 13:25, 17:37, 17:4, 26:152, 26:183, 27:48, 28:19, 28:39, 28:4, 28:77, 28:83, 29:36, 29:39, 31:18, 35:43, 38:28, 40:75, 41:15, 42:42, 46:20, 47:22	40
	(23)	travel, traveling, are journeying	3:137, 3:156, 4:101, 5:106, 6:11, 12:109, 16:36, 22:46, 27:69, 29:20, 30:9, 30:42, 35:44, 40:21, 40:82, 47:10, 73:20	17
	(24)	drive out, get out, scare…off, remove	7:110, 17:76, 17:103, 14:13, 20:57, 20:63, 26:35	7
	(25)	abide in, will be your dwelling place, Dwell securely, habitation	2:36, 4:100, 7:24, 7:74, 14:14, 17:104	6
R(E(G,H))	(26)	cannot frustrate, can by no means frustrate	24:57, 29:22, 35:44, 42:31, 46:32, 72:12	6
	(27)	make you inheritors, made you heirs, grant them… inheritance	7:129, 10:14, 24:55, 35:39	4
	(28)	create a vicegerent, did indeed make thee a vicegerent	2:30, 38:26	2
S(E)	(29)	slipt asunder, is moved, open out, is pounded to power	19:90, 50:44, 69:14, 86:12, 89:21	5
	(30)	be shaken, shakes, will be in violent	56:4, 67:16, 73:14, 99:1	4
	(31)	wide, speciousness, specious	9:25, 9:118, 29:56, 39:10	4
	(32)	a Garden whose width …of the earth	3:133, 57:21	2

The “Types of Earth” that are similar in content to R(E,H) were the following 9 types:

(17) the Earth that human beings are the inheritors of;
(18) the Earth that creates human beings;
(19) the Earth from which human beings receive sustenance;
(20) the Earth on which there are signs to human beings;
(21) the Earth that human beings behold.

(22) the Earth on which human beings make mischief;
(23) the Earth on which human beings travel;
(24) the Earth that human beings get out of;
(25) the Earth which human beings live on; and

The “Earth” that are similar in content to R(E(G,H)) were the following 3 types:

(26) the Earth as a place where human beings must not frustrate the plans of God;
(27) the Earth that God made human beings the inheritors of; and
(28) the Earth that God made human beings the vicegerents of.

The “Types of Earth” that are similar in content to S(E) were the following 4 types:

(29) the Earth shakes;
(30) the Earth is destroyed;
(31) the Earth is spaciousness; and
(32) the Earth is a wide paradise.

4. Conclusion

From the analysis of the 451 Earth verses, it was possible to extract 32 “Types of Earth.” The features of the Earth are shown below.

1) R(E,G) relationship between the Earth and God: The extracted features relate that God: created the Earth(1); has dominion over it(2); is the Lord of it(3); spreads out over it(4); sends down rain onto it(5); gives it life(6); sets firm mountains on it(7); blesses it(8); destroys it(9); makes it the resting place for human beings(10); and exists on the Earth(11). Moreover, the extracted features relate that the things of the Earth: belong to God(12); are known by God(13); praise the Glory of God(14); bow down to God(15); and are produced by God(16).

2) R(E,H) relationship between the Earth and human beings: The following features were extracted: human beings are the inheritors of the Earth(17); God created human beings from the Earth(18); human beings receive God’s sustenance from the Earth(19); there are signs to human beings on the Earth(20); and human beings behold the Earth(21). Moreover, the extracted features relate that human beings: make mischief on the Earth(22); travel on the Earth(23); are to get out of the Earth(24); and live on the Earth(25).

3) R(E(G,H) relationship of the Earth as a place where God and human beings act: The extracted features relate that the Earth is a place: where human beings must not frustrate the plans of God(26); that human beings inherit from God(27); and of which God has made human beings the vicegerents(28).

4) S(E) states of the Earth: The features extracted were that the Earth is extremely spacious(29) and that it is a wide paradise(30). Moreover, when the Final Judgment approaches(31), the Earth will shake and be destroyed(32).

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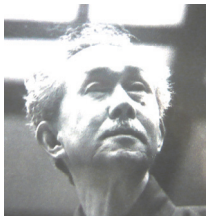
CONSIDERING JAPANESE DESIGN INCLUDING ARCHITECTURE THROUGH BUDDHIST AESTHETIC BY MUNEYOSHI YANAGI



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Keywords: BUDDHIST-AESTHETICS, TARIKI *(ANTI-SELF-POWER)* , MINGEI *(FOLK-CRAFTS)*, CHA-SITSU *(TEA-CEREMONY HOUSE)* , ARCHITECTURE WITHOUT ARCHITECTS

INTRODUCTIONS

Insisting the PURE -LAND OF BEAUTY (an ideal world for the human beings filled with beautiful things), MUNEYOSHI YANAGI (1889-1961) established the aesthetic theory based on BUDDHISM (BUDDHIST AESTHETICS) through understanding some of the his chosen words in the preaching by "AMIDA-NYORAI " (the ultimate existence of BUDDHISM who attained enlightenment). YANAGI's idea was clearly prefaced in his speeches and writings named THE DHARMA GATE OF BEAUTY (laws governing the path to beauty) in 1949. In this study, I would like to show how his ideas were brought out through his very unique and special way of observations for creative processes and results of the indigenous, vernacular, local and traditional Japanese folk-crafts, and to discuss about underlying its influences for design and expressions in historical and modern Japanese architecture.

THE DAHMA GATE OF BEAUTY

Around 1920s, though intensive and energetic researches and studies about Japanese many kinds of existing traditional local folk-crafts disappearing because of modernization, and his increasing interests in BUDDHISM and BUDDHIST AESTHETICS, YANAGI imposed strong mission on him to contribute to the Japanese culture through theorizing BUDDHIST AESTHETICS. Severely criticizing Japan's excessive admiration of the Occident and the lack of Japanese awareness of its own culture after the war, he said, in order that Japan become a really independent nation, it had to impress the world with the significance of Japan as a culturally independent nation. He proposed that there were two things, Japanese art and its BUDDHIST ideas, that Japanese can contribute to world culture with confidence, and concluded that it was time to give a lot of gifts to the Occident, as we have been receiving many things from it. Combining these two things, Japanese art and its BUDDHIST ideas, YANAGI began to develop the idea of preaching his BUDDHIST AESTHETICS.

His objective was to clarify the interpretation of the ideal world filled with beauty is possible from a BUDDHIST point of view, and to explain the BUDDHIST basis on which the nature of beauty chiefly depends. Quoting a category of traditional folk-crafts as the most representing concrete creative phenomenon, he suggested that those made by unknown craftsmen had true beauty and were the most pure and ethical of all objects.

He found that true beauty through his observations on them by "JIKIGE" *BUDDHIST TERM* (he adapted into modern terms "CHOKKAN" meaning a direct insight) . Also, "ICHINYO" *BUDDHIST TERM* (oneness) was emphasized as undifferentiated ways of perceiving beauty instead of differentiated ways of perceiving beauty by intellect and logic. Emphasizing undifferentiated states of beauty itself, he called it "HUNI" *BUDDHIST TERM* (non-dual entirety) or "BISHUU MIBUN" (undifferentiated state of beauty and ugliness). This kind of true beauty exists in a realm called "JODO" (the pure-land : the enlightened world of AMIDA-NYORAI), where there is no dualism, and everything is one and eternal. There is no distinction between the beautiful and the ugly. He named it "THE DAHAMA GATE OF BEAUTY".
" *When I come to attain Buddha-Hood, unless there is no beauty and ugliness among all the beings throughout my land, I will not attain highest enlightenment."* *(1)経典:大無量寿経*

In this fourth of AMIDA'S forty-eight great vows are YANAGI'S found words which could give him the basis upon which to erect an his BUDDHIST AESTHETICS. AMIDA'S declaration means that in the land of BUDDHA the duality of beauty and ugliness does not exist. In the land of BUDDHA no hint of beauty or ugliness is to be found in any corner of it. No dualism figure in our original nature, either. The forms of beauty and ugliness are but the provisional semblances of reality. Dwelling in this inborn nature that transcends the duality of beauty and ugliness is to dwell in a condition of salvation. There we should not immerse ourselves in profitless disputes over beauty and ugliness.

Return to your intrinsic BUDDHA-NATURE which is beyond beauty and ugliness, there is no real or true beauty. YANAGI claims, this ultimate beauty was to be found in medieval crafts and more generally In the Japanese folk-crafts that he researched and discovered. This undifferentiated beauty is to be created by unknown craftsmen who are in the state of non-dual entirety and don't differentiate beauty and ugliness, and are rather simply engaged in repetitive group-labor in the mass, hand-made production of objects for daily use, relying submissively on tradition. Tradition, the accumulation of the experience and wisdom of many generations, is what BUDDHIST calls the "GIVEN POWER" (an aggregate power that in all cases transcends the individuals). To the craftsman, tradition is both the savior and the benefactor. When he follows it, the distinction between talented and untalented disappears. Any craft- man can unfailingly produce a beautiful work of art.

He said. " Even a person not blessed with talent can be saved just as he is. There is no over - looking the fact that many exceptional works of art have been made by nameless and illiterate crafts- man. The medieval IDO-BOWL so highly praised by the great tea-masters is the best illustrations. We do not know the people who made them, but they were not the work of only one potter, or even several. Whoever they were, they could only have been poor artisans. We can hardly suppose that each one of them was a man of genius. They are workmen of the most ordinary kind. They were making low-priced articles. They certainly were not giving any thought to making each piece beautiful. They threw them off simply and effortlessly. If the bowls are described as graceful, that was surely not sought with their makers. The bowls were allowed to follow their own ways into existence, naturally and inevitably. This accounts for the air of elegance with which they are so richly endowed. They are woks untroubled by either beauty or ugliness. This freedom was gained by virtue of their ordinariness and low cost. The overall environment, the received traditions, the selfless work, the simple way of life, natural materials and unsophisticated techniques were combined in the flowering of bowls. When potters were making their wares, they were merely doing matter of fact what was expected of them. " *(2)工芸の道*

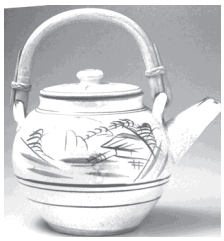
At the end he wrote. "Thus we can see that beauty belongs to the DHARMA-world. If a person dwells in the truth of this DHARMA NATURE, he cannot help dwelling in beauty. Even simple or stupid men are affiliated to beauty just as they are. That is how it is for everyone. This is the significance of AMIDA'S declaration of the transcendence of the opposition of beauty and ugliness. To tell others about such a world of beauty and to let them know of the salvation in that DAHARMA-world is the DAHARMA GATE OF BEAUTY." *(3)美の法門*

Unlike other craft-theorists such as JOHN RUSKIN and WILLIAM MORRIS who emphasized the humanity of craftsman, freedom in creativity or pleasure in labor as the principle of making beautiful things, YANAGI stressed discipline and the law of submissive reliance on tradition which he calls the surrender to the "OTHER-POWER" or "TARIKI" (reliance on an external power or grace) instead of relying on the "SELF-POWER" or "JIRIKI" (self reliance). He said. "Craftsman maybe unlettered, uneducated and lacking any particular force of personality, but it is not form these causes that beauty is produced. He rests in the protecting hand of nature. The beauty of folk-craft is the kind that comes from dependence on the "Other Power". Natural materials, natural processes, and accepting hearts, these are the ingredients necessary at the birth of folk-crafts." *(4) 工芸の道*

YANAGI made a chart contrasting Occidental aesthetics with Buddhist aesthetics.

Occidental aesthetics		Buddhist aesthetics
[Individual person]	vs	[collective people]
[genius person]	vs	[ordinary people]

[way of self-power]	vs	[way of other-power]
[hard practice]	vs	[easy practice]
[signed]	vs	[unsigned]
[fine art]	vs	[craft]
[appreciation]	vs	[functional use in daily life]
[individual creation]	vs	[tradition]
[distinction between beauty and ugly]	vs	[no distinction between beauty and ugly]
[leisure]	vs	[labor]
[small quantity]	vs	[big quantity]
[eccentric]	vs	[normal]



In other words, YANAGI summarized MINGEI folk-crafts wear criterion of beauty such as, handicraft *手工芸*, intimacy *親*, use/function *機能*, health *健康*, naturalness *自然*[spontaneous] simplicity *簡素*, tradition *伝統* [rural]*地方* irregularity *奔放* [vernacular]*固有* inexpensiveness *廉価*, plurality *多数* sincerity/honest of toil *誠実正直な労働* [Indigenous] *土着* selflessness/anonymity *無心,無銘* [anonymous]*無名*

Here, I find the quite similarity of these elements forming the beauty of things suggested by YANAGI to ones forming beautiful architectures by BERNARD RUDOFSKI who proposed to evaluate those charmed architectures, which have been neglected for long time and introduced by him based on the concept "architecture without architect". He summarized its five criterion of charm as [vernacular] [anonymous] [spontaneous] [indigenous] and [rural], that I found accord with MINGEI criterion above.

In 1974 architect-historian B. RUDOFSKI'S "architectures without architects" was exhibited at MOMA and published. It showed us beautiful, interesting and attractive architectures and landscapes all over the world. It was one of the important keys to open architects' and architectural researchers' eyes for those architectures, which lead the new architectural subjects such as urban-design, design-survey, conservation and restoration, and also lead the publishing of progressive and suggestive books like ROBERT VENTURI'S " Learning from Las Vegas" or "Complexity and Contradiction in Architecture" which had quite impacts on contemporary architectural movements as the post-modernism and so on.

BUDDHIST AESTHETIC AND ARCHITECTURE

When we try to find the similarity of MINGEI criterion in Japanese architecture, we can find a typical category for traditional "TEA-HOUSE". YANAGI wrote about TEA CEREMONY-AESTHETIC that established by tea-masters especially SEN RIKYUU in 16th century. RIKYUU adopted such design vocabularies for the place of the tea ceremony (TEA-HOUSE), as [natural], [vernacular], [unknown] and [humble] that exactly fit to criterion for beauty of "MINGEI" proposed by YANAGI.

He wrote. " I have inexhaustible respect to TEA-MASTERS for their discovery of beauty in folk-crafts, their recognition of exceptional and supreme beauty in the normal world, their creation of law and philosophy in its beauty, and their complete devotion to beautifying life. All these things are the reasons why I call the early TEA-MASTERS the great predecessors regarding the beauty of crafts. Their greatness is in the freedom of their creative intuitions to see and seize upon the astonishing beauty lying latent and waiting them in the world of miscellaneous articles that nobody particular noticed. No one ever has as sharp eyes as they had to see the aesthetic value of folk-crafts. They chose nothing but naive handy-crafts called GETEMONO (MINGEI crafts) for their tea-ceremony. Those great masterpieces chosen by them were no more than common GETEMONO costing a few pennies. And the place for it (TEA-HOUSE) was based upon simple peasant cottages." *(5)工芸美論の先駆者について*

The design of TEA-HOUSE was followed for Korean and Japanese local old peasant's houses. TEA-MASTERS digested them and refined them by their own ways. And since then, the law of the design of TEA-HOUSE became the very basic principle "SUKIYA" for various styles of traditional and modern Japanese architectures. And YANAGI'S MINGEI theory suggests us not only the true value of underestimated and neglected genre of designs, but also the importance of spiritual and religious factors that lies behind actual, technical and intellectual way of design. From this point of view, considering of

architectures today, I would like to propose that one of those which are the significant, important and excellent works reflecting YANAGI'S suggestion might be TERUNOBU FUJIMORI*(藤森照信)*'S works. Majoring modern history of architecture and city planning and taught at Tokyo University, he designed several interesting architectures, designing processes of which are quite unique.

He wrote. " RIKYUU was active in the time when in Europe it was the later part of renaissance. Then architectural theory was lead by REONARD da VINCI. He drew that famous human scale graphic to show the basic factor for architecture should be human scale not scale of god or the society. And at the same time RIKYUU designed the new TEA HOUSE which have only one-room of two-TATAMI-mats *(二畳台目)* called TAIAN*(待庵)*. The scale of two-TATAMI-mats is just the same to DAVINCI'S scale of drawing. If ultimate architectural asset of western world might be ST. PETERS CATHEDRAL designed by da VINCI (realized by MICHAELANGELO), RIKYUU'S TAIAN should be ultimate one of eastern world." *(6)人類と建築の歴史*

He wrote. "Today the world of architecture in Japan is without doubt is directed toward white and transparent . The degree of abstraction is accelerating. As an architecture-historian, I do recognize this fact. However, the trouble is that, when I want to make architecture, if I have earth, wood and stone in front of me, my blood becomes excited. I have strong sympathy for cultures peculiar to various regions and indigenous architectural structures." *(7)野蛮ギャルド建築*

About his excellent work "JINCHOUKAN MORIYA HISTORICAL MUSEUM"*(神長官守矢資料館)* he wrote. "About materials: these natural materials blended in well with the surroundings of earth, wood, stone, plants, and water. Moreover, even though natural materials deteriorate when they are exposed to wind and rain, they do not end up appearing dirty like industrial materials. Instead, they take on an attractively weathered look." *(8)野蛮ギャルド建築*

In discussion with art-critic KENJIROU OKAZAKI, FUJIMORI showed his sympathy to ALVA ALTO and SUTEMI HORIGUCHI. Both successfully tried to extract basic indigenous into their famous architectures. Agreeing to FUJIMORI, OKAZAKI said, "Architectural history has to be the manifest of their anonymous productive and underlying construction by many kinds of workers. But after all, it is apt to be talked just as an appearing personal expressions. It's a lie. You (HUJIMORI) know it because you are architecture-historian like BERNARD RUDOFSKI." *(9)野蛮ギャルド建築*

EPILOGUE

Anonymous craftsmen always understand the limit of their ability and also the limit of their field as folk-crafts or architecture. They never sacrifice people's happiness to seek profits or progress. In this point, they are sharing the brief with professional philosophers. J. HUIZINGA said. " New discovery and renovations of existing measures will not always bring higher values and larger happiness. ・・・・ The culture could be destroyed with the real and concrete progress." *(10)Architecture Without Architect*

THE DHARMA GATE OF BEAUTY foretold anonymous and humble craftsman's existence would give good things and spirits to the human beings in this industrialized society. Intelligence and wisdom we can get through this stays not only in the range of aesthetic or social thoughts. It has a significant relationship with how we should live, how we can let others live, and far more, and how we can keep peacefulness in the world.

(1)The Larger Sutra of Eternal Life :BC6C (2)The Road to Crafts:Yanagi1929
(3)The Dharma Gate of Beauty 1949 (4)The Road to Crafts :Yanagi1929
(5)About The Pioneers for Crafts-Aesthetics Articles: M.Yanagi 1981 (6)The History of The human and Architecture: T.Fujimori 2005
(7)(8)(9)Barbarian Architecture:Fujimori1998 (10) Architecture without Architects:B Rudofsky 1964

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TRADITIONAL NOH THEATRE AND ANCIENT GREEK TRAGEDY: COMPARATIVE STUDY TOWARDS A COMMON PERFORMANCE

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Keywords: Noh theatre, ancient Greek Tragedy, hybrid theatre plays

Introduction

In 1899, Greece and Japan established diplomatic relations with various agreements. In 1999 cultural events were organized in both countries to celebrate a century of political, cultural and economic relations. Since then, there has been an intense cultural exchange that includes exhibitions, academics and theatre performances. Theatre holds an important position in the culture of both countries. Since its appearance has had a great impact in social and political life, arts and architecture. Apart from the two millennia time gap between Ancient Greek and Japanese theatre, the two theatre types offer interesting points of comparison **[1]**. A certain analogy can be seen in both types concerning the three elements that define every theatre play: social reaction, performance and architecture **[2]**; a comparison between Japanese traditional Noh theatre and ancient Greek Tragedy, would be beneficent for the study of both. It is of particular interest the production of ancient Greek plays by Japanese theatre groups, translated into Japanese but also adapted to the logic of Noh theatre, as reflected in the works of Tadashi Suzuki and Yukio Ninagawa.

Origins

Although there was an independent development under different circumstances and cultural context, both types of theatre initiated from the worship of a god, Dionysus and Shinto. The ancient Greek drama passed over to Rome stage and from there, to the first renaissance plays, influencing the western drama. The latest form of the 2nd century B.C., came in direct contact with the early forms of Indian Sanskrit theatre. Through Alexander's the Great conquers to the east, the type of Hellenistic theatre was spread, influencing Indian and Chinese drama, and eventually the traditional Noh theatre of Japan **[3]**, although the effect of western theatre to Noh drama is considered to be significantly small in comparison with that of the native Shinto influences **[4]**. Pre Noh theatre includes the performances of a great number celebrating traditions including Chinese origin sangaku **[5]**, which is considered to have had a great impact on it. Certain variations of sangaku referred to various types of performance with song and dance, along with small farce plays formed a mixture that lead to the Nogaku, both Noh and Kyogen theatre. Maintaining a main structure of drama, Noh pass all the external to drama elements to Kyogen, achieving a clear theatrical form focused on the symbolic presentation. In early Noh plays, the dance dominated over drama, as in the tragedies of Aisxilos where lyrics were more emphasized than the epic element. On the other hand, Kyogen theatre was used as an intermission between Noh acts, emphasizing in the comic element as the primary goal was to make its audience laugh. Traditionally, a Noh program includes five Noh plays with comedic Kyogen intermissions in between. Kyogen

play it is often compared to the Italian Commedia dell' Arte, due to the more realistic dialogues and a certain amount of improvisation. A straight connection can be seen though to Greek Satiric Drama, since both plays serve as an intermission to the dramatic parts. The moment that marks the very beginning of ancient Greek drama, is when Thespis, the father of Tragedy, turns and addresses to the chorus starting for the first time a dialogue within the context of a spiritual performance. This dialogue sets the beginning of a presentation of a play, instead of a representation; it first appeared in Athens of 6th century B.C.**[6]**, and evolved to the final form of the performance: "the enrichment of poetry with image and movement" **[7]** at the mid of 5th century. On the contrary, Japanese theatre even from the initial form of spiritual plays, narration and forms of dialogue existed in balance with dance and music. Despite the differences, in terms of performance style, themes and impact to the audience, there is a connection between the two theatre types, as both are focusing on a symbolic presentation of a fact inspired from history or mythology.

Social Aspect

Noh considered being the theatre to entertain the nobles, and as such it was addressed to the upper class. This conservative audience prevented any reformations and novelties to its evolution, thus the moves on the stage, the language and the performance itself, were formed in a way that can be addressed to the specific social class **[8]**. On the other hand, ancient Greek Tragedy through the context of the Drama Games every year was addressed to all citizens including women, children and foreigners. The city - state of Athens provided the price of the ticket to the poor citizens in order to participate as audience, taking under consideration the educational aspect of the theatrical play. In both cases actors formed a separate social class. In ancient Athens acting was an occupation only for men, as only men were allowed to perform **[9]**, while the actors of Noh theatre were members of families specialized in the performing arts; families that had performed various traditional performances for many generations. Women in pre Noh era participated in rituals and performances, but were excluded from traditional Noh plays until recently. In both cases the female character was performed by a man wearing a mask.

Performance and Performance Elements

The three Aristotelian unities of drama are the unities of time, place and action, where a play should have one main action that it follows, with no or few subplots. A play should cover a single physical space, the stage should represent no more than one place, and the action in should take place no more than a day. During this space - time frame, a Greek tragedy opens with a prologue so the audience can have an introduction to the drama. The prologue is followed by the "parodos", after which the story unfolds through three or more episodes. The episodes are interspersed by "stasima", choral interludes explaining or commenting on the situation developing in the play. The tragedy ends with the exodus, concluding the story. The use of space and time in Noh theatre is not portrayed realistically. Rather, there is a freedom of portrayal which requires the members of the audience to use their imagination, as they perceive time and space through certain moves or songs of the actors. Movement in Noh theatre is highly stylized and prescribed, and requires its own slow rhythm of performance **[10]**. Ancient Greek Tragedy on the other hand was based on the interaction of dance with performers, a dance which is a remnant of the past from the religious origins of drama, freer both in expression and in kinesiology. Regarding performance elements, both theatres introduce costumes and masks with a variety of designs, details and colorful combinations, as means of expression and visual impact. The audience could understand

the social status, the emotion or the character of the hero **[11]**. There are many references to the origins of the masks of Noh theatre that focus on the similarity with the grotesque comic masks of the Hellenistic era **[12]**.

Architecture

Regarding architecture, the differences between the two theatre types are significant as to, scale, morphology and means of construction. The form of architecture of the Greek Theatre reflects the society, as it reproduces the gatherings in “agora” and the public life **[13].** The Greek theatre to a greater degree to any of its successors was depended on the natural conditions of the site, and therefore was located in various parts of the city **[14]**. The natural terrain provided to the viewers a good visual and acoustics towards the orchestra **[15]**, where a permeant elevated stage was placed at the rear. Actors were performing on the stage while the rest of the performers where on the orchestra without any additional scenery **[16]**. The whole theatre was made of stone and marble forming a permanent structure. Various mechanical constructions for hovering or appearances from the under stage formed a system of stenographic elements as part of both theatre architecture and performance **[17]**. The Greek theatre reduced the place of dramatic action to its most basic expression, combining stage and auditorium in a single open air space, something that only the Elizabethan theatre model was close to **[18]**. At the very beginning of the Noh theatre, plays were performed on existing stages of shrines and temples **[19]**. Temporary stages constructed for each occasion until the permanent wood structures of the 17th century. The organization of the stage and the stage action is simple as viewers are within the immediacy of the scene, necessary for monitoring the ritual movements of Noh theatre. Actors are performing on an elevated stage, with a roof top which is serving as a diffuser while the under stage as a bass amplifier.

Merging

Every theatre play defines a specific space of performance, as it forms the architecture of the stage. Despite the significand differences between the two types as described, a hybrid play towards a common performance merging characteristics of architecture, stage organization and acting can be achieved due to the adaptability of the theatre play itself **[20]**. Every play is composed on the basis of two factors: the actors and the spectators; theatrical play is a message that is constantly moving between these two poles. This set, actors - spectacle, spectators and message is autonomous, and thus can easily be adapted to various situations. An example of the adaptability of the theatrical play has to do with representation. Modern representations of classical plays have exploited from every aspect of the dramatic text and have it filtered out through almost all contemporary sociological, historical and anthropological aspects. Events from the current political scene become objects of new approaches of classical play. Issues, problems and forms of the past are updated so as to have an immediate impact on contemporary audiences. In relation to the spoken language, drastic changes are also applied. The text-to-performance process belongs entirely to the director's personal assessment **[21]**. Therefore, each play translation could be considered as an adaptation; and no kind of performance has been given so many different interpretations like the ancient drama, which since it first appeared in the post - Renaissance scene in 1585, is being re-translated, commented, modified and reformed until the present day. In the case of Suzuki Tadashi, the ancient drama is degraded to be reformed again in a hybrid that moves in the thematic of the ancient Greek tragedy but through directing and stenographic approach of the Noh theatre. Thus the evolution of the plot acquires a non-space, non-time continuation of Noh performance, whilst does not hesitate to give the main characters

elements from the particular Japanese culture. By contrast, Yukio Ninagawa orientated to a more “universal” theatre **[22]**. His production of “Oedipus Rex” in Athens in 2004, showcases a unique blend of methods, ranging from contemporary drama to traditional Noh, with monk-like costumes and stage installations that include a decayed lotus reflecting Japanese and Asian art styles, within the context of a strictly western music.

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ISTANBUL AND THIRD-WAVE COFFEE SHOPS: A MATCH MADE IN HEAVEN?

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Keywords: third-wave coffee, coffee shop, global vs. local, interior design, design vocabulary, hidden gardens

Quipping with gourmet coffee brewer Çağatay Gülabioğlu, one gets the impression that the Ottomans had never gotten it quite right: Istanbul has one of the oldest coffee brewing cultures on earth, but Gülabioğlu finds the local brew lacking in taste. First, he explains, the beans used for Turkish coffee are of inferior quality, and secondly, the way Turkish coffee is brewed "kills the aroma" [1]. Of course, not all would agree.

By most accounts, it was the Ottomans who introduced coffee to Europe [2]. And while coffee consumption has always been a way of life in the Ottoman Empire and Turkey, second- and third-wave coffee habits have increased this consumption exponentially [3].

Indeed, things seem to have gone full circle, with Turkey –Istanbul in particular– adopting the now-global, third-wave coffee phenomenon hook, line, and sinker. And while the gustatory qualities of coffee are what its aficionados will undoubtedly focus on, to those involved in the built environment, the eerie similarity in architectural vocabulary used in third-wave coffee shops around the world is equally striking.

It is the latter phenomenon that this article aims to focus on, and to decipher its idiosyncrasies as it pertains to a historic yet progressive neighborhood of Istanbul: Beşiktaş.

Methodology

This study adopts a qualitative mode of research, where participative observation, ethnographic data collection, and "emic" data interpretation are the preferred modes of inquiry. The study is dear to me at a personal level as well, for the observations made herein pertain to the neighborhood in which I work, and which I lived in until recently. As such I have had the opportunity to observe firsthand the hasty transformation that Beşiktaş's commercial core has undergone.

I have defined Beşiktaş's commercial core as the area bound by the following streets: Beşiktaş, Ortabahçe, Ihlamurdere, Muradiye Bostanı, Nüzhetiye, Şair Nedim and Süleyman Seba (Fig. 1). This is not the usual definition of the district's commercial core, but I have deemed it appropriate for this study for it is this area that has come to host an inordinately high number of coffee shops of late.

Indeed, a glance at Yandex Panorama[1] reveals that of the 23 coffee shops under scrutiny, only two existed prior to 2012.

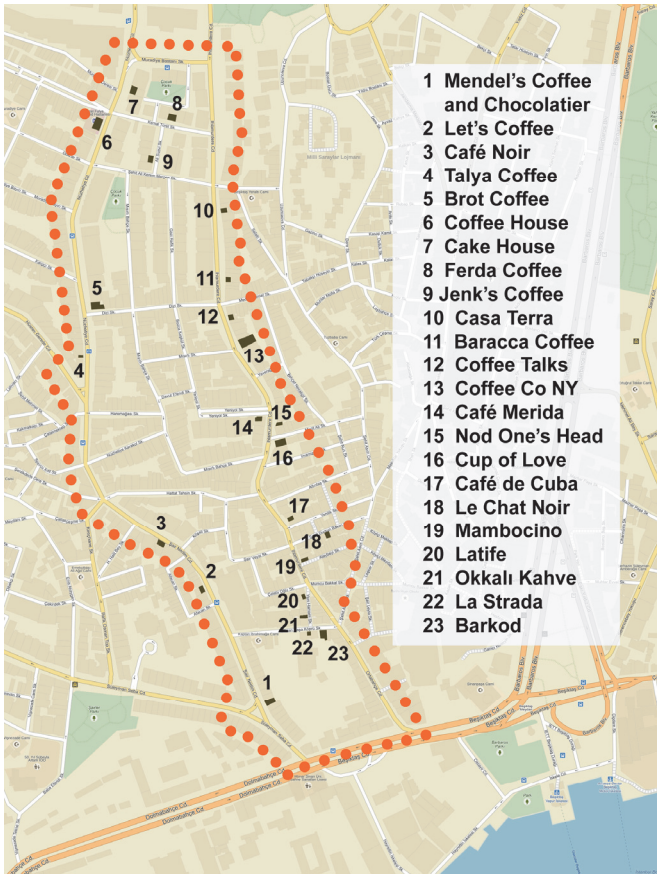

Fig. 1: Coffee shops in Beşiktaş's commercial core (Base map by Yandex)

Hipsters, Crepuscular Chambers, and Hidden Gardens

What has fueled this sudden interest in specialty coffees in Beşiktaş? Granted, the adoption of third wave coffee has been speedy in most parts of the globe, but what renders Istanbul in general—and Beşiktaş in particular—a match made in heaven for third-wave coffee shops?

This is a question with a "layered answer". At the most obvious level might be the rapport between Turkish coffee tradition and the ritualistic nature of specialty coffee roasting and brewing. As Metin Argan explains, Turkish coffee consumption is already rife with rituals [4]. From its preparation in special copper pots to the way it is served, drinking Turkish coffee is highly ceremonial: one doesn't simply "grab Turkish coffee to go." The same can be said of third-wave coffee.

But more specifically, third-wave coffee shops provide a sense of identity and belonging. As Cronin et al. demonstrate, the predominantly 'hipster' patrons of these shops establish symbolic bulwarks against untamed consumer culture, multinational coffee shop chains, McDonaldization, or any other '-ism' viewed to be foreign or undesirable [5]. It is here that the formal design vocabulary of third-wave coffee shops enters the limelight, as will be discussed in more detail below.

All of the above factors have played out in perfect harmony to engender an almost standardized coffee shop in Beşiktaş's commercial core, with a few notable exceptions. But before I delve into an analysis of coffee shops' physical details, I would like to ask: Why do most coffee shops in Beşiktaş (or all over Istanbul, for that matter) look as if they could have come off the same interior designer's drawing board?

As noted above, the fact that these shops cater to an almost-homogeneous class of patrons appears to be the most obvious reason, as the visual trappings of 'hipster culture' seem to be relatively stable world over. Indeed, an image-based internet search for 'third-wave coffee shop' turns up visuals that bear striking resemblance. It is not surprising, therefore, to find that Istanbul's coffee shops also embody these archetypal design elements.

Equally important, however, is the haste with which these shops typically become operational: to maximize profits, both the design and implementation processes are often 'fast tracked'. Standardized design obviously benefits this aim.

Most of the coffee shops in the area under scrutiny feature dark-hued, almost crepuscular interiors, with jet black being a favorite color for walls and sometimes ceilings. Floors are typically paved with patterned tiles.

Ceilings almost invariably sport some sort of wire mesh dropped ceiling, and sometimes wood. These, too, are generally painted jet black, with wood typically being left untreated.
Light fixtures are also standardized, with Edison lamps dominating most coffee shops. These are often affixed on sanitary piping painted, again, jet black.

Yet, as noted above despite the nearly-standardized design vocabulary used in third-wave coffee shops, there are examples that stubbornly refuse to become pastiche.

Take, for example, the Latife and Okkali coffee shops located on Yeni Haman Street. Both of these are 'mid-way' coffee shops which aim to reconcile Turkish coffee tradition with gourmet brewing. They serve Turkish coffee (along with more international brews) and have an interior design scheme that celebrates the local.

Or perhaps more poignantly, there are coffee shops which embody the concept of the 'hidden garden'. Of the 23 coffee shops in the area under investigation, two have back gardens which allow a secluded and lush setting for coffee enjoyers.[2] Since indoor smoking is not allowed in Turkey, these open-air spaces are a boon to the coffee shop.

Furthermore, in an attempt to create as attractive an atmosphere as possible, these back yards are often adorned with plants and greenery. Thus, several of the coffee-shops in question perfectly recreate the Islamic notion of the ‘secret garden’: One passes through a dimly-lit, often-noisy space to end up in a daylight filled, green courtyard. Here, patrons are secluded from the hustle and bustle of street life, and can enjoy their specialty coffees in a lush and serene environment.

Conclusion

As is often the case for elaborate social phenomena, the adoption of third-wave coffee in Istanbul has been delightfully complex and multi-faceted. Rather than repeat the suggestion that Turks have forgotten their own, very rich coffee brewing culture, I would like to turn this

assertion on its head and claim that third-wave coffee has been so hastily adopted in Turkey *because* of the country's extremely rich coffee history.

Furthermore, while the design vocabulary of third-wave coffee shops in Beşiktaş (and by extension, Istanbul) often mimic those of well-known international coffee shops, closer scrutiny reveals that there is much localization going on.

First of these is the 'mid-way' coffee shop which aims to accommodate the local within the global, both in terms of design and also the types of coffee offered.

Secondly, the peculiarities of Beşiktaş's urban fabric, restrictive smoking laws, and a deep-rooted longing for nature have created a uniquely local version of the third-wave coffee shop: one which embodies the notion of the 'hidden garden'.

Finally the way in which these shops are used is somewhat different than at least some examples abroad. In many locales, third-wave coffee shops continue the tradition of second-wave coffee locales where many patrons 'sit alone in the crowd' laptops propped open. In contrast, most third-wave coffee shops in Beşiktaş have patrons who prefer to talk and to interact, rather than sit alone staring at a screen.

All of these issues render the adoption of third-wave coffee shops very unique in Beşiktaş and Istanbul. As such, even an issue as global as third-wave coffee is 'bent and transformed' as it is made local.

Notes

1. Yandex Panorama is similar to Google Street View, but operated by Moscow-based information technologies company, Yandex.
2. Two other shops had back gardens, but had to discontinue using them due to noise related complaints from neighbors.

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IMPACT OF ISLAMIC THOUGHTS ON IRAN SCHOOLS ARCHITECTURE: TRANSFORMATION OF AN INTEGRATED PLACE FOR LIVING, STUDYING AND RELIGIOUS PRACTICES

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Keywords: Religious School, Islamic Architecture, Architecture of Iran Schools, Islamic thoughts (Shariat and Tariqat)

Introduction

There are few documents about schools in Iran before Islamic period. It is written that Jundi Shapur University which was established during Sasanian period was among greatest educational centers in the world at that time. [1] After Islam was spread throughout Iran, schools continued their existence by influence of Islamic thoughts. At first Islamic thoughts in Muslim's holy book -The Quran- was taught in mosques by prophet Muhammad (PBUH). New Muslims gathered around him in a circle shape and listened to the lessons of Islam. This made the traditional form of teaching called "loop teaching"[1]. Some of homeless Muslims (Mohajerin) who stayed in a podium near the mosque called people of Sofeh[2] .By growing the Islam society, mosques were not sufficient for educating all Muslims and also capable of settling Muslim who wanted to study. So schools were founded to answer those needs and gradually made their way through evolution.
The paper discusses how Islamic thoughts have Impact on Iran schools architecture.

According to Prophet Muhammad's (PBUH) Hadith which says: "A moment of thinking is more valuable than thousand years of [just] praying", praying without knowledge is condemned in Islam. The Holy book of Muslims, Quran, is also encouraging Muslims to think thoroughly about everything. Professor Seyed Hossein Nasr states in his book "Islamic art and spirituality" that sacred architecture and calligraphy are two major arts flourished in Islamic history which may be said have issued from mosque [2]. Because of abstraction in both arts which has mutual sense and the prohibition of painting realistic figures calligraphy became so important in Islamic architectural ornamentation.

Islamic Thoughts and Teaching System

In early Islamic Period Islamic thoughts were taught in mosque by loop teaching system. Accommodation of students happened to be in the mosque or on podium near the mosque. Religious practices and ritual ceremonies also were held in the mosque. After generation of Islam and extension of Islamic studies there was a need for initiate schools based on Islamic thoughts. There were limitations for people to attend in holy places in Islamic rules called Shariat. So there should be a separation between three major activities held on schools, "living", "studying" and "religious practices". Absence of greenness and Qibla direction had influence on architectural formation. Congregational prayer which is held in the mosque

needs a wide hall to accommodate a large population and the front wall in which Mihrab is located should be blinded. These provisions made architects to manage the activities by true circulation through spaces. The presence of the Master in the school at madras amongst students while educating has come from Tariqat. Madras[3] places not in geometrical central of school, but has a power on locating within the Hojrehs[4].

Iran Schools Transformation through History

First Islamic Schools literally is said to be founded in 4th century AH in Baghdad named Beit-al-Hekma which means house of wisdom. [3]The nearest formal prototype to school at that time was caravansaries, many Hojrehs assembled round a courtyard which accommodated students. Schools called Nizamieh in Seljuks period was planned to be in four-Ewan pattern. Madras located in four or two side of the school, usually had Dome and was a place for teaching, praying and social gathering.

At Safavid period another kind of schools immerged which called mosque-schools. They were a combination of mosque and schools and were transformed in Zandieh and Qajars period. There were three main types of such schools:

1. Schools separated by levels: These schools formed in two levels. The school is located in down level and the mosque in up level or vice versa. Example: Agha Bozorg mosque-school in Kashan.

2. Schools separated by different courtyard. Example: Molla Ismael mosque-school in Yazd.

3. Schools separated by zone and not a different level. Example: Marvi mosque-school in Tehran.

Historical Period	Century	Explanation	Special features	Examples
Early Islam	1st AH	Mosques were the place for studying Islamic thoughts	Living, studying and religious practices was held in the mosque.	Medinna Mosque
Abbasid	2nd and 3rd AH	In addition to mosques, before Islam schools like Jundi Shapur University were used for studying Islamic thoughts		Jundi Shapur University
Buwayhid	4th AH	First Islamic schools was established	Libraries and Bazars was formed whole the schools.	Beit-al-Hekma in Baghdad
Seljuks	5th and 6th AH	Nizamieh schools was established with four-Evan pattern	Living, studying and religious practices was held in the school following caravansaries pattern	Nizalieh school in Baghdad, Heidarieh school in Qazvin
Ilkhans	8th AH	Schools were influenced by special characteristic of Ilkhans architecture-high proportion	Living, studying and religious practices was held in the school.	Ziayied school in Yazd

Timurid	9th AH	Followed Ilkhans pattern	Living, studying and religious practices was held in the school	Parizad school in Khorasan
Safavid	10th and 11th AH	Immerge of mosque-school pattern	Mosque and school were worked together	Chahar-Bagh school in Isfahan
Zandieh and Qajars	12th and 13th AH	Continuance of mosque-school pattern	Mosque and school were worked together	Agha Bozorg in Kashan

Table 1: Historical development of architectural transformations of Iran schools after Islam (By Author)

Conclusion

The Islamic thought including Shariat and Tariqat has an influence on formation of architecture of schools in Iran. Architecture of schools providing a place for the occurrence of three major activities: “living”, “studying” and “religious practices” through ages, made different type of schools in spite of all other architectural consideration such as site limitations, environmental circumstances, structure and etc.

Notes

1. The interactive “loop teaching” had to be the most traditional method of teaching in Iran. In this method, the teacher sat next to a pillow or a column, and students had to sit in front of teacher or next to him and they made the loop strata. How the students sat beside the teacher was related to the level of achievement and amount of knowledge. Students who were more active sat closer to the teacher in the circle, and those with lower levels of knowledge sat with the new students on the opposite of the teacher. The finest students or the other scholars sat next to the teacher on both sides. The public or the completely new people made new layers of loops and sat in the second and third loops behind the first loop. The loops were usually specified based on the name of lessons; the philosophy loop. [4]
2. Sofeh means podium and is a place for resting.
3. Madras is a kind of large classroom for gathering students in traditional system of education in Iran.
4. Hojreh here means a student room.

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DEVELOPMENT OF A HOUSING COMPLEX IN ACCORDANCE WITH THE SURROUNDING HISTORIC URBAN AREA: *HEISEI-NO-KYOMACHIYA* PROJECT

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Keywords: housing complex, *machiya*, Kyoto, historic urban area, *heisei-no-kyomachiya*

Introduction

This paper aims to show how the housing complex '*Heisei-no-Kyomachiya Higashiyama Yasakadori*' project was designed in accordancewith the context of the surrounding historical environment. The housing project is located in a high density area of Kyoto city. Around the site there are many *Machiyas* remaining, which effectively preserves the traditional landscape. A *Machiya* is a traditional wooden townhouse, and *Machiyas* in Kyoto are called '*Kyomachiyas*'.

Methods

This is a case study aimed at developing a housing design method which enables a housing complex to fit in with its surrounding historical built environment, without sacrificing performance in meeting contemporary needs. The most important characteristic of this study is that it is a real project executed through collaborative research with a local housing developer. The housing project construction was completed by January 2014, and all units have been occupied since the spring of that year.

Fig. 1: aerial photo of the project site

Fig. 2: analysis of building configuration around the site

Fig. 3: front road of the project site

Application of the concept of '*Heisei-no-Kyomachiya*'

'*Heisei-no-Kyomachiya*' is a conceptual framework for a local, modern eco house design paradigm, advocated by Kyoto city government since 2010. This framework was developed due to a serious concern that global models of eco housing, which typically include thick thermal insulation, would destroy the traditional landscape comprised of layered wooden fixtures such as lattices, doors and windows, which has been cultivated over a long history of local dwelling culture in Kyoto city. Our housing project was launched with the aimof applying thisframework when designing a housing complex . The key concepts of '*Heisei-no-Kyomachiya*' are: incorporating intermediate spaces known as 'environmental conditioning spaces' which link the internal and external spaces of the dwelling, and promoting maximum wind flow to cope with the hot and humid climate in the Kyoto basin.

Analyzing the surrounding environment

Eight housing units needed to fit within the project site, which is roughly 1000 square meters. First, we examined how to layout the eight houses to conform to the existing landscape and to most efficiently utilize the limited site area. We examined several layout possibilities from the following points of view : consistent arrangement with the surrounding built environment, garden layout, efficiency in land use, and maintaining a connection to the neighboring alley.

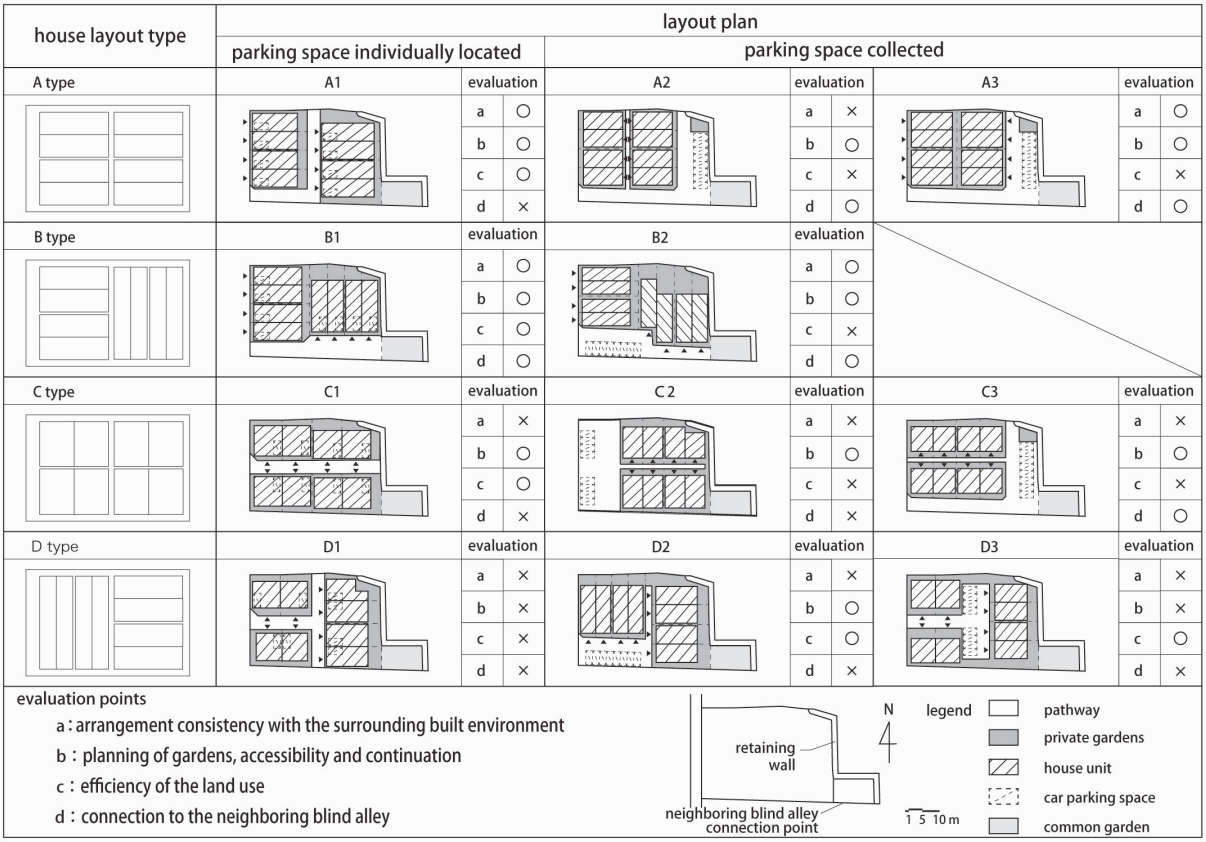

Fig. 4: examination of housing layout possibilities

Five design principles

We brought forth additional new concepts developed from the original principles of '*Heisei-no-Kyomachiya*' in order to design a housing complex consisting of eight houses, as opposed tothe original concept, which was intended to be applicable to an independent, single dwellings. The new concept is based on five design principles: maximum wind flow, nested environmental conditioning space, accessible interconnected open space, adaptable and sustainable floor plan, and the establishment of management rules.

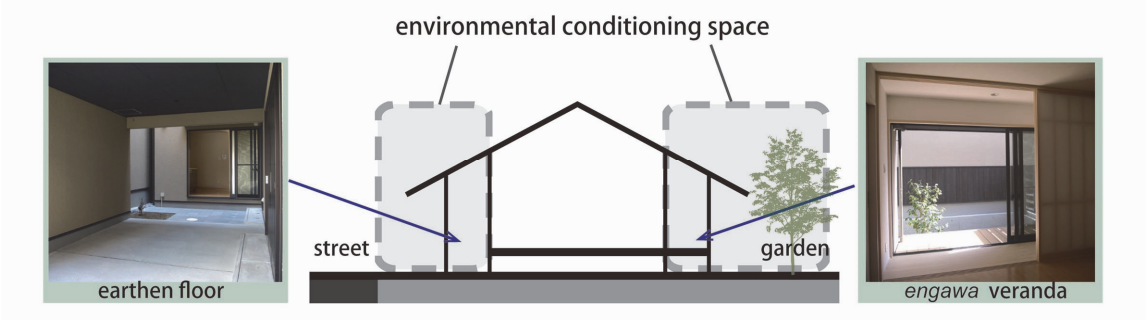

Fig. 5: concept of environmental conditioning space

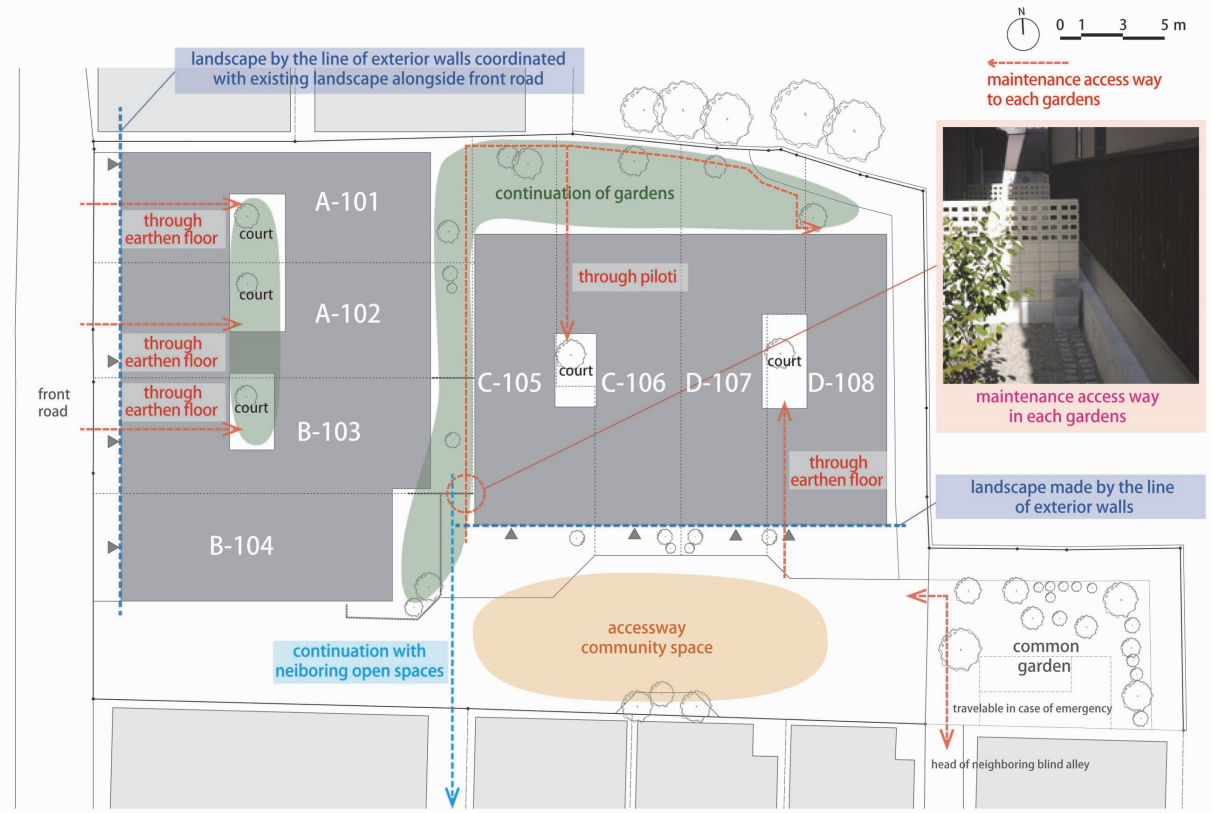

Fig. 6: housing layout plan

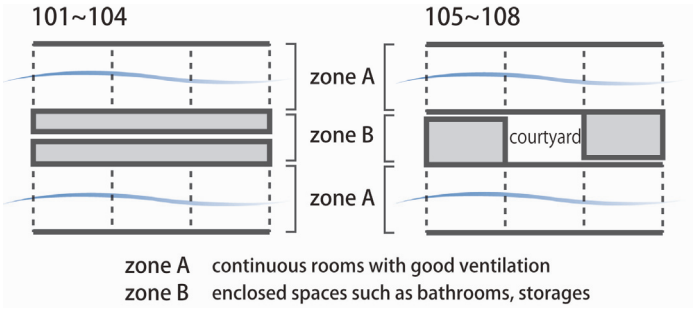

Fig. 7: concept of wind flow

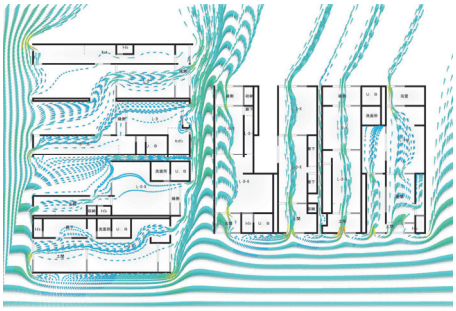

Fig. 8: wind flow simulation

Concluding remarks

While awareness of energy-saving housing design is now required more than ever under the worsening climate change crisis, the broad application of global eco house models may cause serious damage to the historical urban environment of Kyoto, which has accumulated traditions and culture over a long and rich historical context. The design process utilized in this project can be considered as a leading model in making housing complexes better able to fit intotheir surrounding historical environment.

Fig. 9: photos of the completed project

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SHOPPING IN THE CONTEMPORARY CONTEXT: EFFECTS OF CONSUMER BEHAVIOR ON THE DESIGN AND SUSTAINABILITY OF SHOPPING CENTERS

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Keywords: shopping, shopping centre, design criteria for shopping centers, sustainability, change and transformation

Abstract

Shopping has been a never ending activity for human beings throughout ages. Societies have developed specific traditions of shopping in accordance with their cultural, social and economic values. As a result, different forms of spatial organizations serving the so called shopping activity ensued. Worldwide, the final form of shopping manifested itself in Shopping centers, which corresponds to a specific terminology in Turkish, AVM.

The very first AVM in İstanbul was Galleria in the Bakırköy district. Its emergence revealed a fact that AVMs were very profitable investment and they proliferated all over İstanbul and other major cities in Turkey. In an effort to satisfy consumer population needs, increasing number of AVMs were distributed all over urban area. But, a systematic analysis for the sustainability of AVMs failed to follow their proliferation. As for the distance between two AVMs, the important factor is the density of prospective users, accessability, trade types and variety

This paper is an attempt to analyze this topic via some chosen AVM examples in İstanbul. The study starts with the phenomenon of shopping and its historical development. Activity and tradition of shopping and its reflections on spatial organization through ages in Europe, Anatolia and Asia are searched through related literature. The 20th century version of shopping places namely shopping centers or AVM as it is named in Turkey, are studied in historical context.

Introduction

There is growing body of academic literature on shopping centers. Researchers are studying the factors that make shopping centers attractive for users. Literature reveals that both spatial and non spatial factors act upon consumer behavior. According to Ooi and Sim (2007) enhancement of shopping experiences through the employment of exciting trade types and activities can exert a significant magnetic attraction on shoppers. It is seen as shoppers' common expression that going up to higher levels and observing the immediate environment from a wider angle of vision was an exciting experience (Kowinski,1985).

According to existing research, when an AVM reaches its objectives of retail capacity another AVM shows up in a close proximity (Beyard and O'Mara, 1999).

Methodology

The study involves investigation of the physical qualities of shopping centers through some haptic and emotional qualities

- Qualities of shape and form
- Qualities of materials
- Qualities of lighting
- Qualities of color
- Qualities of decoration

The samples of this study consists of 4 shopping centers from İstanbul.

Design criteria for shopping centers are studied under some main headings such as

- Accessability
- Functionality
- Contextuality
- Circulation

Results

After 2001, with the emergence of foreign investment AVMs proliferated. A thorough spatial investigation of İstanbul AVMs revealed that, majority of them are located on the European side of Istanbul. Two major axis indicated a stronger proliferation. First one is the new CBD of İstanbul, on the metro line of Beşiktaş-Maslak axis and second one in close proximity of a major housing district, namely Bakırköy. While the typical user population of AVMs are families in Bakırköy district, students, white collar working people and mostly who care about their life style besides families are the typical users on the Beşiktaş-Maslak axis.

This study indicates that especially the European side of Istanbul has reached its optimum level as far as AVMs are concerned

Discussion and Conclusion

Four AVMs are taken as examples and studied through location, design and sustainability. The study revealed that how much of the expectations of the users are met by the AVM is the main indicator of how sustainable it is.

As for a temporary conclusion it can be said that architectural space is not only physical space but rather lived space. The rule is applicable to shopping centers too. Their sustainable existence is not explained by their geometry or other measurable entities but go beyond that.

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APPLICATION OF LOG-AESTHETIC CURVES TO THE EAVES OF A WOODEN HOUSE

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Keywords: LAC, natural object, gable roof, straight line, curvature, divergent type, cutting line, full scale drawing, fascia, construction accuracy

Introduction

In most contemporary buildings, shapes have straight lines and surfaces are flat. In buildings with curved surfaces, simple forms, including arcs and cylinders, that are easily described in Euclidean geometry are typically used. On the other hand, for most natural objects, shapes and surfaces are curved. These curves have complex forms that are more difficult to describe in Euclidean geometry. Globally, including areas along the Silk Road, buildings formerly included such natural shapes and surfaces. As time has passed, however, many of these have been replaced with simpler forms made up with straight lines and flat surfaces.
While we naturally design using straight lines and flat surfaces, at the same time, we also find beauty in natural curved shapes and surfaces, which are difficult for us to determine and use in architectural design. This seems to be one of the reasons why they are hard to develop in build-to-order buildings, especially houses, as opposed to industrial products, such as cars.
In this research, I experimented with log-aesthetic curves (LACs) [1][2][3], which share characteristics with the curves in natural objects, as eaves for a gabled wooden house as an example of architectural design. My aim is to reveal findings necessary to design houses using such curves.

Methods and Results

(I) SETTING CONDITIONS

The floor plans of the house are described in Fig. 1. For the purpose of this research, I studied the upstairs eaves of the gable roof. I set the conditions of the eaves as shown in Fig. 2. Roof W's pitch is 5:10 (26.57°) and Roof E's pitch is 2.5:10 (14.04°). Each of the three curves, C_W, C_E, and C_S, was selected to connect smoothly with its adjacent straight line. No gutters are mounted on the roofs because of the proximity of deciduous trees.

- C_W connects points W_0 and W_1. The slopes of the tangents at W_0 and W_1 are as shown in Fig. 2. The curvature of C_W at W_0 is 0.
- C_E connects points E_0 and E_1. The slopes of the tangents at E_0 and E_1 are as shown in Fig. 2. The curvature of C_E at E_0 is 0.
- C_S passes through point S_0 and the curvature of C_S at S_0 is 0. C_S is determined to coincide with a part of the curve geometrically similar to right and left reversed curve of C_E. The reason for using a curve geometrically similar to the reversed curve will be explained later.

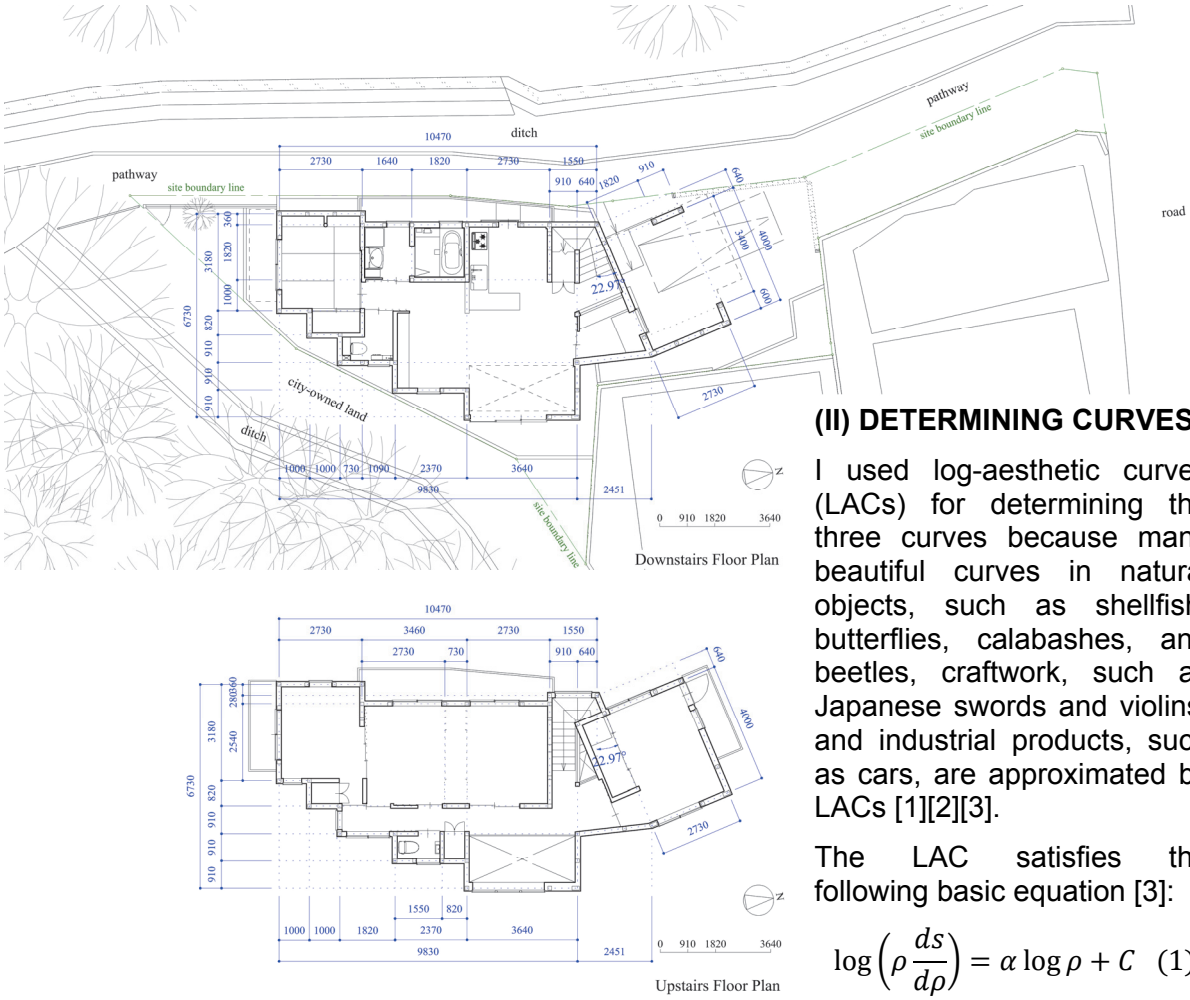

Fig. 1: Site and floor plans S=1:250

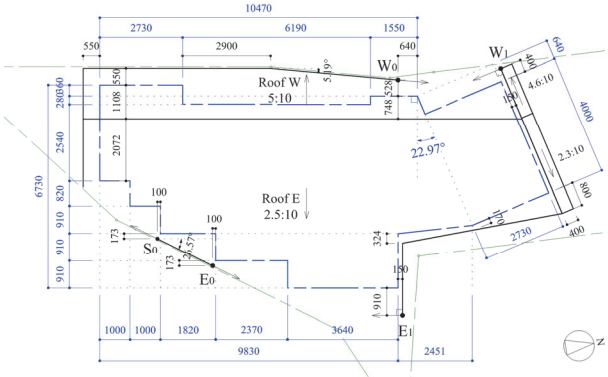

Fig. 2: Conditions of eaves on roof plan S=1:250

(II) DETERMINING CURVES

I used log-aesthetic curves (LACs) for determining the three curves because many beautiful curves in natural objects, such as shellfish, butterflies, calabashes, and beetles, craftwork, such as Japanese swords and violins, and industrial products, such as cars, are approximated by LACs [1][2][3].

The LAC satisfies the following basic equation [3]:

$$\log\left(\rho\frac{ds}{d\rho}\right)=\alpha\log\rho+C \quad (1)$$

where ρ is the curvature radius, s is the arc length, and α and C are constants.

When $\alpha\neq 0$, the general equation of the LACs is:

$$\rho^{\alpha}=c_0 s+c_1 \quad (2)$$

where c_0 and c_1 are constants.

When $\alpha=0$, the general equation of the LACs is:

$$\rho=c_0 e^{c_1 s} \quad (3)$$

The LACs can be classified into divergent $(\alpha<0)$, constant speed $(\alpha=0)$, and convergent $(\alpha>0)$ types [2]. Divergent type LACs with $\alpha=-1$ are referred to as clothoid curves and convergent type LACs with $\alpha=1$ are referred to as logarithmic spirals [3].

Many curves found in natural objects and craftwork are of the divergent or constant speed type [2]. The divergent type LAC can connect to a straight line smoothly since it can have a point where its curvature is 0. On the other hand, the connecting point of the constant speed

type LAC and a straight line always have no curvature continuity since the curve cannot have a point at which its curvature is 0. The convergent type LAC has the same issue [4].

Therefore, I used divergent type LACs to obtain the curves satisfying the conditions described in (I). The LACs were determined not on the roof plan (Fig. 2), but on the plane containing Roofs W or E. The reason for this is that the LACs found in natural objects, craftwork, and industrial products are coplanar, and a curve obtained by projecting the LAC on a plane not parallel to it does not usually satisfy the LACs general equation.

I drew LAC C_W connecting W_0 and W_1 on Roof W using LAC Plugin [5], and set α so that the curvature of C_W at W_0 was 0. As a result, α of C_W became -2.480. In the same way, α of C_E on Roof E became -4.247 (Fig. 3).

It was difficult to determine the α of LAC C_S uniquely after setting its both endpoints because a portion of the curve got too close to or crossed over the site boundary line. Therefore, I first fixed α of C_S to be the same as α of C_E since C_S *and* C_E are apparent at the same time. The C_s was reduced from right and left reversed curve of C_E to be at least 40 mm away from the site boundary line because the reversed curve crossed over the line. The reduction ratio was 0.622 (Fig. 3).

Fig. 4 shows the roof plan and the Fig. 5 shows the elevations.

(III) PRINTING FULL SCALE DRAWING

The allocation of roofboards is shown in Fig. 6. I printed the full scale drawings, including the determined curves and the allocation, on paper rolls. The cutting lines of the roofboards from 20 mm inside of the curves were also printed on the drawing, since the roof is 20 mm larger than the cutting lines.

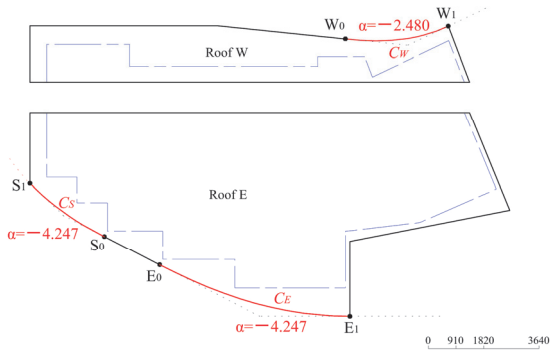

Fig. 3: Determined LAC C_w on the plane containing Roof W and LACs C_E and C_S on the plane containing Roof E S=1:250

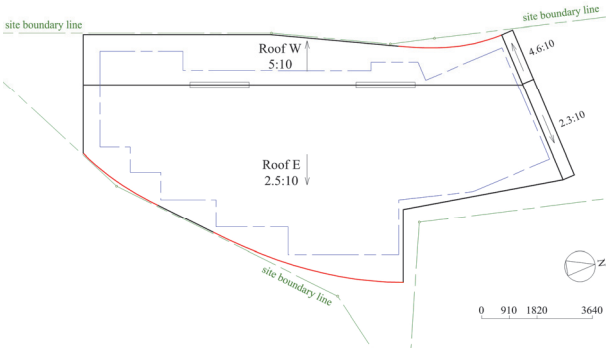

Fig. 4: Roof plan including three curves S=1:250

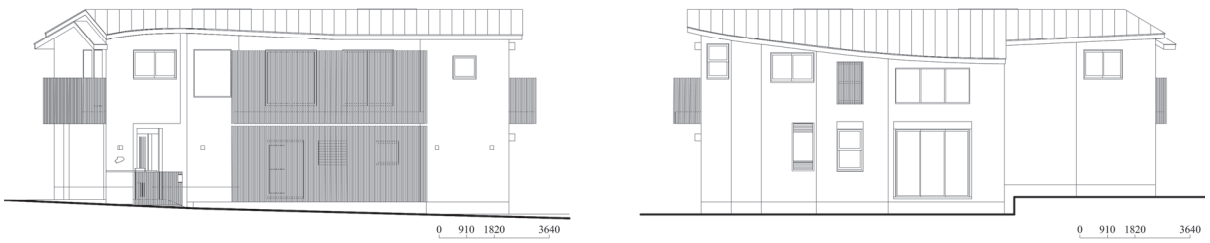

Fig. 5: West and east elevations S=1:250

(IV) CONSTRUCTION OF ROOFS

The full scale drawings were placed on the roofboards (Fig. 7). The roofboards were cut on the cutting lines as per the drawings. They were then roofed with asphalt roofing and Galvalume steel plates, and fasciae were mounted (Figs. 8-11).

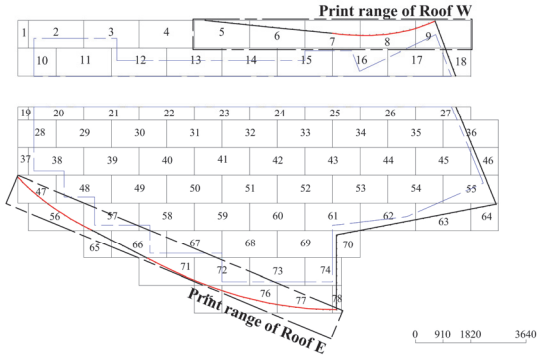

Fig. 6: Allocation of roofboards, cutting lines and print range for full scale drawing S=1:250

Discussion

The curves of eaves can be designed to connect smoothly in a straight line using the divergent type LACs. However, increasing the construction accuracy of the fasciae is not as easy as expected because of its complex curved surface. It would appear that another solution is needed.

Conclusion

This research clarified that the curves of the eaves of a gabled wooden house can be designed and constructed with the help of divergent type LACs sharing characteristics with the curves in natural objects. In the future, we will explore an easier method of increasing the construction accuracy of the fasciae.

Fig. 7: Full scale drawing placed on roofboards

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Fig. 9: Appearance from the north pathway

Fig. 8: Appearance from the northwest side

Fig. 10: Appearance from the east side

Fig. 11: Appearance of the east side

IN SEARCH OF AN IDEAL CITY: THE CASE OF THE OSAKA BUSINESS PARK

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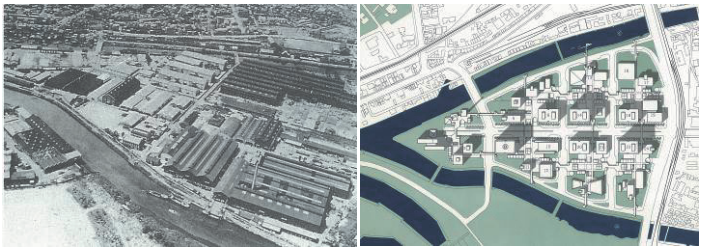
Keywords: master plan, superblock, developer, consortium, leasehold, codification.

1. Introduction

Since the discovery of the ideal city in "The Ten Books on Architecture" written by Vitruvius, ideal cities mainly based on focal plans have been proposed by many architects , such as Filarete , Cesariano or Vasari in the Renaissance period. Among these, Scamozzi's Palmanova was one of the few cities that were realized at that time. In more recent years, variations of form have become more diversified, with proposals seen from Ledoux, Le Corbusier, Hilberseimer or Costa. Further, unlike those architects, social reformers or philanthropists such as More, Saint-Simon, Fourier or Owen [1] announced concepts based on schematic views one after another, questioning Utopia [2] and the ideal city from more social point of view (Fig.1). Compared to the ideal cities of the past several hundred years that were motivated by a desire for protection from newly invented firearms or to escape from the poor living conditions resulting from industrialization, what should cities be like now? As times change, so does the concept of what is ideal. One attempt to answer this question is to review recent business-oriented redevelopment projects, including the Osaka Business Park (OBP) in which the authors participated (Fig.2).

(a)Palmanova by Scamozzi (b)Royal Saltworks by Ledoux

Fig. 1: Some Ideal Cities



(a) Site in mid 60s (b) Master Plan 1969

Fig. 2: Transition of OBP Development

2. Objective

The ideal city has been developed in various ways between the world of the Mandala described by C.Alexander and the star-shaped fort cities that also serve as defense against foreign enemies. Today, the post-industrialization developed countries are absorbed in the creation of charming city centers for the preparation of efficient business creation spaces as they seek the prosperity of tertiary industries. However, the open space and greenery provided there are not necessarily the first principle for citizens, being different from the era of Owen and Howard. They are mainly due to the recognition that the architectural modalities affect the real estate business today.

We will discuss whether or not today's business-oriented cities are a truly comfortable existence -- whether or not one aspect of the ideal city of the 21st century is present -- for not only the people directly involved in the land and buildings, but also for any of the people that live there, work there, or play there and the surrounding people not directly involved. The

objective of research is to figure out the guidelines of urban development suitable for the citizens of tomorrow in the sense of "The City as an Act of Will" as stated by Edmund N. Bacon in his book [3]. In addition, all of the 4 projects this time are projects that received (local) government support for regulations and surrounding infrastructure development, and in which basically real estate development was performed by private companies. The contradistinction of this situation and the previous "ideological prefigurative" ideal city is kept in mind in our discussions.

3. Method

This study employs methodology to analyze and mutually compare the business districts in 4 metropolises that were realized in the latter half of the 20th century. In order to do this, development projects which are of comparative scales and in addition for which there were clear intentions were selected as the subjects. The business overviews of the projects used as subjects here, OBP [4],[5], Tokyo Midtown [6], Battery Park City [7] and Canary Wharf [8], are shown in Table 1 . The analysis procedure is described below:

3-1 On Execution Background

A more objective evaluation is performed by comprehensively comparing the four projects in terms of the project implementation structure, planning premise policies, handling of the image of the desired city that goes beyond the individual buildings, etc. that form the background of the above outputs. The materials used were mainly publications.

3-2 On Physical Output

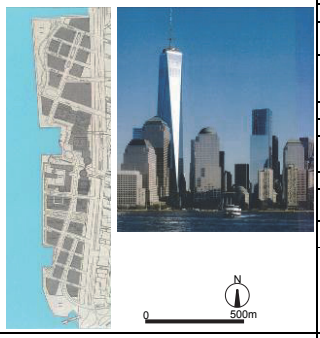
3 concepts to classify Performance Assessment on Spatial Elements were created. The 3 concepts of functionality/usability, perpetuity/adaptability, and amenity/comfortability were listed, and the continuation of the performance of each was studied.

4. Analysis and Findings

Table 2 (showing only OBP here) indicates the performances of the projects organized into 3

Table 1: Four Development Projects

S=1:40,000

Osaka Business Park , Osaka Nikken Sekkei , Takenaka Komuten et al.   	Location: CBD between the river and the Castle Project Area: 26ha Floor Area: 1,000,000 ㎡ Major Function: Office , Commercial , Hotel , Auditorium Shared Function: None Population: 50,000(daytime working) Due Developer: Individual Land/Building Owner Land Status: Individual Landownership Building Status: Individual Ownership Legal Measure: Land Rejustment and Infrastructure Development Project Period: 1968-on going	Buttery Park City , New York Cooper&Eckstut , Cesar Pelli et al.  	Location: Lower Manhattan along the Hudson River Project Area: 37ha Floor Area: 700,000 ㎡(not including residential) Major Function: Office , Commercial , Residential Shared Function: Underground Parking , Building Services System Population: 30,000(daytime working) Due Developer: O&Y of Canada Land Status: UDC(owner)→BPCA(leaseholder) →O&Y et al.(sublease holders) Building Status: O&Y et al.(owners) Legal Measure: Legislation of UDC Project Period: 1979 – 2000
Tokyo Midtown , Tokyo SOM , Nikken Sekkei et al.   	Location: CBD , near Roppongi District Project Area: 10ha Floor Area: 560,000 ㎡ Major Function: Office , Commercial , Hotel , Residential , Museum Shared Function: Underground Parking , Building Services System(for3Towers) Population: 1,200 (nighttime resident) Due Developer: Consortium of 6 companies Land Status: Landownership by the Consortium Building Status: Ownership by the Consortium Legal Measure: Legislation of District Redevelopment Project Period: 2001-2006	Canary Wharf , London SOM , Ceser Pelli et al.   	Location: Else of Dogs , Locklands , along the River Thames Project Area: 40ha Floor Area: 1,500,000 (as of 2015) Major Function: Office , Commercial , Hotel , Railway Station Shared Function: Underground Parking , Building Services System , Population: 110,000(daytime working) Due Developer: O&Y→individual developers Land Status: CWL(leaseholder) → individual owners (sub-leaseholder) Building Status: CWL(owner) → Individual leaseholder Legal Measure: Legislation of LDDC and Enterprize Zone. Project Period: 1985 – on going

categories and evaluated. The individual buildings themselves are not evaluated. In Table 3, the elements (a, b, c) of Table 2 are included in item y and the project execution system is shown as item x and the comprehensive evaluation factors are newly added together with item z. In the following, analysis is performed mainly based on Table 3.

4-1 Project Execution System (x-1, x-2, x-3)

Except for the initial Land Readjustment Project, since the OBP project was not carried out by a single legal body (steering committee system), professionals such as a master architect, construction manager, etc. were not introduced and the formation of specific compulsory rules by them was not performed. On the other hand, for the other 3 projects, the leaseholders and developers formed a unified legal body and executed the project.

4-2 Performance of Spatial Elements（y-1, y-2, y-3）

The integrated development by the same legal body like that mentioned in 4-1 above offers the advantage of being able to require consistency in development of infrastructure other than the individual buildings, and the master planner or master architect provide support for this. Furthermore, this legal body can carry out various kinds of infrastructural development including precedent investment to achieve optimization of the entire district. The differences in decision-making and implementation procedures contrast with those of OBP.

4-3 Comprehensive Factors（z-1, z-1', z-2, z-2'）

One of the fundamental factors in planning is how to handle vehicles, which is a major theme in the creation of a modern city. Specific measures include introduction of transit systems, installation of bypass routes for through traffic, measures to reduce (surface) traffic volume within the district, etc. These involve the understanding and cooperation of the (local) government. For OBP, it was theoretically possible to make the entire east-west trunk line underground, but unfortunately this was done only with the intersection with the JR Line.

Due to the absence of a master architect to plan design rules for OBP, and due to the overall ultra-high density and the adjacent residential area on the west side for TMT, the visual image of the entire district in both cases is thin. The combined use of the two north-south axes of Lower Manhattan and the semiotic expression of the top of the 4 buildings by BPC and the (asymmetric) axis configuration of CW unify the respective whole of each project. In addition, by ensuring waterfront space as a method for mitigation with surrounding existing districts could be effectively introduced for projects other than TMT.

What was found through these analyses is that a system of a single legal body having strong authority and responsibility is necessary. This legal body is the (initial) leaseholder of the land or a consortium. They will also hire a variety of experts in order to make rules for urban development from land utilization to codification of individual building designs and implement them. The selection of the designers for each building and coordination with them is also the work of the legal body, and this body is also involved with the unification of the image and the harmonization with the townscape.

5. Conclusion

OBP has a history of having had the master plan change several times. In the 1972 edition, 2 blocks were developed jointly and the precedent concept such as the aggregation of underground parking again came up. However, due to the system of separate ownership of the land, the project proceeded without being completely in step, including the individual development periods. Also, at the time the fact that there were member companies who were not involved with investment businesses - and who did not consider the need - there was also no initiative to create a consortium to lead to favorable finances. For this early private sector project, there were no such thoughts or systems.

Today, when the shift from the traditional ownership standard to the leasehold standard is often seen in advanced countries, the concept of shared property and term leaseholds is

gradually penetrating land and building projects. In modern times when dictators have become defunct and there is no ideology as pointed out by M.Tafuri, are modern times cities, which advocate functional separation and high efficiency based on capital rationalism, what is considered ideal? Or is the emergence of concepts which surpass modern times first necessary? [9]

Table 2: Performance of Spatial Elements: OBP

Performance		Spatial Elements	Overall : 26ha	Block				
				A: 3.2ha	B: 5.6ha	C: 4.8ha	D: 2.4ha	E: 1.3ha
(a) Functionality/ Usability	Smooth / Safe	Vehicular Road	+ Including East-West Underpass	+ All Peripheral	+ All Peripheral	+ All Peripheral	+ All Peripheral	+ All Peripheral
	Smooth / Safe	Ground level Pedestrian Sidewalk	+ Particularly on the Park Avenue	+ Particularly on the Park Avenue	+ Particularly on the Park Avenue	+ Particularly on the Park Avenue	+ Particularly on the Park Avenue	± Not Well Planned to the West
	Smooth / Safe	Elevated Pedestrian Walkway Network	± Only 2 Networks	+ 2 Walkways but both partially Indoor	- Nil	± intra-Block only	± Walkway but partially Indoor	– Nil
	Enough Capacity and Closer to Workplace	Car Park / Unloading Deck	± Individually laid out Car Park System	- Ugly Above-Grade Car Park Bldg.	- A Ground Level Car Park	± Well Planned System	± Rampways Covered by Bldg.	± Combined with Sunken Drop -Off
(b) Perpetuity/ Adaptability	Underground / Inter-Block Connection	Driveway	– Nil	– Nil	– Nil	– Nil	– Nil	– Nil
	Underground / Intra-Block Connection	Driveway	– Practically No Installation	– Nil	– Nil	± Partially	– Nil	– Nil
	Shared / Underground	Shared Car Park System	– Nil	– Nil	– Nil	– Nil	– Nil	– Under ground
	Centralized / Semi-Centralized	District Shared Services System	– Centralization Planned but not Executed	– Nil	– Nil	– Planned but not Introduced	– Nil	– Nil
(c) Amenity/ Comfortability	Easy to Access	Public Park	– Hard to Access to the West End	– Hard to Access to the West End	– Hard to Access to the West End	– Hard to Access to the West End	– Hard to Access to the West End	± Acceptable Distance but not So Close
	Bigger / Continuous	Roadside Trees	+ Big Trees Well Combined	+ Particularly along the Park Avenue	+ Particularly along the Park Avenue	+ Particularly along the Park Avenue	+ Particularly along the Park Avenue	± Less Attractive on the West Side
	Closer to the Water	Riverside Promenade	+ Continuous 2- Level System	± Less Connected on the North Side	+ Connected to its Central Plaza	+ Connected to its Central Axis	+ Connected to its Axis	± Not Well Connected
	Open to Public	Onsite Greenery / Open Space	+ Introducing "Overall Building Design System"	+ Introducing "Overall Building Design System"	+ Introducing "Overall Building Design System"	+ Introducing "Overall Building Design System"	+ Introducing "Overall Building Design System"	+ Introducing "Overall Building Design System"
	Easy to Access	Commercial / Shops	± Not All the Buildings even those along the Park Avenue	+ Well Planned Ground Floor	± Not Continuous	± Not Continuous to the Hotel at the End	+ Well Planned Ground Floor	- Less Accessive

Table 3: Over-All Summary of Performance

		OBP	TMT	BPC	LCW
x-1	Disposition of Master Planner	1	1	0.5	1
x-2	Disposition of Master Architect	0	1	1	1
x-3	Disposition of Construction Manager	0.5	1	0.5	1
y-1	(a):F/U Safer Pedestrian Walkway	0.5	1	1	1
y-2	(b):P/A Shared Infra-Structure System	0	1	1	1
y-3	(c):A/C Proximity to the Amenity	1	1	1	0.5
z-1	Less On-Site Through Traffic	0	1	1	1
z-1'	Less (Ground-Level)Vehicular Circulation	0	0.5	1	1
z-2	Integrated Visual Image	0.5	0.5	1	1
z-2'	Accordance with Surrounding Townscape	1	0.5	1	1
(Total)		(4.5)	(8.5)	(9)	(9.5)

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INTERNATIONAL EXCHANGE PROGRAMS IN ARCHITECTURAL EDUCATION: INTERCULTURAL STUDY OF ARCHITECTURE (ICSA)

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Keywords: international exchange programs, student exchange, inter-cultural, architectural education

Introduction

As international exchange programs lead to exchange of information, ideas, experiences and provide opportunity for students to develop an understanding of local, global values and cultural issues in different countries; a great number of exchange programs are highly promoted as part of architectural education [1], [2]. The aim of this paper is to discuss the contributions of international exchange programs to architecture students based on the experiences and the outcomes of the exchange program ICSA (Inter Cultural Study of Architecture) that is organized by Mukogawa Women's University, Japan (MWU) and Bahcesehir University, Turkey (BAU). The case of the study, ICSA, is a summer exchange program being held since 2009 in Japan for six weeks with the participation of Japanese and Turkish students and professors. The paper is organized in five chapters. After this Introduction, Chapter Two will discuss the place of exchange programs in architectural education by reviewing the existing literature. Chapter Three will introduce the ICSA program; its content, context, schedule and activities. Then, in Chapter Four, the results of the survey which is conducted to 26 students of ICSA will be presented. Finally, in Chapter Five, feedbacks of the participants will be assessed. For this, observations of the instructors and the answers of the students to survey questions are utilized. The contributions of the program will be discussed in various aspects and the issues that have the potential to improve the program will be outlined.

International Exchange Programs in Architectural Education

Education, especially higher education is becoming international with each passing day as a result of globalization [3], [4]. Based on UNESCO's statistical studies, the number of globally mobile students increased up to 3,4 million students in 2009, from 2,1 million students in 2002 [5]. The number may rise to 8 million by 2025 for international higher education students [6]. With this data, internationalization of the higher education seems to be an important issue to deal with.

As national economies become more interconnected and participation in education expands, higher education is considered as a means to expand students' horizons and help them to better understand the world's languages and business methods. The internationalization of markets and demand for highly skilled individuals encouraged people to gain international experience as part of their education [7]. Studies in recent years indicate that the majority of people attach importance to international education. In that education, world issues are

taught in universities to prepare students for global economy, foreign language is taken as a necessity and study abroad opportunities constitute significant part of the education [8].

Architectural education is one of the most distinctive branches of higher education which requires creative capabilities [9]. So improving students' creativity is an important issue. There are researches that prove the relationship between cultural factors and creativity [10]. "Diversity" at the cultural level challenges people to broaden their ideas about what is right and good [10]. Hence, increasing students' intercultural sensitivities by promoting appreciation of cultural differences appears to be an important issue in architectural education [11].

In this context, international exchange programs play an essential role in architectural education by contributing to inter-cultural understanding of students. Students develop their understandings about other cultures by learning different approaches to life, ways of thinking, traditions, values and beliefs. Since understanding others leads to a better knowledge of oneself, these also help to understand students' own cultures and identities [12].

Intercultural Study of Architecture (ICSA)

ICSA (Inter Cultural Study of Architecture) is an international exchange program for architectural students and faculty which is being held two times in a year, in Summer in Japan (ICSA in Japan), in October in Turkey (ICSA in Istanbul). It is an international organization under the collaboration of MWU and BAU. It was launched in 2009 and since then it has been held for 10 times. ICSA in Istanbul is out of the scope of the paper, so ICSA refers to ICSA in Japan.

ICSA is held in Japan for around six weeks during the summer period with the attendance of 8-10 students and 2 professors of BAU. The main objective of this program is to provide students the opportunity to experience an unfamiliar design process and to observe the role of "cultural interaction" in architectural education, especially in design studio.

All the students in the program are elected through interviews and get scholarships from JASSO (Japan Student Services Organization). The students given this opportunity are determined based upon several criteria like being responsible, hard-working, conformist, good at group studies, etc.

The program has two main stages: Preparation phase in BAU in Spring semester and 6 weeks in MWU in Summer. Preparation phase includes a departmental course named "ARC3916-Architectural Studio in Japan" and a Japanese training course. The purpose of this preparation in the home country is to enable students to be aware of this new and different culture and education system they are about to face and to motivate them to get most of the program. With the help of this preparation, it is aimed to prevent potential cultural shocks, adaptation problems with the new environment and unfamiliar conditions. The period in Japan comprises five main parts: Architectural Design Studio, Basic Design Studio, Lectures, Field Trips and Non-curricular Activities.

BAU students are assigned to 3rd and 4th grade architectural design studios. They are expected to complete an architectural design project in six weeks. Students are not assigned to a group or a tutor, so they are able to get critiques and comments of all instructors. The time (six weeks) given to the architectural project and the routine in the design studio are

different from it is conducted in BAU. There are also major differences in physical conditions of the studios. Each student has her workstation including a drafting desk, separating panels, a cabinet, a double-screen computer and all necessary drawing tools. For desk-crits, instructors visit students' individual units. Students participate in lectures and 1st grade students' Basic Design Studio. Lectures are directly related to design topics and always support architectural design studios while in Basic Design Studio, the topics are generally related with Japanese culture. Ikebana, woodwork and ceramic classes are given by their masters. In woodwork classes, students are asked to design a composition from wooden elements with traditional Japanese timber joint technique by using traditional hand tools.

During the period in Japan, in addition to the studies at the university, there are field trips every Saturday that can be to project sites, modern/traditional buildings, to laboratories, research centers or factories. Besides, extra trips and social activities are organized since it is aimed for students to better recognize and comprehend this culture. Important buildings of Japanese traditional architecture are visited and worldwide known Japanese architects' contemporary designs are seen in their contexts. Within ICSA, students participate in traditional tea ceremonies for understanding the ritual and its spaces and also visit important festivals in order to experience the culture with a large number of Japanese people.

Feedbacks of ICSA participants

In order to discuss the contributions of international exchange programs to architectural students, a survey is conducted for 26 students of ICSA. The survey is structured in four sections: Preparation Phase, During ICSA in Japan, After ICSA and Comments/ Suggestions. In this context, students are subjected to several multiple-choice, yes-no and free questions. This Chapter presents the students' opinions about the program through their answers to the questions. Some of the survey results are shown in Fig. 1, 2 (numbers indicate the number of the students).

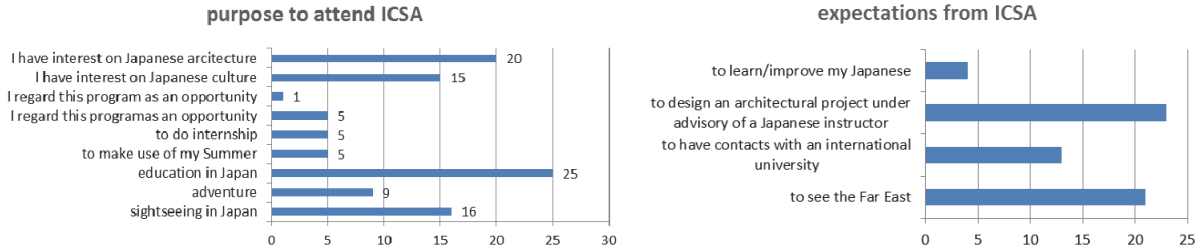

Fig. 1: Purpose to attend ICSA / Expectations from ICSA

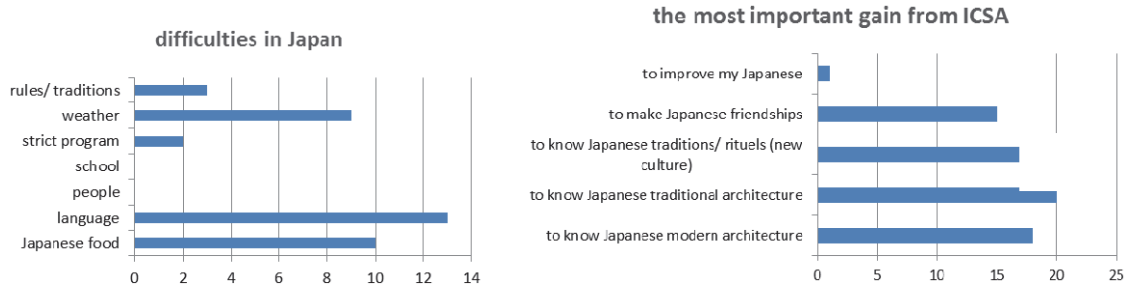

Fig. 2: Difficulties in Japan / The most important gain from ICSA

Discussions and Conclusion

The survey results demonstrate that the biggest motivation of the students for being part of this kind of a program is for academic purposes rather than cultural purposes. The questions regarding the pre and post period of the program show that the structure and the content of the program meet the expectations of the participants. As expected, students found opportunity to observe different ways of studying, design processes and to meet different point of views. For instance, design process through architectural model making was new for ICSA students and they experienced the contributions of studying with a model to the design process thanks to the program.

The inclusion of the cultural issues in the courses was stimulating for the students. Beside the curriculum, extra activities were beneficial to recognize this new culture, their art and architecture. By this means, students gain a great awareness of cultural differences/ similarities and their reflections on design issues. They also become aware of different approaches to global issues like recycling, sustainability and accessibility.

As the instructor of the ICSA, based on the personal observations, it can be easily said, a preparation period is a must for international exchange programs like ICSA. Because cultural and regional differences may cause the students lose some time and decrease their academic performance there. Also, if students are informed well in advance what they will encounter, they will enjoy the program much and will get more benefit.

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Regional characteristics and individuality of living space

Archi-Cultural Interactions through the Silk Road
4th International Conference, Mukogawa Women's Univ., Nishinomiya, Japan, July 16-18,2016
Proceedings

ESSAY ON THE REGIONAL SPATIAL COMPOSITION OF THE MUKO PLAIN

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Keywords: Muko River, Yomo River, spatial composition, Saigoku Kaido, Arima Kaido, landscape, irrigation channel, place-name, microtopography

Introduction

The Muko Plain is located in the lower basin of the Muko and Ina Rivers. Its western part is the result of sediment deposition by the Muko River. The plain is predominately flat and, during these 150 years, its urbanization has drastically increased as Fig.1 shows, making it more and more difficult to determine the direction of its regional spatial composition in the crowded residential areas. Since olden times, this has been an advanced area that linked the ancient capital of Kyoto and economic center of Osaka to western countries. In this paper, I attempt to illustrate some characteristic elements of this region's spatial composition from the perspective of historical roads, irrigation channels, and area divisions.

Fig.1 Map in 1880's (left) and present map (right) of Muko Plain around Amagasaki and Nishinomiya area

Muko Plain and Yomo River as a county boundary

The Muko Plain extends over both of the ancient Muko and Kawabe Counties to form the urban area of today's Nishinomiya and Amagasaki Cities. The Muko River flows down between Nishinomiya and Amagasaki City, establishing a clear administrative boundary. Old maps, however, illustrating the ancient field division system or "Jori-sei," show that Muko County previously occupied the left bank of the Muko River and that the Yomo River served, until the World War Second, as the boundary between Muko and Kawabe Counties. Amagasaki City, established in 1916 as the third city in Hyogo Prefecture, has expanded its municipal area and, in 1942, merged three villages—the Ohsho, Tachibana, and Muko Villages—that were located on the alluvion of the Muko River and belonged to Muko County.

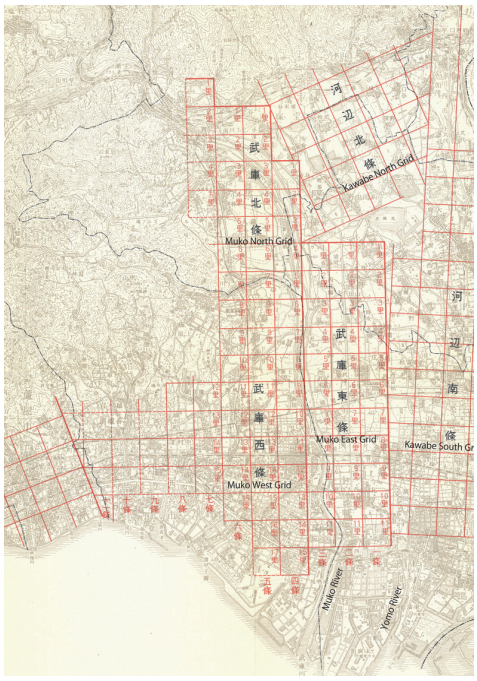

Fig.2 Old map of “Jori-sei” in Muko County (quoted from “Nishinomiya City chronicle” vol.1 and partially revised by author)

The direction of “Jori” of Muko County was different from that of Kawabe County proving the existence of the boundary between these counties. Nevertheless it is so difficult to find out this direction, particularly in Muko East Grid area, because flood disasters had often demolished the topographical features. The Yomo River has since become buried underground partially, causing it to lose its role as boundary. Some tributaries originating from the Rokko Mountains have brought masses of sand that cause frequent flood damage to both sides of the Muko River. The course of the Muko River has never been fixed, generating chaotic wetlands with innumerable narrow streams in case of floods. The Yomo River, like the Shoge River flowing by the ancient Amagasaki Castle, is believed to be one of the old courses of the Muko River. Therefore, the boundary between Muko and Kawabe Counties was not a clear independent course, but an amorphous zone with many channels running through the Muko and Ohsho Villages. These two villages on the left bank of the Muko River have a special bond with the Naruo and Kawaragi Villages on its right bank. There was a plan to unite these four villages to create the new Mukogawa City, whose location is illustrated in Fig.4/right shown later, in 1940 and this fact reflects such boundary characteristics.

Saigoku Kaido and other straight historical roads as topographical axis

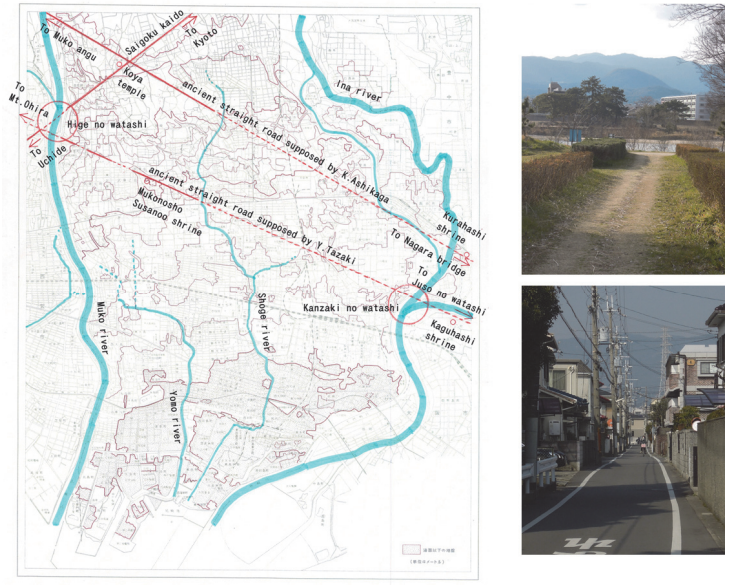

Fig.3 Ancient main roads in Muko Plain[2] and photos of their landmarks(above : Mt. Kabuto for Saigoku Kaido, below : Mt. Ohira for straight road found by Y.Tazaki)

Saigoku Kaido, an ancient main road from Kyoto to Dazaifu in Kyushu, passes in a diagonal line through the Muko Plain even now as national road No.171. Saigoku Kaido is located along some faults at the southern foot of the Hokusetsu Mountains between Takatsuki and Arima. Through this area, it passes almost straight from “Ina no Watashi” of the Ina River in the northeast to “Hige no Watashi” of the Muko River in the southwest, and then continues directly to Uchide Beach, fronting the Inland Sea in ancient times[1]. It could be theorized that travelers walked westward on Saigoku Kaido toward Mount Kabuto, which is

seen close at hand on the opposite bank from “Hige no Watashi” as the above photo of Fig.3 shows, along the Itami Fault. According to K. Ashikaga, ancient Japanese main roads were built in a straight line. He points out the existence of the straight road, that is assumed to be the olden “Arima Kaido”, from the Nagara Bridge of Osaka to “Muko Angu” or the emperor’s temporary adobe on the right bank of the Muko River as an example[3]. I found similar ancient road in this area from “Kanzaki no Watashi” of the Kanzaki River to the above-mentioned “Hige no Watashi.” I believe that this main road, which is mostly nowadays buried under the crowded buildings, linked two important traffic locations, leads to the top of Mount Ohira as a landmark over the Nigawa Valley, and might be ancient Arima Kaido. Along this road, some shrines remain, such as the Kaguhashi Shrine on the left bank of the Kanzaki River, Tsuneyoshi Susanoo Shrine by the Muko River, and Mukonosho Susanoo Shrine, which notably faces southeast and parallel to this road. A microtopographical map shows that this straight road runs along the bottomlands lower than its surroundings, suggesting that it was built intentionally as the shortest course. Such roads, which have landmarks such as mountain tops or tall trees, provided excellent direction for orientation of each region.

Irrigation channels and subsection divisions

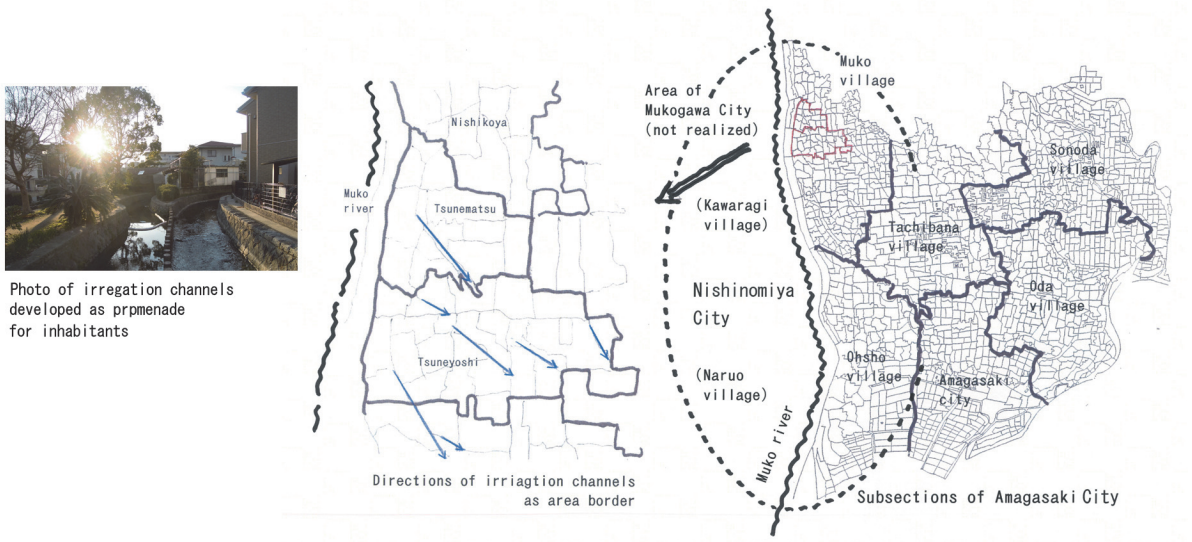

Fig.4 Irrigation channels and division of subsections in Amagasaki City[4] (left : Photo of present landscape of channels in former Muko Villages, center : Directions suggested with some channels in Muko Village, right : Reticulated division of subsections and location of unrealized Mukogawa City)

In some areas of the former Muko Village, many irrigation channels remain but have lost importance for rice farming. Formerly, irrigation maintenance was of the utmost concern to farmers. F. Shono noted that the course of the Shoge River has changed three times and the fork from the Muko River has gradually gone south[5], and, therefore, these channels may be traces of such old courses. Additionally, in this region, the many irrigation disputes internally and against villages on the opposite bank have resulted in common channels such as “Roku-Hi” or six diversion weirs[6]. Nevertheless, such channels could not be drawn on general maps; however, on large-scale maps of this village, we can find some traces of these old channels running in a general northwest to southeast direction. There are a large number of subsections that have distinctive names derived from historical “Myoden”[7]. The “Myoden” is a small rice field owned by local officials in ancient private estates of nobles called “Shoen”.

Each “Myoden” was a small unit surrounded by irrigation channels. Even now, such subsections are often amorphous and desultory, composing complicated village scenes. “Jori-sei” as a national system was very geometrical and massive, while the confused allotment of these subsections seems more human and familiar. Walking along the winding channels in these villages, while we do not find landmarks, we do feel an intuitive direction with such a small scale.

Conclusion

In this paper, I examined the existence of ancient straight roads and the significance of an aggregate of small subsections with irrigation channels in the Muko Plain. Thereby I could find out two directions for this region, although any traces of ancient “Jori” has already disappeared. One is the visual direction of these straight roads which have their landmarks in the distance. Another is the sensuous direction suggested generally by the whole of irrigation channels. These two factors illustrate the orientation of this region individually in order to understand the spatial composition of the Muko Plain. The Muko River is an administrative boundary, but such boundary was historically a linear zone with a certain width, not a line. The boundary distinguishes the two areas and at the same time connects these areas closely. The linear zone around Muko River and Yomo River, which was four villages of unrealized Mukogawa City, is so important for both of Nishinomiya and Amagasaki Cities. In a future study, I would like to examine the transition of the relationship between Nishinomiya and Amagasaki City through their regional spatial compositions.

Notes

1. The course of Saigoku Kaido changed in early modern times in order to pass through Amagasaki Town developed as a castle town and link to Chugoku Kaido directly from Osaka.

2. This microtopographical map is quoted from the document attached to “Amagasaki City Chronicle” vol.1. Because this area is so flat, it is almost impossible to read little undulations in general topographic map.

3. See; K. Ashikaga, “Study on Ancient Geography in Japan”, 1985, and K. Ashikaga, “History read from Maps”, 2012. He has indicated the significance of such straight roads in ancient times against the common theories of the characteristics of spontaneous roads in Japan.

4. These maps quoted from Amagasaki City, “Place-name in Amagasaki”, 1985. This document lists all subsections in Amagasaki City showing their names on the area maps of every administrative unit and also summarizes on the historical transition of these units.

5. See; F. Shono, ‘Transition of landscape in lower area of the Muko River’, in “Historical Study in Hyogo” vol.2, 1954,

6. T. Ikeda, “Roku-Hi”, 1978, is a commemorative document for the 50th anniversary of the union of six irrigation groups in former Muko Village and explains the history of their channels minutely.

7. Concerning “Myoden” and irrigation channel in the Muko Plain, there are included many related subjects in Amagasaki Municipal Archives of Regional Study, “Dictionary on Regional History of Amagasaki”, 1996.

LANDSCAPE ANALYSIS OF TOMBS OF THE FINAL KOFUN PERIOD IN THE KAWACHI AREA USING A THREE-DIMENSIONAL MODEL

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Keywords: Tombs of the Final Kofun period, Kawachi, landscape, visible region, 3-dimensional model

Introduction

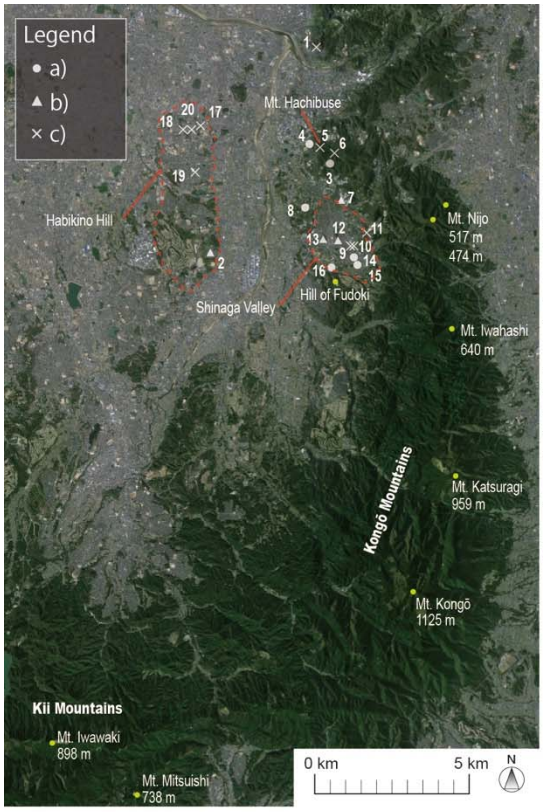
Many of the tomb mounds constructed in the Final Kofun period—the 6th century through the latter part of the 7th century when the trend of keyhole-shaped tomb mounds had faded and the national governance system based on *ritsuryō* codes began—are smaller and look more integral with the natural landscapes when compared with tomb mounds constructed in the early and later Kofun periods, when large-scale tomb mounds were predominant. While the tomb mounds are precious cultural assets that convey ancient thoughts and cultures with an emphasis on achieving harmony between artificial objects and nature, except for a small number of well-preserved tombs, most are ruined and the preservation conditions of the tombs and surrounding natural landscapes are hardly satisfactory. Thus, it is necessary to preserve not only the tomb mounds themselves but also their surrounding natural landscapes.

Previous studies [1, 2] failed to discover any materials associated with the Feng-Shui thoughts held at that time were found. However, concepts originally developed for the selection of tomb locations and the locating principles of tombs of the Final Kofun period must have been based on *Feng-Shui* doctrines imported to Japan. Thus, revealing their locating principles will provide clues to uncover the then-current *Feng-Shui* thoughts.

Methods

The target ancient tombs of my analysis are 20 tombs of the Final Kofun period located in the Kawachi area (Fig.1) that have a Yokoana-shiki sekishitsu (horizontal stone chamber) or Yokoguchi-shiki sekkaku (stone sarcophagus with side entrance) and have a stone chamber/sarcophagus opening in the axial direction [3, 4, 5, 6]. Through on-site survey, I discerned the present conditions, measured the axial directions and took photographs of the landscape from the tombs. The target tombs were classified into the following three types based on their views: a) having a good view; b) having a partially obstructed view; and c) having a bad view (including relocated tombs) (Figs.1, 2). As 10 tombs were classified as c) having a bad view, simulation using a three-dimensional model is essential for visualization of the landscape.

Using a three-dimensional model[1], I created visible region maps and simulated images of the natural landscape view from each tomb (Figs. 3, 4)[2], and analyzed them to determine the characteristics of the natural landscapes from the tombs and the relationship between the landscape and each axial direction.



Tombs
1. Ando G6-3rd Tomb: 50 m (Relocated)
2. Okameishi Tomb: 93 m
3. Kannonzuka Tomb: 96 m
4. Hachibuseyama-nishimine Tomb: 133m
5. Hachibuseya-minamimine Tomb: 194m
6. Oko 8th Tomb: 161 m
7. Taiheizuka Tomb: 69 m
8. Goryoyama Tomb: 80 m
9. Matsuizuka Tomb: 111 m (Relocated)
10. Buddaji Tomb: 119 m
11. Emperor Kotoku's Tomb: 140m
12. Emperor Yomei's Tomb: 92 m
13. Ueshiro Tomb: 76m
14. Emperor Suiko's Tomb: 110 m
15. Futagozuka Tomb: 114m
16. Ishizuka Tomb: 71 m
17. Koguchiyama Tomb: 60 m
18. Hichinjoikenishi Tomb: 60 m (Relocated)
19. Tokurakuyama Tomb: 78 m (Relocated)
20. Tsukaana Tomb: 70 m

Fig. 1: Topographical map of target ancient tombs of the Final Kofun period located in the Kawachi area

Fig. 2: Example photos of each present condition type

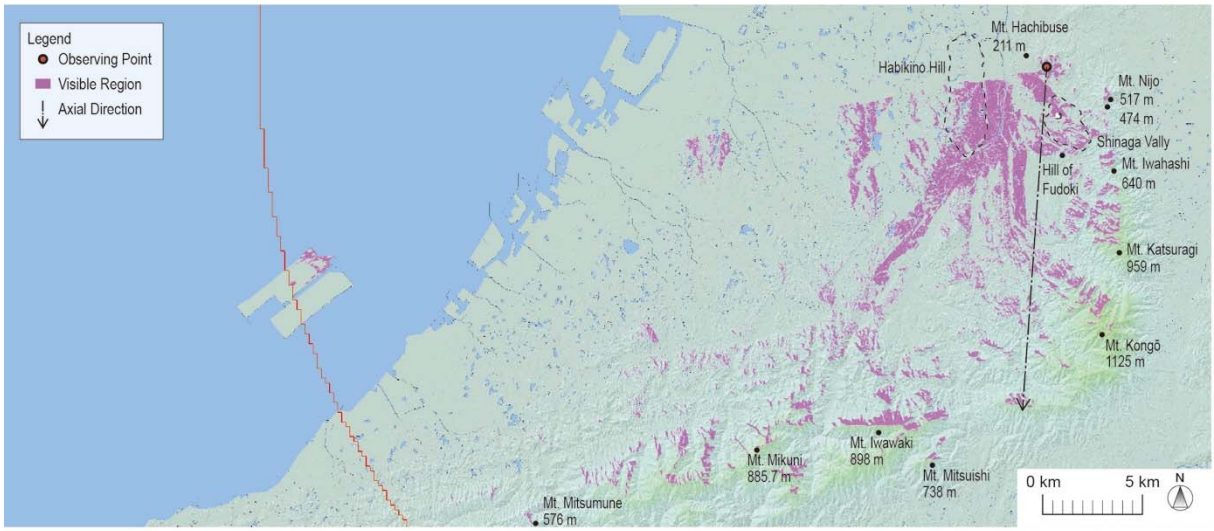


Fig. 3: Visible region map from Oko 8th Tomb (No.6)

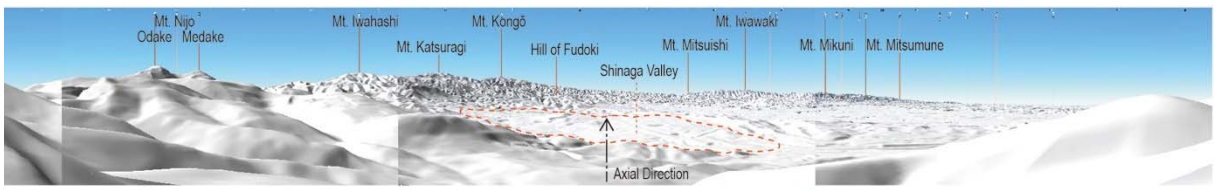


Fig. 4: Simulated image of natural landscape view from Oko 8th Tomb (No.6)

Results and Discussion

Table 1 shows the results of my analysis.

Table 1: Results of Analysis

Legend ○: visible △: partly visible ×: invisible axial direction

No.	Name of Tomb	Present Condition Type	Axis Direction degree (°)	Axis Direction Relationship with Natural Landscape	Visible Landscape Distant View Kongō Mountains Mt. Nijo	Mt. Iwahashi	Mt. Katsuragi	Mt. Kongō	Kii Moutains Mt. Mitsuishi	Mt. Iwawaki	Mt. Mikuni	Mt. Mitsumune	Bay Osaka Bay	Intermediate View Mt. Hachibuse	Shinaga Valley	Hill of Fudoki	Habikino Hill	Characteristics of Natural Landscape view from Each Tomb	Landscape Type
1	Ando G6-3rd	c)	unknown	N/A	△	○	△	○	○	△	○	○	×	○	×	×	○	Intermediate view of Mt. Hachibuse and Habikino Hill and divided distant view of the Kongō and Kii Mountains (Visually Enclosed spece)	2)
2	Okameishi	b)	164	Slightly West of the Mt. Kongō	○	○	○	○	○	○	○	○	×	○	×	×	N/A	Distant panoramic view of the Kongō and Kii Mountains over intermediate view of the basin and short-distance view of Habikino Hill	1)
3	Kannonzuka	a)	161	Between Mt. Katsuragi and Mt. Kongō (Suiko's Tomb)	△	○	○	○	○	○	○	○	×	×	○	○	○	Distant panoramic view of the Kongō and Kii Mountains over intermediate view of Shinaga Vally	1)
4	Hachibuseyama-nishimine	a)	269	Osaka Bay	×	○	○	○	○	○	○	○	○	N/A	○	○	○	Distant panoramic view of Osaka Bay, the Osaka Plain and mountains over intermediate view of Habikino Hill	4)
5	Hachibuseyama-minamimine	c)	168	Mt. Kongō	△	○	○	○	○	○	○	○	○	N/A	○	○	○	Distant panoramic view of the Kongō and Kii Mountains over intermediate view of Shinaga Vally	1)
6	Oko 8th	c)	184	Between Mt. Kongō and Mt. Mitsuishi	△	○	○	○	○	○	○	○	△	N/A	○	○		Distant panoramic view of the Kongō and Kii Mountains over intermediate view of Shinaga Vally	1)
7	Taiheizuka	b)	192	Betweem Mt. Kongō and Mt. Mitsuishi	△	○	○	○	△	△	△	×	×	×	○	○	△	Intermediate view of the surrounding mountains and partially distant view of the Kongō and Kii Mountains (Visually Enclosed Space)	3)
8	Goryoyama	a)	162	Mt. Kongō	△	○	○	○	○	○	○	○	×	×	×	×	×	Distant panoramic view of the Kongō and Kii Mountains over intermediate view of the surrounding mountains	1)
9	Matsuizuka	c)	unknown	N/A	△	○	○	○	×	○	○	○	×	○	○	○	△	Intermediate view of the surrounding mountains and divided distant view of the Kongō and Kii Mountains	2)
10	Buddaji	c)	193	Hill of Fudoki (Emperor Suiko's Tomb)	△	○	○	○	×	○	○	○	×	○	○	○	○	Intermediate view of the surrounding mountains and divided distant view of the Kongō and Kii Mountains	2)
11	Emperor Kotoku's	c)	203	West of the Hill of Fudoki (Futagozuka Tomb)	×	○	△	○	×	○	○	○	△	N/A	○	○	○	Intermediate view of the mountains surrounding Shinaga Vally and divided distant view of the Kongō and Kii Mountains (Visually Enclosed Space)	2)
12	Emperor Yomei's	b)	180	Hill of Fudoki	○	○	○	○	△	○	○	○	×	△	○	○	○	Intermediate view of the mountains surrounding Shinaga Vally and divided distant view of the Kongō and Kii Mountains	2)
13	Ueshiro	b)	184	Between Mt. Kongō and Mt. Mitsuishi	△	○	○	○	○	○	○	○	×	×	○	○	○	Distant panoramic view of the Kongō and Kii Mountains over intermediate view of Shinaga Vally	1)
14	Emperor Suiko's	a)	166	Slightly East of the Mt. Kongō	△	△	○	△	×	△	○	○	×	○	N/A	○	×	Short-distance view of the surrounding mountains in Shinaga Vally and partially distant view of the Kongō and Kii	3)
15	Futagozuka	a)	144	Betweem Mt. Iwahashi and Mt. Katsuragi	△	×	○	△	×	×	△	○	×	△	N/A	○	○	Short-distance view of the surrounding mountains in Shinaga Vally and partially distant view of the Kongō and Kii Mountains (360 degree open on the hill in Shinaga Vally)	3)
16	Ishizuka	a)	unknown	N/A	△	○	○	×	×	△	×	×	×	×	N/A	○	×	Short-distance view of the surrounding mountains in Shinaga Vally and partially distant view of Kongo Mountains	3)
17	Koguchiyama	c)	179	Between Mt. Kongō and Mt. Mitsuishi	○	○	○	○	×	△	×	×	×	○	×	○	N/A	Distant panoramic view of the Kongō Mountains over short-distance view of Habikino Hill	1)
18	Hichinjoikenishi	c)	unknown	N/A	○	○	○	○	×	×	×	×	×	○	×	×	N/A	Short-distance view of Habikino Hill and partially distant view of the Kongō Mountains	3)
19	Tokurakuyama	c)	unknown	N/A	○	○	○	○	△	○	○	△	×	○	△	○	N/A	Distant panoramic view of the Kongō and Kii Mountains over short-distance view of Habikino Hill	1)
20	Tukaana	c)	172	Between Mt. Kongō and Mt. Mitsuishi	○	○	○	○	○	○	○	○	○	○	△	○	N/A	Distant panoramic view of the Kongō and Kii Mountains over short-distance view of Habikino Hill (360 degree open on Habikino hill)	1)

Characteristics of the natural landscape view from each tomb: Most of the landscape views form each tomb consist of the Kongō and/or Kii Mountains as a distant view and basins, hills or mountains as an intermediate and/or short-distance view. The characteristics of the natural landscape views from the 20 tombs were classified into the following four landscape types: 1) having a distant panoramic view of the Kongō and/or Kii Mountains over an intermediate and/or short-distance view of nearby hills and/or mountains (Nos.2, 3, 5, 6, 8, 13, 17, 19 and 20); 2) having an intermediate view of the surrounding mountains and a divided distant view of the Kongō and/or Kii Mountains (Nos.1, 9, 10, 11 and 12); 3) having an intermediate and/or short-distance view of the surrounding mountains and a partially distant view of the Kongō and/or Kii Mountains. (Nos. 7, 14, 15, 16 and 18); 4) having a distant panoramic view of Osaka Bay, the Osaka Plain and mountains (No. 4).

Relationship between the natural landscape and the axial direction of each tomb: The axial directions of almost all of the tombs face mountains (Nos. 2, 5, 8 and 14 face Mt. Kongō; Nos. 10, 11 and 12 face the Hill of Fudoki; Nos. 6,11,13,17 and 20 face between Mt. Kongō and Mt. Mitsuishi; and Nos. 3 and 15 face the Kongō Mountains). The exception is No. 4, whose axial direction faces Osaka Bay. It is possible that the axial directions of nearly all of the tombs were selected based on the mountain views, in particular Mt. Kongō and the Kongō Mountains.

Conclusion

Using a three-dimensional model, I analyzed the natural landscape views from 20 tombs of the Final Kofun period located in the Kawachi area to determine their characteristics and the relationship between landscape and each axial direction. As a result, I clarified the following:

1. The characteristics of the natural landscape views from the 20 tombs were classified into the following four landscape types: 1) having a distant panoramic view of the Kongō and/or Kii Mountains (9 tombs) ; 2) having an intermediate view of the surrounding mountains and a divided distant view of the Kongō and/or Kii Mountains (5 tombs) ; 3) having an intermediate and/or short-distance view of the surrounding mountains and a partially distant view (5 tombs); and 4) having a distant panoramic view of Osaka Bay (1 tomb).
2. It is quite possible that the axial directions of almost all of these tombs were selected based on their mountain views.

Notes

1. The three-dimensional model was developed by using 5 m mesh data distributed by the Geographical Survey Institute using the 'KASHIMIR 3D Ver. 9.2.3' software.
2. The visible range was calculated using the following settings: Center of calculation: position of each tomb and calculation range: 40-km radius. The simulated image of the natural landscape view was calculated using the following settings: Height above the ground: 1 m, photographing range: 40 km; and angle of depression: 0 degrees.

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THE IMPACT OF SOCIAL AND CULTURAL FACTORS IN HOUSING TRANSITION IN IRAN

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Keywords: House, typology, morphology, culture, historical values

Abstract

In the half century since World War II, patterns of housing have been transformed by rapid political social and technical change. Housing has been the center of political and cultural controversy, not least in Iran where tradition and modernity have been juxtaposed in conflicting world views and traditions. Teheran has experienced an ongoing process of economic and social transformations which has seen major change to the fabric of society and its long held traditional values. The present study of the Iranian home analyzes its development trajectory in some historical detail and explores the process of Iran's modernization by examining the nation's interior design in the context of a specific regional background in the context of broader currents of change.

In this regard, the socio-cultural characteristics and lifestyles of inhabitants provide a significant impact on the design of the house and settlement. This shows that it is not possible to separate a house design from the owners because house design is centered on and around the house owner's characteristics. The inquiry into the correlation between socio-cultural and morpho-typological factors in shaping residences demands a methodology that can weigh factors holistically. To reach this target, a both quantitative and qualitative methods have been used to analyse the changes over time of the modern house.

1. Introduction

According to Perkins(2002) [1], an awareness of social and cultural factors will enrich the conventional design perspectives of architects and may assist sustainable and ecological development, provided that this is reflected in the conceptualization of housing design. Sustainability in these two fields can result in the development of social and cultural impacts that can transform the end product or, as in this dissertation, the dwelling unit.

Architects in the early 20th century suggested that a new architecture was needed in response to new industry, technologies, mobility, and changing social and cultural orders.". The consequent radical alteration in typology of new housing projects was concomitant with conspicuous change in lifestyle of residents. Change in the usage of new furniture, new public spaces, increasing independence of residents and so on, were mostly the results of new lifestyle which in its turn has been affected by new housing.

The social requirements of inhabitants as the end users of houses embraces their needs, habits and demands. In consequence there is a need to study the social life and culture of residents as two major factors in shaping the living area.

In terms of the social unit residing in a single or extended family house, developing countries have faced important changes in household composition, and extended families have been replaced by nuclear families composed of 4 to 5 members. As a result, important changes have occurred in the physical form of houses and households, while simultaneously striving to preserve their cultural values. An ideal house form, in this regard, should respect the needs of a new generation, while at the same time it should accommodate cultural values and traditional lifestyles (Mirmoghtadaee, 2009) [2] .

2. Context of Study

This study will embrace the broader context of Mediterranean world through the lens of the transformations of Iranian society, especially the middle class people which can be viewed as an example of a developing city in a developing country.

The changes It can be observed that the impact of increasing living standards on the level of lifestyle and standards of living space has been affected by the growth in the economy, industry and welfare.

In Tehran, the analytical approach taken is to consider the changes in lifestyle in the twentieth century in their regional and cultural context as the genesis of a pervasive architectural typology rather than the examination of architectural history. With this approach, the immediate needs of residents are found to be those ones that form the spaces and places of residences.

To reach this target, the main variables determining the socio-cultural factors are narrowed to those that are discussed in terms of the lifestyle of the sample population. This accords with the fact that in most countries, housing policy has been subject to noticeable change in recent decades. The shift from supply to demand and from government-dominated social housing to a more market-oriented approach has emerged since the 1970s (Smith and Oxley, 1997 ([3].In the case of Iran the impulse for this work has been the process of change from the introduction of modern housing projects by the central government to their democratization through spatial planning the application of modern and postmodern styles by private sector.

3. Methodology

In order to trace the process of interaction and transition, this study will utilize the archival records of the building approvals of municipal authorities to examine the sequential changes in the service areas of dwelling over a thirty year period. The specific areas examined will be for food preparation and bathing, which reflect directly family relationships and internal arrangements. This data will allow the cataloguing of change in spatial planning of residential interiors to look at transitions in the social arrangements implicit in the architectural provisions of apartment and detached housing developments. It will enable the observation of the changing structures of the family unit, the position of women and the relationship between dwelling and workplace.

4. Modernism and residences

The modern movement in architecture which evolved in Europe in the First World War, (Sudjic & Beyerle, 1999) [4], resulted in the emergence of the 'Modern houses' that had plain unornamented walls, large areas of glass, internally separate rooms and a continuum of space made possible by a structural frame.

This kind of space organization could reflect a new openness in living and the facture of old social hierarchies, and a reduced dependence on servants. Despite to some conformity to climatic and cultural requirements, this type of modern house has become commonplace in the whole world (Weston, 2002) [5]. Although neither the structure nor the typology of modern house did not support the way of living a traditional society this new house fulfilled the new vision of living and the new aesthetic, social, and political principles of an industrial society. (Sani & Mahasti, 2013; Weston, 2002) [5] [6].

One of the construction rules that dominate Iranian cities is construction of the building in 60% of the land; this rule defines the new organization of houses and new image of cities in Iran (Sani & Mahasti, 2013) [6].In the early Pahlavi state and foreign capital contributed heavily to nationwide housing project that, for the first time, divided communities along the line of status and professional degrees, thus eradicating the old ascribed status distinction. Most of Iranians looked up to the lifestyle of the class above them and tried to emulate aspects of it.

Many residential neighborhoods in Tehran as well as those in newer industrial areas were all built by professionals in the early Pahlavi period and all divided based on profession and status line (Karimi, 2012)) [7]

5. Land parcel and typology

This new housing type in Tehran introduced concepts of function, modularity and the international style based on applying open plan concepts, avoiding ornaments and reducing detailing aspects to a minimal amount. In the first master plan of Tehran, which was prepared with the assistance of French companies, it was explained that one storey houses are the consequence of poor construction techniques, and central courtyards are the reflection of old social conventions. Women's freedom would eliminate the need for introverted areas and add to the prevalence of apartment living. Balconies would substitute for courtyards, and elevators would increase the number of building stories (Farmanfarmaian &Gruen,1968) [8].

For the newly emerging middle class of society, the governing regime commissioned some housing projects to companies and consortia. In addition, strategies were devised for economic and low cost housing all around Tehran. Typical prototype blocks were scattered in available unoccupied lands within and around the periphery of Tehran.

In the transitional period, neighborhoods lost their mixed use of social and economic functions and changed to strictly residential districts. Land parcels were reduced in size and shaped more geometrically, mostly in rectangular forms. The rectangular lots influenced the spatial characteristics of the houses. As the lots became narrower, the built area had to be located in the northern and southern parts of the land, with the courtyard in the middle. When the house faced south — which was the case in most examples — the northern part, facing the sun, was the main two-storey residential area, with the ground floor allocated to living

areas and the first floor to guest rooms. The other section usually had one storey above ground and one below. The kitchen and service areas were located in the basement, below ground level (Soltanzadeh, 2005) [9].

6. Conclusion

The impact of typology and morphology on social aspect of houses is the axis of this project. This impact can be the subject of study from the opposite view; in other words, social life can affect the typology and morphology of residences. The latter one is evidenced in historical studies on architectural documents. In this dissertation, the attempt has been to collect some samples that can reflect the general typology and morphology of houses in Tehran; so instead of choosing some eminent architectural projects, the sample projects has been chosen according to the criteria that they could reflect the tendency in construction, advertisement and buying houses.

At a glance, the transition in morphology and typology of apartments and the impact of social and cultural factors on the formation of the living spaces can be mapped. In this analysis, the changes in typology or morphology of the houses on one side, and on the other, the changes in social and cultural attributes may lead to the finding of correlation between the two sides.

The correlation between the spaces of the house and type of social aspects like the behavior, texture of population living in the house and their lifestyle can be read through the quantitative and qualitative method. Tehran under the Qajar and Pahlavi were in the forefront of early change from established tradition to twentieth century modernity. The Iranian experience as expressed in the development of Tehran can provide a foundation for the socially sustainable housing patterns and development in the complex social and political milieu of the Eastern Mediterranean

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READING CHANGES IN ARCHITECTURE OF A CITY THROUGH PHOTOGRAPHY

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Keywords: Architectural photograpy, urban space, change, İstanbul.

Extended Abstract

Comperative photography or rephotography containing the critical value affords us comprehensive insight into changing reality of time and space, and "opens a space for the analysis of place" [1]. Such photographs, where the overlapping patterns of a city are depicted, gain great value as the witness to time and space revealing the development and the values added, subtracted, tansformed or lost in time . Farinelli says the static nature of photograhic image is the best way to understand and recover a sense of civitas [2]. Architecture historian and photograher Professor Reha Günay's exhibit of comperative photography titled "Disappearing İstanbul" explicitly reveals the the dramatic changes in architecture of the city, culture of construction and socio-cultural values. The photograps of urban space, streets and buildings in different neighbourhoods of İstanbul taken from the same or similar viewpoints at certain intervals, varying between 10 and 40 years, have become documented evidence about the rapid change in the city.

Objectives

Interpreting the photographs in an exhibition titled " Disappearing İstanbul" in an endavour to search for hidden or the explicit meanings in the visiual material, this study underscores the significance of the critical value of architectural photography. Within this scope, the main objectives of this paper are

• to present the subjective and objective readings of the photographs taken in the streets of Üsküdar, a historic town on the Asian side in İstanbul,

• to discuss the changing meaning of the built environment with its socio-cultural backround,

• to draw attention to some consequences of the vanishing culture of the local timber-frame structures.

Representative instances and their interpretation

One of the photograph, for instance, taken in 1973 depicts the interface of the urban space in between Valide Atik Complex, which is one of the significant examples of Architect Sinan's monumental edifices, a 16th century building, and on the other side, traditional wooden houses right facing it, which replaced with new apartment buildings or improper renovations, as seen in the second photo taken in 2010. Whereas a strong Gestalt, a sharp

contrast appears very clearly in the old picture: massive and solid impression of the gray stone wall of the complex versus fragile and elegant expression of wooden dwellings, small cubes and prisms.

Fig. 1-2: Valide Atik Complex and its near surrounding (1973-2010), Anatolian Castle (1969-2010)

While wooden structures built by their owners and master builders, a reflection of well-known harmonious interaction between social patterns and architecture, appear to be much more architectural rather than ordinary apartment buildings designed by architects or engineers in compliance with legal procedures and regulations in certain degree. There seem no measure having been taken in the windows of old timber-frame houses for preventing break-ins, but in the modern buildings, which were replaced with the old ones, even in the upper floors we see bars on their windows.

These dual depicted narratives were analysed through peronal observation and memories, interview with Prof. Günay, the author of the exhibition[3], and the book titled ” Wooden Houses of Disappearing İstanbul”, and finally the literature on Photography.

Epilogue:

Architecture is open to analysis like any other aspect of experience, and is made more vivid by comparisons (4). The before and after photographs are useful tools “to provoke acts of memory recalling us to things, places, and people. They establish connections across time and space, inducing chains of association.”(5) Taking a retrospective look at the urban space and daily life, the photographs in question are not only nostalgic images, but also rememeber us what we have lost, what values we have exchanged in the name of so-called modernization and progress, and the clues to how we can recover from unsustainable growth.

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Archi-Cultural Interactions through the Silk Road
4th International Conference, Mukogawa Women's Univ., Nishinomiya, Japan, July 16-18,2016
Proceedings

SMALL DWELLING TRENDS IN ISTANBUL

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Keywords: Minimum dwelling, residential trends, gated community residence, small units.

Introduction

Minimum dwelling has become the central problem of modern architecture, and it is also common in today's new housing trend/s. Modernist architects announced the concept of existenzminimum with the aim of solving the dwelling problem emerged after World Wars. The large scale destruction and the housing shortage/crisis that occurred at that time lead to poor living conditions throughout Europe and there was a growing need to find shelter [1]. In order to solve this problem, small dwelling units were designed based on the modernist ideas as an economic and quick solution [2]. Governments started to develop social housing programs especially for lower income groups. The programs provided livable/acceptable dwelling units and quality environments after demolition for lower income groups. The aim was to meet the needs of large numbers of people in terms of providing shelter with the small land use [3].

Modernist architects made an effort to design small and convenient living places for families and they represented the idea of 'modern' life in these small dwelling units. In particular, the famous architect Le Corbusier focused on social housing settlements and emphasized the need for hygienic, comfortable and adequate units [4]. Housing problems occurred in almost all large cities in Europe. Lack of adequate living conditions, activated not only architects, but also associations and societies worked on the minimum dwellings such as the CIAM organization, that worked to develop minimum dwelling designs in urban areas [5].

Although the history of small dwelling units is related to spatial sufficiency, trends in recent years' have shown that it is also a living style preferred in luxury, prestigious housing settlements [6], [7], [8].

Nowadays, small dwelling is a way of living in metropolitan areas. Rising land prices and changing modern lifestyle preferences have contributed to the creation of small residential units. In recent years, along with the neoliberal economy policies, Turkey has met with new housing types and gated community housing settlements have emerged in big cities. After the 1980's with the new socio-economic conditions in the country, lifestyles and housing preferences have also changed. Multi-storey housing developments like skyscrapers were mostly constructed in city centers.

Today these vertical gated community settlements are very popular in big cities of Turkey, especially in Istanbul. Small dwelling units are seen in these very prestigious gated communities. The plan of such unit that includes an open kitchen linked with the living room, a bathroom and a bedroom. These are referred to as, studio apartment (1+1) or one-bedroom units [6], [7], [8].

The one bedroom residential units are largely chosen by young professionals and students. These units are preferred by newly married couples or couples without children.

Especially after 2000's with the rising real estate market and upward land prices, small plan schemes have been preferred by the construction companies. One bedroom (1+1) residential units became widespread in İstanbul and in the other cities. Especially in İstanbul, with the increase of "residence" *(prestigious residential buildings that provide hotel services)* buildings, one bedroom units first appeared at the end of the 90's. These units are generally about 45-75 m2 and have been designed in the modern-rationalist architectural style.
Although these small units are built by different construction companies, designed by different architects and located on different parts of the city, most of them have similar plan schemes. Today, there are lots of residential buildings which include one bedroom housing units for all income groups. In general, the plan organizations are all similar. This study is based on one-bedroom residential units in Istanbul, involves functional analyses and a consideration spatial organizations (plan schemes). The research aims to analyze and evaluate / critique one bedroom residential designs in terms of plan schemes, using examples from different locations in İstanbul.
The main aim is to understand user preferences and to develop a critical evaluation for today's small dwelling units comparing them with the examples from early modernist period.

Methodology

The research methodology used in this study is based on examining/analyzing the plan schemes of the gated residential one-bedroom (1+1) units. The 20 units that are chosen for the comparison were designed by different architects and built on different locations in Istanbul. All of them are marketed for the high-income group. In the comparison, space organization and spatial qualities (dimension, form, aesthetic characteristics, etc.) are examined with regard to each of the plans, and the similarities/differences have been focused on. Small/minimum dwelling ideas and examples of today and the modernist period, were compared and searched for similarities with regard to gated residential one bedroom units.

Findings

According to the findings of the research, there are some similarities between the minimum dwelling of the modernist approach and recent housing trends/developments. Both aimed to create livable housing conditions with minimum land use. But today's users of gated residential units are not similar to the users living in the early modernist period. Although user profiles are different, the architectural plan organizations have some similarities with each other. The plans generally include open kitchen or counter with sink, bathroom, and living room with a sleeping area/bedroom. Basic human needs/activities (common facilities) can be realized in these areas. The plan schemes are flexible to use the space for another activity. Living rooms can be converted to bedrooms. Having a flexible space is saving space. Overlapping area of different activities can help to effective use of space. In the plan schemes some areas are overlapped to saving space, there are no long corridors. Service spaces as kitchen and bathrooms are generally located on the blind façade.

Conclusion

Minimum/ small dwelling idea has long history, because people need to shelter. As Maslow pointed out, dwelling/sheltering is a basic human's need [9]. However this emerged as a global problem after the big urban destruction caused by the wars. Governments, institutions and other organizations found various solutions for the problem and developed some designs and methods for creating minimum sufficient living spaces. With the findings of the research, it is seen that today we're using the similar plan organizations for living in both adequate and luxury conditions.

Small dwellings are preferred, not only by low income groups but also by high income groups. The study shows that the user profile of small dwelling units has changed and it can sometimes be called as 'luxury and prestigious'. Interestingly, the small dwelling is available for both low and high income groups, because the basic human needs are same. So it can be said that today luxury and prestigious idea is related with social environment it is not related with only largeness of the spaces (dimensions). The small dwelling idea is important for a sustainable living environment and the research into 'small/minimum dwelling' should be increased for our common future.

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HIGHLY SOPHISTICATED DESIGNS FOUND IN JAPANESE TRADITIONAL STRUCTURES

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Keywords: sophistication in culture, structural design, Japanese traditional structures, Japanese pagodas, Bruno Taut, Ise Shrines, Daigoji, Myououin, beam-column system, wall system

Summary

The present paper deals with some features of structural expression in traditional Japanese buildings from the viewpoint of elegance in structural design. The concept of structural expression in those traditional buildings is not easy to grasp because of their highly sophisticated designs. Very many people have failed to understand the real structural functions of important components of those buildings because of it. There are always sound reasons for those sophisticated designs which are based on more holistic judgments than mere structural criteria, although careful observation and deep insight are required to find them. This nature of Japanese traditional architecture is illustrated in this paper with the author's hope that this type of study may develop our capability of understanding elegance in traditional as well as modern structures.

1. Columns of Ise Shrines

Fig. 1 shows gable façade of the main building of the Ise Shrines (Naiku) which has been considered to be one of the most important prototypes of shrines and Japanese architecture. The form and style of those buildings have been ideally preserved for more than one thousand years by rebuilding them every 20th year strictly after the design of the previous buildings. The buildings have been widely believed to be of a typical "beam and column system". Actually, however, none of the magnificent columns support anything but themselves. This sophistication has deceived many innocent observers including architects, engineers and critics. Bruno Taut, a famous German architect, is found among those who failed to grasp the structures of Ise Shrines correctly.

Fig.1: Gable Façade of Ise Shrine (Naiku)

The inconsistency between the form and the real structural function can be explained as a result of deliberate design of the builders who pursued the sound air-tightness of the building and the dignity of columns.

2. The Central Columns of Pagodas

As Fig. 2 shows anatomically for Yakushiji West Pagoda, every Japanese pagoda has the

Fig. 2: Aanatomical Sketch, Yakushiji West Pagoda

Fig. 3: Myououin, Eaves Rafters

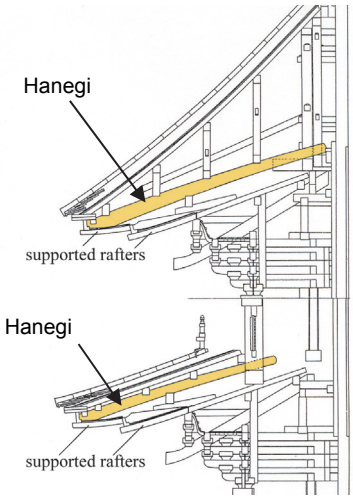

Fig. 4: Myououin, Section

central column which is the biggest in dimensions of all the structural members of the pagoda. So the criteria based on the modern rationalism may suggest that it must have some important structural function, but actually the central column should be independent of all other part of the tower, and it is not allowed to be touched by any other components of the pagoda. This sophistication can be explained by the very divine nature of the central column.

3. Design of Eaves

One of the special features of Japanese traditional buildings may be the elegance of the patterns of rafters supporting the very deep eaves projecting outside the main bodies of the buildings, as shown in Fig. 3 for the Myououin Pagoda.

Our modern rationalism is again apt to guess that those beautiful rafters in double level are undoubtedly supporting the elegant eaves of the pagoda.

In reality, however, they are not supporting the weight of the eaves, but they are rather supported by the other structural members concealed above the ceilings of the eaves. The invisible members that are actually supporting the weight of the eaves are called "Hanegi" (Fig. 4) which were developed in Japan during the Japanization of architectural style which had been imported from China.

Even after the finding of the Hanegi mechanism the builders did not dare to change the traditional appearance of the rafters.

4. Conclusive Remarks

The author is not an historian or an expert of timber structures, but he is a structural engineer who is very much interested in the issue of form and function of structures. The present paper has dealt with this subject in connection with Japanese traditional timber structures with the hope that we might obtain some hints for our design from the ways our forerunners treated the same issue for their structures. We have seen that in attempt to understand Japanese traditional buildings properly we should avoid hasty judgment to be done on the basis of modern rationalism. In many of those building structural components are often designed not only from the mere structural criteria but from more holistic ones sometimes against their appearances.

The author considers that this type of study is useful for us to develop our capability of understanding elegance in structures, traditional or contemporary.

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A STUDY OF THE CHARACTERISTICS OF TRADITIONAL ROW HOUSES' FACADE IN THE ALLEY IN KARAHORI, OSAKA, JAPAN APPLYING INDUCTIVE LOGIC PROGRAMMING

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Keywords: alley, traditional row house, Inductive Logic Programing, 3-D model

Introduction

In this study, the characteristics of row house facades in the alley in Karahori, Osaka, Japan are analyzed using Inductive Logic Programming (ILP) [1], machine learning system that executes inductive reasoning. Traditional row houses, built during the Taisho period (1912 - 1926), populate this area (Fig. 1). The area is notable for its individual townscape of various "expression objects," such as plantings and furniture that are placed along the alleys and used in the everyday lives of the inhabitants. It has been reported that the 2-D configuration rules of the elements in the traditional building facades were described [2], but very few attempts have been made at finding rules of 3-D composition of them. In this study, we define the facade as a 3-D model to include the concept of depth and extract the 3-D composition rules of facade.

Methods

Fig. 1: View from the point of V

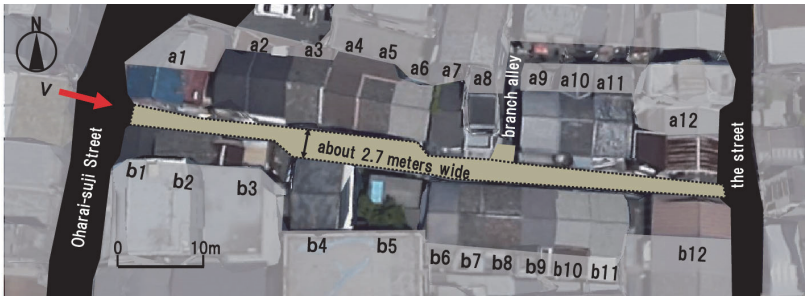

Fig. 2: Satellite image of the site in analysis Satellite image [3]

We focused on the alley that had the greatest number of expression objects, as determined during a field survey. This alley is connected to Oharai-suji Street, which contains many traditional row houses. We analyzed 24 of the houses facing this alley (Fig. 2) and the breakdown of 24 houses is as follows: 3 detached houses (a8, b4, and b5), one middle class apartment (b3), and 20 traditional row houses (a1 - a7, a9 - a12, b1, b2, and b6 - b12).

Our analysis consisted of the following steps: [STEP1] We created elevations of the houses and extracted the building and expression elements that constitute their facades (Fig. 3). We further defined two types of relations: relations on the vertical plane and relations in the depth direction (Fig. 4). [STEP2] Using this data, we assembled 3-D models with computer-aided design (CAD) (Vectorworks 2010). [STEP3] The 3-D models' data were converted into Prolog descriptions (Figs. 5 and 6) by an extension program for Vectorworks that we designed to recognize the relations between elements. [STEP4] These descriptions were input to Progol (ALEPH ver.5) [4], an ILP system, to induct the rules that express

peculiar characteristics of the facade. Input data to Progol consists of positive examples, negative examples, and background knowledge. Each element is regarded as an example to be used for inductive reasoning. Each element type and relation between elements is inputted as background knowledge, constituting an “is-a hierarchy” based on the inclusion relation (Figs. 3 - 6). The elements of one side of two adjacent houses were set as positive examples and the elements of the other house were set as negative examples. Progol constructed the rules that are true on the positive examples and false on the negative examples from these data. [STEP5] The rules were inducted by converting the positive and negative examples (Fig. 7). [STEP6] The above steps (STEP1 - 5) were applied to each house. We call the rules found by comparing to an adjacent house “primary rules.”

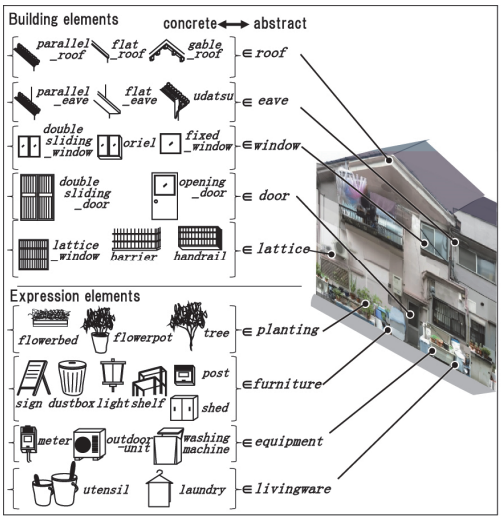

Fig. 3: Types of elements of facade

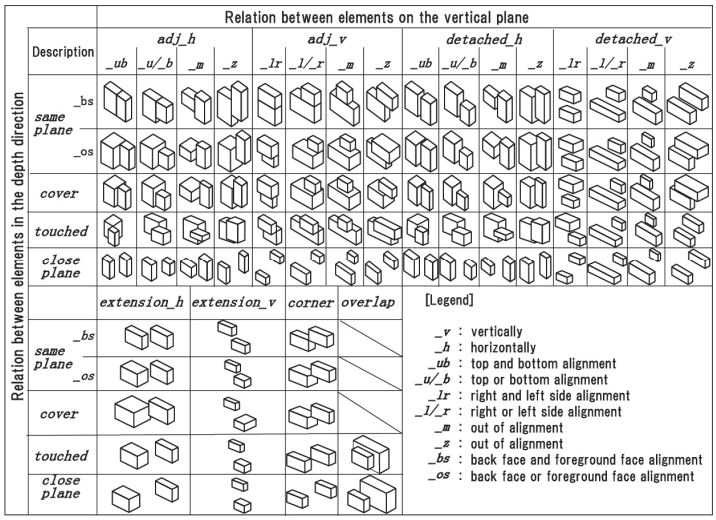

Fig. 4: Types of relations between elements

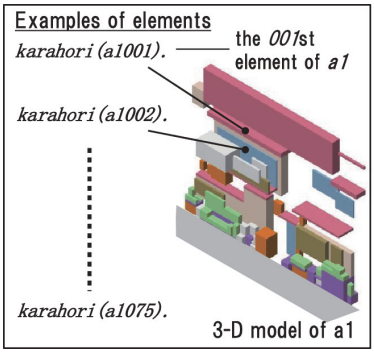

Fig. 5: Descriptions of examples

Types of elements

type (a1001, flat_eave). —— Type of *a1001* is a *flat_eave*.
type (a1002, doublesliding_window). —— Type of *a1002* is a *double sliding_window*.

Types of relations

relation (a1001, detached_v_m, cover, a1002). —— Relation between *a1001* and *a1002* is *detached_v_m* (on the vertical plane), and *cover* (in the depth direction).

Is-a hierarchy of elements

type (X, doublesliding_window) :- type (X, window). —— a *double sliding_window* is a *window*.

Is-a hierarchy of relations

relation (X, detached_v, A, Y) :- relation (X, detached_v_m, A, Y). —— *detached_v_m* in relation between X and Y is *detached_v* (on the vertical plane).

Fig. 6: Descriptions of background knowledge

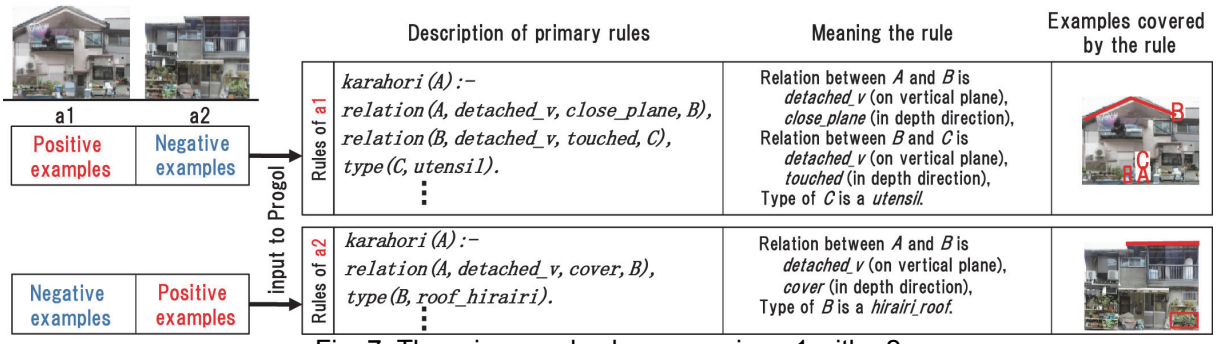

Fig. 7: The primary rules by comparing a1 with a2

Results and Discussion

The results of our analyses are shown in Fig. 8. The primary rules extracted from each house were arranged in order of high coverage. Coverage is defined as the ratio of positive examples covered by the rules to the total number of positive examples [1]. In comparison with the left side and comparison with the right side, we found some of the exact same the rules. We call these “individual rules” that strongly express the individuality of the house.

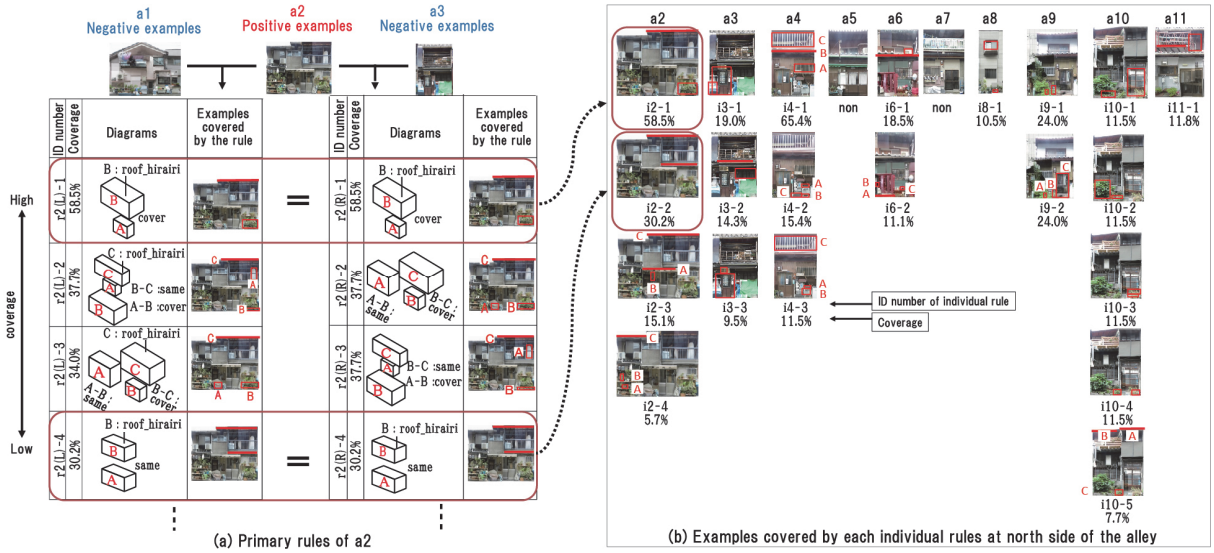

Fig. 8: Results of the analyses using Progol

The primary rules with the highest coverage in the houses that are on both ends of the alley are regarded as individual rules exceptionally. In this paper, we focus on the individual rules with the highest coverage and try to interpret them. Figure 9 shows our interpretation summery.

(1) Comparison of the total number of individual rules
The traditional row houses (a2 - a4, a9, b2, b7, b9, and b11) and the detached house (b4) have over three individual rules. The detached house (b4) has many individual rules because it has many expression elements. We can conclude, therefore, that most traditional row houses have many individual rules.

(2) Trend in relations in the depth direction between elements
Most of the houses (a8, a9, a11, a12, b1-b3, b7, b9, b11, and b12) refer to the relation in edge alignment between elements. In contrast, four traditional row houses (a1 - a4) located close to Oharai-suji Street have different types of relations that are out of alignment between elements. We therefore conclude that the rules of the traditional row houses refer to different types of relations in the depth direction between adjacent houses.

(3) Trend in relations on the vertical plane between elements
The rules of houses a1, a2, a4, a6, a8, b1, b2, b3, b4, and b7 refer to the relations in the vertical direction, such as “detached_v.” In contrast, the rules of houses a9 - a12, b9, b11, and b12 refer to relations in the horizontal direction, such as “detached_h.” Thus, conclude that the two groups divided by a branch alley have different types of regularity; that is, the west and east side groups have rules regarding the relations in the vertical and horizontal direction, respectively.

(4) Characteristic area of the alley

Four traditional row houses (a2 - a4 and b2) located near Oharai-suji Street have many individual rules. Furthermore, one of the individual rules marks the highest coverage in each case. This area is therefore the most characteristic part of this alley.

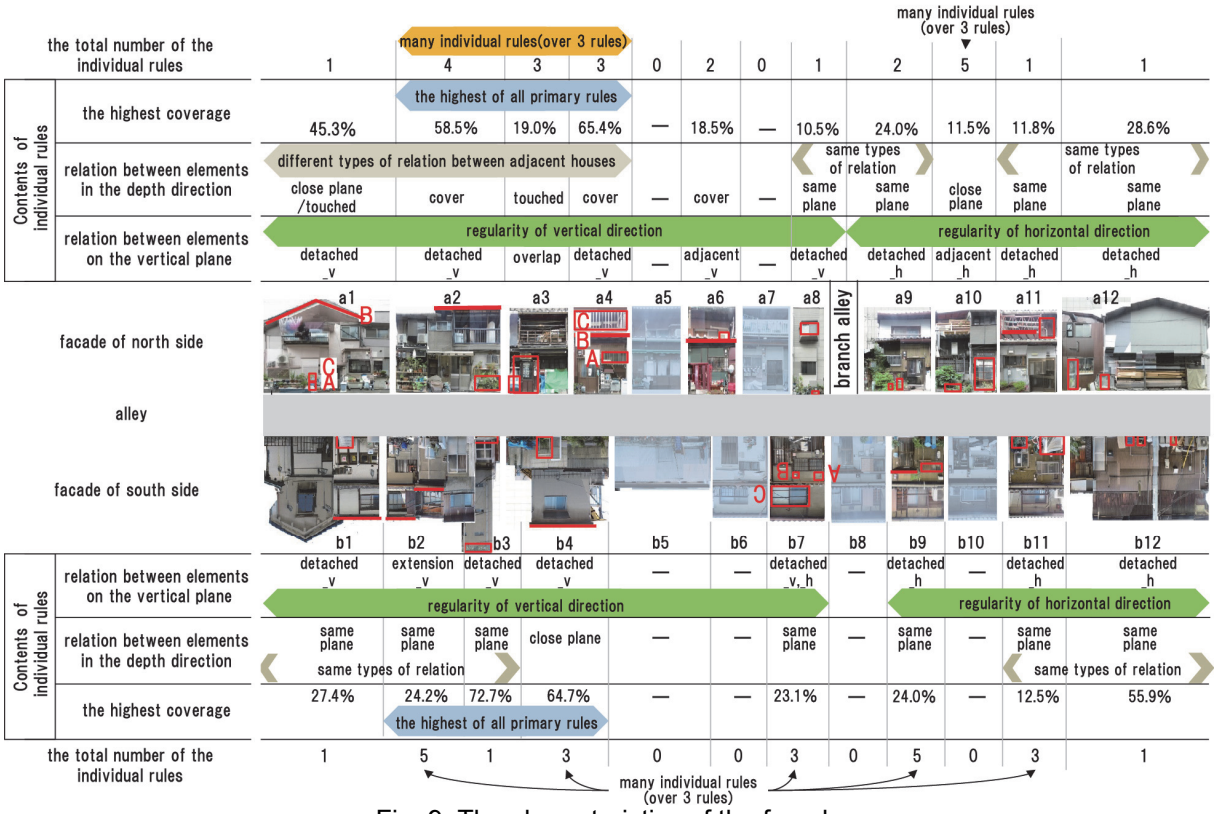

Fig. 9: The characteristics of the facade

Conclusion

In this study, we found the characteristics of peculiar rules of the building and expression elements of traditional row houses in the alley in Karahori, Osaka using ILP. We made the following findings: (1) most traditional row houses have many individual rules; (2) traditional row houses (a1 - a4) have rules that refer to 3-D composition in relation to the depth direction; (3) the two groups divided by a branch alley have different types of regularity in relation on the vertical plane; and (4) traditional row houses (a2-a4 and b2), which are located close to Oharai-suji Street, are the most characteristic of the alley.

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BUILDING FACADE DESCRIPTION SYSTEM AND HISTORICAL FEATURE ANALYSIS METHOD BY ROUGH SET THEORY AND ALGORITHMIC LANGUAGE: A CASE STUDY ON THE TRADITIONAL ARCHITECTURE AND SETTLEMENTS IN GUNANJIE STREET, YIXING, CHINA

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Keywords: traditional architecture and settlements, conservation, building facade, historical feature, digital generation, Rough Set Theory, Processing

Introduction

Considering the existing problem in the implementation of the conservation planning of traditional architecture and settlements' features in China, significant practicability and operability are still expected. As same as other historic districts with pressing demands for renovation, Gunanjie Street, in Yixing, China, is also facing a huge gap between general design and detailed implementation of the conservation planning.

This study focused on the approach to format a reasonable guideline in an objective perspective. In research, a new building facade description and evaluation system has been developed by using the intelligent information data technology to code and describe the morphological features of historical characteristic as the database and using the data mining to extract rules of traditional facade elements and their combination modes. Accordingly, the referable facades were generated by program. Meanwhile, the total cost of renovation could be calculated automatically based on morphological features with corresponding constructions, materials and labor charges, contributing to establish the acceptance evaluation and compensation decision [1].

The current researches of heritage conservation have applied Rough Set Theory and programming to morphological analysis and design as tools [2], [3], [4]. Especially in building surface and performance, programmable tools were used more frequently. The innovation of this study is combining knowledge discovery with generative design by a digital link to explore the solution for the problems mentioned above.

Main Methods and Tools

1. Questionnaire survey was used to attain the judgement of buildings. The data collected was analyzed as the basis of sensibility evaluation.

2. Rough Set Theory is one of powerful tools to deal with fuzzy uncertainty applied to various fields, especially in data mining and machine learning [5]. It was employed to discovery knowledge and extract characteristics and rules of traditional facade and historical feature in this study.

3. Processing is an open-source programing language widely used for digital art and visual design [4]. Considering its superiority of graphic processing, the generation program in this study was written in Processing.

Research Process

1. Present Status surveying and mapping

   Each house on the street was photographed and the whole street facade images were built by splicing the photographs through surveying and mapping (Fig. 1).

Fig. 1: A part of mosaic street facade

2. Sensibility evaluation employing Rough Set Theory [2], [3]

   48 samples were selected to represent all buildings, presented in the questionnaire for traditionality assessment investigation to respondents with and without an architectural background (Fig. 2). At the meantime, the facade was decomposed in to variety of elements and combination modes [6], [7], [8], coding for an evaluation form with survey result (Fig. 3). In other word, the facade was described by coding matrix, which can be learned by computer (Table 1). Then, the coding matrix would be calculated to induce decision of problem by knowledge reduction and rule mining based on Rough Set Theory, which can extract rules of traditional facade elements and their combination modes (Fig. 4) [5].

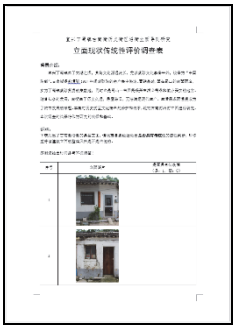

Fig. 2: Questionnaire

Fig. 3: Facade elements

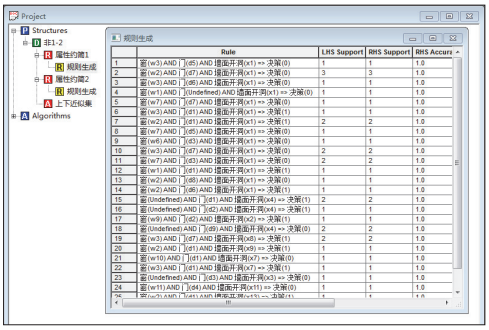

Fig. 4: Rough set calculation software interface

Table 1: Evaluation result of facade traditionality

编号 (No.)	条件属性 (Conditional Attributes)																决策属性 (Decision Attributes)
	屋顶 (Roof)		一层 (1st Floor)					二层 (2nd Floor)			其他要素 (Other Elements)					整体结构 (Monolithic Structure)	
	屋顶形式 (Roof Material)	屋顶材料 (Roof Style)	墙基材料 (Wall Base Meterial)	墙身材料 (Wall Meterial)	墙面开洞 (Window/ Door Holes)	门 (Door)	窗 (Window)	墙身材料 (Wall Meterial)	墙面开洞 (Window/ Door Holes)	窗 (Window)	阳台 (Balcony)	栏杆 (Handrail)	女儿墙 (Parapet)	批檐 (Eave)	雨棚 (Canopy)		
1	r1	t1	j2	m1	x1	d5	w2									z1	0
2	r1	t1	j2	m1	x1	d1	w3									z1	1
3	r1	t1	j2	m1	x1	d1	w6									z1	1
4	r2		j2	m1	x1	d7	w12						k1			z1	0
5	r1	t1		m1	x1	d2	w9								c1	z1	1
…									…								…
44	r1	t1	j1	m2	x1	d3	w7	n2	y16	w1				p1		z4	0
45	r1	t1		m1	x11	d3		n2	y16	w10						z4	0
46	r1	t1		m2	x12	d4	w11	n2	y5	w10						z6	0
47	r1	t1		m1	x13	d1	w2	n5	y15	w9						z5	1
48	r1	t1		m1	x14		w5	n8	y15	w1					c1	z4	1

3. Digital generation by programming based on Processing [4]

   Through programing in Processing development environment, present facade status drawn in 3dm format could be read by layer to further processing (Fig. 5). Redundancy elements could be eliminated and expected traditional elements could match in appropriate locations according to rules at present. The generation result after optimization could be used as referable facades in the guideline (Fig. 6).

Fig. 5: Processing software interface with generative facade

Fig. 6: A part of referable facade

4. Repair cost automatic calculation according to construction and details

   Because each facade element corresponds to a construction technology and cost accordingly, total cost could be calculated automatically during the generation process, which helps to acceptance evaluation and compensation decision.

5. Guideline compilation [9], [10]

Discussion

It should be noted that this study is still primary, some deliberations still needed. Firstly, for example, more samples are needed. Secondly, elements classification must be objective and recognized according to local tradition and features. In addition, more functions and code optimization of generation program are expected. What's more, some other effective algorithms also could be used in the future. And the relationship between guideline and policy in social perspective is also a possible direction of further research.

Conclusion

This study aims to establish a building facade description system and historical feature analysis method by using Rough Set Theory and Processing. The procedure and result can be used as a relative universal tool in guideline compilation, acceptance evaluation and compensation decision, expected to improve the serious situation of historical districts conservation in China.

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ON THE EXPERIENCE OF HISTORY AT THE WANG RIVER VILLA OF WANG WEI

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Keywords: Wang Wei, the Wang River Villa, the Wang River Collection, Chinese poetry, history, experience of a villa

Introduction

This paper attempts to clarify an aspect of the experience of the villa by offering an interpretation of the *Wang River Collection*（『輞川集』）of poetry by Wang Wei（王維）, a Chinese poet of the Tang Dynasty, in considering the meaning of the history of place. In this study, the author takes the poem as a certain representation of experience, and employs the method of analyzing the poetic representation in language. Since poetry is an art, the process of deciphering the poem is also an experience, which cannot be separated out from the historical frame in which we are living today or from the cultural frame of the reading, which here is done by a Japanese interpreter. Therefore, this paper does not purport to offer the "true meaning" of this history, nor does it have any purpose for doing so. Thus the purpose of this paper is to clarify what one feels or how one experiences a place.

In the *Wang River Collection*, Wang Wei composed twenty scenes, which are the titles of its twenty poems, meaning twenty different landscapes are described by the poems. Some titles refer to classic literature, such as the *Wen Xuan*（『文選』）or *Chu Ci*（『楚辞』）, before the Tang Dynasty, in which each poem is a short verse written in the style of five-character quatrains. By referencing classical literature, they carry particularly profound meaning. The poetry is arranged in twenty poems starting with "Mengcheng Hollow（孟城坳）" and ending with "Pepper Garden（椒園）." At the beginning, the history of the Wang River Villa is explained, and its natural landscape is described. The subject of the poem is not indicated; the viewpoint is impersonal. In other words, there is an absence of human. Whereas in the middle, guests visit obliquely, and humans appear in the poem. The guests actually visit and then leave; so in the latter half, humans are absent again. As indicated in the title, this paper especially aims to clarify "the experience of history at the Wang River Villa." As the most important poems for our purposes are the first two of the twenty, the opening poems "Mengcheng Hollow" and "Huazi Hill（華子岡）" will be considered in this paper.

On "Mengcheng Hollow"

"Mengcheng Hollow" is the first poem of the *Wang River Collection* by Wang Wei. The hollow is located at the mouth of the villa, in the northern part of the Wang River villa [1].

孟城坳	Mengcheng Hollow
新家孟城口	Built a new house at the mouth of Mengcheng
古木餘衰柳	Old trees, an elder willow remain

來者復爲誰	Who will be the next owner?
空悲昔人有	Feel empty and sorrow for the past owner

In this poem, the first two lines describe the place, and the last two detail the emotions inspired by it, feeling emptiness and sorrow for a past owner. In the first line, we discover that Wang Wei built a new house. It is said that there was an ancient castle nearby [2]. The “old trees” of the second line are a vestige; “elder willow” too recalls the past. A newly built house and old trees contrast “new” with “old.” The ancient castle inferred is the house of the former owner, Song Zhiwen（宋之問）. However, there is a theory that it was from the Eastern Jin period（東晋）[3]. The history might be one that includes a number of past owners. Yet, in the third line, the poem speculates about a future owner, asking “who will be the next owner”? Since Chinese poetry lacks a subject as well as tense, the subject “thinking” may not be Wang Wei. In the same way, the subject of the fourth line, who is “feeling empty and sorrow for the past owner,” is unknown. If Wang Wei is the subject, he is the one who is grieving; but if the subject is the future owner, then it changes. Here, Wang Wei is the object of the grief. He is both a subject and an object in the last line.

History in this poem is experienced both by oneself and, at the same time, by others. The experience is ambiguous. By the absence of subject and tense, the poem holds a certain universality. Individual experience is also an experience of others. Someone else’s experience invokes one’s own experience. Since there have been many owners here, the history is multi-layered, just like one’s experience. Wang Wei experiences grief both by himself and in being grieved by others at this place. Therefore, the emotions of history at the “Mengcheng Hollow” are ambiguous and multi-layered, arousing “emptiness” and “sorrow.” Zhang said, “Emptiness and sorrow are universal feelings which a human feels, when one is touched by an ‘eternity’ of time and space.” [4] In this case, such a viewpoint becomes very important.

On “Huazi Hill”

Next, we consider Wang Wei’s second poem, “Huazi Hill.” The hill is said to be a small mountain near Mengcheng Hollow, and the origin of the name is said to come from a poem by Xie Lingyun（謝靈運）.

華子岡	Huazi Hill
飛鳥去不窮	Flying bird endlessly fly away
連山復秋色	Ranging mountains are in autumn colors again.
上下華子岡	Going up and down the Huazi Hill,
惆悵情何極	Sorrowful feelings overflow

In this poem, the first two lines describe the landscape, and the last two are linked with feelings of sorrow experienced while climbing there. “Flying birds” appear in the first line and a state of flying away is described. Birds flying incessantly convey a feeling of endlessness. In the second line, one is glancing over autumn-colored mountains. This also expresses a boundless landscape. Next, the third line, “going up and down the Huazi Hill,” links with the sorrowful feeling in the fourth. Nevertheless, for us readers, it is unexplained why “going up and down the Huazi Hill” elicits sorrow. We do not know whether the hill is sorrowful, or climbing is sorrowful, or the landscape is sorrowful. Here the meaning of “Huazi Hill” must be determined.

Wang Wei borrowed the title from Xie Lingyun [5], so we should look at the original “Huazi Hill,” which is collected in “*Wen Xuan (volume 26)*.” The latter half of the poem reads, “a hermit is no longer there, the hill is just empty. The book that tells about the hermit is worn out; even a stone monument does not exist. You never know what it will be like a hundred generations later. How could you to know about a thousand years ago? I decided to be alone, listen to the sound of the water under the moonlight. And enjoy the scenery that rests just in front of me, I am not here for the past.”

In Xie Lingyun’s “Huazi Hill”, the old hermit is absent and the traces of his history are lost; it is completely empty. A people’s history is apprehended sentimentally, just in trying to embrace the vision of nature before one’s eyes. This is some kind of momentary attitude to enjoy the setting with admiration. In the case of Xie Lingyun, the place is neither idealistic nor transcendent, but rather ontological. So the “Huazi Hill” that Wang Wei cites is also probably not meant as a utopia. Rather, what Wang Wei references is a place with the trace and idea of the human, which has vanished through the years, just the sort of place where an eternal natural landscape expands. In particular, the meaning of “again” in the second line marks a seasonal landscape, which repeats itself even after human influence and then disappears. Nature supersedes human works and continues cyclically. This may also be considered history.

Conclusion

In the poetry of Wang Wei, the feelings of the history are described in terms of “emptiness” or “sorrow.” They emerge in the universal experience in which one becomes the other and the other becomes one. And this feeling is inspired by the overwhelming power of nature, where human work is rendered meaningless in the transcendent experience. In this way, the experience of one’s individuality is almost relativized by eternal time. In the face of the onward marching historical time, there is a moment when one loses his identity. This triggers some kind of “oceanic feeling,” a “sorrow” or “emptiness.” In other words, history for the individual is universal and transcendent.

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Modernization, globalization and urbanization

Archi-Cultural Interactions through the Silk Road
4th International Conference, Mukogawa Women's Univ., Nishinomiya, Japan, July 16-18,2016
Proceedings

THE KOBE MUSLIM MOSQUE: Experience of "Miracles" - *1945 Air Raid & 1995 Earthquake*

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Keywords: Jan Josef Švagr, Takenaka Co., Muslim Community

1. Introduction - Kobe Muslim Mosque

The Kobe Muslim Mosque is the oldest in extant and most prominent architecture which represents the faith of local Muslim community as well as legacy of architectural modern development in international port city Kobe and Japan. Tenacious fund rising among Muslim traders, uncountable tense negotiations with authorities, unique design led by Czech born architect *Jan Josef Švagr*, and drawn and built by early day's construction giant *Takenaka Corporation*; the place, community and architecture has been witnessed as they are living proof of an important Kobe's urban cultural legacy. Interestingly enough, this structure has been recognized a landmark and evidence of "International Port City Kobe", however, it has not architecturally examined previously. Especially, complexity of construction process has still indicate uncertain portion as such as real figure of commitment and contribution of architectural professions, and "miracle" of survivals from uncountable tragedies upon the mosque – fires of Kobe Air raid during WW2 reach to the wall of the mosque, and subsequent postwar social disorder, Kobe Flood in 1938, and Great Earthquake in 1995. Previously, author presented these outlines as a primarily account which entitled; *Kobe Mosque: A Preliminary account of the Place, Community and Architecture*[1]*,* and summarized on earlier sections of this article. In this paper which will be presented as a sequel to re-examine facts behind, particularly survivals from war and disasters which sometimes accepted as "miracles" by public in general in Kobe.

2. The Mosque and Kobe City

The location of the mosque is on a boundary district which neighbored between Foreign Settlement in coastal harbor and residential hill side area. This area accommodates and lined up religious institutions which inevitably functions Kobe's urban legacy as an international maritime trade city then. The mosque has been noted as historic symbols which revealed following respective accounts; historic back ground of local Muslim community (Y. Fukuda, 2011) [2], governmental built heritages inventory (Educational Board of Hyogo Prefectural Government, 2006) [3], and architectural records edited by Goichi Takeda and prominent architects (Modern Architectures Pictorial, 1936) [4].

3. Architecture of the Kobe Muslim Mosque

- **Location**: 2 Nakayamate Douri, Chuo-Ku, Kobe City, Hyogo Prefecture.
- **Construction**: 1935 (Official occupational certificate issued)
- **Structure**: Reinforced Concrete
- **Floor level**: 3 levels + 1 Underground level
- **Roofing**: Flat Roof with partially Dome (Wooden Structure and Copper Roofing)
- **Walls**: *"Exposed-aggregate finish by washing"*
- **Total Floor Size**: 250 sqm
- **Architectural Design**: *Jan Josef Švagr*
- **Construction works**: *Takenaka Corporation*

Dome has particular design with copper roofing (300×400mm) and curved surfaces. Internal structure is wooden structure and places on reinforced concrete roof top slub. **Minaret** has 3 levels with different design. Floor and wall shapes are differed on each level and details with oriental influences. Exterior has different attire, but interior has same and simple finishing, except steel stair. **Exterior Walls** has finished *"exposed-aggregate finish by washing"* which provides unified images as a part of street scape, even though the building design has composed diverse architectural design elements. **Ground Floor** has main prayer hall and corridor space. There are traces of doors between main hall and corridor which provide more spaces for prayers. Player hall is square plan, faces to West with Mihrab (Arch height: 3487mm AFL) and Minbar (1090mm AFL) which decorated white marbles. **First Floor** has smaller prayer hall where mainly occupied by female prayers. Rest of the space is void space above of main prayer hall on ground floor. Void space and female prayer hall is separated and decorated parapet. **Second Floor** has large prayer hall and pitched roof with small void space connecting main prayer hall. This function makes all mosque 3 levels are connected and deliver imam and prayer's voice on G/F. Interior is same as main prayer hall and rest of the area.

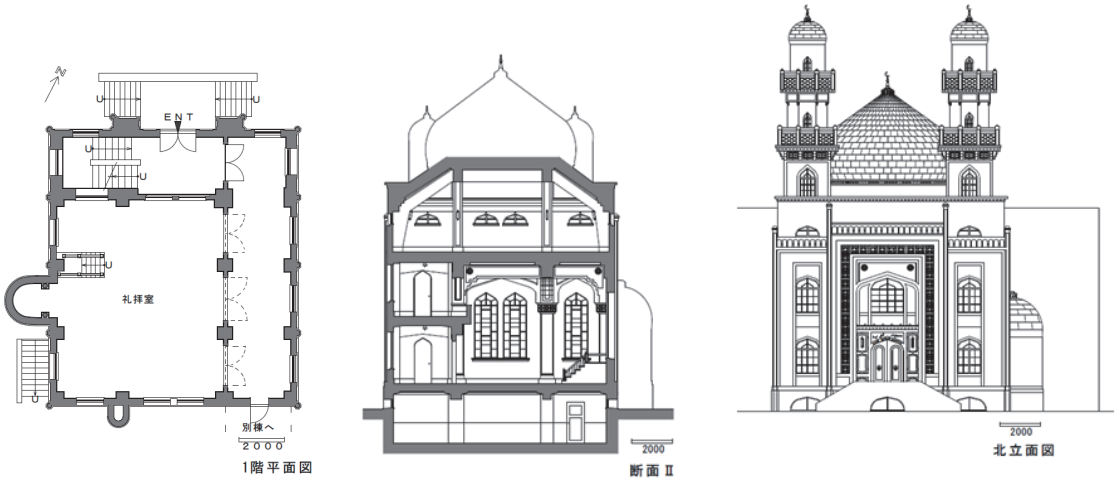

Fig 1. Plan (G/F), Cross Section and Front Elevation (2012)

4. Architect Jan Josef Švagr and Takenaka Corporation

Jan Josef Švagr was born in Bohemia, Czech in 1885. He educated in Czech Institute of Engineering. Later, he fled to Russia due to military service and religious reason. Unfortunately, his life in Russia is interrupted by Russian October Revolution; again he fled to China, then Japan. He met with architect Antonin Raymond in Shanghai, and worked under him from 1923 to 1930. Švagr opened his own office near Yokohama Catholic Church which he designed. Immediate before the WW2 in 1940, he offers his office for his Japanese collaborator and left to Argentina, and passed away in 1969. According to Takeyoshi Hori, Švagr was hired as a "*structural expert"* by Raymond. At that time of Yokohama, architects received high demand of *Kanto Great Earthquake* recovery. Švagr is the part of leading architects among them. Takeyoshi Hori described Švagr's recognition as *"one of the three prominent foreign architects in Yokohama"*. Interestingly enough, there are no significant architectural design sequences on Švagr's works in Japan. All his works have different design, somehow designed different architects. In fact, some of research indicated that Švagr is a structural engineer rather than architectural designer. Švagr had architectural work from 1923 to 1940 in Japan. During his carrier in Japan, he carried out his projects mainly in Yokohama and Tokyo during early 1930s. Late 1930s, he extended his project in Hokkaido and Kyushu, includes mosque in Kobe. **Takenaka Corporation** then, new blanch office were established in Kobe to pursue their further company's growth as a part of modern architectural field, especially to establish reinforced concreate engineering method. Their office and Kobe Mosque is located almost same quarters, and Takenaka committed mosque construction from the beginnings to prepare particulars of building certification application. Their design team was led by Kuro Washio, a renowned architect who was the division head of design office of Takenaka. Takenaka's plan has not touched architectural details of the mosque as well as structure. After they submit these drafts, Jan Josef Švagr invited to the project to brash up both architectural design detail and structural reinvention which could be an unforeseen factor of "miracles" later years. According to the areal picture taken in 1936, urban built up areas were already extended and elevated railway lines are appeared as current Kobe City area, and clearly indicate two minaret and dome of the mosque.

5. The Mosque and Disasters

The mosque experienced "miracle" of survivals from uncountable tragedies to them - Kobe Flood in 1938, Kobe Air raid during WW2, subsequent postwar social disorder, tourism development as "*Izinkan gai*", and Great Earthquake in 1995. In this paper, author analyze background of major disasters - 1945 Air Raid and 1995 Earthquake - and pointed out possible reason generated the "miracle"; (1) the surroundings of the mosque had slightly wider buffer space with adjoining properties, (2) consisted stronger ground and stable soil condition, (2) structure has enough strength to resist, and (4) sophisticated management and continuous maintenance by mosque committee members.

WW2 Air raid 1944: Kobe air-raid during the WW2, the fires and destruction reached to the mosque area, Kobe air raid in March, 1945, 21% built up area is burned and destructed. According to the picture taken in 1946, a few structures were remained, mainly reinforced concrete structure. Other remains are chimney of burned residential buildings. The picture (Fig.3) indicates completely burned Kobe city area, until the line of elevated railway lines and *Sannomiya Station*. Immediate after the war, aerial picture taken by US Army indicated completely destroyed nature of city, and fires are reached to another two blocks up to the hill

side. However, the picture shows us clearly, shadow of two minarets and dome of the mosque surrounded burned field, and only windows were broken.

Kobe Earthquake 1995: January 17 earthquake destroy wide area of the Kobe City. The mosque had slightly damaged, despite of the surrounding buildings were seriously destroyed and ruined. According to the map which recorded and analyze the damage happened individual building, mosque has been recorded "no damage". Surrounding areas were experienced more serious damage, especially area has survived WW2 Air raid 1944. It could be understood that mosque stands above stable land, and stronger structural design by architects Jan Josef Švagr who trained as engineer and witnessed aftermath of *Great Kanto Eathquake* in Yokohama. Immediate after the earthquake, the mosque functioned as a shelter for Muslims staying in Kobe, and accommodate them as long as a month until basic needs were recovered. These evacuee required specific diet – halal foods, fresh waters, and daily necessities for infants. Remarkably, Muslim community both from international and locals send these necessities to the mosque immediate after the disaster, and evacuees were helped each other beyond their origins and nationalities.

Fig 2. The Mosque and Kobe: Immediate after the war

Picture sources: Kobe City, edited, 1989, Kobe Pictorial: 100 Years, Kobe City, pp.110-111. *Caption: USAF's B29 bombers were left late afternoon, fires remained till evening in down town. Muslim temple was survived. Air Raid on 5 June. (Picture's original is provided by The Mainichi Newspapers*)

Notes

During onsite architectural study and interviews, Mr. Ahasan Arai of the Kobe Muslim Mosque kindly support site field works. Professor Junichirou Ishida provides valuable comment and observation during final stage of drafting Japanese version of preliminary report as well as subsequent research activities. This article has prepared as an *extended abstract* for iaSU2016, and author will publish respective publication in the future.

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TWO NATIONS IN THE PROCESS OF MODERNIZATION – PERSPECTIVES ON THE INTERIOR SPACE IN TURKEY AND JAPAN IN THE INTERWAR PERIOD

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Keywords: modern architecture, westernization, domestic interiors in Japan and Turkey, furniture, interwar period.

Introduction

The interwar period has marked an important stage in the social, economical, and political histories of the countries throughout the world. Meanwhile, architecture has kept on being used as a means of expressing the state of the mainstream as well as the changing notions. Especially for the newly flourishing nation-states such as Turkish Republic and for the growing economies such as Japan's, the explicit presentation and concrete modeling of their developing societies could be achieved by architecture. For the time period in concern, modern architecture was perceived as a tool for displaying/promoting the ways that those countries maintained for the development of their societies and their statue among of the leading powers of their time.

Published in the magazines and newspapers, endorsed by the state, and seen by the public from the exterior, modern architecture was introduced by several different channels and was favored by the local architects, educational curriculum, and some parts of the society, both in Turkey and in Japan. However, the question was how the modern architecture could be a part of the social transformation more thoroughly. The groundbreaking ideas of the supporters of the modern architecture should have penetrated into the minds of every citizen in such a way to establish the notion of the new society more effectively. The way to achieve this was to promote new ways of living through new domestic interiors. Yet, how would these novel interior spaces, hence new ways of living, be introduced into two introverted societies like Turkey and Japan? In which means the interior spaces would be presented to spread the transformation to the overall segments of the society?

Within the lead of these questions, this paper will analyze the modern interiors designed and promoted in Turkey and Japan in the interwar period. In addition, the issue of furniture design as a significant denominator of the interior space will be examined along with the aspects that affect the production and consumption process. As the studies on the era reveal, some of the periodicals of the period were to be the essential resources with articles, drawings and even advertisements they presented to their readers as well as the essays by the prominent architects from Europe and Japan, which will be examined through the research. [1] [2]

Modernization of Interior Space in Turkey and Japan in the Interwar Period

As Selçuk Esenbel asserts, both Turkish and Japanese societies have resemblances in introducing the western culture particularly to their everyday lives. [3] Although affiliation with

the West sets back to earlier periods, the westernization process in the Ottoman Empire began in the second quarter of the nineteenth century and it did not have any direct accounts on altering the very nucleus of the society, the family, until the first decade of the twentieth century. After the proclamation of the constitutional monarchy for the second time in 1908, the government was eager to modernize the domestic structure of the society. Yet, the members of the family began to be affiliated with the new (European) home furnishings and modern way of living through school books. [4] The first two decades of the twentieth century, the residential architecture was open to the current stylistic approaches such as neoclassicism, neo-baroque, Art Nouveau and Art Deco, along with the new types of housing such as the apartments. Meanwhile, there was a search for a national style among the Ottoman architects which were accompanied by several foreign architects. Especially after the dissolution of the Ottoman Empire, the First National Style –or the Ottoman Revivalism-, which was criticized as being anachronistic and eclectic, was abandoned in the beginning of the 1930s and the newly established republic promoted the modern architecture as a means of "official production, supervision, and dissemination of a distinctly republican visual culture of modernity". [5] The prominent architectural magazine of the era, Mimar, strengthens the visualization of the modernist cities and spaces with the articles, photographs and sketches being published constantly (Fig.1).

Meanwhile on the other side of the world, Japan had already started to be a medium where different approaches towards architecture became apparent. Westernization and introduction of western architectural practices and techniques in Japan were started with the Meiji Era. The new Japanese government executed reforms and enacted a national policy to catch up with the western social, economical and cultural developments. Modern architectural design and techniques were introduced both by invited foreign architects and specialists who were to design or supervise the existing and new constructions and lay the foundations for a Western system of architectural education; and by the Japanese architects, who went abroad to study or work with leading architects of the time. [6] Different architectural movements and phases of modern architecture such as Art Deco, Expressionism and Bauhaus were studied and reflected to the Japanese architecture, domestic interior space and furniture, where the primal motivation was to "disseminate functional homes" and "the amelioration of domestic fittings in a moderate and progressive manner" [7] and accordingly, their reception and reaction in the society varied. (Fig.2)

Development of industrialization and modernization improved the educational methods both in Japan and Turkey; hence, this improvement caused the creation of a distinction between social classes with an increase in the urban population. Domestic interiors were altered in the meantime, while experiencing radical changes in social developments, household roles and occupation. Transformation of the household was observed according to the changes in new patterns of habits and perspectives on family life in the new domestic interiors. Certain parts of the house, which had been identified with specific gender, became common spaces both for male and female inhabitants, such as reception and study rooms. For the publicity and debates on these alterations, not only works of the local or Western architects (such as Bruno Taut, Richard Neutra, Antonin Raymond, Yamamoto Setsuro and Abidin Mortaş) or articles in daily newspapers or architectural magazines (such as Ulus and Mimar from Turkey) were involved in introducing new styles and furniture choices, but also magazines for women (such as Ladies' Graphic and The Housewife's Companion from Japan) were used as a medium for promoting modern interiors. [8] [9]

Fig.1: Lighting proposal for a living room in *Mimar* (May 1931), p.175

Fig.2: Dining room, Higuchi Hisagoro model house (1924)

Conclusion

This paper examines the impact of modernization on Japan and Turkey in the early 20th century. Japan and Turkey, which have long-standing cultures and traditional architectural background, are selected to analyze the resemblances and differences in terms of their encounters with westernization through modern architecture. The outcome of this research is to execute a comparative reading on Japanese and Turkish domestic interiors and furniture in the interwar period with reference to social, cultural and architectural developments.

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Archi-Cultural Interactions through the Silk Road
4th International Conference, Mukogawa Women's Univ., Nishinomiya, Japan, July 16-18,2016
Proceedings

JAPANESE ARCHITECTURE IN THE 21ST CENTURY: *THE QUALITY OF CONSTRUCTION*

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Keywords: Architecture, Design, Building Construction, Quality, Contemporary Japanese Architecture, Japanese Architects, Interviews, Craftsmanship, Quality control, Japanese Building Industry

Introduction

Many regions along the Silk Road have distinctive architectural traditions from the Roman Empire, through Persia and Tibet and into China and finally Japan. However, few architectural traditions have had as great an impact on contemporary architectural practice as has Traditional Japanese architecture. After a long visit to Japan in the 1950s Walter Gropius wrote, " I am convinced that invaluable benefits will accrue to a contemporary student of art and architecture from a visit to Japan. There he will find sublime, mature solutions of the intricate, ever-new problems of space and human scale, the very media for the art of architectural creation."[1]
Today the challenges facing Architects and builders are very different from those faced in the distant past. Today building codes, economic constraints and changing social norms all conspire to make the creation of quality buildings a difficult proposition. Even so, until the present, Japan has maintained a high level of quality in its contemporary Architecture. The creation of high quality architecture in a contemporary context involves many different factors. The process must begin with a good design but that is not enough to ensure that a high quality building will result. Continued involvement of the architect during the construction phase of the project is critical to the creation of a high quality product. This research focuses on aspects of building design and construction in Japan that result in high quality architecture.

Methodology

This paper is a summary of interviews between the author and six prominent Japanese architects chosen because of their reputations for producing well-designed, high-quality architecture. As an indication to their competence and the relevance of their ideas, one architect is a Pritzker Prize laureate and several are university professors now or have taught extensively in the past[1]. All have been published widely and have won numerous awards for their work. Four of the architects practice in Tokyo and two of them practice in the Osaka area giving them slightly different perspectives on the building industry. The author drew from his own experience as an architect and craftsman in Japan[2] to design questions and to sustain conversations with the interviewees that begin to shed light on the current state of quality in contemporary Japanese architecture. To establish a standard of consistency through all of the interviews the author sent a research abstract and interview questions to each architect prior to the meetings[3]. The questions acted as a general outline for each interview but the ensuing conversations went on many interesting tangents.

Results

Each of the six architects interviewed has his own approach to design and method of working with client's, contractor's, craftspeople, academics etc. so generalizations about the results of the interviews are difficult. Because of the relatively long period of downturn in the Japanese construction industry many of the architects referred to the difficulty of making high quality buildings with limited budgets and with the bidding system for awarding work to contactors. Yasuhiro Yamashita of Atelier Tekuto emphasized the importance of research in producing quality buildings. Yamashita has been successful at forming alliances between companies and academics to perform research that benefits all parties and results in innovations that improve building quality. Kengo Kuma has worked closely with crafts people on many of his projects to produce high-quality contemporary buildings using many traditional craft techniques. Toyo Ito has taken advantage of highly skilled workmen to produce some of his most innovative structures. His Mediatechque library in Sendai (Fig.1) was on the cutting edge of technology when completed in 2001 and much of the building's interest center's around a group of cylindrical steel supports that would not have been possible without the contribution of highly skilled steel workers who improvised on the design of the supports as they were being built. Go Yoshimoto is practicing in The Kansai area where he has access to skilled carpenters who contribute greatly to the quality of his buildings. Shuhei Endoh who is well known for his innovative building techniques works closely with builders to realize his designs.

Fig. 1: Sendai Mediatheque Library by Toyo Ito

Conclusion

Although the Japanese Construction Industry is facing many of the same problems that work against the production of high quality architecture in developed western countries, certain situations and circumstances [some historic, some social, some cultural] have helped them overcome these obstacles to a large extent and they continue to produce some of the most creative, innovative, and highest quality architecture in the world. This series of interviews with some of the leaders in the field brings to light many of the circumstances that contribute to the creation of high quality architecture in 21st century Japan.

Notes

1. Architects interviewed
   Toyo Ito – Toyo Ito and Associates Architects
   2013 Pritzker Prize Laureate, Professor –Japan Women's University
   Kengo Kuma- Kengo Kuma and Associates
   Professor- University of Tokyo
   Shuhei Endo- Shuhei Endo Architect Institute
   Professor- Kobe University
   Takaharu Tezuka- Tezuka Architects
   Yasuhiro Yamashita- Principal- Atelier Tekuto
   Go Yoshimoto- Go Yoshimoto Architect and Associates

2. Stanley Russell worked for Team Zoo Atelier Iruka in Kobe Japan and apprenticed with a master carpenter on Awaji Island. Russell designed and built several projects in Japan under the office name "Teuchi Kenchiku". Russell's work has been published in Jutaku Tokushu, Kenchiku Chishiki, Shonan Style and Kazi.

3. Interview questions:
   How do you feel about the current state of the building industry in Japan?
   How do you feel about the quality of construction now compared to other times in history?
   What signs do you look for to judge the quality of construction in your projects?
   What steps can the architect take to help ensure high quality construction takes place?
   How does the size of a building project relate to the quality of construction?
   How important is collaboration with other professionals in your work?
   Are architecture students in Japan taught the importance collaborating with others?
   Is craftsmanship an important factor in contemporary Japanese architecture?
   Is craftsmanship a part of the work of the architect?
   How important is the contribution of craftsman to the successful completion of a project?
   What is the relationship between Architects and craftsman?
   Are architecture students in Japan taught the importance of good craftsmanship in buildings?
   How have digital tools influenced the quality of design and construction?
   Do you think that Japanese clients will pay more for high quality design and workmanship?
   What are the major differences in creating high quality architecture abroad vs. in Japan?
   Please talk about one of your projects that you feel achieved a high quality of construction and craftsmanship. What factors were involved in the successful completion of the project?

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MODERNISM IMITATION

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Keywords: Modernism, Economy, Residential, Oodlajan

Introduction

The issue of the relationship between culture and architecture and the effect of intellectual movement on them are interdisciplinary issues that attract different sciences such as sociology, architecture, urban design, archaeologist, etc.

The main function of culture is the expression of human subject ideas. Architecture helps the culture to make subject ideas visible.

In our age, modernism movement impacts on our lives and on the former generation and any incorrect perception of that creates problems.

This proposal tries to survey the effects of modernism, urbanization and globalization on one of the olden locale of Tehran and tries to probe the issue as far as it can.

Fig .1: Oodlajan residential architecture Chopani St.

Tehran was known as a city when the "Qajar" administration started to administer the country. Tehran had 12 small locales. Due to city development and increase of the population the locales joint and Tehran finally had 5 important locales. "Oodlajan" was one of them.

Oodlajan was close to the important and huge market called "bazaar" that played a great role in the economic activity of country and Qajar palace. This neighborhood made Oodlajan architecture valuable but now there is not much information about it. Researchers had studied the urban planning of Oodlajan and its issue to some extent, but they had not realized enough information. The author and his colleagues in their new research found some documents that show the value of Oodlajan architecture. This locale deserves to be investigated more to be completely known.This research briefly surveys the cultural change in past century on Oodlajan and expects to answer the questions and to encourage another researchers to study about that.

Methods

A. Research Questions

The main questions of research are:

1. What is the main reason that Oodlajan is forgotten?

2. What factors have changed Oodlajan function?

3. What is the relation between intellectual movement, culture and architecture?

B. Research Hypothesis

Oodlajan that once was considered as one of the most majestic residential locales in Iran, is now in an awful situation and it will perish soon if the situation remains the same.

The hypothesis of this research indicates that modernism movement, globalization and urbanization have changed the previous old culture and the new culture requires new activities. So, the place expanded. The impossibility of constructing new buildings makes old buildings to function in different ways. Continuing this unexpectable function makes the building start to ruin. In fact, incorrect perception of modernism movement, globalization and urbanization and agressive efforts to achieve it caused the locale culture(silk road culture) to be replaced by the stranger one.

C. Research Method

The research method is logical ratiocination.

Result

Oodlajan before social revolutions: Locating Oodlajan near Qajar palaces and bazaar made it one of the excellent and rich residential locales. Many of the residents of this locale were politicians or rich businessmen. Political and economic potency influences the architecture and the residents tried to introduce the Iranian art and culture by architecture. In that locale, there is a wide variety of architectural design details, made by brick(“Ajorkari”), tail(“Kashikari”), stucco(“Gachbori”), mirror, detail in “Oroosi” door and etc, And these are just a few examples of this valuable forgotten architecture.

For example, latest researches and conformity of the documents with Iran contemporary history helps us to find the house of “Abdolghadirazad” senator and minister candidate.

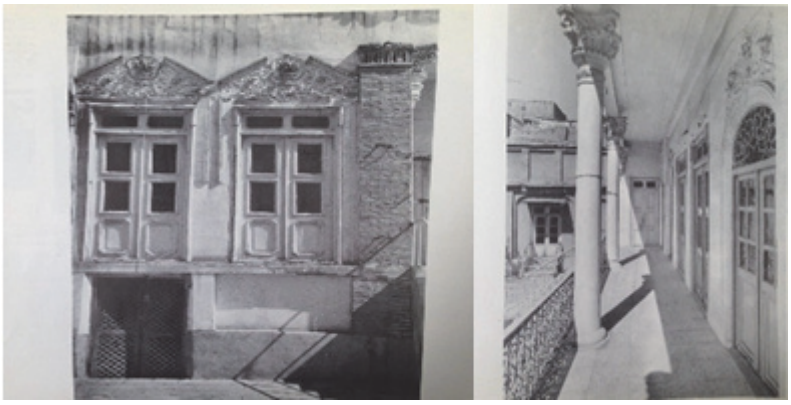

Fig.2: Abdolghadir Azad's house, Fakhromolk St.

Oodlajan mutation: Leading country by Mohammad Reza shah(second king of Pahlavi), occurring important events like dependence on bargaining oil, increasing relation with foreign countries, increasing the population, etc, caused some changes in the bazaar. Bazaar needed to have more space and must have started to develop to answer the new economic activities. The only solution for developing was changing the function of residential buildings next to the bazaar. Oodlajan is one of these locales that had been hurt. Some huge effect of this mutation on Oodlajan locale are:

1. Changing the function of building from residential to economic units such as workroom or storage. This irrelevant changing function reduces the standard of a residential building while missing the architecture behind.

2. Replacing local residents with immigrant workers. Due to the increasing economic activity in bazaar new worker migrated and worked in this new workroom and started to live there .The cultural difference between immigrant workers and local resident made problems and these problems are reasons to forget Oodlajan and its valuable architecture and any effort for repairing it.

3. The absence of the sense of belonging to the locale by entering the multi foreign cultures is the other reason to forget solving locale problems since these new residents fundamentally did not recognize the locale as their own.

4. The security problem is one of the other reasons that has stopped foreign researchers to study about it, mostly due to the existing different and irrelevant cultures.

5. The traffic issue is one other problem that makes the condition of locale harder to act as residential.

Oodlajan after mutation

These reasons altogether cause below events:

First, the local residents who are the first potential hopes to come over the problems have no willing to stay there and almost all of them want to migrate.

Second, the price of Oodlajan building reduces daily and it makes the situation better for immigrant workers and also for replacing the residential building with workrooms and storages.

Third, because of the cultural and security problems a few researchers accept the conditions and accept the hardship of studying it.

Now the main problem in studying on the architecture of buildings is convincing residents of buildings. They do not welcome researchers and it is hard to find a way to provide a document of the oldern architecture. The author and his colleague have been trying to find new documents of this architecture and could registrate some of them.

Conclution

Oodlajan and its valuable architecture need more studies. This proposal tried to have a very brief introduction about this forgotten architecture.

Results show that:

1. Incorrect perception of modernism movement, urbanization, globalization and fast imitation of it will cause removing and forgetting the culture that has been formed there. The depth of alienation and abandoning is understood when you find out that this forgotten area is located in downtown and center of economic activity.

2. Each architecture is defined with events that have occurred in it. Oodlajan architecture before its mutation has the residential identity but after mutation, its identity changed. So the architecture that has acted as the residential place plays the economic role now. So, one fixed architecture can do a wide variety of functions and exactly these functions define its identity. The influences of intellectual movement on culture and what has happened to it as we saw in Oodlajan intellectual movement can directly have an effect on architecture and its identity.

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note: most of these information are released by our research and there are few sources about that. so visiting our site is strongly recommended.

URBAN TRANSFORMATION in ISTANBUL

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Keywords: Urban transformation, housing, housing stock, Istanbul

Introduction

Istanbul is the biggest metropolitan and global city in Turkey. Due to globalization, Istanbul is undergoing rapid urban transformation and development. The 1999 earthquake in Marmara has had an impact on the residential buildings, housing market and all the topics related to the construction sector. In this sense, this earthquake is the turning point in the urban transformation process which plays an important role in order to renovate-regenerate the building stock. Istanbul is the most-affected city by these transformation, especially in housing buildings. The new regulations supported and encouraged this urban transformation process in housing. The new urban transformation has affected different districts in various ways based on district properties, plot properties as well as socio-economical structure of the residents. Therefore distinct practices related to housing can be seen in several districts. In this context, Kadıköy district is a suitable sample area to scrutinize these practices where diversified examples can be found which reflects the aforementioned properties. The aim of this study is to scrutinize the process, actors and practices of urban transformation in housing. The main discussion will be on the potentials and problems of urban transformation, focusing on different practices in Kadıköy.

Urban Transformation in Istanbul

Urban transformation can be defined as "demolish illegal housing, unpermitted buildings and the buildings that do not comply with the planning regulations of the city and create new urban settlement areas that comply with the planning regulations" [1]. Even though urban transformation varies between nations, the main aim is to create a solution for the urban problems of the transformed area. This solution must have a holistic approach which integrates the cultural, social, economical and environmental aspects to the transformation of physical space [2,3,4].

Urban transformation policies and applications in Turkey and especially in Istanbul; can be discussed in three different period which have distinct features: 1950-1980 period, 1980-2000 period and after 2000 [5]. Between 1950-1980, because of migration from rural to urban areas and rapid population increase; urban transformation focused on regeneration and rehabilitation of squatter areas and urban decay (degradation) areas in central parts of the city. The second period (1980-2000) is the period of rapid socio-spatial transformation due to globalization and neoliberal policies and urban transformation focused on the urban renewal and rehabilitation of the areas with decreased life quality and preservation / gentrification of historical areas. Gentrification of historical housing areas continued and new housing areas are also developed (mostly gated communities). The 1999 earthquake in Marmara is the turning point for urban transformation. After 2000, the focus of urban transformation has shifted to renewal, reconstruction of the housing stock and urban housing

areas based on the new regulations. Moreover, after the 1980's, local municipalities gained power in the planning regulations and process. Also, globalization and privatization gave private sector a bigger role in the construction and urban transformation area. All these developments have accelerated the urban transformation process and changed the main actor from public sector to private.

Urban transformation has been practiced in the planning area since 1980's in Turkey [6]. Urban terminology such as urban transformation, urban renewal, urban regeneration, urban rehabilitation, gentrification etc. became popular in planning in this era. Even though these terminology have different meanings fundamentally, while practicing they point towards the same aim: to rehabilitate a problematic urban area and improve the life quality in that section of the city. The conflict between the meaning of the terminology and practice affect the implementations and process unfavorably. Various regulations and their ambiguity also create problems for the actors to solve during the urban transformation process and practice. The ambiguity of the regulations and the conflicts in the practice may be beneficial for the involved private sector economically.

New Regulations and Practices

There are many laws and regulations effective today in the urban transformation process. The practices may be affected from different factors such as plot properties, local and environmental features of the site, socio-economic status of the residents, and socio-demographic structure etc.. The diversity of urban transformation process and application can be seen in the same area and even possible to be seen in neighboring parcels. The four of the regulations become prominent which dramatically effects the aforementioned conflict and causes the variety in the practices[1].

The first regulations is the one enacted by Istanbul Metropolitan Municipality in 2007, detailing the urban transformation process (dated 23.06.2007). The other ones are dated 01.06.2013, 08.09.2013 and 14.09.2013 (revised version of the regulation dated 08.09.2013) consecutively enacted by Ministry of Environment and Urban Planning. The real complication emerged in the execution of the law after 01.06.2013[2]. Projects receiving permits and initiated the procedure:

1- before the effective date of the regulations is subject to the new regulations dated 01.06.2013.
2- before the effective date of the regulations is subject to the new regulations dated 14.09.2013.
3- between 01.06.2013 and 08.09.2013 are subject to choose the favorable articles of the two aforementioned regulations
4- between 22.05.2014 and 01.01.2017 are subject to choose between the four aforementioned regulations.
5- before 01.06.2013 are subject to choose between the favorable articles of the aforementioned regulations.[3]

[1] This study focused on the recent regulations dated 23.06.2007, 01.06.2013, 08.09.2013 and 14.09.2013 and details can be found in the given links: http://www.ibb.istanbul/tr-TR/kurumsal/Birimler/ImarMd/Documents/imar_yonetmelik.pdf (15.03.2016), http://www.resmigazete.gov.tr/eskiler/2013/06/20130601.pdf (15.03.2016) and http://www.resmigazete.gov.tr/eskiler/2013/09/20130908.pdf (15.03.2016), http://www.resmigazete.gov.tr/eskiler/2013/09/20130914.pdf (15.03.2016)

[2] On 22th of May, 2014 an temporary article is announced concerning the effectiveness of the abovementioned regulations; http://www.resmigazete.gov.tr/eskiler/2014/05/20140522.pdf (15.03.2016)

[3] The details and practice differences can be found in the given link http://www.mevzuat.gov.tr/Metin.Aspx?MevzuatKod=7.5.4877&MevzuatIliski=0&sourceXmlSearch (15.03.2016)

Due to the fact that these districts have different characteristics and the abovementioned complications; Kadikoy became an area that should be examined carefully in terms of the current urban transformation projects. Therefore, in this study, the focus will be on the two districts in Kadıköy.

Kadıköy Case

Two cases are selected in order to discuss characteristics of the districts, features of the plot, the actors and stakeholders of the process, transformation type etc. The districts are selected as Suadiye and Moda which are in the borders of Kadıköy Municipality in the Anatolian side of Istanbul. Both of the districts have middle-high and high income group of habitants. The districts are close to each other, and near to the sea shore while they have different urban fabrics, building coverage ratios and heights.

Fig. 1: Suadiye (A) old apartment and (B) the proposal for the same plot (Architect: BTMH, Photographs: Ismail Tandoğan Archive)

Fig. 2: Moda (A) old apartment and (B) the new one for the same plot (Architect: Hasan Alp Demir, Photographs: Serdar İncirlioğlu Archive)

Suadiye Case: In the former fabric, the houses are usually 4-5 stories high and have adequate green areas (Fig 1A). On the other hand, the height of the building have increased dramatically; in the new fabric, the houses are raised to 14-15 stories high (Fig 1B). The houses are detached and have gardens in the previous versions. Even though garden sizes are the same in the newer versions, because of the obligatory car park on the basements and foundations, the quality of green areas decreases. In most of the cases, the size of the

houses decreases, while infrastructure and social facilities remain the same. In other words the life quality decreases while the rant and number of habitants increase. Another important point is that, because of the rant, and height rise, constructors prefer to reconstruct the buildings. The habitants also prefer this renewal even though the house size usually decreases, real estate value increases.

Moda Case: In the former fabric, the houses are usually 4-6 stories high and mostly attached houses (Fig 2A). The height of the buildings have not increased in this district (Fig 2B). Therefore constructors do not find the district profitable which changes the actors of the constructions; habitants need to pay for the reconstruction. In most of the cases, the size of the houses, infrastructure and social facilities remain the same. In other words the life quality and the real estate value increases, but the differences are slight in comparison with Suadiye.

Concluding Remarks

According to the definition of TDK, current urban transformation practices in Turkey; correspond with the renewal of the housing stock but does not create new urban settlement areas that comply with the planning regulations. Apart from the aforementioned disagreement, the practices usually deal with plot and city block scale instead of urban scale. As seen in the cases, even though the houses are renewed in both of the cases, type of the process, power of the actors and characteristics of the districts change dramatically.

Urban transformation becomes the major practice area for the real estate market while it was an important implementation tool for planning. The ambiguity and contradictory use of the regulations acts for the benefit of rant real estate values. This openness to interpretation must be fixed in order to preserve local values, urban fabric and increase life quality in the transformed area of the city.

Acknowledgement

We would like to thank Mr. Ismail Tandoğan (MArch) for his support of this study.

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SILK PROSPERITY REMINISCENCES: A CASE STUDY IN SUZHOU'S URBAN FABRIC

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Keywords: Suzhou, Urban Analysis, Place Analysis, Place Theory.

Introduction

Cities are not made of a homogenous and continuous urban fabric. On the contrary, they are usually composed of a vast variety of buildings and spatial configurations; old and new buildings, different densities, continues facades, low rise, skyscrapers. Just by looking at these spatial configurations we can read all kinds of interactions; historical periods, functions, technological changes, cultural changes, wealth, architectural trends and urban ideologies. Some of these interactions often seem to have fundamental conflicts with each other, suggesting that they cannot possibly be part of the same system or environment. Yet, they are remarkably held together, firstly by what we call public space, and secondly by the citizens. The city of Suzhou in Jiangsu Province, like other cities in China, has undertaken urban and construction changes of unprecedented speed and magnitude, creating a city in which these urban differences have reached unforeseen scenarios and contrasts. Is the speed in which these changes are occurring actually too fast, to the point in that citizen and public spaces cannot 'hold together' a city anymore? Or can a city's main urban characteristic be dissolved, change or replaced? In this case study we explore these questions by inviting a group of architecture students to investigate specific areas of Suzhou's old town to see if they could still identify and recognize some of the city's main features and landmarks.

Background and Context

Suzhou, Located in Jiangsu province and founded in 525BC, is one of the oldest and most unique cities of China. Renowned for its network of canal systems, the city is also considered the best contemporary example of Song Dynasty's principles of city planning [1], still retaining its most essential features. Since Suzhou has been connected to the national waterway network almost since its origin it was a key and prosperous city during the Sui and Tang Dynasties. It was also a major producer and supplier of silk during the Tang and Song Dynasties. However, it was only after that the city was partially destroyed by the Chin armies in 1129AD that Suzhou was rebuilt following the layout recognizable even today, creating the remarkable network of more than 100 canals which can be seen in the famous Ping-jiang map by Lu Yen (Fig. 1). This urban development also allowed the advancement and improvement of unique building typologies, like the Suzhou's traditional courtyard houses, in which the courtyard acts as spatial coordination center for number of buildings and chambers which altogether form a housing entity with the courtyard becoming the main place of meeting and interaction among neighbors [2]. Today, only about 36km of canals remain out of Song's 82km original network. Although most of the small canals disappeared during Qing Dynasty, a significant decline occurred after 1949, when many canals filled were cup in order to get more land in order to provide dwellings and facilities for an increasing population [3].

Currently, most of the main canals still preserve their original shape, yet their interaction with the modern urban fabric could be described as complex, disjointed at times; some selected canals of undeniable historical value, like Ping Jiang Lu, have been kept, maintained and potentiated as touristic spots. But other canals and street of comparable value and beauty seem concealed within the old town. These areas are the ones to be visited during the proposed case study.

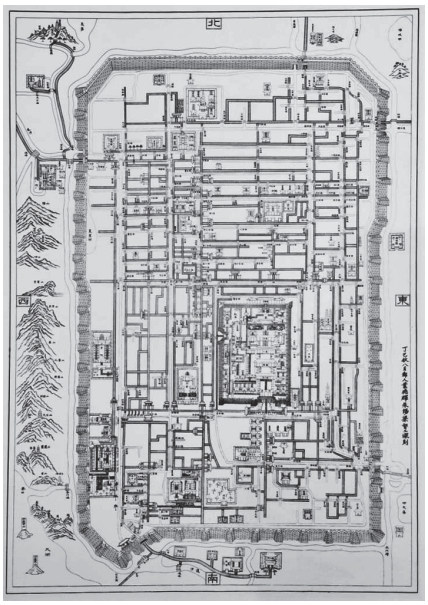

Fig. 1: Ping-jiang map by Lu Yen

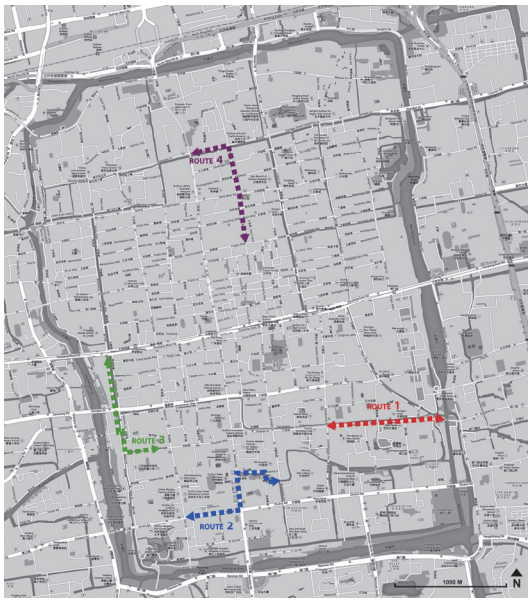

Fig. 2: Current Suzhou and proposed routes

Exercise

A cohort of 115 first year architecture students had to organize themselves into groups of 4 to 6. Then, they were presented with a map indicating four walking routes within Suzhou's old town (Fig. 2). Each route was about 1 km long. These routes were carefully selected taking into account their potential for offering a variety of urban experiences as moving along them. All four routes incorporated historical canals and buildings at some point (as explained before, a feature not so easy to find within Suzhou's urban fabric anymore). At the same time, the selected routes purposely steer away from mayor touristic streets/canals like Ping Jiang Lu or Shan Tang Jie, emphasizing the idea of discovering the normal and mundane interaction between historical and modern urban elements. Students were instructed to select one of the proposed routes and analyze it using a variety of introduced techniques and media -plans, sketches, photos, videos, etc-. They were asked to record and elaborate on their impressions of the city while exploring their selected route. The main reason why we decided to undertake the case study with students from first year was because, since they are just starting their studies, their attention and interest could be less directed and conditioned by already acquired academic knowledge, resulting in perhaps basic observations which are also more candid and genuine. Following this premise, students were not specifically told to focus their efforts in the relationship between the old and the new, although this was subtlety suggested. For instance, attention was raised about the possibility of encountering 'historical landmarks', knowing that at least two of the routes purposely pass by important Unesco's world heritage sites; the Master of the Nets Garden and the Cangland

pavilion. Both built during different stages of the Song Dynasty, each one of these landmarks have different relationship with the city; Master of the Nets is somehow hidden within Suzhou's urban fabric, yet the Cangland pavilion is vastly exposed to the city and it cannot be missed when walking exploring route 2. However, the most important characteristic of the proposed routes is their offered variety of contrasts. For example, route 3 confronts the students with the newly built replicas of Xueshi St. which superficially emulate traditional Suzhou architecture, while right across the canal they can see the genuinely old and bustling living quarters of Jianjinquiao Alley. In other words, we expected the routes to be an invitation to discover these or other dynamics between old and new.

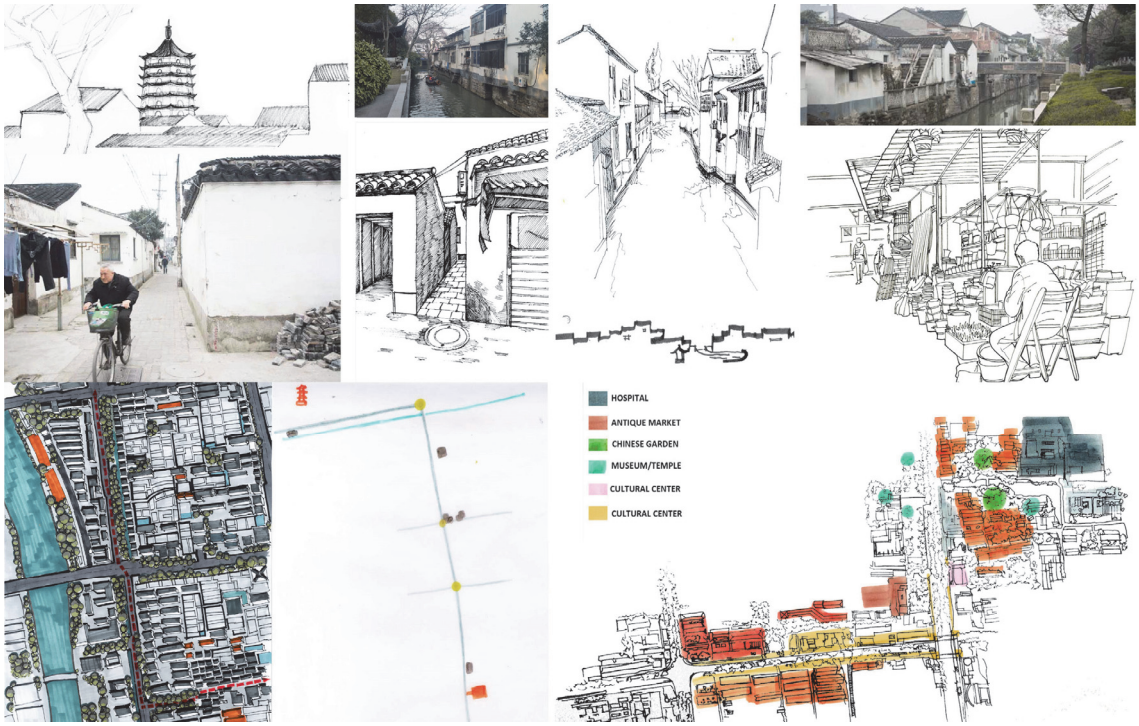

Fig. 3: Samples of the student's work produced during the route analysis.

Results and Partial Conclusions

Results of the route analysis showed mixed yet interesting insights. For instance, only about half of the students directed their attention to the canals and waterways on their route, which is less than expected (it is important to point out that 80% of the students are not from Suzhou, and they were mostly unfamiliar with the studied routes). However, the students who did focus their attention on the canals (Fig. 3) were able to elaborate very interesting observations not focused on their historical or aesthetic value, but in their abstract quality as built environments. For instance, they highlighted the quality of 'buffer space' of the canals, providing a distance which separated the residential side from the loud streets. They also pointed out the pedestrian vocation of the alleys and streets alongside the canals. More difficult to be accessed by cars due to most of the bridges being pedestrian ones, these streets allowed unique uses of streets and sidewalk by the residents. These and other observation suggests that the value of these spaces is not only rooted in their past but in their actual present as unique, contemporary environments. We expect that future steps of the case study will help to clarify these and other conclusions by incorporating students from

other years and even regular citizens so we can see how their observations compare and overlap. In the meantime, it is interesting to notice that in this first approximation, what it appeared to be subject of heritage and history for first year students were not individual buildings or streets, but an overall lifestyle; a compelling and intertwined relationship between specific types of built environments and their dwellers. This kind of relationship seems to be missing (or at least is not that clear and evident) in modern urban developments in Suzhou.

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"INVISIBLE CITIES": CALVINO'S ORIENTALISM AS A TOOL OF CRITICISM AGAINST MODERN ARCHITECTURE AND URBANISM

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Keywords: Invisible Cities, Italo Calvino, Asian Architecture, modernism, post-modernism, urbanism, literature.

Extended Abstract

Introduction

"Invisible cities" is a novel written by Italo Calvino, published in 1972 and translated in English in 1974. The significance of this work, stands on the numerous discussions that this book has evoked over the years, concerning the exchange of ideas between literature, arts, and architectural theory and the sciences of urban environment. This book is often considered as a typical example of postmodern literature, since it has an inconsistent narrative style and provides a great deal of narrative freedom to the reader himself. [1] Nonetheless, through the included brief descriptions of the "invisible" cities, it delivers a vigorous critique against the architectural and urban phenomena, caused by the half-a-century dominance of modernism in architecture and urban design. In some cases, Calvino's critique is straightforward, using examples of dystopian brutalist built environments, but in most cases, he produces a strong contrast by adding descriptions of a lost and nostalgic architectural past, and by reviving the exotism of oriental architectural qualities.

Description

The story is organized around a discussion between Marco Polo and Kublai Khan, where Polo entertains the emperor with his tales about all the cities of his empire that he has never seen yet. A total sum of 55 cities is described in this novel, narrated by Polo. The cities are divided in eleven subcategories, depending on the context that they belong to. Among these narrations, short dialogues between the Venetian explorer and the emperor are interspersed, to offer more information about the general concepts that are exposed in Polo's stories, and to construct the overall literal frame of the novel.

Most narrations of the short tales are obscured, with a poetic attitude, and do not intend to give a clear image of the described cities, but they rather manage to stimulate the readers' imagination and thinking, and to offer ground for discussions about urban life and environment. Topics, such as ontology, ethics, semiotics, linguistics, and metaphysics, are raised by the way the descriptions of the cities and the discussions of the main characters are depicted by the author. [2]

Aim of the paper

By the time that this book was written, the modern movement in architecture was the dominant architectural style and the framework of most architectural and urban theories. From the first decades of the 20th century, till the late 60s, modernism was undeniably applied in both architectural and urban scale, shaping up the global urban morphology.

From the late sixties a growing tendency gradually appeared, which questioned the validity of the modernist claims of purity and mechanization of dwelling. One of the first aspects of modern architecture that were criticized severely was the urban environment, and the failure of modern urbanism to produce qualitative and viable spaces. [3]

Therefore, in the following decades, there was a noticeable shift towards an inquiry for new ideas and new architectural theories. In the end of the1960s, the neo-rationalist movement appeared in Europe, and one of the main representatives of this movement was the Italian architect Aldo Rossi. Neo-rationalist architects, blamed modernism for the sameness and boredom of the urban environment, and for the lack of identity and historical succession. Aldo Rossi's book “The Architecture of the City” was manifesting his ideas, concerning the urban space. Rossi showed great interest about the overlooked from the modern movement, unseen features of the urban space, such as the historical context and the spirit of the place (“genius loci”). [4]

The main aim of the paper is to reveal the ways and the methods, that the author uses to demonstrate the failure of modern architecture and modern urban design. From the declining urban environments of the “continuous cities” of the last part of the book, till the contrast of the nostalgic descriptions of idealized utopias of the orient. Except from the descriptions of the 55 cities, the interfering dialogues between Marco Polo and Kublai Khan, offer great deal of further information about the frame of ideas posed by Calvino in this book.

Although the main story of the novel is dated to the era of Marco Polo and the Mongol empire, the apparent time span of the historical urban atmosphere of the described cities is quite wide, and ranges from the ancient years till the near future. At the same time it offers a wide range of architectural ethnical styles as well. All this variety of periods and styles serves the escalation of contrast between the lack of identity of modernism and the new architectural ideas of the – newborn by that time – post-modernist movement. This paper will try to underpin the way Calvino uses Asian architectural descriptions and atmosphere to contradict modernism.

Furthermore, other resources will be examined, such as the extensive reviews of his work, written by journalists, critics, architectural and literature theorists. There are also, numerous letters, lectures and essays, written by Calvino himself, talking about his novel and its connections with other scientific fields. A thorough record of these, can be found in Letizia Modena’s book “Italo Calvino’s Architecture of Lightness”. [5]

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Science, technology and sustainability

POST-OCCUPANCY EVALUATIONS IN ARCHITECTURAL PROGRAMMING PROCESS: A CASE STUDY OF EDUCATIONAL BUILDINGS

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Keywords: post-occupancy evaluations, programming, educational buildings, schools

Introduction

The purpose of this research is to discuss general practices of Post-Occupancy Evaluations (POE) in school building design cycle process. It has generally been assumed that programming just provides architectural designers with information about identification of client goals, user needs and space requirements.1This information is utilized in the process of architectural design decision-making. That is, architectural programming is mostly regarded as it starts at the pre-design stage, includes design, and construction phases. Post-construction phases, and finishes with the feedback of post-occupancy evaluations of school buildings have generally been neglected.

School buildings in Turkey are mostly built as large educational complex, educational levels of which ranges from nursery school to High school. Additionally, contemporary school buildings comprise of several facilities such as gymnasium, conference hall, foyer, indoor swimming pool and other sorts of spaces supporting extracurricular activities. Spatial organization schemas of school buildings may vary distinctively according to several parameters including construction rights of the site, climatic and topographical features, clients and users demands. Classroom patterns of each education level and their relation with the location of the above mentioned facilities are very crucial in design process of school buildings.

Motivation & Methodology

POE provides the designer a useful opportunity to assess whether the building has met the requirements satisfactorily or not.

The study began with a literature survey of existing documents on design process of educational buildings and programming issues. Specifically, currently active different programming approaches, their theoretical basis and the contemporary role of POE are examined in detail.

Some of the most basic materials used in architectural programming are as follows: interviews, questionnaires, checklists, photos, (showing the problems and necessities), drawings, diagrams.

It is not in the scope of this research to discuss purposes and benefits of programming in design process. Rather post occupancy evaluation phase of the design cycle is focused on in detail. Conceptions of POE models are analyzed and compared with each other.

In the final part of this research, existing research methods and materials generally used in POE models are studied comparatively in three different school complex from Turkey in order to exemplify post-occupancy evaluations. POE surveys are conducted to different sort of users such as students, teachers, and administrative staffs.

Post-Occupancy Evaluations Models

Contemporary Architectural literature often divides modern design practice into four molar processes[1]: Programming, Design, Construction, and Post Occupancy Evaluation. Although POE is paid more attention in the recent years, there should be more studies on this issue in order to utilize experiential information for the next projects.

POE studies are generally used as the continuity of architectural programming issues. In order to understand the role of POE in design process, programming needs to be clarified first.

Contemporary definitions of programming goes beyond of conventional methods and try to benefit of users experiences by means of adopting POE.

The history of the architectural programming, which means the list of space requirements for the users of the building, goes back to the antiquity. [2] Of all the definitions of programming, specifically Palmer's following phrase is very clear to understand what it really is: "Programming is an organized collection of the specific information about the client's requirements which the architect needs in order to design a particular facility" [2]

J. Christopher Jones Studies on the industrial design methods for the purpose of understanding why new data on ergonomic researches was not incorporated into industrial design process became the birth of the design methods movements. [3]

While Duerk [4] define it as "the gathering, organizing, analyzing, interpreting, and presenting of the information relevant to a design"; Hershberger [5] put an emphasis on values by writing as follows: (it is) "a document in which the identified values, goals, facts and needs are presented."

Hershberger brings a new concept to architectural programming as 'quality architecture,' which goes beyond mere functionalism and claims poetic approach. He proposes designer should also be the programmer. Contemporary definition of programming is more close to the real conditions by going far beyond providing basic technical data necessary for design process.

POE studies can be based on several types of analyses and assessment situations, such as client's perspective [6], facilities management [7], building performance [8], users' point of view [9]. POE surveys conducted at this research specifically base on conceptual framework for architects.

'Guide to Post Occupancy Evaluation' [10] and 'Post Occupancy Evaluation Survey Report' [11] are among the most important and useful publications available on the topic, which exemplifies POE survey questionnaires.

Case Studies:

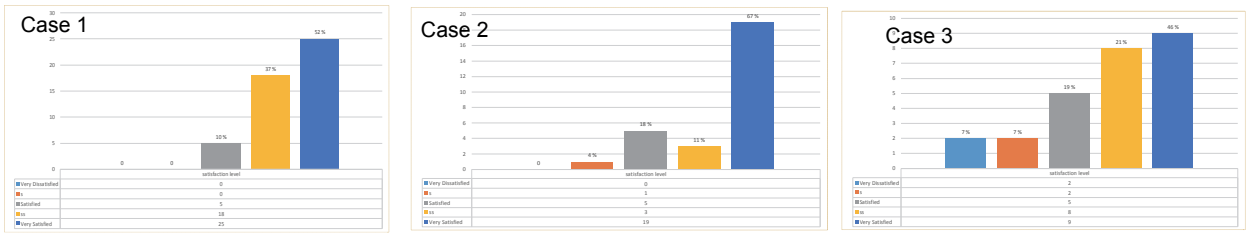
Although there are various concerns that can be discussed after collecting data from the POE surveys, it has just been limited to deal with the spatial issues that are mainly dealt with architects in design process of school buildings as follows: Relation between different educational levels, Location of the Nursery School in the school settlement, Spatial organization chart of the classrooms, Spatial relation in between classroom and wet areas, Satisfaction level from the size of the classrooms, Satisfaction level from the size of the indoor activity area. In addition to personal observations on the site, surveys of POE consist of interviews, questionnaires and checklists.

DISCUSSIONS & CONCLUSIONS

This research dealt with spatial compositional issues of designing school buildings by means of utilizing POE surveys conducted in three different school buildings in Turkey, in the cities of Manisa, Bodrum and Burdur. It is hoped that the results of the POE surveys will contribute to improve the quality of school facilities for the following design works in design cycle. After literature survey on the programming and POE in the first chapter, it has been focused on the answers of the following basic questions: How satisfied are users with the architectural features of the facilities in terms of location, size, proportion, relationship among the facilities etc.

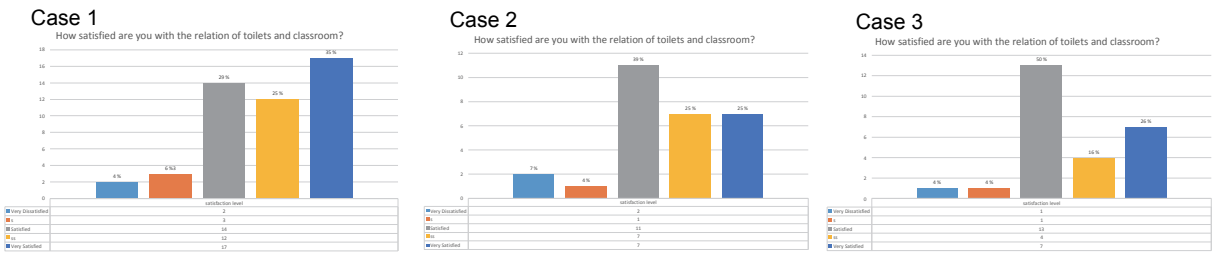
The location of the nursery school in the school complex is one of the primary concerns that needs to be decided in the preliminary phase of design process. Surveys related to the pre-design phase in order to create brief and expectations of clients and users show that having a separate building for pre-primary class students is mostly preferred. But the POE studies prove that satisfaction levels do not much differ between the different sorts of the buildings as integrated or independent unit.

Table 1: Satisfaction levels from the location of Nursery School in the complex



The relation between classrooms and wet areas is also very critical in design process of nursery schools. Since children of these ages need to use WC very often, the location of WC should be easily accessed by children. POE surveys showed the following satisfaction levels for different planning solutions.

Table 2: Satisfaction levels from the relation between wet areas and classrooms



In conclusion, POE surveys of three different school campuses, each one of which has a distinct spatial schema in terms of critical issues related to school design, are conducted and the results are compared with each other to create useful information for the future design works of school buildings.

Notes

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CREATING A PSYCHOGEOGRAPHIC MAP of CAPPADOCIA

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Keywords: Psychogeography, Mapping, Situationism, Cappadocia, Mobile Methods

BAU Cappadocia School

BAU Cappadocia School, held in October 02-08, 2015, was an exploratory and analytical site trip for design students. Ten students instructed by two instructors from Departments of Architecture and Interior Architecture in BAU, together with a sculpture artist from Germany spent a week in Cappadocia region. They discovered volcanic peaks and man-carved cave structures dating back to the late 6th century BC and their reflections on contemporary architecture and interior design around Uçhisar, Göreme, Avanos, and Mustafapaşa districts, Kızılçukur and Ihlara Valleys, and underground city Derinkuyu. The main goal aim was to hold experimental techniques in analysing this site specific architecture.

Urban theorists such as Pinder (2005, p. 385) would support: *"Experimental arts and modes of exploration can play a vital role in the development of critical approaches to the geographies of cities, where they may challenge norms about how urban space is framed and represented, and where they may help to open up other possibilities"* [1]. Particular inspiration was taken from the work of the Situationist International and using their "dérive" technique, local forms, structures, materials and techniques for building in/carving out this unique landscape were explored. The walks were recorded using mobile methods (cameras, sketches and social tweets). Depending on this documentation, students were each asked to explain their personal observations verbally and represent their experience via their individual artistic and technical skills. This paper aims to link all that experience, knowledge and documentation to place, creating a "*psychogeographic*" map of Cappadocia, in order to make a qualitative research on the spatial experience of the city.

Fig. 1: BAU Creative Platforms for Arts & Design Workshop in Cappadocia,
Theme 2015: INSIDE-OUT: Climate Change, Topos and Design

Psychogeographic Maps by Situationists

Psychogeographic mapping is used by planners and designers, as a technique to bring together personal narratives about urban space hence allowing new interpretations of urban landscape. In Naked City (1957), Debord and his colleagues questioned the conventional logic of mapping the city and constructed an alternative geography that favored the marginalized, and often threatened, spaces of the urban grid [2]. Torn from their geographical context, areas were woven together by arrows inspired by the itineraries of the "dérive." The "psychogeographic" maps proposed a fragmented, subjective, and temporal experience of the city as opposed to the strict gridal perspective of the planimetric map. Although the Situationists most likely regarded these maps as a record of the drift and a means for provoking new tactics for inhabiting the city, they also represented a valuable schema for creating new forms of cartography.

Fig. 2: The Naked City, a psychogeographic map by Guy Debord (1957)

Creating A Psychogeographic Map of Cappadocia

De Certeau (1974, p. 97) argued that "*the act of walking ... is to the urban system what the speech act is to language* [3]*."* Similar to Bassett's Psychogeographic Experiments [4], students were asked experiment with the Situationist vocabulary of uniteÂs d'ambiences-(area of particularly intense atmosphere), plaques tournantes (stations on the drift, junctions in the flow), pentes(slopes), passages, axes, borders and defences, paths of attraction and repulsion etc., extending them with suggestions of their own. They were asked to think about ways of representing the hard and soft phenomena of the city (feelings, senses of calm or dislocation, attractions and repulsions etc) with different audio-visual forms: sketches, maps, photographs and video recordings to capture the sense of place, thus generating a visual and aural record of their progress as a kind of `walkscape' [5]. It was suggested they might also capture meanings and sensations of place through their associations with certain `found objects' such as postcards, artefacts etc., which they could collect during their progress. They were urged to think of imaginative ways of communicating their experiences (Figure 3).

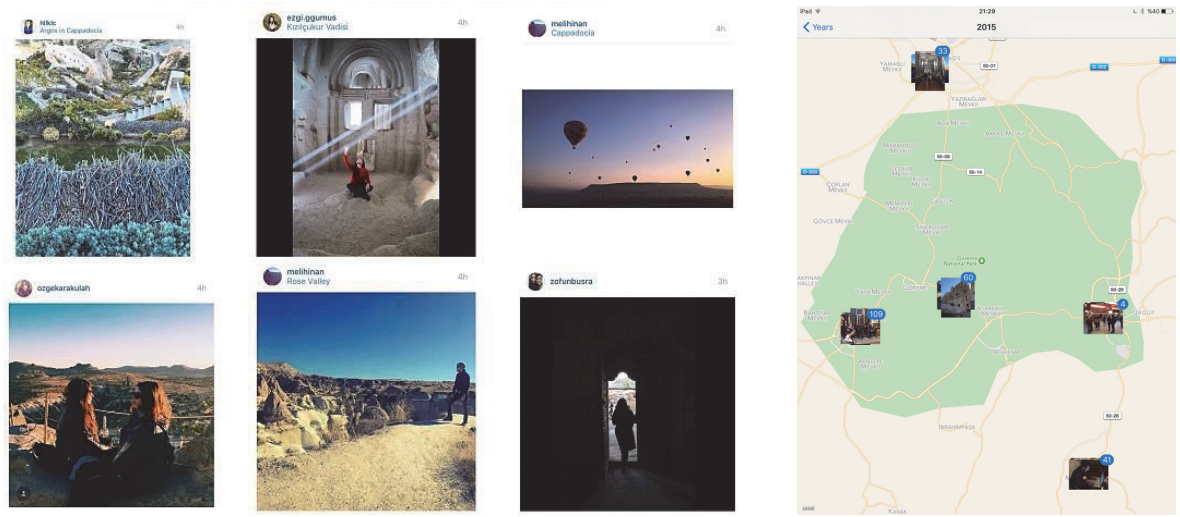

Fig. 3: Creating a walkscape in Cappadocia

Cappadocia emerged as a critically important site for city walking experiences due to its complex stone formation and continuously transforming sillhouette driven by man-made and climate-driven factors. The historic context together with modern architecture adapted to this vernacular architectural style offered various spatial qualities. For understanding place and creating an archive of experiences geo referencing and mobile methods: such as GPS to identify locations, orient oneself in the city, turned out to be indispensable inputs. Figure 4 shows a sample poster work who representing air balloon trip experience. Psychogeography demands new forms of cartography. New digital technologies for global positioning, mapping, information sharing and storing promise various tools for representing spatial experience and creating psychogeographic maps.

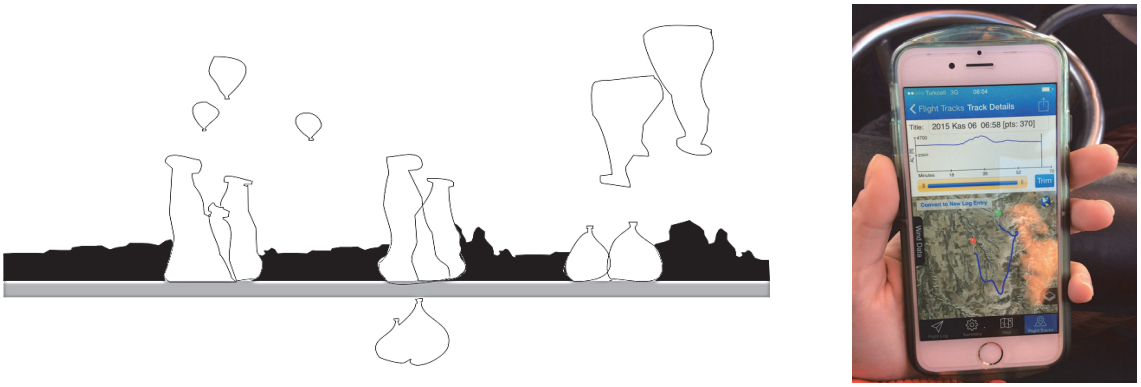

Fig. 4: Air balloon trip- Spatial experience and mobile methods

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THE FUNCTION OF THE ORNAMENT: BIRD PALACES IN OTTOMAN ARCHITECTURE

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Keywords: Ottoman Architecture, Bird houses, Bird palaces, Architectural Ornament, Animal Spaces

"... The evolution of the culture is synonymous with the removal of ornamentation from objects of everyday use... There is no longer any organic connection between ornament and our culture..."

Louis Sullivan, Ornament in Architecture, 1982 [1]

Introduction

In the history, Ottoman Architecture showed a worth mentioning approach towards encountering birds into architecture by allocating spaces for them to shelter inside the ornamenting elements on the facades of the buildings. Bird palaces, are specific facade elements and unique examples for establishment of an organic bond between the culture and the architectural ornament. Such approaches for building facades are so rare to see in the history of architecture. In the literature, this value given to the birds indicated to stem both from the religious identity of Ottomans and the Turkish Culture inherited from the central Asia. [2]

Human beings, who are the main subject of architectural space, are privileged users of architecture. Even the negative spaces, which can be defined as hollowing out of the void created by building in the environment, is again tend to be conceived in the content of visual contact of the privileged user of the architecture. Inevitably, buildings are creation of openness and enclosures to be explored and occupied by the other beings of the earth; such as plants, animals and as in focus of the study, the birds. Negative spaces of architecture, determined by the facades, the roof and the shell of the building, are open for a variety of spatial qualities to be redefined by those unintentional users of architecture.

Architecture is the human's resistance against the nature. Nature withstands architecture, by trying to penetrate into it, in order to include it. Today, building's relationship with birds is also an encounter of this kind, which mostly ignores and excludes bird's existence in the content of architectural space. According to the estimates, between 365 million and 988 million birds die from crashing into windows in the United States each year. [3] Counter to that, birds, which are known as the innate architects of the nature, persist to interact with architecture by nestling to suitable gaps left over by architecture. Swallows are famous for the architectural masterpieces they build on the ceilings of balconies out of mud, while the chimneys of the buildings create safe coves for a variety of birds including seagulls, storks and ravens. Smaller birds such as sparrows and finches hide into the tiny holes between the window frames and the wall openings in order to survive through the cold days of the winter. The window sills are preferable spaces for doves and pigeons to stay warm. So birds are undercover figures of our architectural environment, and a part of the culture and everyday life.

Modest inclusion of these interactions and acceptation of bird's spatiality as an aesthetic value for architecture culture, makes the bird houses and bird palaces of Ottoman architecture very radical and unique. Even though there is no historical relation between, bird palaces and the theory, these examples of architectural ornamentation can be re-interpreted as a good stance against an important amount of literature written about the existence of ornament as an unnecessary element, by the western-based theoreticians at the beginning of 20th century. Against the aesthetic theory that is raised by the Modernist thought depends on mechanical reproduction techniques, and its nature of standardization, Ottoman bird palaces are re-functioning of the ornamentation. Ever since Viennese Architect Adolf Loos had disparaged ornament as unnecessary, childish and even criminal, architecture realm dragged into an understanding, which is freed from all kinds of ornamentation, indicating the rise of the Modernist thought. [4] As a precede of Loos, Louis Sullivan's criticism towards ornamentation in architecture created a milestone which has been adopted and projected for many times by Modernist architects in the following period. As asserted by the Modernist radical aesthetic definition the production of noble forms is only possible by getting rid of ornamentation which is nothing but a time-consuming, superfluous labor work. Modernism took function of the building and the needs of the ideal user which is defined as the modern man as a superior source of information while leaving cultural, traditional and other aspects of architecture aside.

Today we still carry the concerns defined by the Modernist architects about a hundred years ago. In the digital era we live in, production and construction techniques has evolved to a level that allows production of unique pieces and one-offs without causing extra costs. Since standardization ceased to be an economical saving and customization is no longer a money-saver, Modernist radical aesthetic lost its main economical reason for being the major design principle for architecture.

Objectives and Methods

From that conceptual framework the study aims to bring a new perspective to the Bird palaces of Ottoman architecture, other than as naive ornaments decorating the facades but special spatial element as a redefinition of the negative space. Bird palaces are reflections of culture into the architectural space, as an opposition to the prevailing Modernist aesthetic prejudices architecture still tends to believe today.

Most of the researches on the Ottoman bird palaces wander around the humanity scale of these elements as a part of the Ottoman culture. Above that, this study aims an approach to understand bird houses as functional spatial elements in relation with the theory of ornament, but not from the point of view of the privileged user.

In the study, bird palaces will be analyzed through the visual sources, which will be gathered by literature research. As a result of the analyses bird palaces will be redefined according to their architectural styles, architectural compositions, spatial elements, construction materials and methods and spatial functions.

Decorating the facades of the buildings with birdhouses can be seen in the classical Ottoman Architecture as early as 16th century. However, most elegant pieces appear in the 18th and 19th century. Ottoman bird palaces are usually found on the public buildings such as mosques, madrasahs, inns, houses, bridges, libraries and tombs. As Erman asserted, birdhouses can be divided into two groups in terms of their way of construction, architectural

composition, and spatial needs of the user birds. [5] (Fig. 1) The first group consists of individual or adjacent small holes specifically left between the cladding of the masonry buildings. The birdhouses in the second group are like projected chambers and look like single floor villas projecting like bay window, frontage decorated with arched windows, top covered with roof or small domes.[6] Birdhouses were usually made out of stone, sun-dried bricks, stones, wood, marble or terracotta and were installed in the high and safe parts of the buildings for the birds to be protected from other animals, under eaves of the roofs, on the sunlit and wind-shielded facades of the building. (Fig. 2) (Fig. 3)

Fig. 1: On the left, an example for group one on the façade of Ayazma Mosque in Üsküdar, İstanbul,
In the Middle, an example for group two on the facade of Bayezid Hasan Paşa Medresesi, İstanbul,
On the right side another example for group two on the facade of Ayazma Mosque in Üsküdar, İstanbul

Fig. 2: The left top image a Baroque birdhouse on the Façade of Halep Pasajı, İstanbul,
The right top image, birdhouse on the facade of Çuhacı Han made out of brick, İstanbul
The bottom left image, Gothic birdhouse on the facade of Darphane, İstanbul
The bottom right image, a wooden birdhouse on a residential building in Sıraselviler, İstanbul . [7]

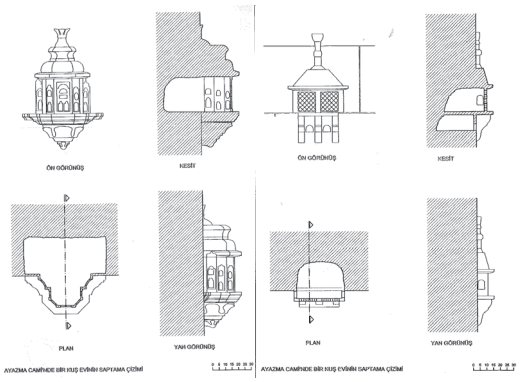

Fig. 3: Survey drawings of birdhouses on Ayazma Mosque by Bektaş Mimarlık [2]

Discussions

From that conceptual framework, the study aims to make a compilation by bringing the researches on the topic together, and make analyses of these architectural ornaments in relation with their spatial qualities and architectural compositions. The study inquiries the ways building facades can be refunctioned. This study points how negative spaces can turn into other spatial definitions when the subject of architecture ceases to be understood only from the point of view of the privileged user.

The second part of the research will take place in Japan. According to Malik Aksel, bird-palaces are unique facade elements to Turkish architecture and there aren't similar examples in any other culture.[8] Cengiz Bektaş who has made researches on birdhouses and bird palaces of Classical Ottoman Architecture, tells that he found mentions in written sources about existence of such a tradition only in Japanese architecture. He mentions that he has written to two separate addresses in Osaka however couldn't get a reply back. As a second step of the study it is aimed to search for existence of such an architectural tradition during visit that will be made to Japan in the context of the conference.

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A PRACTICE PROCEDURE FOR MAKING THE "TATAKI" CUBE: A LEARNING PROGRAM ON JAPANESE TRADITIONAL ARCHITECTURAL MATERIAL

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Keywords: traditional technique, teaching aid, clay, slaked lime, soil composition, compressive strength.

Introduction

Tataki is a traditional technique usually used in Japanese architecture, especially as a floor finish at the entrance (Fig. 1). It is made by kneading and then pounding a mixture of soil, slaked lime, bittern, and water [1]. The tools and materials to make *tataki* are quite simple. *Tataki* is an ancient practice that was established in Japan during the *Jomon* period, at least ten thousand years ago. Until cement and concrete became popular in the modern era, it was used for finishing the floors at entrances, as well as for mounding a building's foundation and preparing the ground. The occupants of a traditional farmhouse cooked meals, performed indoor agricultural activities, and bred cattle on a *tataki* floor as if it were outdoors. Therefore, it can be said that a *tataki* room has a unique atmosphere. Learning the techniques of *tataki* today may bring us further knowledge of traditional building materials, and inspiration to form new architectural spaces that have long been a part of Japanese culture.

Fig. 1 *Tataki* floor in a traditional house

This paper draws on the methodology proposed by Okuda et al. [2] for conducting a *tataki* workshop and investigates the proper soil composition (i.e., the ratios of clay and slaked lime) required to make *tataki* cubes. One of the features of the workshop is the use of paper boxes (e.g., Tetra Paks, generally used for storing wine, juice, and milk in Japan) for making *tataki* cubes 7 cm × 7 cm × 7 cm in volume.

Procedure for Making a *Tataki* Cube

This study uses a paper box identical to the one described by Okuda et al. [2] and develops a procedure for making a *tataki* cube. Since paper boxes are commonly available and easy to make at no additional cost, they could be used as a teaching aids in classrooms. The tools and materials (with quantities) required for the preparation of a *tataki* cube are shown in Table 1.

The procedure for making a *tataki* cube is as follows:

1) Pour 3/4 L of soil into a paper box that has a volume of 1 L. The box can be procured either by the workshop host or by a participant. The host is expected to organize the other tools and materials (see Table 1).

2) Pour the soil from the paper box into a transparent plastic bag. After cleaning the paper box, cut the box and draw measured lines on it as shown in Fig. 2. This makes it the inner form case of a *tataki* cube.

3) Install the inner paper form case inside the outer form case, which is constructed out of wooden boards, as shown in Fig. 3.

4) Add slaked lime and salt, as indicated in Table 1, into the plastic bag and mix with the soil. If the mixture is not damp, spray an adequate amount of water into the bag.

5) Pour the mixed soil into the form case until it comes up to the level of the lowest line marked. Then tamp the soil with the wooden bar, and flatten the surface.

6) Pour the mixed soil again, this time to the level of the next measured line, and tamp it until it is flattened. Repeat this operation twice, ensuring firm soil to a height of 7 cm from the bottom.

7) Extract the inner paper form case with the soil cube from the outer wooden form case by using the thick wooden plank.

Measuring the Compressive Strength of a *Tataki* Cube

Decomposed granite soil, also known as “ordinary soil,” contains a moderate ratio of clay to sand and is the best material for making *tataki*. Since the exact ratio of clay to sand is not known, *tataki* cubes were made using different ratios of materials as shown in Table 3, and compared for compressive strength. In this experiment, the decomposed granite soil used was the mix of coarse sand and mountain sand containing calcium chloride found on the

Table 1: Tools and materials for making a *tataki* cube

Tools for each group	Atomizer / Bucket / Wooden plank to force *tataki* cube out of form case (7 cm × 7 cm × 1-3 cm thick)
Tools for each participant	Measuring cup (500 mL) / Measuring teaspoon / Transplant shovel / Work mat / Transparent plastic bag (No smaller than A4 size) / Felt pen / Scissors / Ruler / Wooden bar for tamping (about 20 cm in length and thick enough to grip) / Paper form case (made from a paper box: see Fig. 2) / Wooden form case (see Fig. 3)
Materials for a *tataki* cube	Soil (3/4 L of loam soil, clay loam soil, or light clay: see Table 2) / Slaked lime (1/4 L) / Salt (teaspoonful, containing a small amount of bittern)

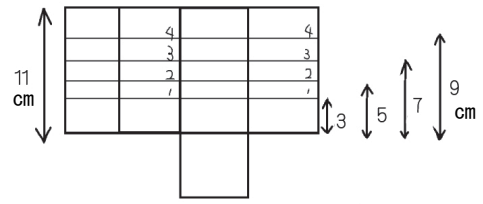

Fig. 2 Method of making an inner paper form case from a paper box

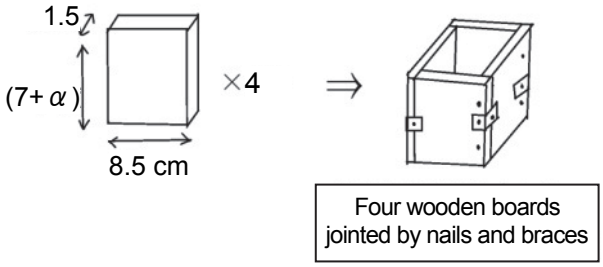

Fig. 3 Method of making an outer wooden form case

Table 2: Standard for judging a category of soil [3]

Category	Clay inclusion ratio	Properties
Sandy soil	< 5 %	Rough, not possible to form a solid figure with it.
Sandy loam soil	5 – 15 %	Feels like a mixture of sand with small amounts of clay. It can be formed into a thick bar.
Loam soil and clay loam soil	15 – 25 %	Feels like an equal mixture of sand and clay. It can be formed into a stick like a pencil.
Light clay	25 – 45%	Feels like a mixture of clay with small amounts of sand. It can be formed into a thin stick, like a matchstick.
Heavy clay	> 45 %	Feels slimy and sticky, it can be formed like a wick.

Table 3: Compressive strength of a *tataki* cube (average of two samples) [N/mm^2]

Combinations of soil types (c/s: ratio of clay to sand)	Ratio of soil to slaked lime			
	4:0	3:1	2:2	1:3
Decomposed granite soil	122	66.7	33.0	21.9
Clay	unable to measure.	17.5	10.2	11.0
Mixed soil #1 (c/s = 1:4)	—	44.2	—	—
Mixed soil #2 (c/s = 2:3)	—	10.2	—	—
Mixed soil #3 (c/s = 3:2)	—	18.5	—	—
Mixed soil #4 (c/s = 4:1)	—	18.0	—	—

playground of Miyagi University of Education. In addition, NN kaolin clay (Takehara kagaku kogyo Co., Ltd.), 70 slaked lime (Rimusaachi Ltd.), and *Asobi suna* [Sand for play] (Keiyo Co., Ltd.) were used as clay, slaked lime, and sand respectively. *Naruto no shio* [Salt of Naruto] (Naruto Salt Mfg. Co., Ltd.) including bittern was also added at a 5 % volume ratio to the soil for the *tataki* cube.

Results and Discussion of Experiment

Seven days after the cubes were made using the procedure described above, cracks over 4 cm in length appeared in the cubes that were made only of clay—especially the cube which did not have slaked lime, which was too brittle for the measurement of compressive strength. The compressive strength of *tataki* cubes was measured by applying downward pressure at a rate of 5 mm/min of movement, as shown in Fig. 4. Table 3 and Fig. 5 show the results and compare the compressive strengths of *tataki* cubes to C_2S and C_3S, which are the main components of Portland cement.

Fig. 4 Measurement of compressive strength of *tataki* cube

In general, *tataki* cubes made from decomposed granite soil rather than artificially mixed clay and sand had higher compressive strengths. Cubes with less slaked lime had higher compressive strengths. The highest compressive strength, which surpassed the value for

C_3S (46 N/mm^2), was observed when no slaked lime was added. This implies that decomposed granite soil is the appropriate material for making *tataki* cubes, and that the natural adulterant in soil assists in solidification. However, the compressive strength of the *tataki* cube made only of clay indicated 17.5 N/mm^2 at the highest. All mixed soil values were higher than the compressive strength of C_2S (5 N/mm^2) but there was no direct correlation between the ratio of sand to clay and the compressive strength values, probably because of the complications arising from chemical reactions, dynamic balance, etc. Although clear relationships do not exist between the soil mixture and compressive strength, each *tataki* cube investigated was as strong as expected.

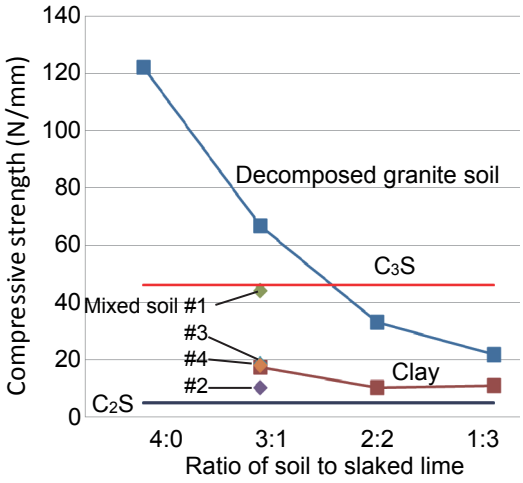

Fig. 5 Comparison of compressive strengths of *tataki* cubes and cements at the material age of seven days

Conclusion

The goal of this study was to develop a learning program for understanding *tataki* by setting down practice guidelines, and defining a procedure for making *tataki* cubes. Cubes were made as part of this study, and their compressive strength characteristics were investigated. The workshop takes no more than 2 h to facilitate, making it ideal for University classes. University students enjoyed the program when it was offered, and have given it favorable feedback. The next step is to understand the effects of moisture regulation on *tataki*, and continue the investigation into *tataki* cubes.

Acknowledgement

I wish to express my gratitude to Prof. Masato Kawamukai, Mr. Sho Okuda, and Ms. Yuriko Otomo for their helpful suggestions and assistance. This work was supported by JSPS KAKENHI Grant Number 26560031.

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CURRENT VEGETATION OF THE SURROUNDING FOREST OF SHUGAKUIN IMPERIAL VILLA

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Keywords: forest management, forest landscape, deer browsing, wilt diseases, vegetation survey, Shugakuin Imperial Villa

Introduction

Shugakuin Imperial Villa is known as a circuit style garden that represents Japan. The surrounding forest is an important element for the landscape and thus it is managed for conservation. On the other hand, the forest around Kyoto Basin recently has some severe problems: pine wilt disease [1], the mass mortality of oak trees caused by the fungus *Raffaelea quercivora* [2], the expansion of *Castanopsis* forest [3], the vegetation degradation caused by deer browsing [4]. Shugakuin Imperial Villa is located at the bottom of the northeast hill of Kyoto Basin thus the same problems can affect the vegetation of the surrounding forest and its landscape. In 2008, every tree measurement survey is conducted in the surrounding forest. This study aims to grasp the current vegetation of the surrounding forest of Shugakuin Imperial Villa and its changes in the last 7 years, and to consider the future management for the conservation of the vegetation and landscape.

Methods

The every tree measurement and vegetation survey of understory was conducted on 24 quadrats (10m*10m each) placed on the surrounding forest of Shugakuin Imperial Villa, located on northeast of Kyoto Basin, Kyoto Prefecture, Japan. 5 quadrats were placed on Japanese red pine (*Pinus densiflora*) forest and 19 quadrats on Broad-leaved forest. The species, height and DBH were surveyed in every tree measurement targeting trees of more height 1.3 m and more DBH 1 cm. In vegetation survey, 5m*5m quadrats was set on each 10m*10m quadrat, the emergence species, the coverage and the sociability for each species was surveyed targeting the vegetation below 1.3 m. From the results of every tree measurement, the vegetation of plots was classified into 4 layers each; canopy layer (80% or more of the maximum height), sub-canopy layer (50% - 80%), lower layer (20% - 50%), and shrub layer (20% or less). In each layer, the degree of dominance (the basal area ratio) of the species was estimated and the plots were classified according to the vegetation of each layer.

Results and Discussion

For 5 plots of Japanese red pine forest, the population of Japanese red pine was reduced from 160 to 86 in 2008 to 2015. These plots were classified roughly into two types without pure stand according to the vegetation of sub-canopy layer; the plots lower tree species are dominant such as *Ilex pedunculosa* and *Lyonia ovalifolia*, and the plots tall deciduous tree

species are dominant such as *Quercus variabilis* and *Quercus serrata* (Table 1). When the Japanese red pine in canopy layer is reduced by pine wilt disease in the future, the dominant species of the canopy layer are going to change according to the type of sub-canopy and lower layer vegetation; The plots of former type is going to transfer into unclosed forest whose canopy layer is composed of lower tree species, and later they change into evergreen broad-leaved forest that is dominant in lower layer and shrub layer; The plots of latter type is going to transfer into deciduous broad-leaved forest, but deciduous tall tree species are suppressed by lower tree species in lower and shrub layer, thus it is necessary to promote the growth of the successor.

Table 1: The degree of dominance for Japanese red pine forest

		Plot number				
Layer	Life form	R1	R2	R3	R4	R5
Sub-canopy layer	Coniferous tall species	100%	0%	100%	0%	53%
	Deciduous lower species	0%	0%	0%	0%	0%
	Deciduous tall species	0%	0%	0%	0%	35%
	Evergreen lower species	0%	100%	0%	32%	0%
	Evergreen tall species	0%	0%	0%	68%	12%
Lower layer	Coniferous tall species	100%	0%	100%	0%	19%
	Deciduous lower species	0%	0%	0%	0%	38%
	Deciduous tall species	0%	0%	0%	0%	13%
	Evergreen lower species	0%	0%	0%	100%	3%
	Evergreen tall species	0%	0%	0%	0%	27%

The 19 plots of broad-leaved forest were divided into two stand types according to the dominant species of the canopy layer (Figure 1): deciduous broad-leaved forest (11 places) and unclosed forest (lower tree species make up the canopy; 8 places). In addition, each stand type is grouped roughly into two types according to the vegetation of the sub-canopy and lower layer; the plots tall evergreen tree species are dominant and the plots lower tree species are dominant. Because most plots of deciduous broad-leaved forest has canopies composed of large oak trees such as *Quercus variabilis* and *Quercus serrata*, when such large oak trees die from Japanese Oak Wilt, they lost large area of their canopies and the stand type is going to transfer to evergreen broad-leaved forest or unclosed forest according to the vegetation of the sub-canopy layer. The vegetation of unclosed forest plots is going to transfer to evergreen broad-leaved forest or remain unclosed forest in the same way.

In addition, deer traces (browsing traces or feces) have been confirmed in all plots in this survey. Because many species important in maintaining the current vegetation, such as *Quercus variabilis*, *Quercus serrata*, *Lyonia ovalifolia* and *Quercus glauca*, are considered to be food plant of sika deer (*Cervus nippon*) [5], it is concerned about the vegetation simplification and obstruction of regeneration by deer browsing.

To conserve the current forest vegetation and landscape, it is necessary to protect the trees composing the canopy from wilt diseases, and to promote the growth of successor of the canopy trees. It is considered to be effective to establish the deer-proof fence to guard from deer browsing and to cut shade trees down selectively.

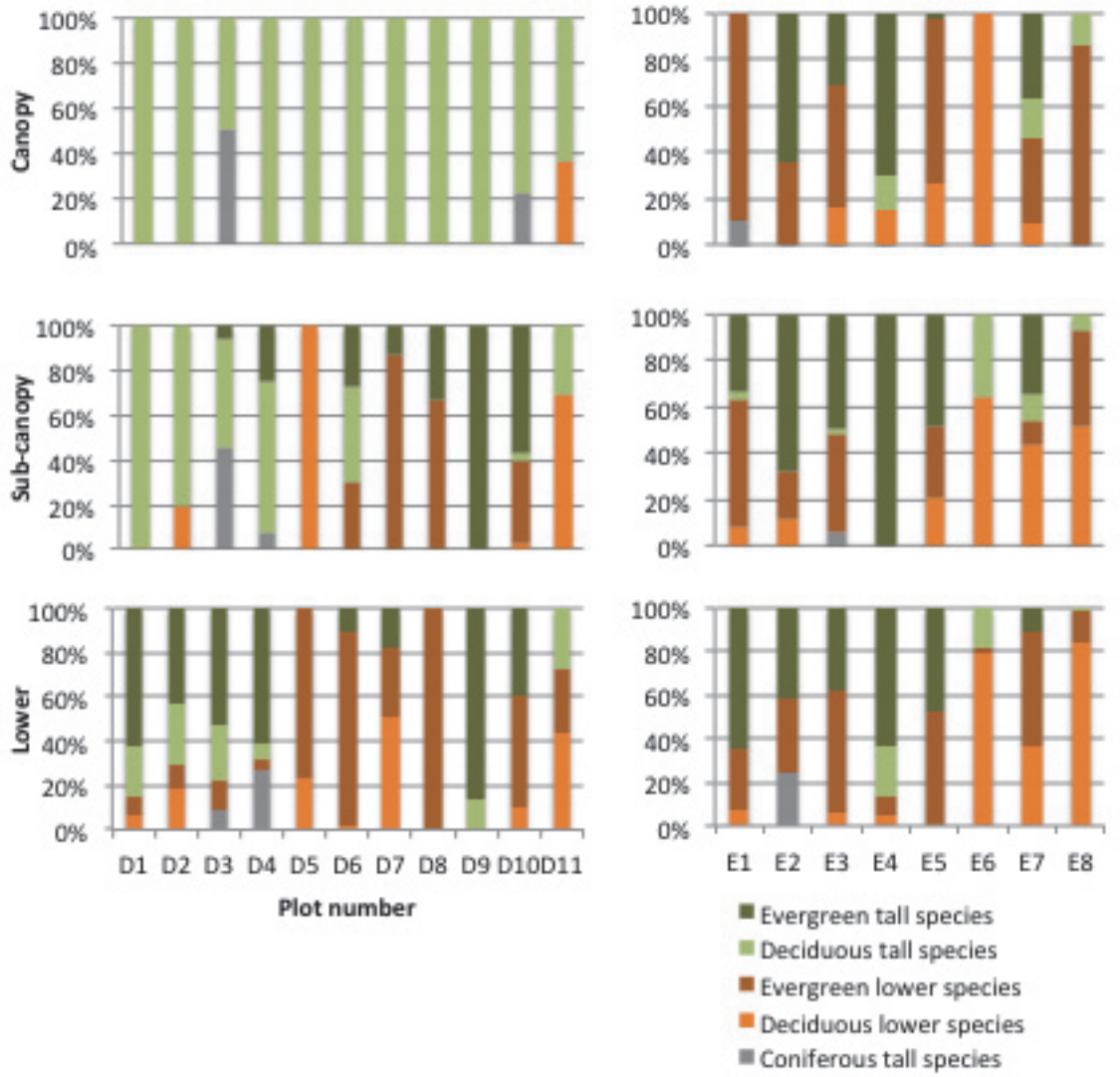

Figure 1: The degree of dominance for deciduous broad-leaved forest and unclosed forest

Acknowledgements

We appreciate the Kyoto Office of The Imperial Household Agency for cooperation in our survey.

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LARGE-SCALE SURVEY OF FLOWERING CHERRY TREES USING AIRBORNE LIDAR

Junichi Imanishi[1], Youngkeun Song[2], Takeshi Sasaki[3], Yoshihiko Iida[4], Yukihiro Morimoto[5], Tamao Kojima[6]

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Keywords: *Cerasus* species, remote sensing, airborne LiDAR, orthophoto, Yoshinoyama

Introduction

The Japanese are particularly fond of flowering cherry trees. Being the most famous scenic location for cherry blossom appreciation in spring, the landscape at Yoshinoyama, Nara Prefecture, has a history of 1,300 years. In 2004, the landscape was designated as a UNESCO World Heritage Site, the Sacred Sites and Pilgrimage Routes in the Kii Mountain Range. The landscape of flowering cherry trees at Yoshinoyama is an important cultural heritage for the Japanese people and also an important economic resource for local people who benefit from tourism.

Recently, however, diminished tree vigor has gradually become a concern of some of the local people. Upon request, an extensive survey was conducted from 2008 to 2010 [1]. The survey, which focused mainly on the central area of Yoshinoyama (called Nakasenbon), collected data at the individual tree level and attempted to comprehend the possible mechanism of decline and death of trees. Although 74 trees were studied intensively and 22 trees (about 30 %) were assessed as being in decline, the survey could not reveal the status of the cherry trees in the whole area of Yoshinoyama. Therefore, the local government decided to carry out a large-scale survey using remote sensing in order to understand the overall condition of cherry trees throughout Yoshinoyama. This work is a pilot study aimed at developing a new large-scale survey method for obtaining information essential to developing a management plan for the flowering cherry trees.

Methods

Yoshinoyama (34°22′ N, 135°52′ E), located in the center of Nara Prefecture, has an elevation range of ca. 200 to 850 m above sea level, and flowering cherry trees (mostly Japanese mountain cherry, *Cerasus jamasakura* (Siebold ex Koidz.) H.Ohba var. *jamasakura*), have been planted within a total area of about 50 ha. Airborne remote sensing was conducted twice, on April 17 and August 4, 2011. A helicopter with a mounted LiDAR system (LMS-Q560, RIEGL) and a fine-resolution digital camera flew back and forth to cover the whole Yoshinoyama area. An on-ground survey was carried out simultaneously to collect location data of 324 cherry trees and to assess the condition of vigor (using a conventional visual four-rank assessment method by two experts) of 288 cherry trees.

First, individual crowns of cherry trees were delineated manually by referring to the orthophotos and a digital surface model (DSM) derived from the LiDAR data. Orthophotos acquired in April were used to identify cherry trees based on the color of the flowers. Then, the number of cherry trees in the whole area of Yoshinoyama was estimated by considering the detection rate. The detection rate was calculated as N_R / N_A, where N_R is the number of cherry trees detected by remote sensing and N_A is the actual number of trees.

Second, two growth indices were derived for each tree crown from the LiDAR data (converted in advance to 50-cm grid data) to assess cherry tree condition in the whole area of Yoshinoyama:

[Index 1] the Height Index (HI), which indicates the growth of tree height, was calculated as the height difference of the DSM between April and August.

[Index 2] the Density Index (DI), which indicates the density of branches and leaves in the tree crown, was calculated as the laser interception rate L_V / (L_V + L_G), where L_V is the number of laser hits on vegetation and L_G is the number of laser hits on ground.

After calculating these two indices for each tree crown, the two indices, HI and DI, were standardized (i.e., the data were converted to have mean = 0 and S.D. = 1), added together, and then standardized again. This mathematical operation yielded the standardized LiDAR Growth Index (LGI). Lastly, the tree growth condition was evaluated according to a threshold that was established by referring to the results of the simultaneously conducted on-ground survey: Good (Rank 1.0–1.5 in on-ground survey, corresponds to LGI ≧ 0.5); Fairly Good (Rank 1.5 – 2.5, LGI = 0.5–0.0); Fairly Bad (Rank 2.5 – 3.5, LGI = 0.0 – –0.9), and Bad (Rank 3.5 – 4.0, LGI < –0.9).

Results

The number of cherry trees estimated in Yoshinoyama was about 10,300 (about 9,700 to 11,000 at the 95 % confidence level) (Table 1).

Among the 7,246 cherry trees that could be analyzed in the whole area of Yoshinoyama by remote sensing, 13 % of the trees were estimated as being in “Bad” condition. If “Fairly Bad” condition trees and “Bad” condition trees are summed, 48 % of all the cherry trees can be assessed as being in an unfavorable condition (Fig. 1). Smaller trees had a greater proportion of “Bad” condition trees (about 20 % for mean tree crown height < 5 m).

Table 1: Estimated number of cherry trees in the whole area of Yoshinoyama (as of April 17, 2011)

Estimated number of cherry trees in Yoshinoyama (point estimation)	10,252
Estimated number of cherry trees in Yoshinoyama (95 % confidence interval)	9,654 − 11,019
(Reference) Detected number of cherry trees in Yoshinoyama by remote sensing	7,499
Mean detection rate at the on-ground survey sites	73 % (237 out of 324 trees)
95 % confidence interval of mean detection rate at the on-ground survey sites	68 − 78 %

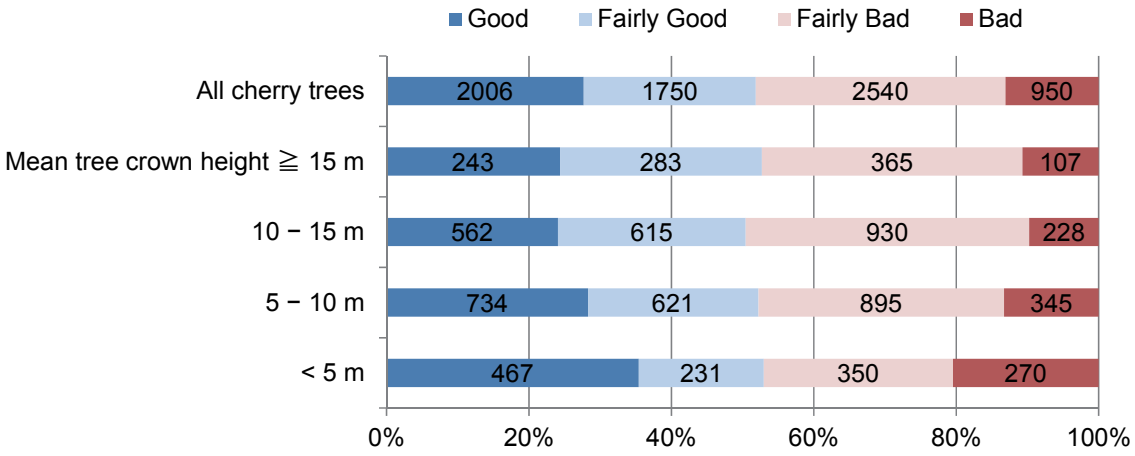

Fig. 1: Estimated growth condition of cherry trees in the whole area of Yoshinoyama

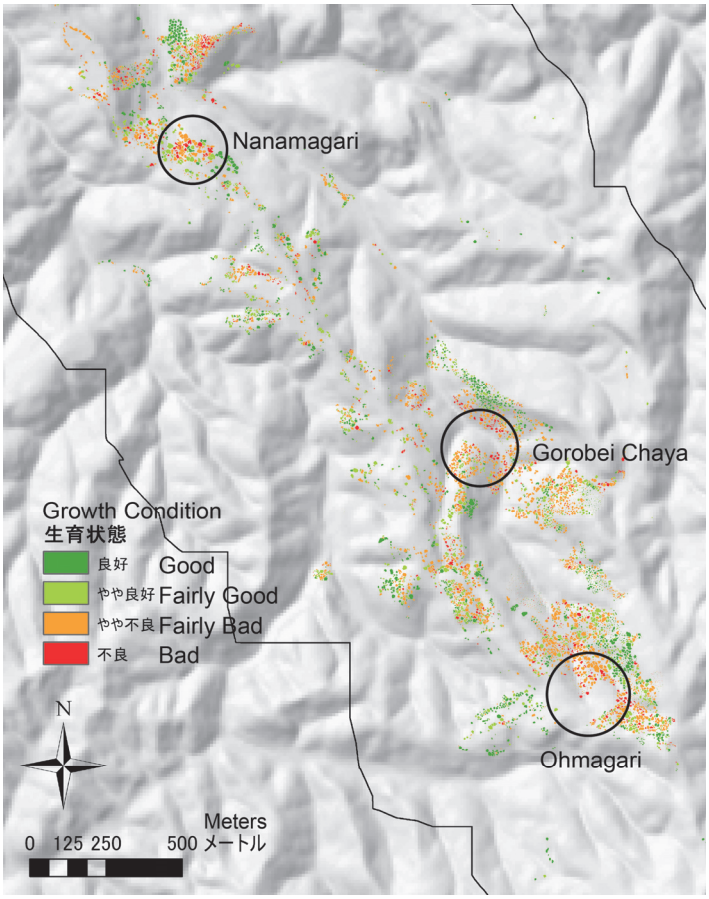

Fig. 2: Spatial distribution of estimated growth condition of cherry trees from the lower area (Shimosenbon) to the upper area (Kamisenbon) in Yoshinoyama

The spatial distribution of tree growth condition showed a distinct structure. For example, the Nanamagari area in the lower area, the Gorobei Chaya area in the central area, and the Ohmagari area in the upper area had more “Bad” or “Fairly Bad” condition trees (Fig. 2).

Discussion

This study revealed that about 10,300 cherry trees were growing in Yoshinoyama at the time of data collection (Table 1). Although a relatively large-scale survey of cherry trees was conducted in Nara Prefecture in 1993 and 1994, the survey covered only one-third of Yoshinoyama and the status of the whole area of cherry trees remained unknown. Therefore, obtaining the total number of cherry trees was important to the local government for considering a future management plan of the flowering cherry trees.

In this study, an evaluation method that utilized airborne LiDAR data of two seasons, spring and summer, was developed. This technique successfully estimated the growth condition of more than 7,000 trees based on two aspects: height growth and branch and leaf density. As a result of the estimation, 48 % of cherry trees were in an unfavorable, “Bad” or “Fairly Bad,” condition (Fig. 1). This percentage was greater than the previously reported 30% estimated from a small population of 74 trees [1]. Thus, it indicates the necessity of taking urgent measures.

Smaller trees, deemed as younger trees, had a greater proportion of “Bad” condition trees. This implies that the initial establishment following planting has some problems, possibly poor condition of seedlings, insufficient light conditions beneath taller trees, feeding damage caused by deer, or unsuitable weather conditions after planting.

The spatial analysis of tree growth condition revealed that trees in undesirable conditions are concentrated in some areas, e.g., the Nanamagari, Gorobei Chaya, and Ohmagari areas. Because these areas are the most visible regions to tourists, it is suggested that an intensive tree care program be implemented in these areas.

Conclusion

The overall condition of flowering cherry trees was estimated by acquiring airborne LiDAR data for two seasons. This unique technique could be implemented successfully in a large-scale survey. It is expected that the results obtained in this study will be utilized effectively to develop a future management plan for the cherry trees in Yoshinoyama.

Acknowledgements

We appreciate the town of Yoshino for providing the remote sensing data. We also appreciate the Yoshinoyama Hoshokai and the Nakanihon Air Service Co., Ltd. for their assistance in acquiring the remote sensing data and conducting the on-ground survey.

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COMPARISON OF TWO URBAN EXAMPLES OF BIODIVERSITY IN TOKYO AND OSAKA

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Keywords: Biodiversity, Tokyo, Osaka, Urban area

Introduction

Recently, some places have been created that provide both urban amenities and ecological open spaces. They provide vegetation and flowers not only in parks but also in commercial and office areas.

Some previous reports show examples of these urban green spaces. I will discuss two green spaces made recently. Otemachi Forest is in Tokyo, which is in eastern Japan, and Namba Parks is in Osaka, which is in western Japan.

Existing literature on these spaces include a report written by one of the designers of Namba Parks. Hayashi[1)] tells about the design concept and how people use this space. In another report, Ro[2)] discusses the behavior of people in Namba Parks. An explanation and planning sketch for Otemachi Forest can be seen by the public on a website. [3)] We have not, however, had a comparison of the background and details of these two green spaces.

I believe that understanding the differences and the reasons for changed concepts is valuable. Moreover, it is important to study these urban green spaces to aid in the design and building of new spaces in the future. I focused on comparing their concepts and the biological diversity of their tree planting as well as how people interact with them in these spaces.

The locations of Namba Parks and Otemachi Forest can be seen in Figure 1. The first is in Osaka City, which is the second largest city in Japan. The other is in Tokyo, which is the capital of Japan. Namba Parks in Osaka was completed in 2007. Otemachi Forest in Tokyo was just completed in 2014.

Method

For my methodology, I examined their design concepts, and asked the following questions. How do people use the open spaces? How do local people relate to them?

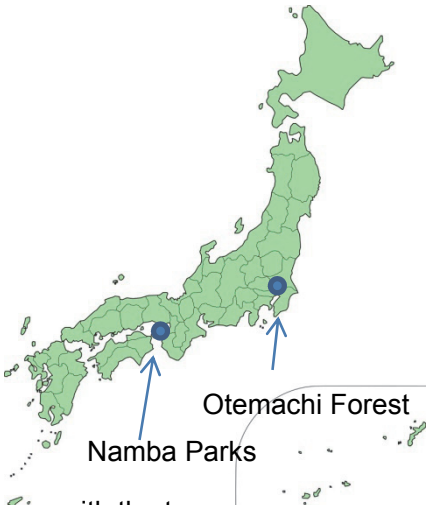

Fig. 1: Map of Japan with the two green spaces

How is the technical management? How do they treat biodiversity? I used documents, the Internet and interviews.

Results

Namba Parks uses rooftop tree planting in a commercial complex. The so-called “Parks Garden” was made with the concept that people could have connections with both the city and nature. Shops are united with trees and flowers so people can interact with nature and have rich experiences. For the purpose of promoting community design, they planned with the participation of citizens in a community committee. They also made farming spots for people to have fun growing vegetables. The amount of green open space is about 11,500 m^2 including 5,300 m^2 of vegetated area and 6,200 m^2 of paths and open spaces. They have more than 40,000 plants of about 2,500 species.

Looking at the following photos, people can be seen enjoying open spaces and walking with nice views of flowers and vegetation. They can also find some shade if they want to rest. The main purpose of the place is to provide a good combination of commercial areas and green open spaces for the guests. In the Grand Opening year, they had almost 30 million visitors.

The features of Otemachi Forest are quite different. This project has a natural-style forest and makes a clear distinction from conventional man-made open space. It offers “wild nature” as a public space. This is part of a new wave of forests being made in cities. In addition to reducing the heat island effect, it has a variety of other values. The area is about 3600 m^2 and is almost 1/3 of the whole development site.

Fig. 2: Entrance to Namba Parks

Fig. 3: Public open space

Fig. 4. Shade

Fig. 5: Flower bed

Fig. 6: Map of Namba Parks (http://www.nambaparks.com/index.html)

Figs. 7, 8: Otemachi Forest

They tried to cultivate and manage 1/3 of the forest in another place (Kimizu City in Chiba Prefecture) before the construction in Tokyo. It took three years to grow the forest and to replant it in Tokyo. Experimenting with the method to grow the forest, they finally moved it to this place, which is near Tokyo Station. This approach helped reduce the risk of dying plants and make a more mature forest in a short period. Characteristics of this forest are the concept of long-term transition, the mixture of evergreen and deciduous trees, different ages and contrasts between coarseness and fineness.

Discussion

People have changed their ideas about ecological places and biodiversity. A big turning point for ideas about biodiversity was COP 10, which was held in Nagoya, Japan. This was an epoch-making event for many professionals because they came to understand more serious ways to be ecological and be aware of biodiversity. Of course, this event was not the only reason. There are many enlightening and educational reports about urban design with biodiversity published by national and municipal governments and public housing organizations.[4)] A French landscape architect also joined in planning Otemachi Forest. Gradually, this approach of creating “wild” forests rather than the usual greenery and flowers in commercial areas has become one of the mainstream approaches.

Conclusion

Namba Parks were made at the beginning of the 2000s as a place that increased the charm of commercial facilities. Users shop and enjoy the vegetation and floral art. In addition, the system through which the local community could participate has been important.

The Otemachi Forest in 2014 emphasizes natural ecosystems more, and reproduces vegetation faithfully. Scenery as it should be in nature was more important than amenities for people. This project, however, has made strong impressions on citizens.

Both spaces have received many awards from various organizations. What is also important, however, is that people have opportunities to be aware of wild green areas as well as enjoy flowers and vegetation even in very urban areas.

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SILK ROAD AND ISFAHAN'S GARDEN CITY SUSTAINABILITY DURING SAFAVID PERIOD

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Keywords: Garden City- Sustainability- Isfahan- Climate – Safavid Dynasty

1. Introduction

Historians credit the Safavids with being the first rulers to lay a foundation for a national consciousness in Iran, a land populated by diverse ethnic and linguistic groups. They established Shiite Islam as the state religion, promoted Sufism, and instituted state capitalism to support wide-ranging political and social goals. Commerce was so important to the Safavid polity that its most powerful dynast, Shah Abbas I (reign 1588-1629), effectively re-routed the Silk Road through Isfahan so that his empire would enjoy a trading monopoly [11]. The Silk Roads' were an interconnected web of routes linking some ancient societies. The silk roads' which are defined as a network of land and sea paths built with commercial purposes in Asia and connected East Asia to the West and South Asia as well as the northern Africa and East Europe, resembling a chain of countries [5].It contributed to the development of many of the world's great civilizations and enabled the exchange of technologies and ideas that reshaped the known world.

The area of the Silk Roads encompasses a wide variety of topographic, hydrographic, climatic and ecological regions, including the physical and climatic zones of mountain, steppe, grasslands, deserts, river valleys and deltas. These geo-ecological zones lay at the core of some of the most important Silk Roads interactions, and their significance is reflected in the naming of sections of the route; such as the grass route, the steppe route, and the oasis route. These factors had a significant impact upon the nature of the routes: including the specific choice of routes (mountain passes, desert margins, river crossings, etc.), the seasonality of routes, and the ability to sustain major population centers along the routes. The “trans-ecological” nature of the routes [6] may have also been of major significance, providing an impetus for the movement of goods and materials between different zones. Silk Roads empires and societies adapted to the ecological context of regions, but they also exploited the contrasts between them to develop long-distance exchanges.

The art of garden designs and landscapes has always been favored by the residents living near the silk path. In those eras, being surrounded by green mass gardens, most of the Iranian cities were regarded as convenient havens for the residents and cities such as Isfahan, Shiraz, Qazvin, and centuries earlier, cities of Neyshabur, Balkh, Herat, Samarqand, and Bactria were famous for their beauty, liveliness, delicacy, and numerous marvelous gardens in those days [10].This paper will focused on Isfahan city.

By the seventeenth century, Isfahan attracted not only European merchants but also missionaries and mercenaries, as it became a religiously tolerant hub of mercantile and diplomatic activity. The city fabric is significant as an embodiment of this religious, commercial, and political unity, and was exceptional in the early modern Islamic world [11].

Isfahan developed on this time according garden city model which has explained in this paper.

2. Abstract

In general, Iran has an arid climate which characterized by long, hot, dry summers and short, cool winters. The climate is influenced by Iran's location between the subtropical aridity of the Arabian Desert areas and the subtropical humidity of the eastern Mediterranean area. Therefore, sunlight and its heating effects were important factors of Iranian architecture and gardens structural design. Textures and shapes were selected by architects to harness the light and supply a shadow in the summer.

Water is very important in this climate, both in the architectural design and longevity of gardens. In addition to water, the plants in Iran had been particularly significant. In the ancient civilisations of Iran, plants had a special position. Life-giving, youthfulness, productivity and immortality have been some of the supernatural powers possessed by trees that made them sacred to ancient Iranian people. Therefore garden has been invaluable to Iranians.

Form the ancient eras, the form and appearance of Iranian gardens has always been in harmony with the climate, environment and the amount of water available to them. The phenomenon of garden designs has an old history in Iran and the paintings of springs and forests on the pottery found in the city of Susa along with other similar patterns could indicate the importance of gardens in the lives of people who were used to deserts and sunshine in the ancient region of Iran. In fact, most of the Persian gardens had a sustainable design [3].

The Persian garden style has been developed during the centuries. Persian garden's design system includes three main orders which among them water is the most important. However, the climate conditions in more sections of Iran has always been difficult to provide water. This problem and its solutions have been explained in the first section of this paper with emphasizing on Persian garden's types (Table 1) as well as garden city.

Throughout much of the sixteenth century, Iran was troubled by turbulence and instability caused by internal political upheavals and external threats, especially the military advances of the Ottoman Empire in the west and of Uzbekistan in the Syr-Oxus basin in the east . The reign of Shah Abbas I (1587-1629) marked the apogee of the Safavid era and a unique period in its dynastic history. Born in 1571, Shah Abbas I (sometimes known as “the Great”) was an overpowering individual: energetic, curious, courageous, impetuous, and imperious [4]. Unlike his predecessors, this Shah was not just an aristocrat, but an autocrat. He presided in Isfahan, after transferring the capital there from Qazvin in 1597, and directed the affairs of a highly centralized government. His monarchy resulted in “enlightened despotism” which manifested in politics, the national economy, international trade, and even art, thus reviving the ancient grandeur and glory of his country [1].

The Safavids’ access to foreign markets was confined because Uzbeks controlled the trading routes (the Silk Road) to the east, the Portuguese monopolized those in the south, and the Turks occupied the silk-producing provinces in the north-west. Realizing that a strong economic base was a prerequisite for creating a stable and powerful state, and supporting an infantry and artillery armed with muskets and cannon [9], Shah Abbas I placed an emphasis on the expansion of Iranian trade.

Shah Abbas I planned the beautiful city of Isfahan and its architecture as propaganda for his government and for the promotion of national and international trade. The capital was admired by European travelers as one of the great cities of the world and to the contemporary Persian poets, it was Nisf-i Jahan (Half the World), a metropolis of monuments and gardens, political magnificence and architectural beauty [4]. According to more references, Safavid era was the golden age for Persian Garden and some of the best gardens were constructed in Isfahan. Gardens have played a significant role in the beauty of this city. Therefore this paper will explain the Isfahan Garden City design process as the Safavid Dynasty Capital.

The city has been designed and planning for enhancing citizens' health and wellbeing. Climate adaptation and water supply problems have been solved in Isfahan's urban design (Fig. 1). The image of the town altered by water channels that ran all around the city and expansion of gardens as major physical composer elements along Charbagh Street and other new city regions. The subjective image of new city depicts an ideal figure of Heaven and integrated it with the beauty of gardens and nature. This research discuss the methods which Safavid's had applied for attaining sustainable water supply and proper shade space to produce urban vitality in hot and dry climate of Isfahan.

Persian garden types according form and function	Garden City	Garden city is the Islamic concept of the Ideal City, formed according to the Garden of Eden, was taken into consideration in the Safavid period. Gardens as parables of Heaven were often used as composing elements in urban design. This idea resulted in the formation of a strength procedure of city planning.
	Bagh Kooshk(Pavilion Garden)	
	Bagh Hayat(Court Garden)	
	Bagh Maghbereh(Tomb Garden)	
	Bagh dar Bagh(Garden inside Garden)	
	Bagh Chador(Tent Garden)	
	Bagh Ghaleh(Castle Garden)	
	Bagh Tajir(Garden with Semitransparent wall)	
	Bagh Takht(terrace garden)	
	Bagh-e Vahsh(Zoological Garden- Such as Tavoos khaneh va Shir Khaneh in Isfahan)	
	Bagh-e Shekar(Hunting Garden)	
	Bagh-e Aab(Water Garden)	
	Bagh-e Melli(National Garden)	
	Bagh Bisheh(Forest Garden)	
	Bagh-e Giah shenasi(Botanic Garden)	

Table 1: Persian garden types.

Finally, this paper introduces the foundations of urban design and the city axis features to indicate the inventions and adaptation to climate. The result of the study shows that Isfahan's urban design principles has been used in accordance with climate conditions during Safavid period, created a state of longevity in the design of the city and its environment. Most of new buildings have been constructed inside gardens as pavilion and changed to extrovert model (Fig. 2). Some buildings formed according introvert model with big courtyard as garden. Therefore, the gardens provide thermal comfort as the new technique. This innovation was the new solution in urban design and architecture to be adapted to the hot and dry climate.

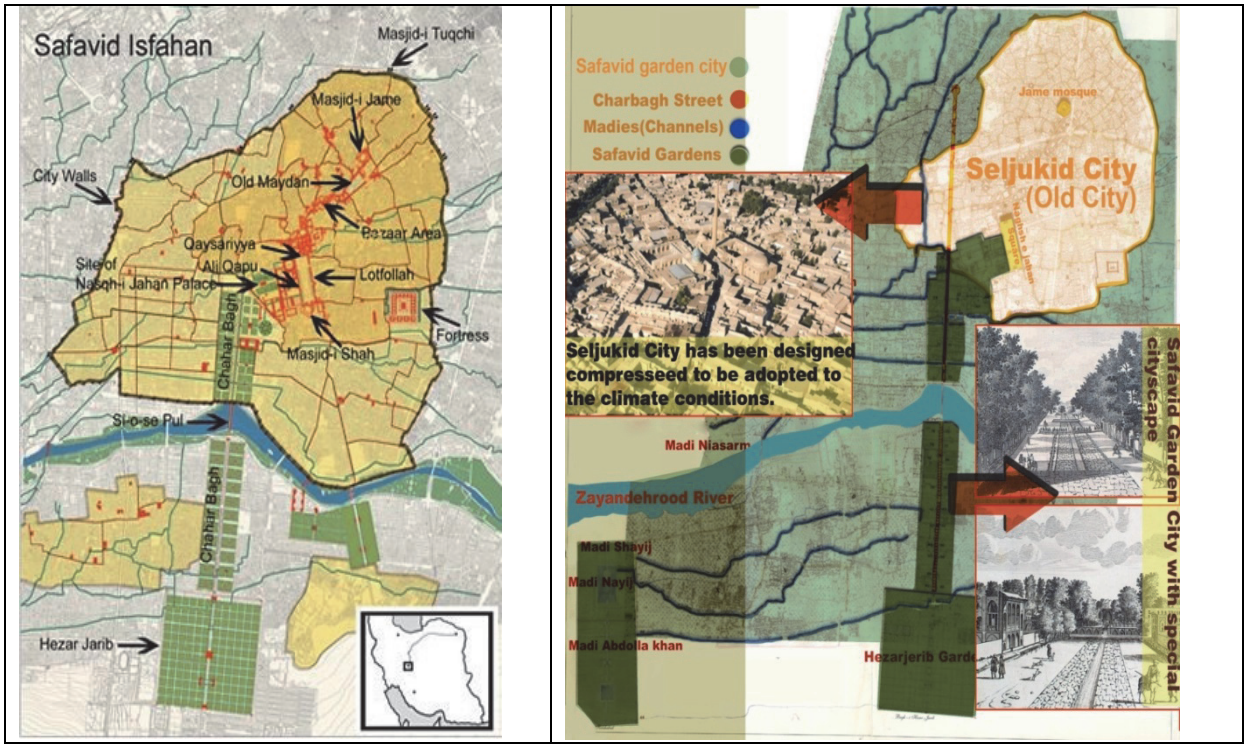

Figure1: Isfahan Seljukid(old) city and its development as garden city during Safavid period. In order to create long-lasting green cityscapes in garden city, the Safavids developed and used dug canals (madi) which branched off the river. The old and new sections of city were different in cityscape. The trees have been the main elements of cityscape in Safavid garden city [6].

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INFLUENCE OF SHELLAC COATING AND ENVIRONMENTAL CONDITIONS ON CONSERVATION OF AJANTA CAVE PAINTINGS

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Keywords: Mural paintings, Earthen wall, Shellac coating, Past conservation, Mechanism of deterioration, Insects, Thermal environment, Lighting environment, Simulation of illuminance.

Introduction

The Ajanta Caves, located in the west-central part of India (20º N, 75º E) along the Wagora river, were constructed between B.C. 2-1 (early phase) and A.D. 6 (later phase) [2]. Overall, this site comprises approximately 30 caves, which have richly decorated wall paintings and sculptures.

The climate in this region is very harsh, as the maximum temperature during the hot season is more than 40 °C, while the relative humidity (RH) is > 80% and < 20% in the rainy and dry seasons, respectively [4]. When they were rediscovered in 1819, the caves were concealed by jungle, infested with bats, and occupied by vagrant plants. Subsequently, several international teams comprised specialists with arts or scientific backgrounds performed conservation work on the Ajanta Caves. At present, the Archaeological Survey of India (ASI) is responsible for conservation and preservation of the site.

The target cave of this study, Cave 2, was constructed in the late phase and contains a *vihara* (Fig. 1). The wall and ceiling of the main hall and shrines in Cave 2 are covered by remaining paintings. Conservation work on this cave was conducted with research cooperation between the National Research Institute for Cultural Properties, Tokyo (NRICPT), and ASI [4]. A deterioration condition survey of the wall paintings was conducted, so as to identify adequate conservation methods and to obtain scientific information on the materials and techniques used to create the paintings. Subsequently, various additional studies were conducted, such as those designed to predict the future deterioration induced by the black substance caused by bat excretion[1] and the influence of the shellac resin layer (applied to the paintings for conservation in the past) on the present condition of the paintings[2].

In the present paper, the deterioration mechanism of the paintings with shellac coatings, related some holes which could be induced by insect, and the influence of the environmental lighting and thermal conditions are discussed, based on a condition survey of the site and using high-resolution digital images.

Conditions of Wall Paintings in Cave 2

Composition of the wall paintings: The paintings in Cave 2 were constructed using several layers (Fig. 2). The paintings have a layer of rough earthen plaster created from plants and having the form of the ballast rock surface, along with layers of fine earthen plaster, ground layer (lime plaster), and paint. During the conservation works conducted in the 1920s, shellac coating (a few~30 μm thickness) was applied to the paintings in order to facilitate easy viewing of the images and to protect them against the harsh external climate conditions. At

present, darkening of the shellac over time is one of the current problems degrading painting visibility [4]. This darkening of the surface is serious at the upper part of the wall and it is possible that the high temperature outside air which is over the point of softening temperature of the shellac resin, over around 30°C, influences to the upper side [5]. Further, some paint layer and earthen plaster has disappeared and small holes are apparent on the surfaces of the shellac-coated paintings, as shown below. This can also be an ongoing problem.

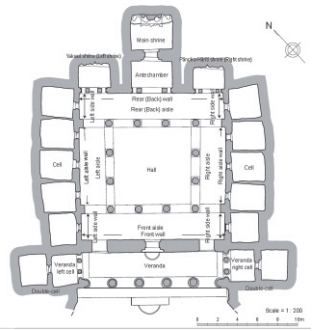

Fig. 1: Plan of Cave 2.

Condition Survey Focusing on Shellac-coated Painting

The condition survey of the shellac-coated paintings was conducted carefully. Small holes with typical sizes of a few millimeters can also be observed on the surfaces of the paintings (Fig. 3a). There are visible white lines of accretions at the same parts. The holes appear in conjunction, as reported previously [4, 1]. The paint layers have disappeared in the vicinity of these holes in the wall painting surface, and some holes are connected to others (Fig. 3b-d).

As regards the areas with shellac coatings, the earthen plaster layer has disappeared, but the shellac-coated paint and lime plaster layers remain (Fig. 3a). An insect (*Ptinidae*) was observed inside the small hole in Fig. 3e in the Cave. As the larvae of that insect family create holes inside earthen plaster, there is a high probability that the presence of these insects is related to the deterioration of the earthen plaster.

Distribution of mural painting deterioration: We examined the wall paintings by focusing on the above mentioned small holes. Fig. 4 shows the areas where the small holes and the white accretions were found. Clearly, the holes are located in the portions of the cave where severe deterioration of the paintings has occurred. There are less holes on the ceilings and upper regions of the walls, while there are more holes on the lower sides of the walls.

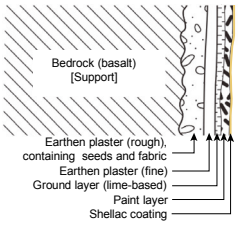

Fig. 2: Structure of the wall paintings

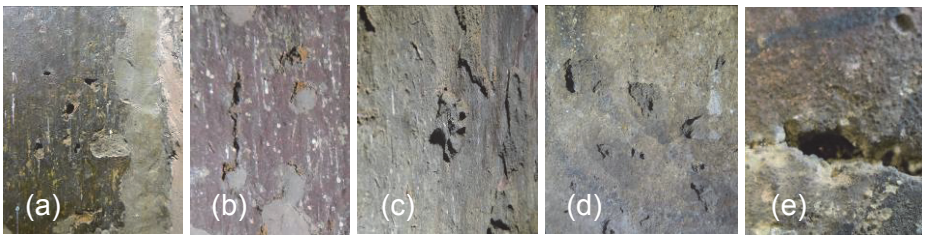

Fig. 3: Condition of the surface of the paintings (a: There are small holes and white accretions on the surface with shellac coating. b, c: The holes connect to others on the inside of the earthen plaster. d: The paint layer around the holes are disappeared in the paintings without shellac coating. e: There was an insect like to *Ptinidae* in the cracks on the paintings.)

Fig. 4: Distribution of the small hales and white accretions on the paintings of the left aisle wall.

Insect-induced holes: According to the previous reports [4], the small holes are widespread in all areas of the Ajanta Caves. In this study, we observed the distribution of the small holes in Cave 2 (Fig. 4). Further, during the condition survey of the surfaces, an insect (might be *Ptinidae*) was observed in one of the small holes. According to reports on the conservation of Cave 17, several small insects such as *Silverfish*[3] and *Ptinidae*[4] are identified using bio traps and they distributed throughout that cave [1]. As noted above, because *Ptinidae* larvae usually create holes in bio materials [3], there is possibility that they cause deterioration of the earthen plaster. Usually, these insects lives under darker and moderate condition.

Lighting and Thermal Environmental Conditions

Thermal Environment: In the rainy season, the air temperature in the cave is 25-30 °C, with more than 60%RH [4, 6]. As the inside temperature of the earthen plaster remains moderate and the humidity is over 60%RH, being almost identical to the condition of the air inside the cave [5], this constitutes a suitable insect habitat [3]. Thus, preservation measures to protect against insect-induced damage should be adopted in the rainy season. Because the temperature and humidity distributions inside the cave are relatively small, the influence of the thermal environment on the distribution of the deterioration features, such as the small holes, may also be small.

Lighting Environment: In order to assess the lighting conditions, we simulated the illuminance of the cave interior using the DIALux computer program [7]. The reflection ratios of the wall, floor, and ceilings were assumed to be 20%. Fig. 5 shows the result obtained for the case in which the sun was positioned at the top of the sky and the sunlight diffusion was high.

Hence, it is apparent that direct sunlight does not enter the cave, except in the case where the sun is positioned at lower 15° and south west in the evening. While the diffused sunlight can enter the cave through the three openings on the west side (Fig. 1), where it can reflect on the floor and walls and weakly illuminate the paintings. The lighting conditions on the front aisle or the back sides of the pilasters are lower than 3 lx and slightly weak in comparison with the surroundings. The areas in which the deterioration involving the small holes is observed correspond to the areas with low illumination. Although the lighting conditions may be one of the factors influencing the distribution of the deterioration features, such as the small holes, this effect cannot sufficiently explain their vertical distribution. Other factors, such as the insect behavior, also have an influence.

Mechanism of Deterioration

The deterioration in the form of small hales and plaster loss may be caused by insects. As

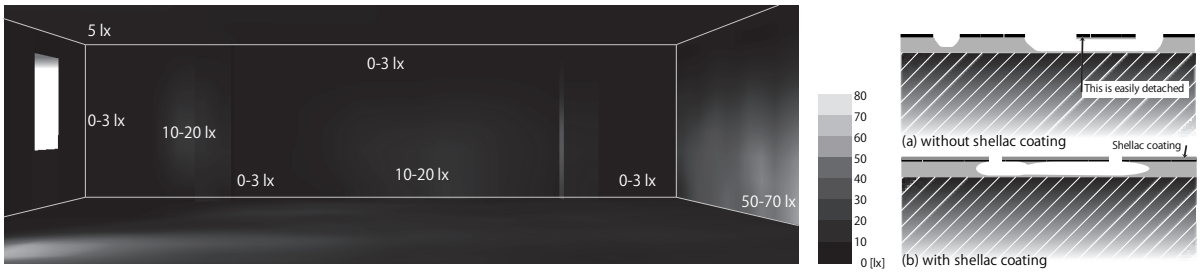

Fig. 5: Illuminance distribution on the paintings of the left aisle wall. The *vihala* and shrines are not considered. The places where there are small holes are located under 3 lx.

Fig. 6 Mechanism of the deterioration (a: without shellac layer, b: with shellac layer)

regards the paintings without shellac coatings, once the earthen plaster has disappeared, the lime plaster and paint layer (which is harder than the earthen plaster) cannot remain in place for a long period of time. Indeed, it can be detached easily under minimal impact. Thus, the disappearance of the earthen plaster can be directly linked to detachment of the lime plaster and paint layers (Fig. 6a). However, it is possible for a shellac-coated paint layer to remain in place even if the underlying earthen plaster disappears (Fig. 6b). From the above analysis, it is apparent that one of the causes of the earthen plaster deterioration and the paint-layer detachment is the presence of insects. However, the shellac layer prevents the paint layers from detaching from the surface.

Conclusion

In this paper, we considered the deterioration mechanism of the wall paintings in Cave 2, Ajanta. Detailed observations of the surface were conducted both in the field and using high-resolution digital images. In addition, the influences of shellac coatings and insects on the deterioration were also analyzed. We suggested some larvae such as *Ptinidae* create the holes in the earthen plaster, and the deterioration is found under the low illuminance condition. Thus the insects' deterioration can be influenced by rather the lighting environment than the thermal environment. The shellac coatings might prevent the paint layer from being detached.

Notes

1. Scientific research fund, no. 24501261.
2. Scientific research fund, no. 25350396.
3. Silverfish have lengths of approximately 10 mm. They damage surfaces, but do not create holes. They require humid and moderate conditions in darkness, and are active at night [3].
4. Mature and larval Ptinidae have sizes of 2.5–3 and 5 mm, respectively. The larvae create holes as habitats, thereby damaging the mud plaster [3].

Acknowledgment

This work was supported by JSPS KAKENHI Grant Numbers 24501261 and 25350396.

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RAINWATER ABSORPTION AND EVAPORATION COMPARED TO DEGRADATION OF WALL PAINTINGS OF HAGIA SOPHIA, ISTANBUL

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Keywords: Hagia Sophia, conservation, exfoliation, heat and moisture transfer, salt damage

Introduction

Hagia Sophia in Istanbul, which is the authentic byzantine architecture built in the 6th century, has been suffering from severe degradation such as exfoliation of wall paintings and inner finishing materials mainly due to salt crystallization within the walls especially at the exedras of the 2nd cornice (Fig. 1 and Photo 1) [1]. Because it is important to understand the primary cause of degradation related to salt damage that is considered to be moisture accumulation and evaporation within the walls, we conducted a field survey and numerical analysis of heat and moisture behavior within the walls, with the aim of proposing a method of preservation based on physical understanding.

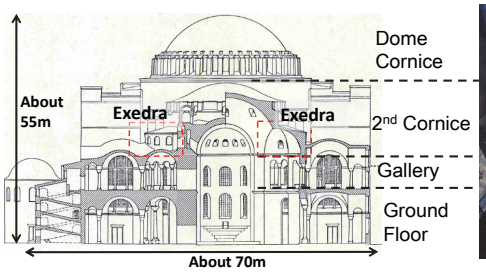

Fig. 1: Section of Hagia Sophia

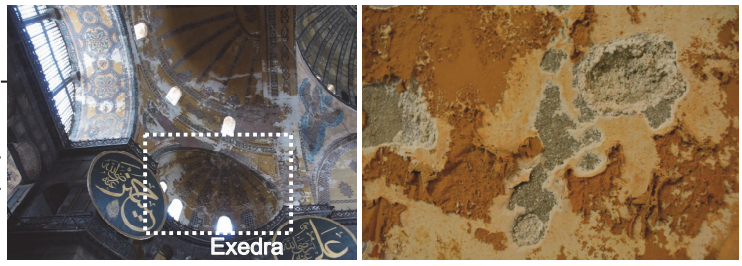

Photo 1: The northwest exedra and degradation due to salt damage

Measurement of moisture content at the 2nd Cornice

A continual deterioration survey and measurement of moisture content of the inner walls has been conducted since 2010. Fig. 2 shows the values of the moisture content measured using a contact-type TDR moisture content sensor at the 2nd cornice. The moisture content tends to be higher at the semicircular-shaped walls, i.e. the exedra. A high moisture content exceeding 20% is confirmed at the exedra in every direction. Fig. 3 shows the moisture content averaged along the inner surface of each exedra wall. The value of the northwest (NW) exedra is the highest, while the one of the northeast (NE) exedra is the lowest. Photo 2 illustrates the degradation of the walls at the NW and NE exedras; that at the NW exedra is the most terrible. As seen in [3], salt-related degradation generally corresponds to a high moisture content. At Hagia Sophia, the locations with a high moisture content are considered to be corners where rainwater runoff from the upper walls is expected (see Photo 3). Fig. 4

shows the annual cumulative amount of rainwater runoff at the walls of exedra. Judging from the roof geometry, three times the amount of the measured precipitation is assumed to be imposed on the outer walls of the exedras. The direction of exedra to which the largest amount of wind-driven rain in addition to the large amount of rainwater runoff is estimated is the NW; the average value of moisture content at the inner surface of which is also the highest. At the NW walls, it is considered that a larger amount of rainwater infiltrated the outer surface and diffused through the wall, causing a higher moisture content and a consequent severer degradation of the inner surface at the exedras.

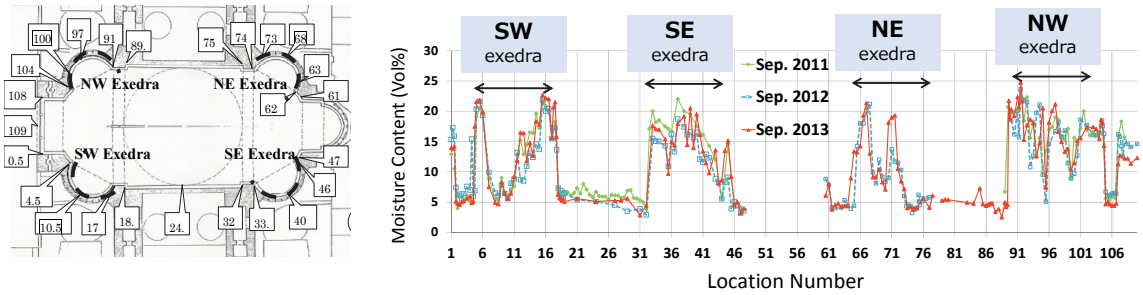

Fig. 2: The location numbers (Left) and moisture content of the inside walls measured at 2nd Cornice level (Right)

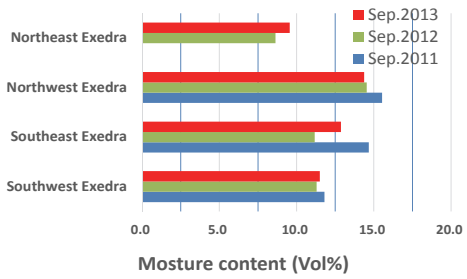

Fig. 3: Average moisture content at each exedra

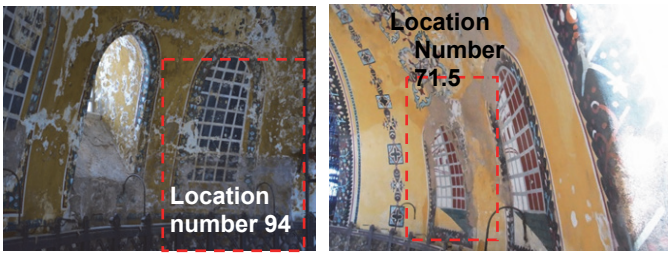

Photo 2: Degradation of the inner wall at NW exedra (left) and NE exedra (right)

Photo 3: Trace of rainwater runoff at the outer wall of NW exedra (Location number 94)

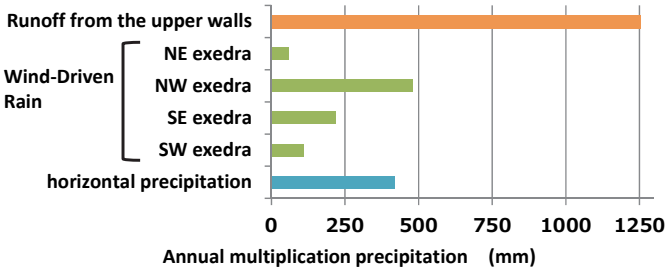

Fig. 4: Annual rainwater runoff and wind-driven rain at the exedra's outer wall surfaces

Influence of accumulation and evaporation of infiltrated rainwater

We perform a numerical analysis of heat and moisture transfer in the NW exedra wall that severely deteriorated (Fig. 5) to clarify the influence of the accumulation and evaporation of rainwater runoff from the upper walls on the degradation at exedra. The coupled heat and moisture transfer equations are solved [3]. The third kind of boundary condition is applied to the inner and outer surfaces of the walls. The temperature, humidity and precipitation

measured outside and inside of Hagia Sophia every 30 minutes between September 26, 2012, and September 25, 2013, are used as the boundary conditions. The solar radiation for vertical walls facing the north is calculated by separating the direct and diffuse components of the measured total horizontal solar radiation using Bouguer's equation and Berlarge's equation. The liquid water diffusivity of the brick, connection mortar and outer finishing materials are measured for specimens exfoliated from the outer walls of Hagia Sophia. The other hydrothermal properties are taken from literature [4].

Fig. 7 shows a seasonal change of distribution of water saturation in the wall. A change in saturation is bigger at the upper part of the wall. The saturation is higher in winter and spring, i.e. the rainy season, while those are lower in summer and fall, the dry season. On the other hand, the saturation at lower part of the wall is almost saturated throughout the year, meaning that accumulated rainwater in the lower part of the wall cannot evacuate. Fig. 8 shows the spatial distribution of the evaporation rate in the inner wall of 3 m below the upper end of the wall at 0:00 on October 1. Evaporation is mainly observed to be significant between the stucco and the middle-layer mortar and between the middle-layer mortar and the brick structure consisted of brick and connection mortar. In addition, the evaporation rate at the lower part of the wall is bigger, especially between the middle-layer mortar and the connection mortar as shown in Fig. 9. Besides, those locations with the high evaporation rate generally correspond to those with severe degradation such as exfoliation of the inside stucco and the middle-layer mortar. This coincidence between the evaporation and degradation confirms a relation between the moisture evaporation and salt crystallization.

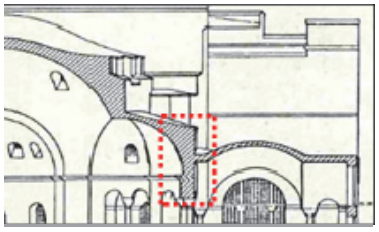

Fig. 5: The analysis modeling range

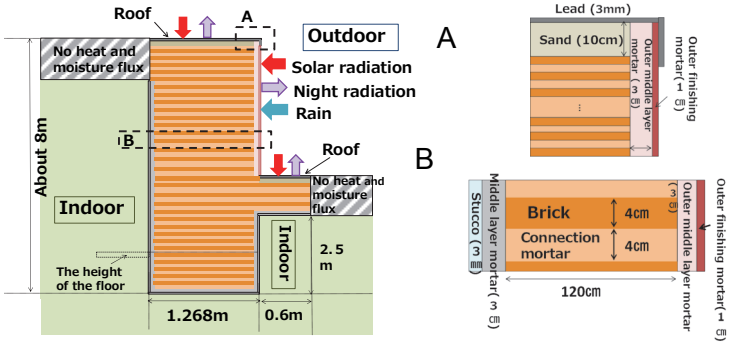

Fig. 6: Outline of the wall model and component of the walls

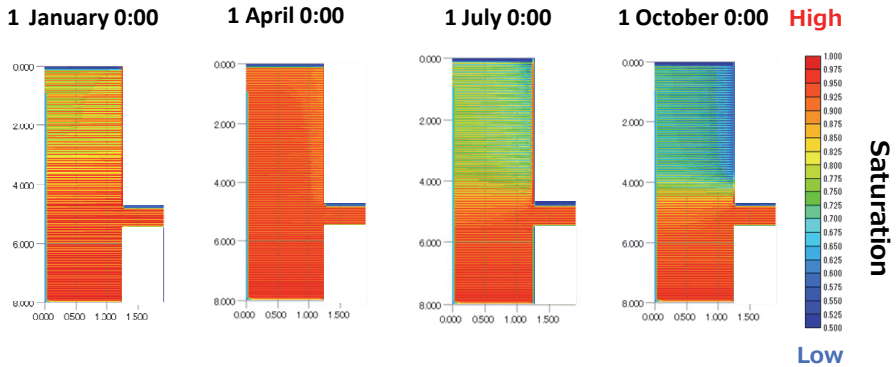

Fig. 7: Distribution of water saturation in the wall

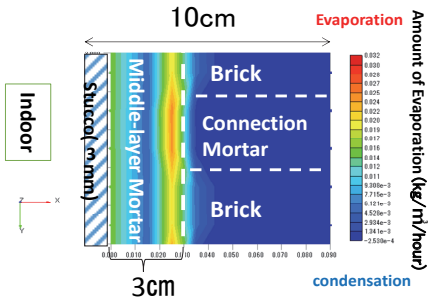

Fig. 8: Distribution of evaporation rate around the inner surface under 3m from the upper end (1 October 0:00)

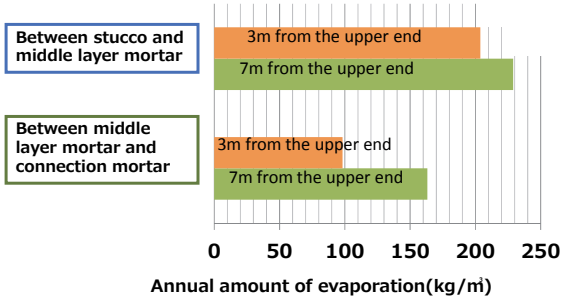

Fig. 9: Annual sum of evaporation

Conclusion

We investigated influences of rainwater absorption and evaporation on degradation of the inner walls due to salt crystallization based on field survey and numerical analysis at exedras.

The results obtained from the field survey are as follows.

-Rainwater tends to infiltrate the outer surface and diffuses through the wall causing high moisture content and consequent degradation of the inner surface at the exedras.

-It is likely that the deterioration of the inner walls at the NW exedra is attributable to more wind-driven rain in addition to much rainwater flowing down at the outer wall.

Our numerical analysis suggests the followings.

-The infiltrated rainwater flowing down the outer wall surface is accumulated especially at the lower part of the wall.

-There is a high possibility that evaporation at the boundary of the layered materials caused salt crystallization and exfoliation of the inside stucco and the middle-layer mortar.

Acknowledgements

This research was partly supported by JSPS KAKENHI grant number 26709043. We appreciate understanding and cooperation of the curators and other staff of Aya Sophia Museum in this researach.

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MOISTURE EVAPORATION FROM EYES AND PREVENTION OF SENSATION OF DRYNESS UNDER LOW INDOOR HUMIDITY

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Keywords: Indoor thermal environment, Low humidity, Sensation of dryness, Eye, Tear, Evaporation, Temperature, Blink rate, Radiation thermometer, Subject experiment

Purpose

To create an indoor thermal environment with no sensation of dryness, it is necessary to control the indoor temperature, humidity, and air flow. Under low humidity conditions, occupants sometimes complain of a sensation of dryness at the throat, eyes, and skin [1]. It is therefore necessary to quantify moisture evaporation from the surface of the body and to identify an optimum method of control for the indoor environment [2, 3, 4]. The minimum humidity level for an acceptable thermal environment has never been clarified, though it is known that low humidity may cause skin drying, irritation of the mucous membranes, and dryness of the eyes [5]. In this study, the eyes were focused on, and the evaporation rate at the eyes was studied experimentally. It is difficult to measure the evaporation rate at the eye surface directly. The surface temperature of the eye was therefore measured using radiation thermometers, and the correlation between the surface temperature and the blink rate as an indicator of the condition of the eye was studied for the basis of the quantitative estimates of the evaporation rate of tear.

Method

Two kinds of subject experiments were conducted. In both, the ocular surface temperature and the blink rate were measured using contactless methods. In the first experiment, 100 university students were recruited as subjects. The surface temperatures of the eyes and face and the blink rate were measured in a standard room in the university, at 21 ºC and 50%rh. The surface temperature was measured using an infrared camera (Avio, TVS-700), and the blink rate was determined from a video recording. In the second experiment, two subjects (university students) were tracked for periods of 130 min per day in an artificial climate chamber for three days, and the temperature and the blink rate were measured as the environment was varied from 23-35 ºC and 40-50%rh. The ocular surface temperature was measured using a radiation thermometer (Japan Sensor TNH91S-L500N5S3A), and the blink rate was measured by a blink counter (Takei Scientific Instruments S-13044).

Results

Experiment 1 (Measurement of a moment for 100 subjects)

The results are summarized in Table 1. The ocular surface temperature was 33.7 ºC on average. The ocular surface temperatures of subjects not wearing contact lenses were 0.5 ºC higher than those of subjects wearing contact lenses, whereas the skin temperature at the face did not differ. The blink rate of subjects not wearing contact lenses was lower. As shown in Figure 1, the ocular surface temperature was negatively correlated with the blink rate.

Table 1: Results of Experiment 1 (Measurement of a moment for 100 subjects)

		All subjects	Without contact lens	With contact lens
Ocular surface temp. [ºC]	Ave.	33.7	34.0	33.5
	S.D.	0.67	0.46	0.72
	Max.	35.3	35.3	34.8
	Min.	31.9	32.9	31.9
Skin temp. at face [ºC]	Ave.	33.1	33.2	33.0
	S.D.	0.71	0.65	0.76
	Max.	34.7	34.3	34.7
	Min.	31.2	31.3	31.2
Blink rate [times/min]	Ave.	18.6	15.3	21.3
	S.D.	12.9	10.7	14.0
	Max.	64	45	64
	Min.	1	3	1
Number of data		100	46	54

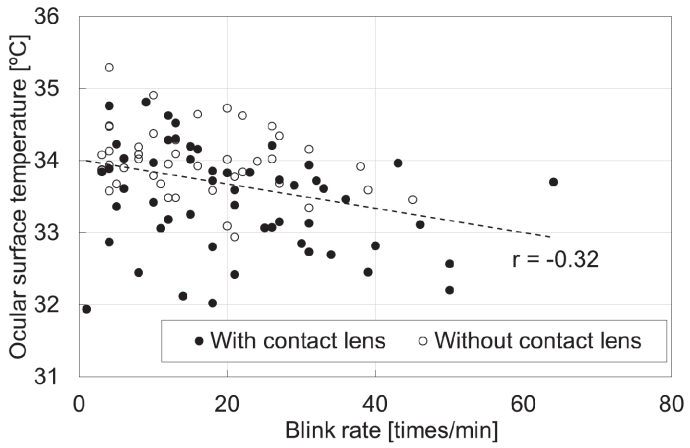

Fig. 1: Relationship between blink rate and ocular surface temperature (Experiment 1, n=100, room air temperature 21.3 ± 2.8 ºC, room air relative humidity 49 ± 9%)

Experiment 2 (Measurements repeated three times for two subjects)

As shown in Figure 2, the ocular surface temperatures of both subjects varied day by day although the subjects were exposed to almost the same conditions of the thermal environment. The ocular surface temperature followed the room air temperature, while the blink rate fluctuated independently of the room air temperature. Taking the average values for one day, the ocular surface temperature was negatively correlated with the blink rate, as shown in Figure 3.

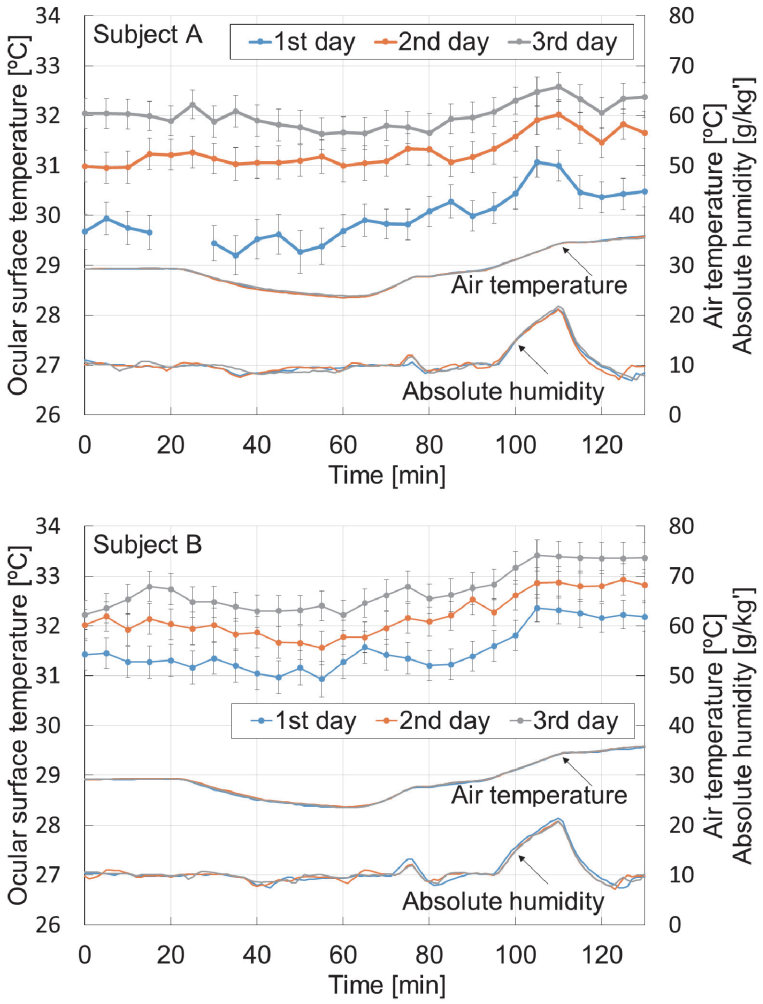

Fig. 2: Results of Experiment 2 (Measurements repeated three times fortwo2 subjects, Subject A wore contact lenses, and Subject B did not)

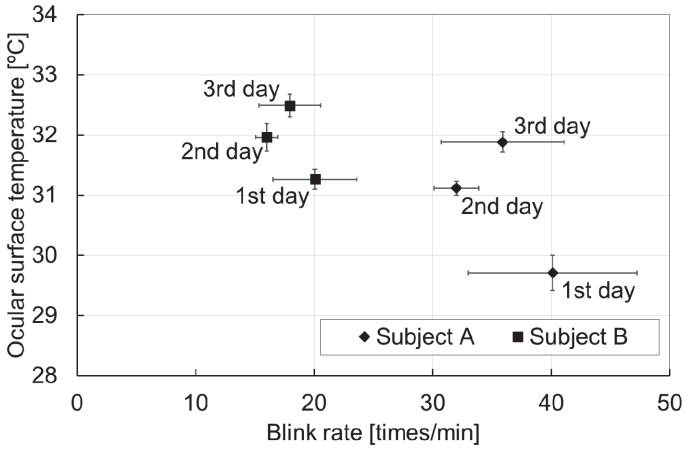

Fig. 3: Relationship between blink rate and ocular surface temperature (Experiment 2, Average and S.D. are shown)

Discussion

The ocular surface temperature is determined by the heat balance, in which the evaporation rate of moisture is one element. If the body and ambient temperatures are the same, a difference in the ocular surface temperature should reflect the difference in the evaporation rate. Ophthalmology has shown that blinking prevents evaporation from the ocular surface by forming an oil layer at the outer surface of the tears [6, 7, 8]. An increase in blink rate may therefore reflect the condition of the tear film on the eye. In Experiment 1, the ocular surface temperature was negatively correlated with the blink rate. This suggests that a high blink rate is associated with a high evaporation rate, and thus with a low ocular surface temperature. This could also explain the results from Experiment 2, both for the three day data on one subject, and for the entire data set. However, the correlation coefficients shown in Figures 1 and 3 were not high, and confirmation is therefore necessary through further experiments. Experiment 1 focused on between-subjects difference, whereas Experiment 2 also focused on within-subjects differences. The results of this study suggest that both inter- and intra-individual variations may arise in the conditions of tears, and that it could affect the ocular surface temperature.

Acknowledgements

This research was partially supported by the Japan Society for the Promotion of Science, Grant-in-Aid for Challenging Exploratory Research, 22656124, and Grant-in-Aid for Scientific Research (B), 25289195.

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INFLUENCE OF VENTILATION IN THE AIR LAYER OF CLOTHING ON HEAT AND MOISTURE TRANSFER AROUND THE HUMAN BODY

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Keywords: clothing, air layer, human thermal model, ventilation, transient heat and moisture transfer, computational fluid dynamics, numerical calculation, indoor thermal comfort

Introduction

In the air layer between the human body and clothing, ventilation with the ambient air occurs through the apertures of clothing such as the collar, sleeve, hem, and pores of the clothing. Measurements of ventilation rate in the air layer have been attempted [1]. However, it is difficult to measure the whole characteristics of the ventilation because the air velocity is generally low and is distributed. From the viewpoint of simulating the thermal comfort of indoor occupants, it is important to quantify the ventilation rate in the air layer of clothing and to evaluate the influence on the thermophysiological responses of the human body. In this study, the transient heat and moisture balance equations for the clothing and human body system [2] were solved coupled with calculation of ventilation rate in the air layer of clothing, and the influence of the ventilation on human body was clarified.

Methods

The target of the calculation was the heat and moisture transfer in and around a Japanese male in his twenties with an average body shape and wearing only a T-shirt. Figure 1 shows a conceptual diagram of the movement of heat and moisture in and around the human body, and the human thermal model used in this study (Stolwijk model) [3]. Here the trunk segment was treated as the covered skin. The calculation was conducted for a given condition with a stepwise change in air temperature and humidity (Figure 2).

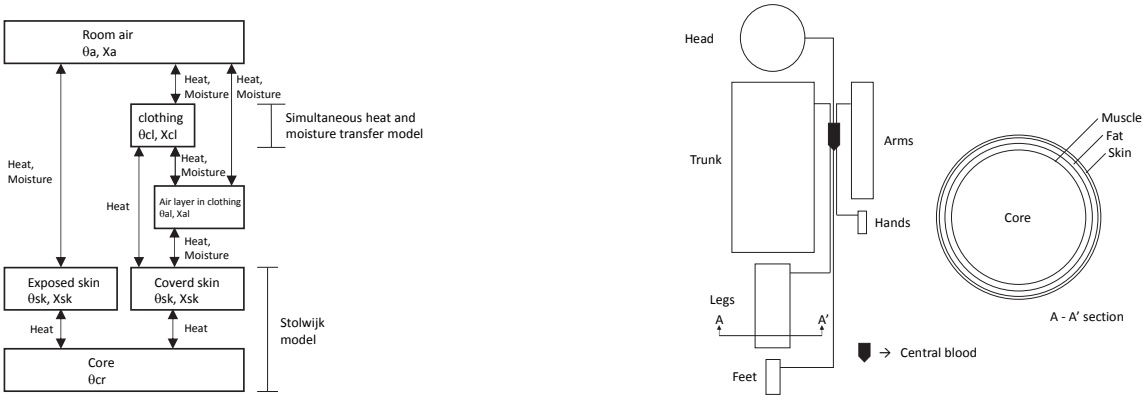


Fig. 1 Conceptual diagram of the heat and moisture transfer models
(left: human body and clothing model, right: Stolwijk model)

Ventilation in the air layer of clothing was expressed by equations (1)-(3). Heat and moisture balance equations for the air layer and the clothing with their boundary conditions were given by equations (4)-(12). A correction coefficient k was introduced to equation (2) to match the ventilation rate calculated by computational fluid dynamics for the target case considering the real shape of the human body [4]. Temperature differences and wind pressure were taken as the forces driving the ventilation. The areas of the apertures at the sleeves, hem, and neck were based on a three-dimensional scan of a real human body and clothing [5]. Permeation of air through pores in the clothing was also considered. The wind pressure coefficient and discharge coefficient of the apertures were determined using computational fluid dynamics to simulate the target conditions [4]. Each aperture was divided into front and back of the human body. The conditions were given in Tables 1-4. Cases of no air flow in the room and those considering air flow from the front wall of the human were calculated.

$$\Delta p_{j,l}(z) = -p_0 - \Delta\rho g z + \frac{1}{2} C \rho_{out} V^2 \tag{1}$$

$$0 = \sum_j k \cdot \mathrm{sign}(\Delta p_j) \cdot \alpha A_j \sqrt{\frac{2|\Delta p_j(z)|}{\rho_{ave}}} + \sum_l k \cdot \mathrm{sign}(\Delta p_l) \cdot \int_0^{z_h} \frac{|\Delta p_l(z)|}{R} B dZ \tag{2}$$

$$\text{and,} \quad \mathrm{sign}(\Delta p_{j,l}(z)) \equiv \begin{cases} +1, & \Delta p_{j,l}(z) \geq 0 \\ -1, & \Delta p_{j,l}(z) < 0 \end{cases} \tag{3}$$

$$c_a \rho_a V \frac{d\theta_{al}}{dt} = \alpha_{csk}(\theta_{sk} - \theta_{al})S + \alpha_{ci}(\theta_{cl,i} - \theta_{al})S + c_a \rho_a Q_t(\theta_a - \theta_{al}) \tag{4}$$

$$\rho_a V \frac{dX_{al}}{dt} = \alpha'_{sk}(X_{sk} - X_{al})S + \alpha'_i(X_{cl,i} - X_{al})S + \rho_a Q_t(X_a - X_{al}) \tag{5}$$

$$c_{cl}\rho_{cl}\frac{\partial\theta}{\partial t} = \frac{\partial}{\partial x}\left(\lambda\frac{\partial\theta}{\partial x}\right) + L\frac{\partial}{\partial x}\left(\lambda'\frac{\partial X}{\partial x}\right) \tag{6}$$

$$\rho_w \frac{\partial w}{\partial t} = \frac{\partial}{\partial x}\left(\lambda'\frac{\partial X}{\partial x}\right) \tag{7}$$

$$w = f(X, \theta) \tag{8}$$

$$-\lambda\frac{\partial\theta}{\partial x}\Big|_{s,\ in} = \alpha_{ci}(\theta_{al} - \theta_{cl,i}) + \alpha_{ri}(\theta_{sk} - \theta_{cl,i}) + L\alpha'_i(X_{al} - X_{cl,i}) \tag{9}$$

$$-\lambda'\frac{\partial X}{\partial x}\Big|_{s,\ in} = \alpha'_i(X_{al} - X_{cl,i}) \tag{10}$$

$$-\lambda\frac{\partial\theta}{\partial x}\Big|_{s,\ out} = (\alpha_{co} + \alpha_{ro})(\theta_{cl,o} - \theta_a) + L\alpha'_o(X_{cl,o} - X_a) \tag{11}$$

$$-\lambda'\frac{\partial X}{\partial x}\Big|_{s,\ out} = \alpha'_o(X_{cl,o} - X_a) \tag{12}$$

Symbols Δp: Pressure difference [Pa], p_0: Static pressure at standard level [Pa], $\Delta\rho$: Difference in density between inner and outer air volumes [kg/m^3], g: Gravity acceleration [m/s^2], z: Vertical coordinate [m], C: Wind pressure coefficient [-], ρ_{ave}: Average density of air in and out of the air layer [kg/m^3], V: Wind velocity [m/s], Q_t: Ventilation rate [m^3/s], k: Correction coefficient [-], α: Discharge coefficient [-], A_j: Area of aperture [m^2], Z_h: Height of shirt [m], R: Air resistance [Pa·s/m], B: Width of aperture [m], H: Height of aperture [m], c: Specific heat [J/kg/K], V: Volume of air layer in clothing [m^3], θ: Temperature [°C], t: Time [s], S: Surface area [m^2], X: Absolute humidity [kg/kg'], α_c: Convective heat transfer coefficient [W/m^2/K], α_r: Radiative heat transfer coefficient [W/m^2/K], α': Moisture transfer coefficient [kg/m^2/s/(kg/kg'))], λ: Thermal conductivity [W/m/K], L: Latent heat [J/kg], λ': Moisture conductivity [kg/m/s/(kg/kg')], w: Volumetric moisture content [m^3/m^3]

Subscripts j: Number of apertures with infinitesimal height , l: Number of apertures as porous media , in: Inner side of clothing, out: Outer side of clothing, a: Room air, al: Air layer in clothing, sk: Skin, cl: Clothing, w: Water

Table 1. Cases of calculation

	Wind velocity (m/s)	Correction coefficient	Ventilation
Case 1 (no wind)	0	0.08	Considered
Case 2 (no wind)			Not considered
Case 3 (wind from front)	0.5	0.28	Considered
Case 4 (wind from front)			Not considered

Table 2. Parameters used in calculation

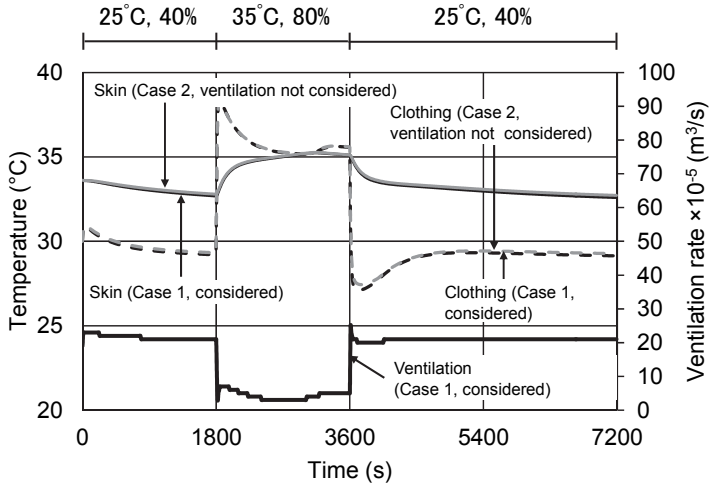
λ (clothing) [W/m/K]	5.6×10^{-2}	ρ (clothing) [kg/m^3]	3.5×10^{2}	c (air) [J/kg/K]	1.0×10^{3}
λ' (clothing) [kg/m/s/(kg/kg')]	6.5×10^{-7}	d (clothing) [m]	5.0×10^{-4}	L [J/kg]	2.5×10^{6}
c (clothing) [J/kg/K]	1.4×10^{3}	S (clothing) [m^2]	7.0×10^{-1}	V [m^3]	8.0×10^{-3}

Table. 3 Parameters related to calculation of ventilation rate

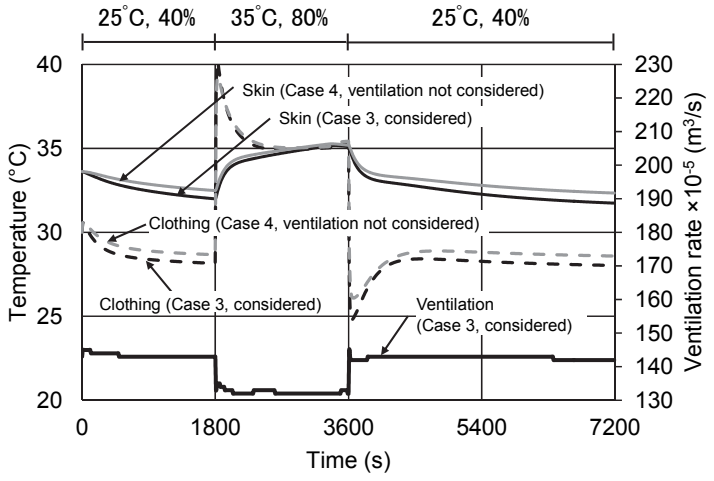
Aperture	Hem		Sleeve		Collar		Pores of clothing	
Position	Front	Back	Front	Back	Front	Back	Front	Back
k	(Wind velocity 0.0m/s) 0.08 , (Wind velocity 0.5m/s) 0.28							
α	0.6							
R [Pa·s/m]							249	
H [m]	0		0.4		0.6		0 - 0.6	
S [m^2]	1.5×10^{-2}	1.2×10^{-2}	6.8×10^{-4}	8.1×10^{-3}	1.3×10^{-3}	6.3×10^{-4}	2.8×10^{-1}	4.4×10^{-1}
C	0.63	-1.08	0.64	-0.33	0.62	-0.60	0.71	-0.74

Table. 4 Heat and moisture transfer coefficient

	Covered skin, Clothing inner side	Exposed skin, Clothing outer side
α_c [$W/m^2/K$]	10.0	(Wind velocity 0.0 m/s) 3.1 (Wind velocity 0.5 m/s) 5.5
α_r [$W/m^2/K$]	4.65	4.65
α' [$kg/m^2/s/(kg/kg')$]	0.01	(Wind velocity 0.0 m/s) 0.0031 (Wind velocity 0.5 m/s) 0.0055



(a) Cases of no wind



(b) Cases of wind from the front

Fig 2. Calculated skin and clothing temperatures and ventilation rate

Results

The ventilation rate was lower in the high temperature condition than in the low temperature condition because the difference between the room air and skin temperatures was small (Fig. 2). The clothing temperature rise at 1800 seconds was due to the absorption of moisture, and that at 3000 seconds was due to the onset of sweating. At 3000 seconds, the skin temperature was decreased by sweat evaporation. The ventilation rate in the case with wind (Case 3) was larger than that in the case without wind (Case1), and the skin and the clothing temperature was lower. In the cases without wind, the difference between Case 1 (with ventilation) and Case 2 (without ventilation) was small. In contrast, in the cases with wind the difference between Case 3 (with ventilation) and Case 4 (without ventilation) was as high as 0.6°C. The variation in the ventilation rate due to the temperature difference between the air layer in the clothing and in the room had no significant influence on the skin temperature.

Conclusions

The influence of the ventilation rate in the air layer on skin temperature was negligible under natural convection, whereas when there was a wind of 0.5 m/s from the front of the human subject, a 0.6 °C difference in skin temperature was observed. The variation in the ventilation rate caused by stepwise changes in the temperature difference between the air layer and the ambient air had no significant influence on skin temperature.

Acknowledgements

This research was partially supported by the Ministry of Education, Science, Sports and Culture, Grant-in-Aid for Young Scientists (A), 20686039, and by the Japan Society for the Promotion of Science, Grant-in-Aid for Challenging Exploratory Research, 25630239.

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ANALYSIS OF TEMPERATURE AND HUMIDITY IN THE BEDROOM OF A JAPANESE DWELLING HOUSE IN WINTER

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Keywords: Temperature, Humidity, Bedroom, Dwelling house, Renovation, Insulation, Numerical analysis, Field measurement

Introduction

Accurate prediction of indoor temperature and humidity is important for the design of a healthy and comfortable living environment[1-5]. In this study, we conducted an analysis of the temperature and humidity of a bedroom based on simultaneous heat and moisture transfer theory, and the results were compared with those from field measurements. At the same time, the effect of the renovation (adding thermal insulation) for the target bedroom was quantitatively evaluated using the validated analytical model.

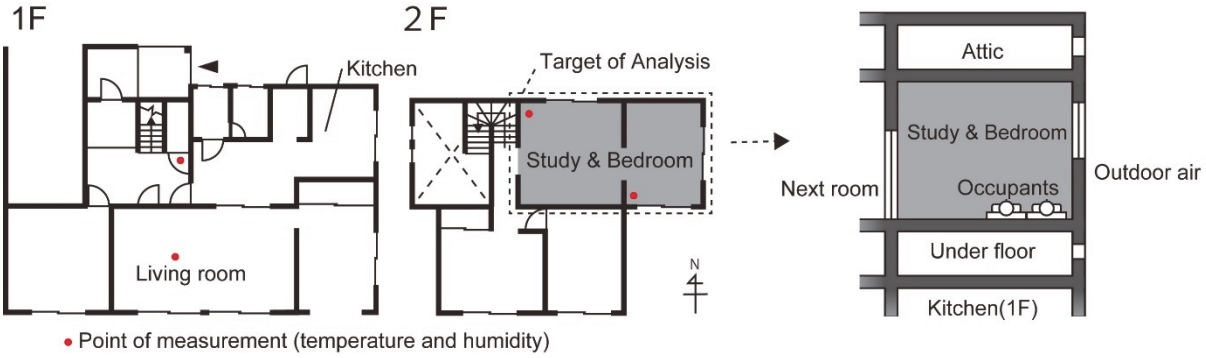

Fig.1 Plan of whole house (left) and vertical section of room targeted for analysis (right)

Methods

The target is a bedroom on the second floor of a two-storied dwelling house in Hokkaido, Japan that was built 34 years ago. In the analytical model, the bedroom and study were treated as a single room with dimensions of W6.2 m × D3.5 m × H2.4 m, giving a volume of 52.1 m^3. The points at which temperature and humidity were measured are shown on the plan of the whole house in Fig.1. The two inhabitants of the house used the bedroom only between 10 pm and 7 am without the use of heating or air-conditioning. Measurements were conducted between January 14 and March 15, 2014. Between February 3 and 13, the bedroom was renovated: insulation was added to the existing outer walls, floor, and ceiling of the bedroom, and the door leading to the staircase was replaced with a more airtight one. The components of wall of the target room before and after renovation are shown in Table 1.

Table.1 Components of walls of target room

Segment	Material		Thickness [mm]	Area [m^2]
Window	Glass		-	4.6
Outer walls	After renovation	Gypsum board	12	24.9
		Styrofoam	30	
	Before renovation	Gypsum board	12	
		Moisture barrier	-	
		Glass wool	120	
Partition		Gypsum board	12	24.9
		Moisture barrier	-	
		Glass wool	120	

Segment	Material		Thickness [mm]	Area [m^2]
Floor	After renovation	Wooden floor	6	21.7
		Veneer	12	
		Styrofoam	25	
	Before renovation	Plywood	12	
		Air layer	-	
		Gypsum board	12	
Ceiling	Before renovation	Gypsum board	12	21.7
	After renovation	Styrofoam	25	
		Glass wool	100	

Table.2 Values used in calculation

Heat generation rate [W/person]			70
Moisture generation rate [g/h/person]			20
Solar absorptivity of window [-]			0.4
Solar absorptivity of surface of outer wall [-]			0.8
Thermal resistance between living room and kitchen* [m^{2}K/W]			0.5
Ventilation rate [times/h] (Before/After renovation) Daytime 7:00–22:00 Nighttime 22:00–7:00	Next room	Daytime	0.2/0.2
		Night	0.05/0.01
	Outside air	Daytime	0.05/0.01
		Night	0.05/0.01

*The kitchen immediately beneath the bedroom was not measured. The boundary condition of temperature for the first floor was given at the living room, and an apparent thermal resistance between the living room and the kitchen was determined.

Table.3 Heat and moisture balance equation of the air in the target room as a concentrated mass

Non-steady-state heat balance equation

$$\rho_a c_a V \frac{dX_i}{dt} = \sum_{k=1}^{5}\{\alpha_i S_k(\theta_{s,k} - \theta_i)\} + \rho_a c_a Q_o(\theta_o - \theta_i) + \rho_a c_a Q_n(\theta_n - \theta_i) + P + \eta_1 J S_1 \quad (1)$$

Non-steady-state moisture balance equation

$$\rho_a V \frac{dX_i}{dt} = K'_2 S_2(X_o - X_i) + K'_3 S_3(X_n - X_i) + \alpha'_i S_5(X_{s,5} - X_i) + \alpha'_i S_{4bed}(X_{s,4bed} - X_i) + \rho_a Q_o(X_o - X_i) + \rho_a Q_n(X_n - X_i) + G + \alpha'_i\{X_{sat}(\theta_s) - X_i\}S_1 \quad (2)$$

Symbols

θ : Temperature[℃], t : Time[s], ρ : Density[kg/m^3], c : Specific heat[J/kg/K], V : Volume of room[m^3], S : Surface area[m^2], α:Overall heat transfer coefficient[W/m^2/K], Q:Ventilation rate[m^3/s], P : Heat production rate[W], η : Solar heat gain coefficient[-], J : Solar radiation at window[W/m^2], X:Humidity ratio[g/kg'], K': Moisture transmission coefficient [kg/m^2/s/(kg/kg')], α':Moisture transfer coefficient[kg/m^2/s/(kg/kg')]

Subscripts

a:Air, i:Indoor, o:Outdoor, n:Nextroom, s:Surface, sat :Saturated
1:Window, 2:Outer walls, 3:Partition, 4:Floor, 5:Ceiling

Heat and moisture balance equations for the air in the target room, treated as a concentrated mass solved numerically. The equations considered ventilation with the staircase and outdoor air. Non-steady-state heat conduction for the solid (walls, floor, and ceiling) were solved coupled with equations (1), (2). For windows, transmission of solar radiation was considered as well as heat transmission. The temperatures of the outdoor air, staircase, and living room were the measured values. Solar radiation was taken from the local meteorological data, and incident not only on the window but also on the outer wall surface was taken into account, based on the aspect of the surface. The air temperature of the space under the floor of the bedroom was solved with a heat balance equation similar to that used for the bedroom itself. The upper surface of the ceiling of the bedroom was treated as being thermally insulated. For moisture, measured values of absolute humidity of the outdoor air and the staircase air were used in the calculation of ventilation, and the surfaces surrounding the bedroom were treated as being sealed, except for the gypsum board ceiling, the moisture capacitance of which was considered using simultaneous heat and moisture transfer equations for hygroscopic range. Heat and moisture generation by the two inhabitants was applied in the heat and moisture balance equation only in the period from 10 pm to 7 am (during sleep). The door leading to the staircase, was assumed to be open except at nighttime, and contributed to the variation in the ventilation rate. The numerical values used in the analysis are summarized in Table 2. Table 3 gives the heat and moisture balance equations respectively.

Results

The air temperature in the bedroom (Figure 2) peaked at 2 pm and then fell, in the daily variation mainly due to solar transmission. This trend was reproduced in the calculated results, both before and after renovation. The absolute humidity in the bedroom (Figure 2) peaked twice daily, at 2 am and 3 pm. The former peak was due to moisture generated by the human inhabitants, and the latter to desorption from the ceiling caused by the rise in temperature. The latter peak was higher, and again the trend was reproduced in the calculated values. Overall the analytical model was validated.

Using this analytical model, the effect of the renovation was then evaluated under the same climatic conditions (Figure 3). After renovation, the air temperature in the bedroom increased by 0.9 °C in the daytime and 1.2 °C at night. This was due to the reduced heat loss from the outer wall and the increase in the storage of solar heat in the surface materials. The absolute humidity was higher after renovation by 0.6 g/kg', because of the increased air-tightness of the bedroom.

Conclusions

It was shown that the trends in temperature and humidity measured in the bedroom of a dwelling house in winter were reproduced by an analytical model based on heat and moisture transfer theory. The model took account of the boundary conditions for the adjacent space, and considered the real wall components and the effect of the occupancy patterns on the ventilation rates and the generation of heat and moisture. In addition, the validated model was then used to quantitatively outdoor temperature and humidity and solar radiation.

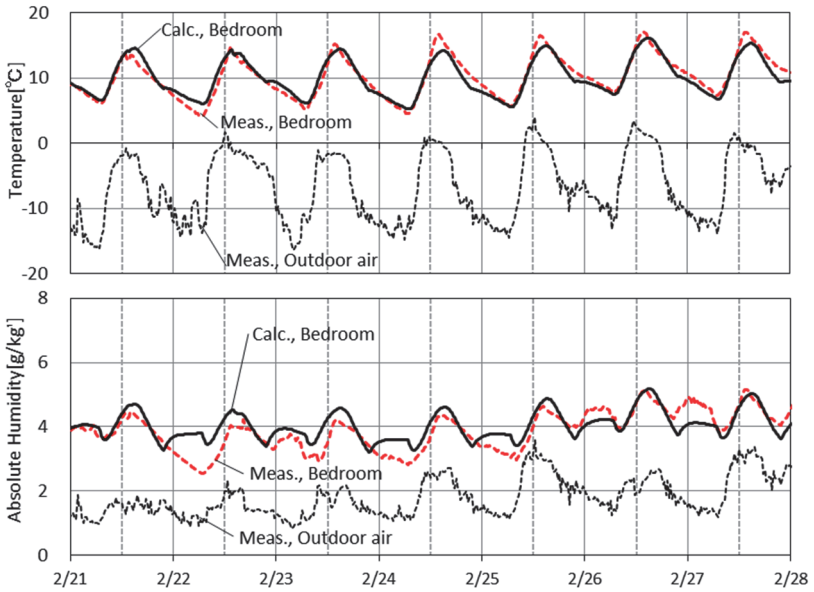

Fig.2 Measured and calculated temperature and humidity of air in the bedroom and outdoor

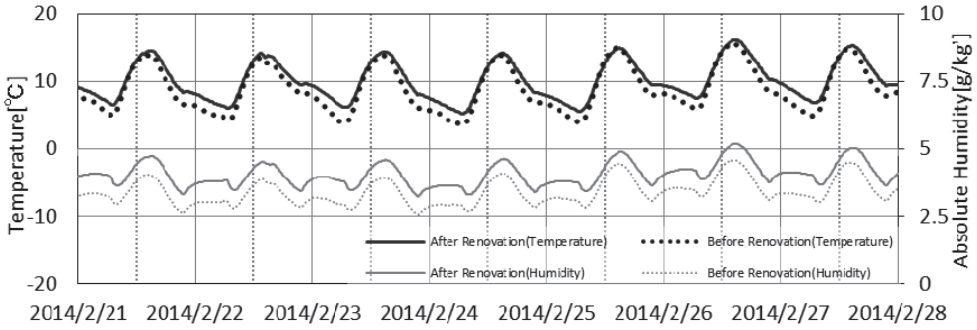

Fig.3 Temperature and humidity of air in the bedroom before and after renovation calculated under the same climatic conditions

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THE PROBLEM OF DISCRETIZATION FOR DYNAMIC ANALYSIS

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Keywords: dynamic analysis, discretization, lattice-vibration, numerical dispersion

Introduction

Today, numerical analysis and a calculation based on digital data or the numerical model are essential technology for structural engineering. A continuous signal or the continuum system includes an infinite number of values in any short time or any small space. Digitalization of them is reduction or thinning-out into a limited number of values. This process is called sampling or discretization and causes an information loss of original signal or system. However, according to Nyquist sampling theorem, perfect reconstruction is possible from discrete signals which are sampled at a rate more than twice of the highest frequency of the original continuous signal. Then, before sampling a continuous signal must be cut off any frequency higher than 1/2 of the sampling rate (that is called Nyquist rate) by a low-pass filter or an anti-aliasing filter. Therefore, a reconstructed signal can be represented approximately by Fourier polynomial (or a convolution of discrete data with a periodic sinc function) not including higher components than Nyquist frequency, and it is mathematically continuous and smooth.

Time-discretization

Ground motion of earthquake was digitally recorded usually at a sampling rate of 100Hz in accordance with the sampling theorem. Digital reconstruction of intermediate data in the sampling interval is called up-sampling. Fig.1 shows a part of reconstructed data from the UD acceleration recorded at the IWTH25 (Ichinoseki-nishi) station of KiK-net (Strong motion sensor networks in Japan) on Jun. 14, 2008 which is known as the Guinness World record. The up-sampled data are obtained by interpolation using the FFT (First Fourier Transform).

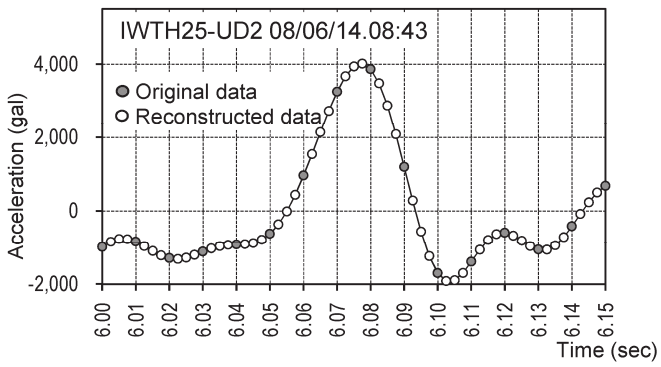


Fig. 1: A part of reconstructed data from the UD acceleration records at IWTH25-station on 2008/06/14 (13sec time-shifted)

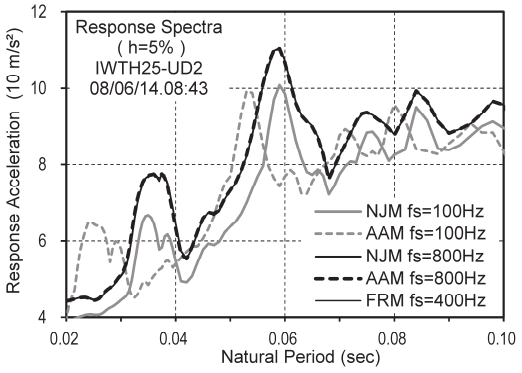


Fig. 2: Response Spectra of IWTH25-UD2, 08/06/14, 08:43 caluculated by 3 metods

The peak ground acceleration (PGA) of 4,015.8 gal can be find at intermediary of sampling data and it is lager than “PGA = 3,866 gal” in the document [3]. Fig. 2 shows response spectra of this sismic wave which are calculated by 3 methods of average-acceleration method (AAM), Nigam-Jennings method (NJM) and frequency-response-function method (FRM). And sampling frequencies (f_s) of input data are 100Hz of the original data, 400Hz or 800Hz of up-sampled data by FFT interpolation. In the case of f_s = 800Hz, response spectra calculated respectively by 3 methods are approxmately equal. Those response at T=0.06sec are nearly 9% lager than “9,853 cm/s² at T = 0.06sec” in the document [4].

Therefor, up-sampling of an input seismic wave is recommended for dynamic analysis of a structure with high natural frequency. On the other hand, it seems as if reconstruction or interporation based on the sampling theorem would be inconsistent with “the law of casuality”, because the periodic function (which is reconstucted) repeats its values in a certain period.

Space-discretization

The above-mentioned studies are about problems of time-discretization. There are also problems of space-discretization or discrete models of continuum system. The most simplified model of the continuum system is a homogeneous linear-elastic bar with fixed ends. It is a natural modeling of continuum system to decompose into small elements of the inertial mass or elasticity. Lattice-vibration model shown in Table 1 is primitive and classical but it is same as the FEM (Finite Element Method) model of one-dimensional (1D) system.

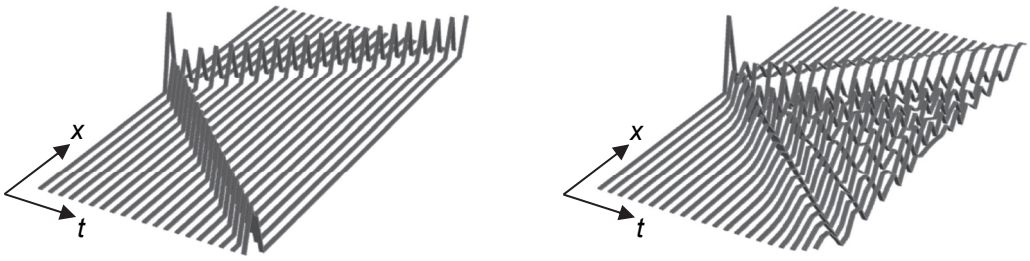
Table 1: 1D continuum model and lattice model

	Continuum Model	Lattice Model
Model	 Length : L, density : ρ Stiffness : μ	 Spacing : $d=L/N$ Mass : $m=\rho d$, Spring : $k=\mu/d$
Motion Eq.	$\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ $c^2 = \mu/\rho = \text{const.}$	$\ddot{u}_j = c^2 \frac{u_{j-1} - 2u_j + u_{j+1}}{d^2}$ $\rightarrow \; m\boldsymbol{u} = -\boldsymbol{K}\boldsymbol{u}$
Normal Modes	$q_n(x) = \sin(\kappa_n x)$ $\kappa_n = n\pi/L$	$\boldsymbol{q}_n = \sqrt{2/N}\,[\sin(\kappa_n j\, d)]$ $1 \le n,\ j \le N-1$
Natural Frequency	$\omega_n = \kappa_n c = n\pi \frac{c}{L}$	$\omega'_n = \frac{2Nc}{L}\sin(\frac{n\pi}{2N})$

The dynamic properties of the system are characterized by natural frequencies and normal modes depending on material properties of L, ρ and μ. All of normal modes of the lattice model match those of the continuum model not more than the N-th mode of vibration. However, the n-th natural frequency ω'_n of the lattice model is less than ω_n of the continuum model. The higher the frequency is, the greater is the difference of them. This phenomenon is called “dispersion relation” or “numerical dispersion”. The free vibration is expressed by Eq. (1) when the initial condition is a periodic sinc function.

$$u(t,x)=\frac{2}{N}\sum_{n=1}^{N/2}\sin(\kappa_{2n-1}x)\cos(\omega_{2n-1}t),\quad u(0,x)=\frac{2}{N}\sum_{n=1}^{N/2}\sin(\kappa_{2n-1}x) \qquad \text{Eq. (1)}$$

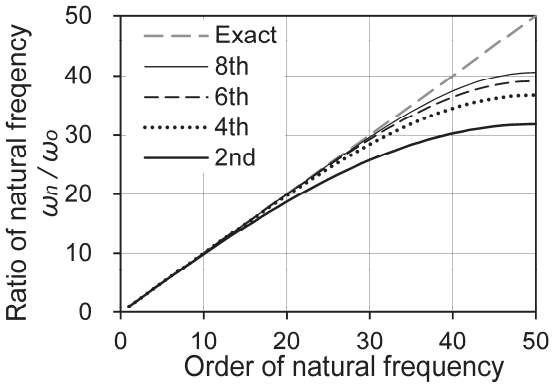
In addition, it is the wave propagation as shown in Fig. 3.



The continuum model without dispersion The Lattice model with dispersion

Fig. 3: Difference of wave propagation between 2 models

On the other hand, the lattice model is also same as FDM (Finite Difference Method) model of 1D system. There are a number of finite-difference approximations of high-order accuracy shown as below. Even if they are applied, the normal modes are same as the lattice model (because of the symmetry of the coefficients). However, the higher the order of accuracy is, the dispersion is small, as shown in Fig. 4.



The 2nd-order derivative approxmation by central finite difference of higher order accuracy

$$u''_i\, d^2 \approx \qquad u''(x)=\frac{\partial^2 u}{\partial x^2}$$

2nd: $-2u_i + u_{i\pm1}$

4th: $-\frac{5}{2}u_i+\frac{4}{3}u_{i\pm1}-\frac{1}{12}u_{i\pm2}$

6th: $-\frac{49}{18}u_i+\frac{3}{2}u_{i\pm1}-\frac{3}{20}u_{i\pm2}+\frac{1}{90}u_{i\pm3}$

8th: $-\frac{205}{72}u_i+\frac{8}{5}u_{i\pm1}-\frac{1}{5}u_{i\pm2}+\frac{8}{315}u_{i\pm3}+\frac{7}{240}u_{i\pm4}$

Fig. 4: Dispersion relation of FDM (N=50) used approxmation of higher order accuracy

When FDM is represented by a matrix-vector equation, the bandwidth of stiffness matrix is larger as the order of accuracy is higher. In addition, the stiffness matrix reconstructed by the normal modes and the natural frequencies of the continuum model is a full matrix. The stiffness matrix of the lattice model is tri-diagonal matrix which shows “local-action theory”. Therefore, it shows nonlocal action that the bandwidth of the stiffness matrix is more than 3.

Fig. 5 shows a 1D model of multi-layered soil and its normal modes (or stationary waves) of the 1st to 4th order. This model is formed by jointing several homogenous bars. When it vibrates at a natural frequency ω_n, the mode shape of each bar is a part of sinusoidal curve same as that of a homogenous bar. The natural frequencies and normal modes can be determined to satisfy boundary conditions of each layer (in the same manner as multi-reflection theory). And an apparent wave number in each layer can be equalized by scaling the depth of layer. In the same manner as Fig.3, Fig. 6 shows a wave propagation in the

medium formed by jointing symmetrically 2 models in Fig. 5. And, in this model, the length of each bar is scaled. Reflected waves on the boundary can be find.

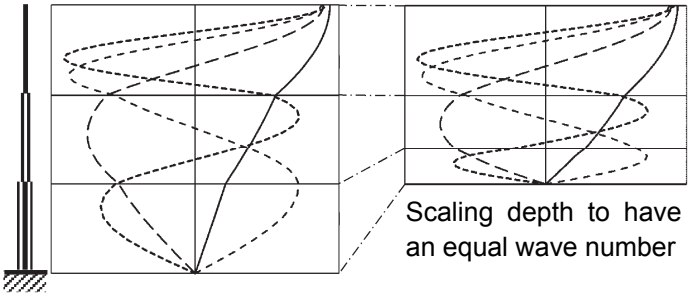


Fig. 5: Normal modes on a 1D model of multi-layered soil

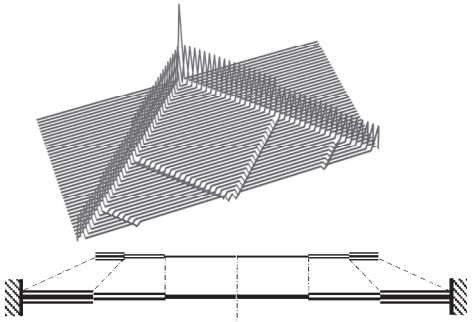


Fig. 6: Wave propagation in a multi-bar system (without dispersion)

In the lattice model of the above system, when the lattice spacing (or mesh size) d_i is proportional to the wave velocity c_i of the i-th layer (that is d_i / c_i = constant) and the boundaries are also at the lattice points, all normal modes of the lattice model match to those of the continuum model. However, their natural frequencies do not match to those of the continuum model and there is a “dispersion relation” same as the simply model.

Summery

1) Discretization causes the essential difference and that cannot be quantitatively compensated always.

2) In some case, up-sampling of the digital record of seismic wave is necessary before the time-history response analysis.

3) The high mode vibration cause numerical dispersion in the space-discrete model formed by connecting adjacent nodal points by elastic elements. Such a discretization is also based on the local-action.

4) This study shows the problem of a simple model of linear one-dimensional. However, in a complex model as non-linear or three-dimensional, it might be other problems exist.

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SEISMIC SIMULATION OF JAPANESE AND U.S. TYPE STEEL MOMENT-RESISTING FRAME STRUCTURES: MACRO-MODELING WITH BEAM AND SHELL ELEMENTS

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Keywords: Japanese and U.S. type, steel moment-resisting frame structure, seismic simulation, seismic and gravity frames, beam and shell elements, composite effects by slab

Introduction

Typical steel moment-resisting frame structures in Japan are designed so that almost all frames resist vertical and horizontal loading simultaneously, connecting all columns to beams with rigid connections as shown in Figure 1(a). Since columns are subjected to biaxial bending, hollow-square section members are often used for columns. In contrast, typical steel moment-resisting frame structures in the United States and many other countries in seismic regions consist of seismic and gravity frames as shown in Figure 1(b). Here, in seismic frames, beams are connected to columns with rigid connections, and in gravity frames, beams are connected to columns with bolts at the web, often modeled by pin connections in practical designs.

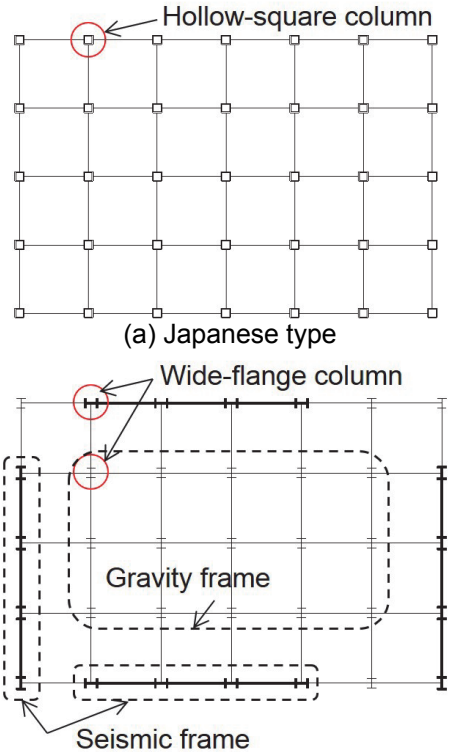

Fig. 1: Steel moment-resisting frame structures (plan)

MacRae and Mattheis [1], and MacRae and Tagawa [2] conducted 3D frame analysis for U.S. and Japanese type steel frame structures. These studies suggested that the different framing systems may exhibit different collapse mechanisms. Particularly, Japanese type steel structures may exhibit soft-story mechanisms due to biaxial yielding of columns when subjected to a severe earthquake [2]. Hasegawa et al. [3] and Kimura [4] conducted 2D frame analysis for Japanese and U.S. type steel frame structures. However, in these previous analyses, floor slabs were not modeled. Moreover, conventional structural analysis programs that account for geometric nonlinearity, often referred to as *P*-Δ effect in structural engineering, assuming small deformation were used, thereby signifying that complete collapse behavior was not simulated. In this study, seismic simulation was conducted for Japanese and U.S. type moment-resisting frame structures using a general-purpose finite element analysis program. In this paper, a macro-modeling approach using beam elements for columns and girders and shell elements for floor slabs is described; an eigenvalue analysis was conducted to verify the modeling approach.

Modeling Approach using Beam and Shell Elements

Analysis models for Japanese and U.S. type steel moment-resisting frame structures are shown in Figure 2. These are set on the same plane, referred to as the virtual shaking table in this study, and subjected to the same level of ground motion in seismic simulations. A list of member sizes is given in Table 1. In the Japanese type simulation, hollow-square section columns were used. The elastic modulus of steel used was 205 kN/mm^2 and that of concrete used was 11.25 kN/mm^2. The density of steel used was 7.85 ton/m^3 and that of concrete used was 2.4 ton/m^3. The thickness of floor slab was 150 mm. Member and section sizes were derived from the three-story steel moment-resisting frame structure designed in the SAC steel project [5] for the U.S. type and the three-story steel frame structure designed according to Japanese standards by Hasegawa et al. [3] for the Japanese type.

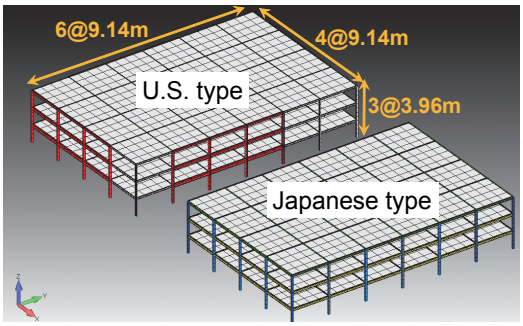

Fig. 2: Analysis models on virtual shaking table

Table 1: List of member sizes

(a) Japanese type

	Column	Beam
3/roof	□-450x16	H-550x200x9x19
2/3	□-450x19	
1/2	□-450x22	H-550x200x12x22

(b) U.S. type

[Seismic frame]

	Column		Beam
	exterior	interior	
3/roof	W14x257	W14x311	W24x68
2/3			W30x116
1/2			W33x118

[Gravity frame]
Column: W14x68
Beam: W18x35 (except roof), W16x26(roof)

Each beam element for columns and girders was divided in four, and each edge of floor slab was divided in four, according to the division of the adjacent girders. The number of nodes for the U.S. type was 2300, and the number of elements was 1116 for beam elements and 1152 for shell elements. In the actual building, the axis line of a girder is located under the center line of the floor slab. Therefore, a beam element for a girder was placed under the shell element for the floor slab and the multiple-point constraint (MPC) condition was applied to connect the nodes of the girder and slab as shown in Figure 3. This MPC condition kept the distance between two nodes constant, assuming that the plane remained intact following deformation. This modeling approach was expected to account for composite effects of the floor slab, such as increased stiffness and strength explicitly. The modeling was conducted using FEMAP [6].

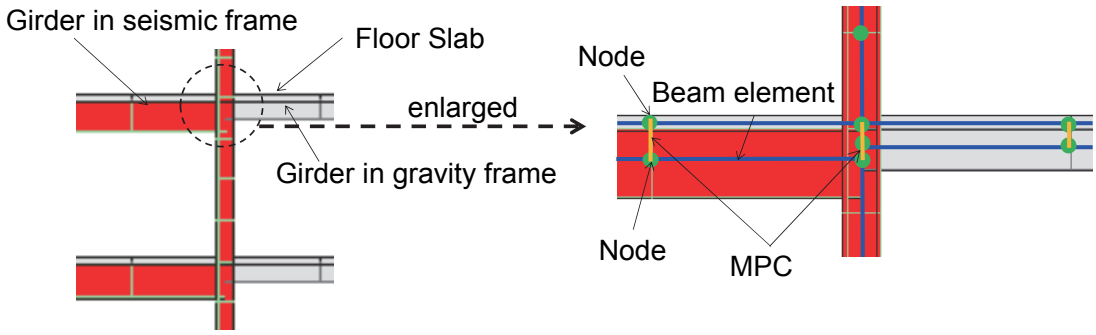

Fig. 3: Multiple-point constraint (MPC) condition between nodes of the slab and girder

Eigenvalue Analysis

Eigenvalue analysis was also conducted for Japanese and U.S. type steel moment-resisting frame structures using NX-Nastran [6]. For reference, the analysis was conducted for the models in which the beam element of a girder was placed at the same level as the shell elements of the floor slab as shown in Figure 4. The 1st, 2nd, and 3rd natural periods are shown in Table 2. The 1st mode shape for the U.S. type is shown in Figure 5. This is a translational mode. The 3rd mode shape is shown in Figure 6. This is a torsional mode.

As shown in Table 2, for the U.S. type structure, the 1st natural period was shortened from 0.769 s to 0.678 s when shifting the beam element of a girder under the shell element of the floor slab in the modeling. This means that the 1st mode stiffness increased by $(0.769/0.678)^2$ = 1.286 times because of the composite effect of the floor slab, considering both models have the same amount of mass. Moreover, the 1st and 2nd natural periods (which correspond to the translational mode) of the U.S. type were larger than those of Japanese type. This is likely because of the smaller number of seismic frames in the U.S. type structure. However, the 3rd natural period, which corresponds to the torsional mode, was smaller than that of the Japanese type. This is likely because of the location of stiff seismic frames at the perimeters of the structure, which is most effective for torsion.

Table 2: Natural fundamental periods

(a) Japanese type

	girder placed at same level to slab	girder placed under slab
1st mode	0.621s	0.524s
2nd mode	0.608s	0.516s
3rd mode	0.533s	0.457s

(b) U.S. type

	girder placed at same level to slab	girder placed under slab
1st mode	0.769s	0.678s
2nd mode	0.748s	0.654s
3rd mode	0.496s	0.443s

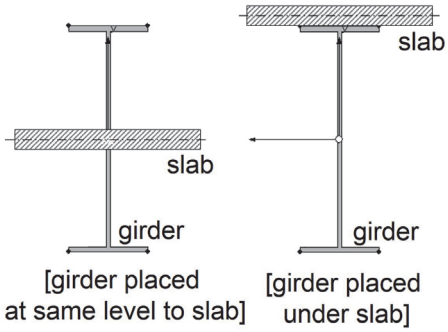

Fig. 4: Location of slab and girder in modeling

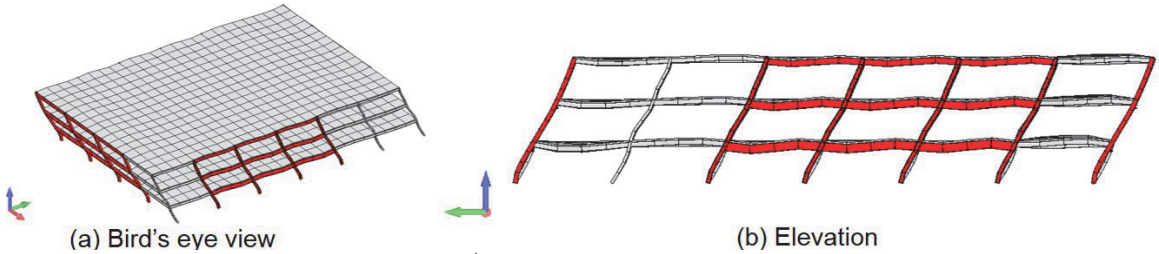

Fig. 5: 1st mode shape (translational)

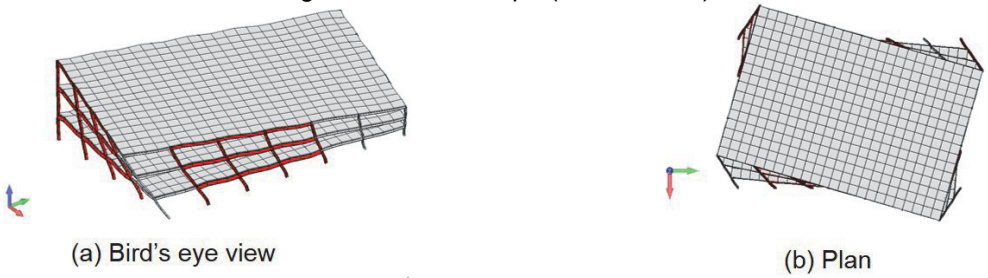

Fig. 6: 3rd mode shape (torsional)

Architecture Studio in Mukogawa Women's University

In this study, a framing system consisting of a 3D moment-resisting frame was considered to be the "Japanese type," and one consisting of separate seismic and gravity frames was referred to as the "U.S. type." This is not always true. For example, Architecture Studio at Mukogawa Women's University consists of seismic and gravity elements as shown in Figure 7. Walls decorated with border tiles are of seismic nature, and exposed-concrete wall pillars contain gravity elements as shown in Figure 8.

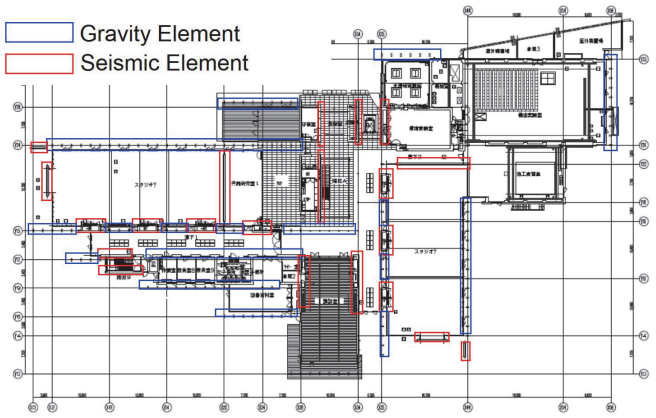

Fig. 7: Architecture Studio in Mukogawa Women's University

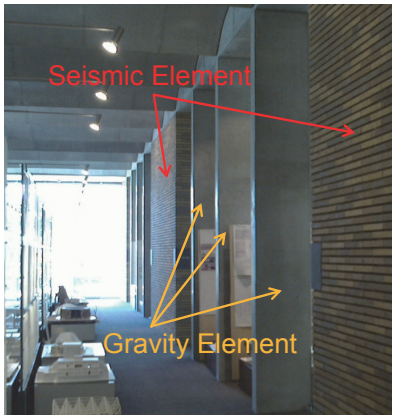

Fig. 8: Seismic and gravity elements

Conclusions

A macro-modeling approach using beam and shell elements is explained. To consider the composite effects of floor slabs, beam elements representing girders were placed under shell elements representing floor slab and MPC conditions were applied to connect the nodes of these elements. Eigenvalue analysis was conducted for Japanese and U.S. type three-story steel frame structures. The 1st natural period of the U.S. type steel structure was shortened from 0.769 s to 0.678 s when shifting the girder under the floor slab due to the composite effects of the floor slab. The macro model proved to be a successful tool for use in seismic simulations of Japanese and U.S. type steel frame structures.

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EARTHQUAKE ENGINEERING RESEARCH FACILITIES IN NIED: POSSIBLE CONTRIBUTIONS TO INTERNATIONAL DISASTER MITIGATION

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Keywords: E-Defense, shake table, retrofit, preservation, disaster mitigation

Introduction

There are a large number of cultural structures in countries with high seismic activity along Silk Road. Some of those buildings are world heritages, national/local symbols and/or tourist attractions supporting local economy. It is quite important to preserve them from earthquake events, and high cost-performance seismic retrofit with minimum damages in their historical and cultural specifications needs to be developed. In addition, it should not be forgotten to protect craftsmen inheriting traditional technology for cultural architecture from disasters. For development of optimum disaster mitigation, a series of shake table tests with large- or full-scale specimens is one of the most effective approaches. In fact, researchers and public officers in charge of disaster mitigation in some countries visiting NIED have earnest desire to build this kind of large facilities. However, maintenance of such large-scale facilities requires gigantic cost and high technology. Therefore, it is one of the most reasonable options to obtain basic results from numerical analyses, static tests, and dynamic tests using a small-scale shake table available, and then, develop reasonable research plan and use existing international facility for large-scale experiment. In light of this, it seems valuable to provide fundamental information of two large-scale shake table facilities for common use in NIED as possible international facilities in this paper.

E-Defense Shake Table

The world largest 3-Dimensional Full-Scale Earthquake Testing Facility (Fig. 1), nicknamed "E-Defense" was constructed in the city of Miki, the north-west neighbor of Kobe city by NIED. The most important motivation of building this giant facility was the 1995 Hyogoken Nanbu (Kobe) Earthquake. Because of this background, capacities of E-Defense at the beginning of its operation were designed in order to input earthquake motions observed in Kobe Earthquake to full- or large-scale test specimens (e.g., [1], [2]). Dimensions of this table is 20 m by 15 m, payload is 12 MN and the maximum velocities in horizontal and vertical directions are 2.0 m/s and 0.7 m/s under the maximum loading condition.

In 2011, another tragic earthquake, the 2011 off the Pacific coast of Tohoku (Tohoku) Earthquake happened. Special features of this earthquake were long-duration and -period motions and a main shock followed by large aftershocks at quite short interval as well as tsunami occurrence. Since 2011 Tohoku earthquake, dynamic behaviors and damage accumulation of structures in such earthquakes have become ones of the most noticeable research topics in earthquake engineering because long-duration and -period motions are expected also in future Tokai-Tonankai earthquakes. However, the original E-Defense was

not able to produce these motions with their full intensity because of capacity shortage of its hydraulic system. Therefore, E-Defense had been upgraded in 2013 in order to enable inputting motions recorded in Tohoku earthquake.

As of March, 2016, 80 test projects including some collaborative researches with foreign research organizations have been completed since E-Defense opening. Most of them are related to seismic performance of buildings. Results from those projects provide useful data to capture phenomenon, develop reasonable retrofit and update design guideline. In addition, indoor safety and behaviors of non-structural elements during earthquakes have been evaluated by placing furniture, office facilities, pipelines and ceiling in test structures. More detailed specifications of E-Defense shake table and test movies taken in most of past experiments are available in E-Defense webpage [3].

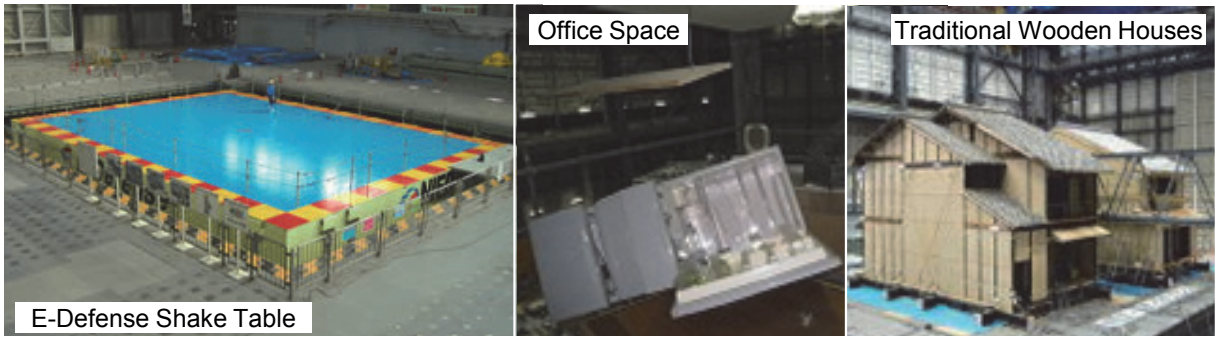

Fig. 1: E-Defense Shake Table and examples of past experiments [3]

Large-scale Earthquake Simulator

The other large shake table, Large-scale Earthquake Simulator (Fig. 2), was established in Tsukuba City by NIED in 1970, and has been used for shake table tests on various kinds of full- or large-scale structures. Results from those experiments have provided great contributions toward improving seismic performance of structures. Through several significant maintenances and upgrades of the facility, it can now produce many of earthquake motions recorded in past events more precisely and shows potential for more sophisticated researches. This shake table can input horizontal 1-directional motion to test specimens placed on. Its dimensions is 15 m by 14.5 m, payload is 5 MN and the maximum velocity is 0.75 m/s under the maximum loading condition Comparing with capacities of E-Defense, ones of Large-scale Earthquake Simulator has considerably less, but it is still sufficient in many cases when the critical direction of motion for structures in interest is obvious. For instance, if experiments with various conditions are necessary, usage of Large-scale Earthquake Simulator is probably more reasonable because of its relatively low cost.

Some examples of test specimens used in past Earthquake Simulator tests are shown in Fig. 2. This shake table is also a facility for common use and various types of research projects have been performed, such as NIED own experiments, domestic and international collaborative researches. As a recent international collaboration, a series of shake table tests on non-engineered masonry houses were performed in 2014 with Indonesian researchers. In this test series, two houses with and without reinforcement were placed on the table, and effectiveness of the reinforcement used could be verified. More information on the shake table and examples of past experiments are available in a webpage of the facility [4] and elsewhere [5].

Fig. 2: Large-scale Earthquake Simulator and examples of past experiments [4]

Research Planning

Performing a series large- or full-scale shake table tests takes significantly large amount of cost, and therefore, it is difficult to do so many times and effective research planning is significantly important. In this section, typical concepts of E-Defense research planning is provided because it may help people who want to have such large facilities in their own countries to get more understanding.

Fig. 3(a) shows a position of E-Defense shake table test to classify its roles in earthquake engineering. It is noticeable that this figure includes only shake table test and analysis, but there are more kinds of research, such as element tests and static load tests. Summary of past research works and performance of fundamental experiments and numerical analyses under various conditions give valuable information to develop reasonable research plan for large-scale experiments. A single large-scale test provides a large number of useful data only under a single test condition, and therefore, the results need to be extended to under other conditions by complementing with the above researches. So, a series of large-scale shake table tests is a big event but occupies a small part of entire research project.

Fig. 3(b) presents a position of E-Defense test included in earthquake engineering in disaster mitigation. In previous times, main objectives of most researches were to capture dynamic behaviors, evaluate seismic performance of structures and update design standards because there were many unknowns. Though there are still many significant unknowns in earthquake engineering, it is not easy to find sufficient budget to perform large-scale experiments only with the above objectives. Therefore, connections between earthquake engineering and others need to be considered as main- or sub-objectives. For instance, a large number of digital cameras are placed in test specimens of recent experiments to take movies for educations on earthquake preparation as well as for engineering purposes. These movies are used to help public obtaining better understanding on earthquake engineering and promote them considering what they can do in emergency.

Possible Contribution to International Disaster Mitigation

E-Defense has accepted a large number of visitors to the shake table. For instance, in the 2014 fiscal year, more than 6,000 people including public officers and engineers from foreign countries had usual or technical tours of the E-Defense facility. Most of the technical tours for foreigners are arranged as international training programs by JICA, other national research institute or universities in Japan. In the tour, more detailed information on the facility and past experiments, such as project planning and testing, are usually provided. For the tour,

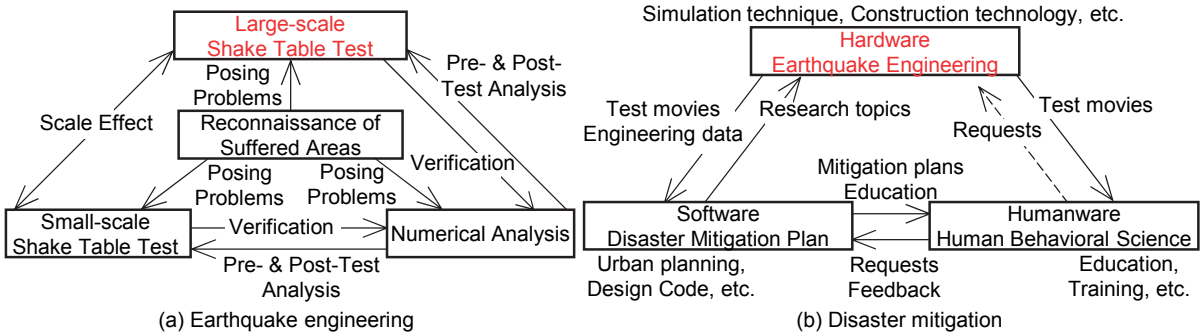

Fig. 3: Positions of E-Defense shake table test

application is required in the webpage [3]. Also, all of E-Defense shake table experiments except private tests are open for public at their test dates. Schedule of the open experiments are published in E-Defense webpage [3] usually only in Japanese approximately one month before the tests.

Research collaboration is another possible option. If specific large-scale shake table projects are under planning, NIED “may” help the projects by performing collaborative experiments or renting the shake table facilities; that is, E-Defense and Earthquake Simulator. In addition, NIED “may” accept engineering trainees learning sequence of large-scale shake table experiments.

Concluding Remarks

In this paper, fundamental information on NIED shake table test facilities is provided. Shake table test is merely one of the indispensable elements in total plans for mitigating disasters from earthquakes, and it is important to develop reasonable total research plan including facility management by considering other kinds of experiments and numerical analyses. Also, various factors, such as politics, economy and culture, need to be taken into account for effective mitigation. Performing effective researches for disaster mitigation, significant contribution to preservation of cultural architecture can be made. At the last moment in this paper, contributions from all researchers and engineers are gratefully acknowledged.

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DESIGN AND FABRICATION OF ORIGAMI DOME

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Keywords: Folded plate structure, design and fabrication, full-scale model, movable facility

Introduction

Origami is representative of a traditional Japanese craft, and is a promising technique for frontier fields (e.g., spatial structures [1], medical stents [2]). The improvement in portability achieved by folding is a great advantage for these applications. In addition, in the architectural field, the folded plate structure has been applied to many long-span roofs, although they are not deployable in common. Graduate school students in the architectural design class at Mukogawa Women's University designed and fabricated a portable and deployable dome with a folded plate structure, shown in Fig. 1, as an assignment in the first semester of 2015. Students considered the aspects of aesthetics, structure, thermal environment, and construction method. In this paper, the following three factors are summarized: design and fabrication process, thermal performance, and structural performance of the dome.

(a) Exterior view (b) Interior view (b) Night view in winter

Fig. 1: Final product of the origami dome

Design process

First, the students set the architectural usage type as a temporary facility used for a private space, or a resting place at events. Next, students studied the form and the type of folding method by creating various forms with paper and cardboard, as shown in Fig. 2. Moreover, they understood that the diamond pattern known as the "Yoshimura Pattern [3]" was appropriate to fold a plate of that thickness. Following this, a mock-up model with a simple vault form was constructed using polypropylene cardboard, as shown in Fig 3. This structure required rigid frames around the open edges for stability. Finally, the form of a dome, which does not have any open edges, was adopted. The size of dome was determined taking the wind load, floor area, and workability into consideration. Polypropylene cardboard was selected as the main material of the dome structure for the following reasons: it is lightweight

for its strength; it has high heat insulation properties (thermal conductivity of 0.061 W/mK); its capability of being made hinges by ruled line fabrication using a hot wire method, without the requirement for additional metal parts.

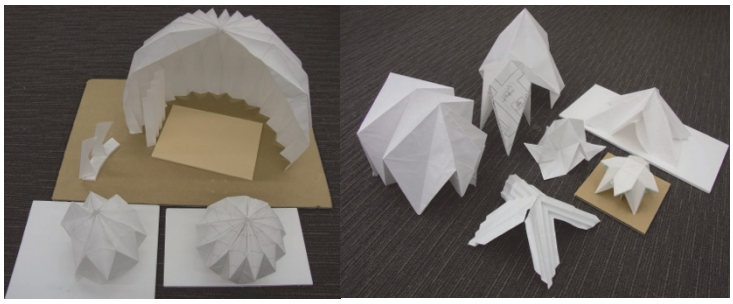
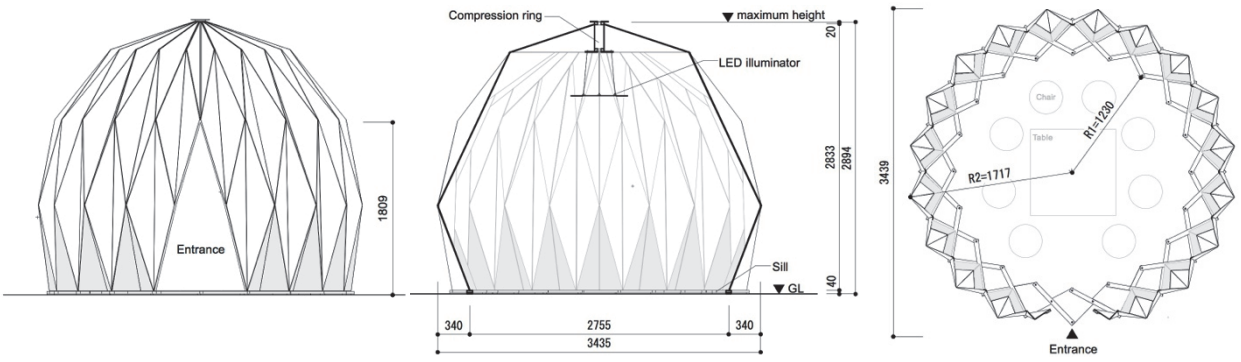


Fig. 2: Intermediate paper design models

Fig. 3: Initial mock-up model

The final product

The drawings and other basic information of the final product of the origami dome designed and fabricated by the students are shown in Fig. 4. The details of the joints used in this structure are shown in Figs. 5, 6, 7 and 8.



(a) Elevation (b) Section (c) Plan

Floor area: 6.8 m^2, Weight: 25.7 kg
Material: Main part of dome: Polypropylene cardboard (4mm in thickness and 0.6 kg/m^2 in density)
Bottom of dome: Polycarbonate cardboard (4mm in thickness and 1.0 kg/m^2 in density)
Sill: Cedar

Fig. 4: Drawings and basic information of the origami dome

Fig. 5: Compression ring

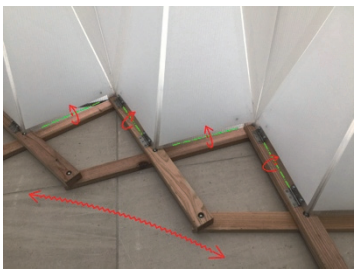


Fig. 6: Joint of folded plate and sill

Fig. 7: Reinforcement at vertex

Fig. 8: Joint by zippers

The ridges and valleys of the upper end of the folded plate are concentrated at the compression ring, which is comprised of a paper tube and inserted into the radial slits (Fig. 5). The bottom edge of the dome is connected by metal hinges to the sill, which has a structure with scissor-like-element (Fig. 6). This mechanism enables the dome to deploy and fold uniformly in linkage with the movement of scissors. The dome is fixed to the ground by weights on the sill or pegs. Four ridge lines and two valley lines concentrate at each vertex. This point contains a hole, which was sealed and reinforced with adhesive tape and four sets of bolts and nuts (Fig. 7). The dome is divided into two units, connected by zippers (Fig. 8).

Deployment process

When not in use, the dome is divided into three parts: a compression ring and two units of folded plate. The deployment process of the dome is shown in Fig. 9. The dome is manually deployed and folded in approximately four minutes by seven female students.

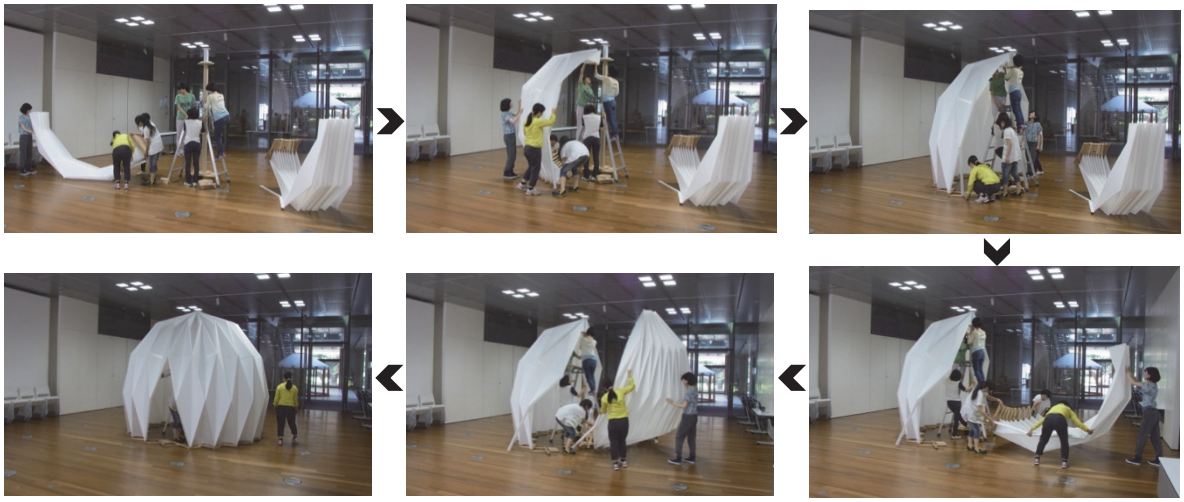


Fig. 9: Deployment process of the origami dome

Thermal performance

A simple experiment with internal heat generation (1200W) was conducted at the entrance hall in the architectural studio, in order to understand the thermal performance of the dome in winter. The heat losses through the walls and floor, and by air exchange, were estimated at the steady state of the measured internal air temperature. When the openings were not closed, the internal temperature of the lower part closely approximated that of the outside air (Fig.10 left), and 45% of the heat loss was caused by the air exchange (Fig.10 right). In the case of the closed opening, the internal temperature could be higher, and the heat loss by the air exchange was reduced to 2%.

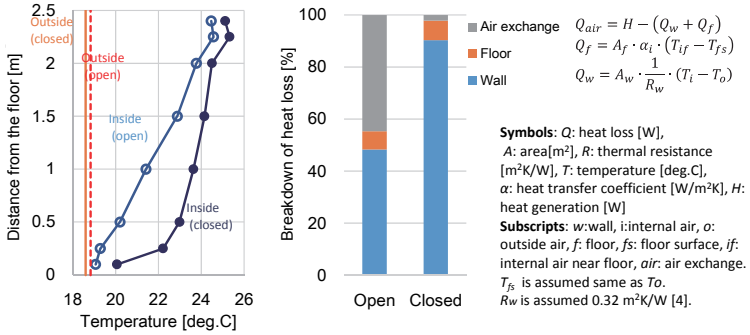
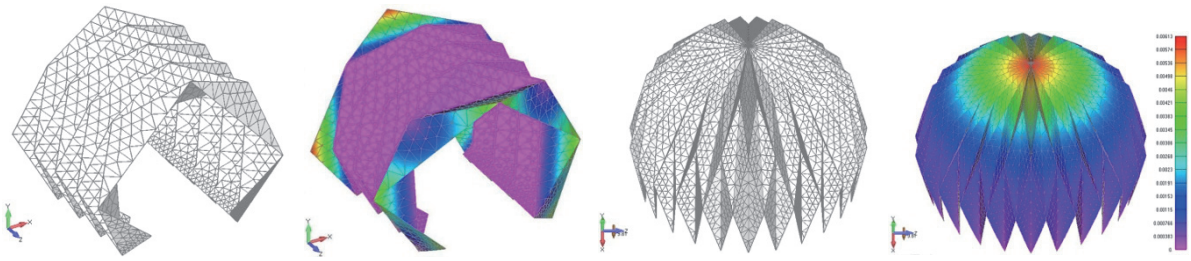


Fig. 10: Internal vertical temperature distribution (left) and breakdown of heat loss (right)

The majority of the heat loss was through the polypropylene cardboard. However, there is a possibility that the thermal resistance of the cardboard was underestimated because it seems that the heat loss of the air exchange is slightly low. An improvement in the thermal performance of the cardboard is required for better thermal conditions.

Structural analysis

Structural analyses are conducted for two types of origami structures, as shown in Fig. 11. The first one is a vault form structure, as shown in Fig. 11(a), which is representative of the initial mock-up model in Fig. 3. The second is a dome form structure, as shown in Fig. 11(c), which is representative of the final product shown in Fig. 4. As shown in Fig. 11(b), large displacements occur in the regions around the open edges when subjected to gravitational loading. This result suggests that rigid frames in the span direction are necessary to stabilize the vault form structure. In contrast, as shown in Fig. 11(d), the dome model has a maximum displacement of approximately 6 mm, which is small, when subjected to gravitational loading. These analysis results correspond well to the observation during the fabrication of the origami dome.



(a) Vault model (b) Analysis result (c) Dome model (d) Analysis result

Fig. 11: Analysis models and analysis for gravitational loading

Conclusions

A portable and deployable dome with a folded plate structure, such as in origami, was designed and fabricated in architectural design class. This dome has excellent portability and workability in construction. By measuring the heat loss, the thermal performances were estimated. It was further confirmed by structural analyses that the origami dome is more stable than the vault form structure.

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ADVANCEMENT ON SELF-ASCENDING PANTADOME SYSTEM USING PLASTIC BOARD MODEL WITH ELECTRIC MOTOR

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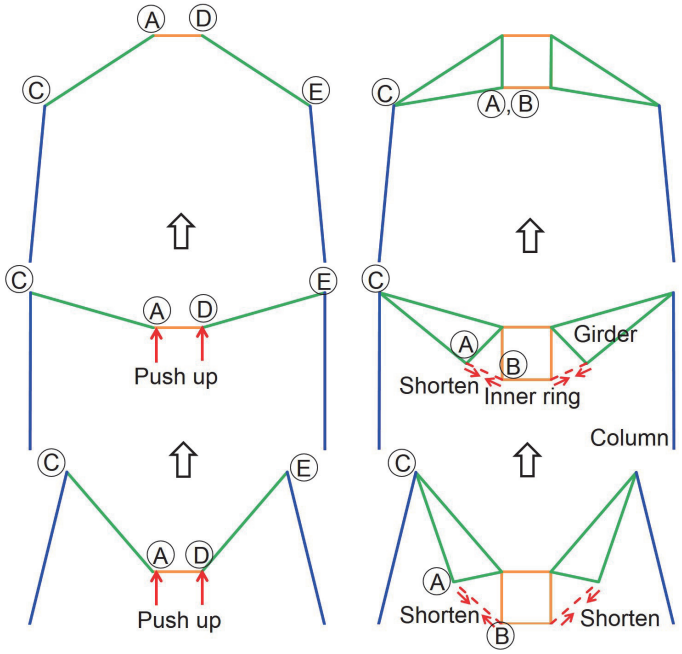
Keywords: Pantadome system, self-ascending, mechanism, electric motor, plastic board

Introduction

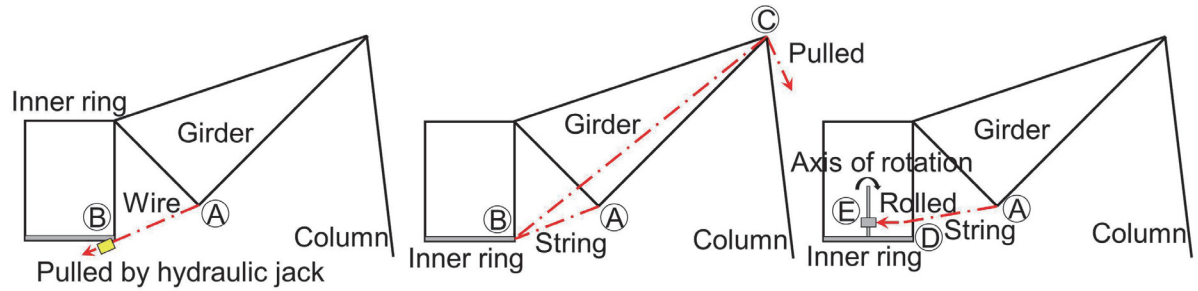
The principle of the Pantadome system, which was conceived by one of the authors and has been applied to many long-span roof structures, is to make a dome structure foldable during erection by temporarily removing several elements [1], [2]. The "self-ascending" Pantadome system [2], [3], an innovative variation of the original Pantadome system, was first applied to the roof structure of a bullring in Xàtiva, Spain [2], [3]. The fundamental mechanisms of the Pantadome system and the self-ascending Pantadome system are shown in Figure 1. In the Pantadome system, hinge points A and D are pushed up by support columns, often hydraulic jacks, as shown in Figure 1(a). In the self-ascending Pantadome system, a roof is lifted by shortening the distance between A (the lower vertex of a girder) and B (the lower chord of inner ring) as shown in Figure 1(b).



(a) Pantadome (b) Self-ascending Pantadome

Fig. 1: Mechanism of the Pantadome system (in plane)

In the self-ascending Pantadome system, several methods of shortening the distance between A and B in Figure 1(b) may be used for various situations as shown in Figure 2. The first method involves pulling a wire installed between A and B using hydraulic jack as shown in Figure 2(a). This method was adopted for the reconstruction of the bullring in Xàtiva, Spain [2], [3]. The second method involves pulling a string, which is fixed at A and passes through a pulley at B and C (the head of a column), using human power as shown in Figure 2(b). The third method is to wind a string, which is fixed at A and passes through a pulley at D, using an electric motor located at E (axis of rotation) as shown in Figure 2(c). When the rotational direction of the electric motor is reversed with a switch, the wound strings begin to unwind, thereby increasing the distance between A and D and lowering the roof. Therefore, using an electric motor and reversing switch enables the roof to be lifted or lowered automatically, changing the configuration of the whole structure.



(a) Pull wire by hydraulic jack (b) Pull string by human power (c) Roll string by electric motor

Fig. 2: Methods for self-ascending of a Pantadome system

A round ger and an oval ger utilizing the Pantadome system, which corresponds to Figure 1(a), were designed and fabricated in 2013 and 2014, respectively, as shown in Figure 3(a) and Figure 3(b) [4]. When the roofs were lifted, support columns were used as shown in Figure 3(a). A ger utilizing the self-ascending Pantadome system, corresponding to Figure 1(b) and Figure 2(b), was designed and fabricated in 2015 as shown in Figure 3(b) [4], [5]. Here, students outside the ger pulled strings through a pulley mechanism to lift the roof. In this study, further development of the self-ascending Pantadome system was attempted using a plastic board model with an electric motor, corresponding to the method shown in Figure 1(b) and Figure 2(c), to lift and lower the roof automatically.

(a) Pantadome ger in 2013 (b) Pantadome ger in 2014 (c) Self-ascending ger in 2015

Fig. 3: Ger utilizing Pantadome, self-ascending Pantadome system

Simulation of Self-ascending Pantadome System

The deployment process of the self-ascending Pantadome system was simulated using Microsoft Excel as shown in Figure 4. Here, the ceiling height between the ground level and the level of the lower chord of inner ring, *H*, is shown. The calculation assumed constant lengths of the girder, column, and inner ring, and the coordinates of each node were computed as a function of *H*. This model configuration was applied to the plastic board with an electric motor model designed and fabricated in this study. The column height was set to 1.8 m and the distance between the bottoms of paired columns was set to 3.6 m. When *H* was 2.0 m, the model was approximately fully deployed. The distance between A (the lower vertex of a girder) and B (the lower chord of the inner ring) was 0.761 m initially (*H* = 0 m) and reduced to a value of zero at the fully deployed stage (*H* = 2.0 m).

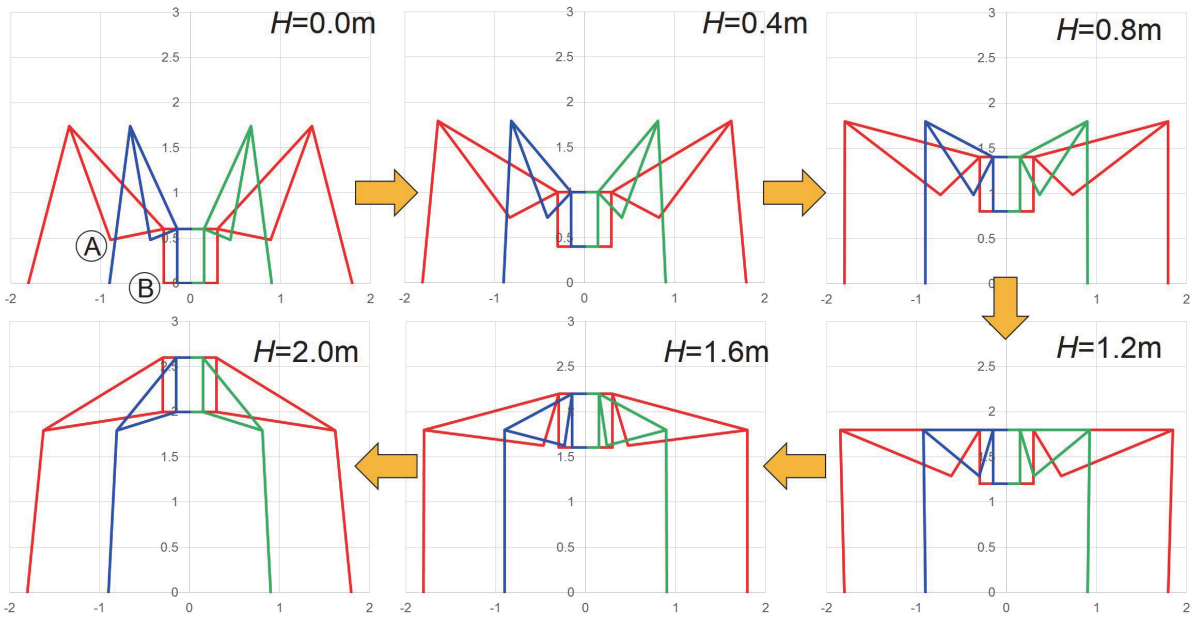


Fig. 4: Simulation for deployment process of self-ascending Pantadome system

Plastic Board Model with Electric Motor

Fig. 5: Plastic board model

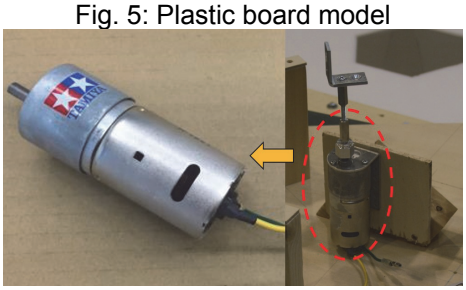


Fig. 6: Electric motor

The plastic board model used in the self-ascending Pantadome system is shown in Figure 5. This shows the final model, in which many circle holes were cut on the surface of the girders and inner ring to reduce the self-weight without reducing the stiffness and strength substantially. The upper and lower surfaces of the inner ring were hexagons having edge lengths of 0.3 m and 0.26 m for the upper and lower surfaces, respectively. The height of the inner ring is 0.6 m. The height of the trapezoidal upper surface of the girder was 1.55 m and the height of the triangular lower surface of the girder was 1.34 m. The electric motor shown in Figure 6, often used for miniature cars or robots, was utilized to wind up the strings installed between A, D, and E in Figure 2(c). Since the location at which the string passes through the surface of the inner ring changes, a slit was made on the surface of the inner ring as shown in Figure 7. The arrangement of the electric motor and pulleys at the bottom of inner ring is shown in Figure 8. Here, the pulleys were installed so that the location at which the string was wound about the axis of rotation maintained an almost constant position. The upper chord of inner ring was connected to the upper vertex of a girder by hinges as shown in Figure 9. The deployment process of the plastic board with an electric motor is shown in Figure 10. As the strings were wound by the electric motor, the inner ring ascended automatically. When the direction of rotation was reversed, the strings were loosened, and the inner ring descended. Such a deployment process can change the configuration of the entire structure drastically.

Fig. 7: Slit for string

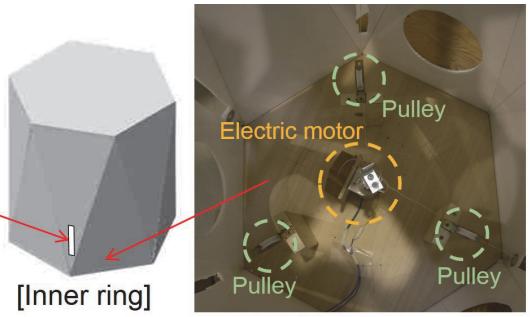


Fig. 8: Arrangement of bottom of inner ring

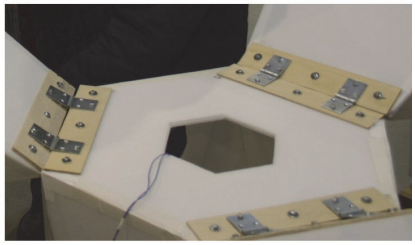


Fig. 9: Hinge connections

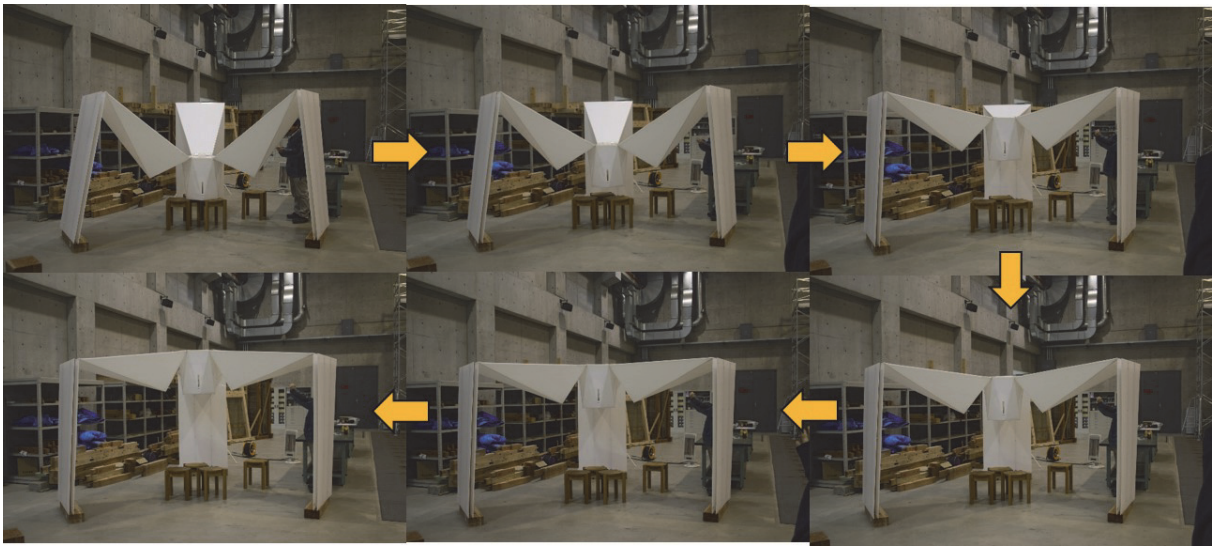


Fig. 10: Deployment process of plastic board with electric motor

Conclusions

The advancement on the self-ascending Pantadome system was attempted using a plastic board model with an electric motor. The electric motor enabled the roof to automatically ascend or descend, changing the configuration of the whole structure drastically.

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DESIGN AND FABRICATION OF MODERN GER UTILIZING SELF-ASCENDING PANTADOME SYSTEM

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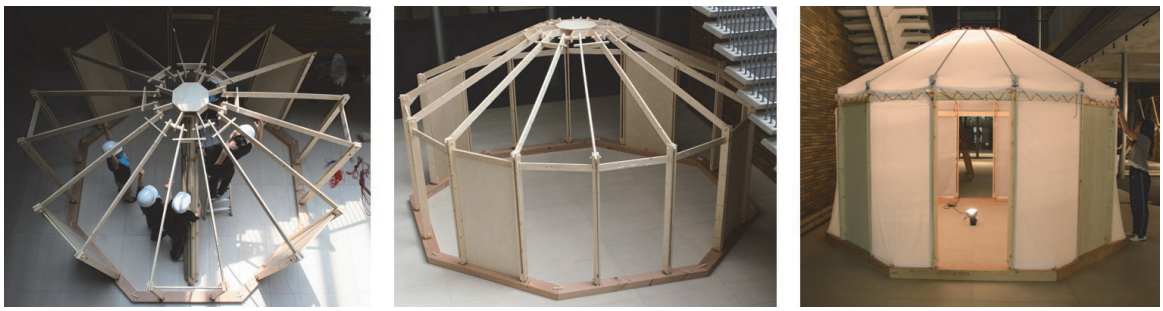
Keywords: Pantadome system, self-ascending, ger, design and fabrication, full-scale model

Introduction

Each semester in the architectural design class at Mukogawa Women's University, graduate students are assigned to design and fabricate full-scale architecture [1]. In the first semester of 2013, a ger such as that shown in Figure 1, was designed and fabricated. A traditional ger is a portable, round tent covered with skins or felt that is used as a dwelling by nomads in the steppes of Central Asia. The ger in Figure 1 is modern, utilizing the Pantadome system [2], [3], which was conceived by one of the authors and has been applied to many long-span roof structures [2], [3]. A 1:5 scaled model demonstrating the Pantadome mechanism is shown in Figure 2. In the second semester of 2015, a more advanced ger was designed and fabricated, utilizing a "self-ascending" Pantadome system [3], [4], which was first applied to the roof structure of a bullring in Xàtiva, Spain [3], [4]. In this paper, the design and fabrication processes used to construct a modern ger with a self-ascending Pantadome system, referred to as self-ascending Panta-ger in this paper, is described.



(a) Construction (lifting the roof) (b) Wooden framing (c) Final structure

Fig. 1: Ger utilizing Pantadome system in 2013

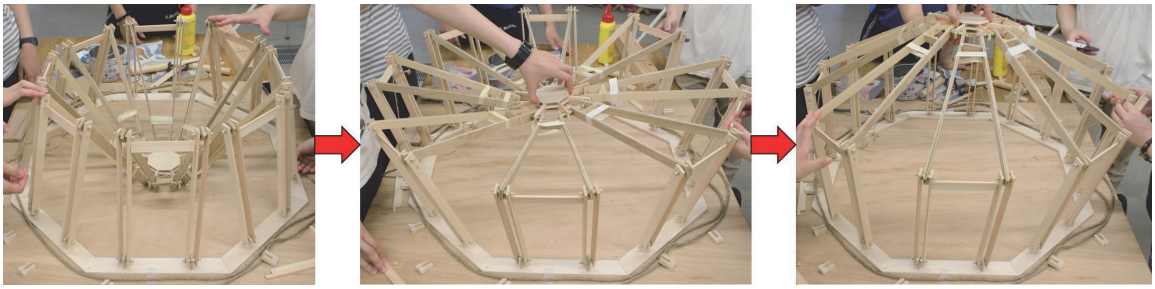


Fig. 2: Demonstration of the Pantadome mechanism using a 1:5 scaled model

Design and Fabrication Process

This ger was designed to be used for performances by students of the architectural department at a costume festival held every year at Mukogawa Women's University. To fulfill this purpose, the ger required quick construction using human power of several students pushing from a platform. Simple models such as that in Figure 4 were created to illustrate the self-ascending Pantadome mechanism, in which the roof is raised by shortening the distance between A (the lower vertex of a girder) and B (the lower chord of an inner ring) as shown in Figure 3. To shorten the distance between A and B, strings were fixed to A at and passed through a pulley at B and C (the head of a column), and pulled from the outside the structure.

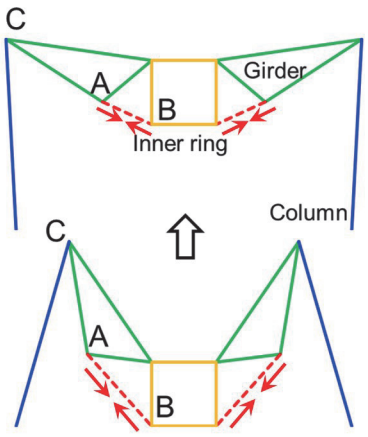
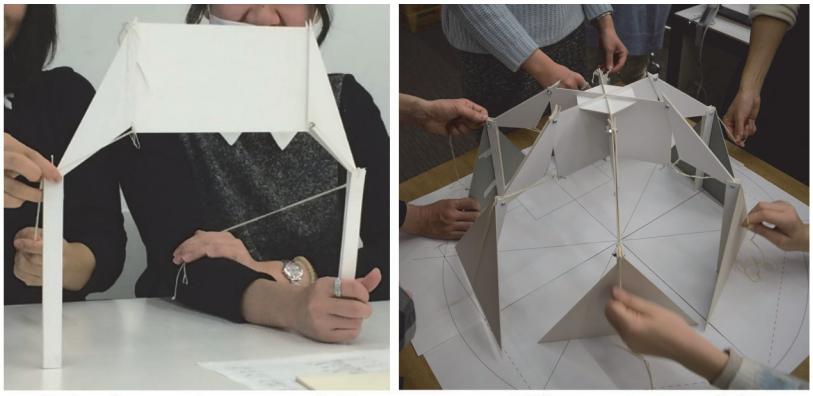


Fig. 3: Mechanism of self-ascending Pantadome



[Simple one-frame model] [1/20-scaled model]

Fig. 4: Scaled models for study

Structural aspects such as the stability of the Panta-ger were investigated by fabricating partial full-scale models and conducting experiments as shown in Figures 5(a) and 5(b). Through this, several aspects requiring improvement were identified, which are as follows: 1) the inner ring made of a wooden pole did not provide enough stability, and required replacement with an assembly of wooden plates as shown in Figure 5(c); 2) the columns were subjected to large compression forces and horizontal shaking when pulling the strings, thereby requiring that they be strengthened with bracing; and 3) the self-weight of the a plywood plate was excessive and required replacement with a wooden truss frame.

(a) One-frame model (b) Two-frame model (c) Inner-ring

Fig. 5: Experiments using partial full-scale models

The roof and walls were comprised of folded bellows of paper as shown in Figure 6. As the roof frame was lifted by pulling the strings from outside the structure, the bellows of paper

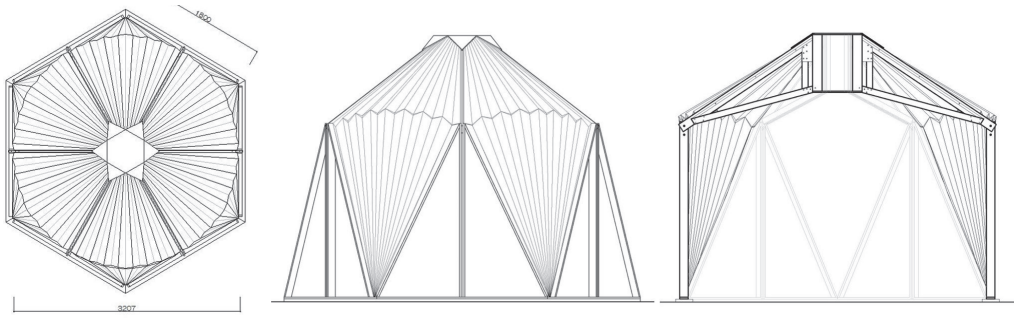
unfolded, creating the final Panta-ger structure. Partial full-scale and entire full-scale models were used to ensure full roof and wall coverage of the paper bellows given the movement of the wooden framing, as shown in Figures 6(a), 6(b), and 6(c).

(a) 1:10 scaled model (b) Partial full-scale model (c) Entire full-scale model

Fig. 6: Follow-up investigation of folded bellows to ensure full covering of the roof and walls

Final Product of Self-ascending Panta-ger

Design drawings of the final product of the self-ascending Panta-ger in its fully deployed stage are shown in Figure 7. Configurations were selected such that the columns were vertical upon completion. The deployment process of the self-ascending Panta-ger is shown in Figure 8. The major difference between this self-ascending Panta-ger and the previous one is that the roof was lifted externally through means of a pulley system as opposed to internally through means of manual pushing from below (Figure 1(a)).



(a) Roof Plan (b) Elevation (c) Sectional View

Fig. 7: Drawings of the fully deployed self-ascending Panta-ger

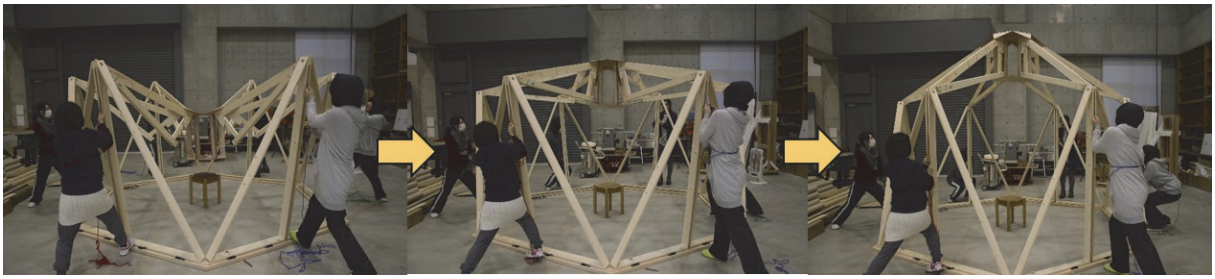


Fig. 8: Deployment process of self-ascending Panta-ger

The pictures of the final product are shown in Figure 9. Folded bellows of paper exist in harmony with wooden framing, creating an elegant aesthetic. At night, the ger may be lit up like a huge lantern using lighting equipment installed inside the ger as shown in Figure 9(c).

(a) Outside (b) Inside (c) lighted up at night

Fig. 9: Final product of self-ascending Panta-ger

Future Improvements

Future improvements for the self-ascending Panta-ger include: 1) removal of central columns since the truss frame bracing is substantially stiff and strong; 2) inclusion of an axis rod to wind strings Ⓐ and reduce the distance between the lower vertex of the girder and the lower chord of the inner ring, by pulling strings Ⓑ as shown in Figure 10. This would eliminate the need to pull the strings with exactly equal forces in order to lift the roof evenly as required by the current design.

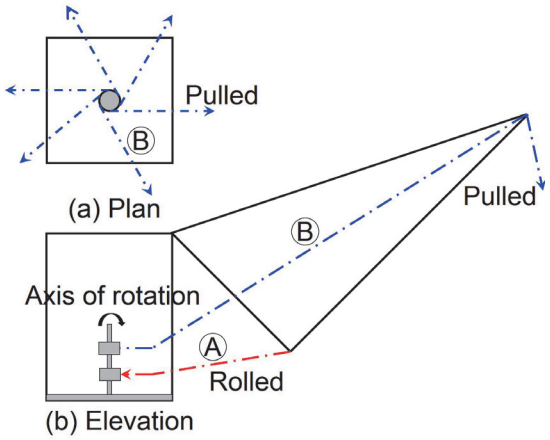


Fig. 10: Axis rod to wind strings Ⓐ, rotated by strings Ⓑ

Conclusions

The modern ger utilizing a “self-ascending” Pantadome system was designed and fabricated by graduate students in the architectural design class at Mukogawa Women’s University. The final product of the “self-ascending” ger is elegant, especially when lit up at night like a huge lantern.

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Archi-Cultural Interactions through the Silk Road

4th International Conference, Mukogawa Women's University, Nishinomiya, Japan, July 16-18, 2016, Proceedings

2016 年 11 月　第 1 刷発行

編集:　iaSU2016 JAPAN Publication Committee

発行者:　大河原　量

発行所:　武庫川女子大学出版部

〒663-8558　兵庫県西宮市池開町 6-46

電話　0798-45-3522　ファックス　0798-45-3570

Printed in Japan

ISBN 978-4-907594-04-6

Koshien Hall　Mukogawa Women's University, Kami-Koshien Campus

Mukogawa Women's University Press