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Abstract Architecture: Representation of Architecture Through Brick Toy Workshop

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Abstract. The purpose of this paper is to explore the structure of building recognition based on the hypothesis "Abstract Architecture." The hypothesis is expressed through a couple of small models of architecture made with brick toys (LEGO® bricks) in the workshop. The study extracts three components of representation of "Abstract Architecture", such as "silhouettes," "fragments," and "elements" and analyzes the models made in the four workshops in the two types. For the analysis, the model was redrawn with a brick toy 3D renderer to detect relationships among the three components and explore the structure to visualize the perception of what we recognize architecture.

Key Words: abstract architecture, representation, brick toy, model, workshop

MSC 2020: 97G80

1 Introduction

1.1 Defining Abstract Architecture

This paper examines how models made from brick toys represent abstract architecture. The paper proposes the concept of "Abstract Architecture" to serve this purpose. This hypothesis on Abstract Architecture was developed at the 13th International Symposium on Architectural Interchanges in Asia [9]. This study analyzed the results of workshops conducted at the 16th Annual Meeting of the Association for Studies of Culture and Representation and at the 2022 Annual Meeting of the Japan Society for Graphic Science, used to consider the perception of architecture [10].

"Abstract Architecture" is a concept that evolved from the definition of *Absolute Architecture,* a term used by architectural theorist Pier Vittorio Aureli. With several references in the architectural history after the Renaissance, Aureli (2012) discussed *Absolute Architecture*

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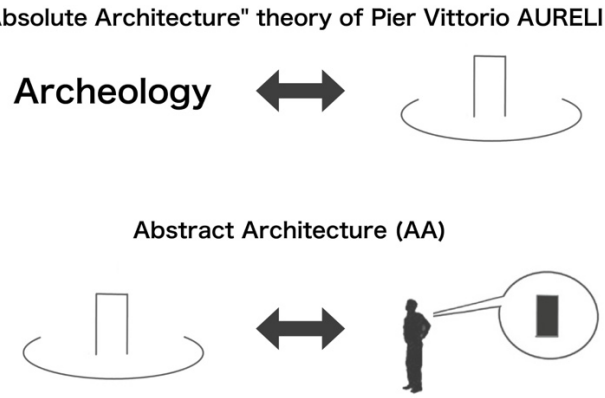

Figure 1: Abstract architecture

as the concept that confers architecture the possibility to confront capitalist urbanization within the city [2]. While Aureli's *Absolute Architecture* is not defined clearly enough in the book, it is said to be developed from an instinctive interest in the "formal absoluteness of architecture" of the Italian architectural theorists Manfredo Tafuri and Aldo Rossi and the term "*L'architettura ab-soluta* (The *Ab-solute* Architecture)" of Gianugo Polesello, the oldest collaborator of Aldo Rossi [4]. It is supposed that "absolute architecture" is defined by one's own memory, autobiography, and the archaeology of one's view of history [5].

From this perspective, to reconsider the epistemology of architecture itself, in this research "Abstract architecture" (below as "AA") is defined "Abstract Architecture" as an epistemology of corrective memory for contemporary architectural education in Japan, which represents fluctuating images between corrective memory for contemporary and potential buildings (Figure 1) [1].

Representation by AA is a further simplification of Jean-Nicolas-Louis Durand's discussion in *Precis des Leçons d' Architecture* [3], in which architectural elements are decomposed and recomposed. Specifically, the "objects" are converted into brick toys, and the "limits" are set based on fixed parts and scale. This makes it easy to redefine architectural elements and express "objects." In other words, the process of recognizing an existing building can be understood. The "object" is then expressed as various "patterns under restriction" created by "restriction," and the recognition range of the "object" can be extracted by analyzing these "patterns under restriction."

This paper redefines "object" as the architectural form that manifests itself without context or external meaning. To explain this redefinition of "object," it is helpful to refer to the architectural theory of Kazunari Sakamoto, architect who learned from Kazuo Shinohara and made his theoretical position beyond him. Sakamoto and his disciples wrote *Studies of Architectural Composition* (2012) [7] and explored architectural form itself, like the language of autonomous "box" and the grammar of the connection of the "boxes" in contemporary architecture. Their view rejected external meanings, such as "history," "function," and "society," and reconsidered the relationship between or among the architectural components as "objects."

1.2 Significance of Brick Toys: Visualizing Architectural Allometry

The representation of the "object" with brick toys is to reduce the size of the actual building and represent it. Therefore, the degree to which the proportions of the building are to be

maintained and the priority to be given to abstraction will depend on the person doing the work. The discussion of the "allometry" of the architecture scale is explored in Hirotoshi Takeuchi's "The Concept of Scale in Architecture" (2005) [8] to complement the process of abstraction while clarifying the significance of brick toys and the WS method.

Takeuchi [8] refers to architecture space as an example of the dimensions of space from the visual and psychological aspects, indicating an emphasis on the hierarchy of dimensions. According to Takeuchi, architectural scale is a system of dimensions that indexes various levels, such as physical, visual, technological, and economic, as well as manifests itself as the architectural form, which indicates "allometric transformation" between similar forms resulting from differences in size, arising from structural, functional, visual, and thought factors.

With Brick Toys, it is supposed that "allometry" in architectural form is visualized. There are various levels of indicators, such as the limitation of parts and the brick-specific way of assembling, each containing its own thoughts and having a dimensional system such as freely changing the size of reproduction (visual relationship between reduction and expansion), which supports that representation by brick toys is an appropriate method to recognize objects from the perspective of scale. Based on the above, a pilot workshop was conducted, and a hypothesis wasformulated based on the results.

2 Building Recognition Method with Toy Brick Models

Based on the previous section, First, three types of buildings (Villa Savoye, Byodoin Phoenix Hall, and Tokyo Tower) were selected as motifs to be treated equally. In order to raise awareness of the potential, a workshop was conducted (as a pilot program) with the following procedures and limitations in order to prioritize spontaneous thinking. About the details of this workshop (WS1) the authors reported in the 13th International Symposium on Architectural Interchanges in Asia. To summarize the report as below;

- Workshop Procedures

Using Studio2 (modeling software for the brick toy), the following procedure was used to abstract architectural components.

The participant extracted architectural components from the completed work and determined the order of importance of the components.

On July 5, 2022, a pilot workshop using the method described above was conducted with the SOSEKI-KEN Group (組積研, meaning "Stereotomic Lab"), which includes Tokyo City University undergraduate students A and B and graduate school student C, who had learned architecture and experienced the brick toys on June 28, 2022.

Judging from the results of WS1, there were stages in the recognition of buildings in the order of "silhouette," "fragment," and "element." We also considered that mutual interference by fragments is the boundary of recognition (Figures 2, 3) since the recognition of "silhouettes" alone is possible, and recognition becomes clearer when fragments were added.

Rossi refers to *pezzi as frammento* ("fragment" in English) [6]. What Rossi calls *pezzi* is the first architectural element that cannot be reduced further. It further describes *pezzi impiegati* (working fragments) such as cylinders, pilasters, thin partition walls, packed bearing walls, closed openings, exterior stairs, bridges-beams with rectangular or triangular cross-sections, packed roofs, cupolas, and cones. According to Rossi's definition, the concept of *pezzi* is interpreted as "fragments," the opposite of semiotics. In this sense, the relationship between elements is defined as a "fragment," based on Rossi's definition of the fragment as the primary element. While the "elements" were inherent in the fragment, the "element" creates the

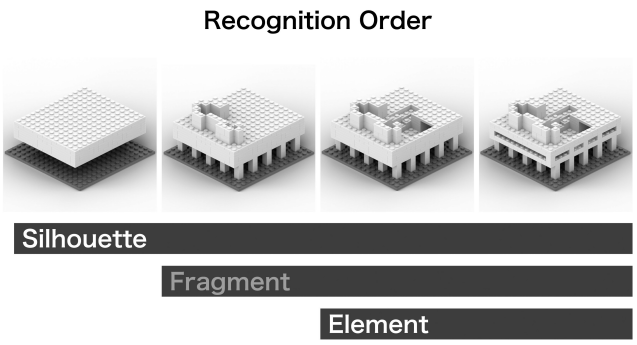

Figure 2: Recognition order

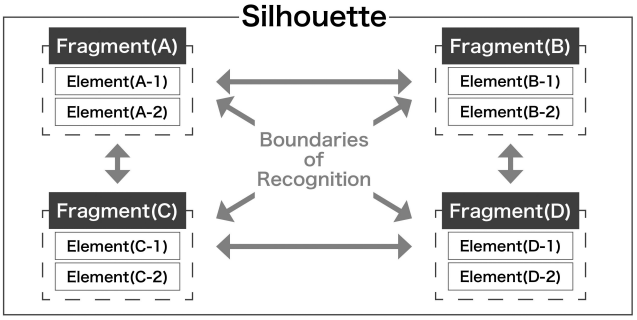

Figure 3: Boundaries of recognition

relationship of fragments that work within it.

According to this idea, the "element" in this "AA" is redefined as elements that do not work intrinsically and "fragment" is redefined as an irreducible group of recognitive "elements" (Figure 4). Also, "silhouette" is redefined as an irreducible volume of recognitive whole mass, which is obviously different from each "fragment" and each "element." According to redefinition of "silhouette," "fragment," and "element" the hypothesis will be tested by exploring the perceived boundaries of the building through three workshops.

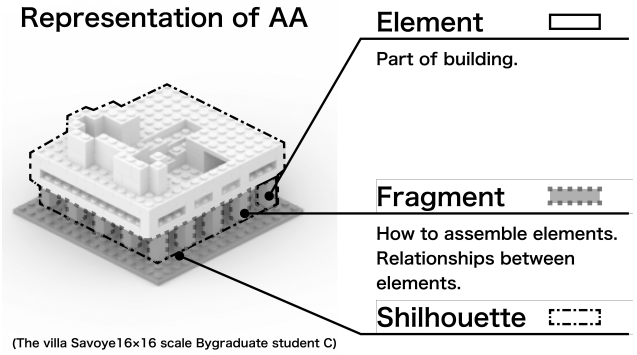

Figure 4: "Silhouette," "Fragment," and "Element"

Photo 1: Making models in WS2.

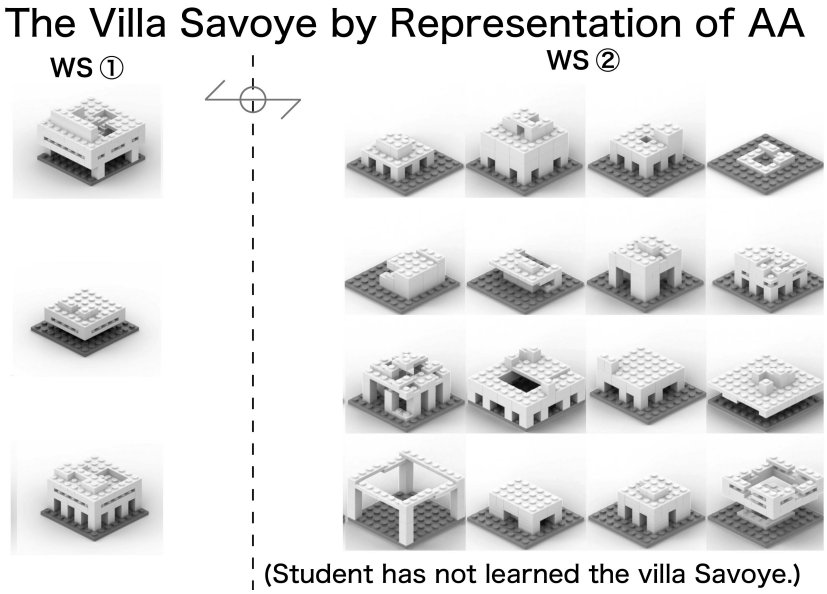

Figure 5: Comparison of the results of WS1 and WS2.

3 Undergraduate Student Workshop (WS2)

Based on the hypotheses in the previous chapter, First, a WS was conducted for first-year architecture students to analyze how to abstract (represent with brick toys on 8×8 plates) famous buildings (Tokyo Tower, Byodoin Phoenix Hall and Villa Savoye). First, a WS was conducted for first-year architecture students to analyze how to abstract famous architectural structures (Tokyo Tower, Byodoin Phoenix Hall, Villa Savoye) into representations using brick toys on 8×8 plates. This workshop took place on September 22, 2022, at the building of the Department of Architecture at Tokyo City University for 16 students of Design Basics 1 at Tokyo City University).

From Figure 5, the WS1 commonly expressed up to the "elements," while the results of WS2 tend to lack to express the "elements," having only common points ("silhouettes") such as square dots in general. From this, it can be inferred that the first-year undergraduates

Photo 2: Making models in WS3.

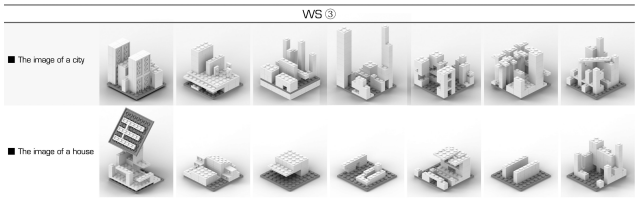

Figure 6: List of AA Brick Models in the WS3.

have less learning experience than the members of the *Soseki-ken* group; therefore, their images are less dense. In other words, the difference in learning experience led to differences in recognition.

4 Workshop in Osaka (WS3)

The undergraduate WS indicated that the difference in experience is an essential issue of perception. From this point on, the works made by graduated people are analyzed and the range of perceptions due to differences in experience will be seen using different WS methods. From the results of WS1 and WS2, the motif (existing building) existed, and the motif is abstracted and analyzed. This time, the motif (abstract language) is obscure, and the WS3 is to analyze the abstraction of the motif. The participants are asked to express the "image of a city" and "image of a house" using toy bricks on 8×8 plates and to describe the emphasis of the artifact. On November 12, 2022, WS3 was conducted at Kansai University, Umeda Campus, Osaka, Japan, for six WS participants (educators from different fields with rich learning experience) at the 16^{th} Meeting of the Society for Representational and Cultural Studies (Photo 2). Figure 6 is a summary of its workshops as the final result.

First, it is observed that the overall volume for the images of city is high and the volume is always low. Furthermore, most of them represented transportation. Based on the descriptions, the cases are classified into three categories: cases that are based on existing cities, cases that are extracted and reconstructed from various existing cities, and cases that are completely imaginary cities. From this, it can be confirmed that as the scale of representation increased,

Photo 3: Making models in WS4.

there is a tendency to express the city with an awareness of its composition.

Next, the images of the house are analyzed. Unlike the images of the city, most of the models of houses are represented by low volumes. Furthermore, approach representation for each of the two is always present. The descriptions also exhibited numerous approaches and self-occupied houses.

From the above, it can be concluded that both have one thing in common: they express the image of a flow line. Since the motif is obscure, the scale does not refer only to the building but can be interpreted as an image that includes the external environment of the building as well. In addition, compared to the hypotheses, it is possible to consider that images of the city tend to represent "silhouettes" without "fragments" or "elements," while each image of houses seems to represent all of "silhouettes," "fragments," and "elements."

The AA concept defines "silhouettes," "fragments," and "elements" within the scale of a single real building. Therefore, the interpretation differs when expressing "the image of a city."

Because the "silhouette" within the scale of a single real building is adaptable to a "fragment" or "element" within the scale of "the image of a city."

5 Workshop in Kushiro (WS4)

Next, WS4 was conducted with a target audience limited to architectural educators in the field of architecture, considering differences in the educational experience of architecture. This workshop was conducted on November 19, 2022, at Akanko Tsuruga Wings in Kushiro, Hokkaido, Japan, for seven participants (educators in the field of architecture with extensive learning experience) at the Congress of the Japan Society for Graphic Science (Akanko Olsen).

First, from the image of the city, as in WS3, Large and small volume representations and no fragments are identified. However, unlike WS3, only the form and function of the buildings are expressed, without including the external environment, such as the transportation network.

Next, an analysis was conducted on the images of the house in WS4. Similar to WS3, the half of the respondents had an approach. In addition, two descriptions are identified: single-volume and multi-volume. Analyzing the descriptions revealed that structural and functional

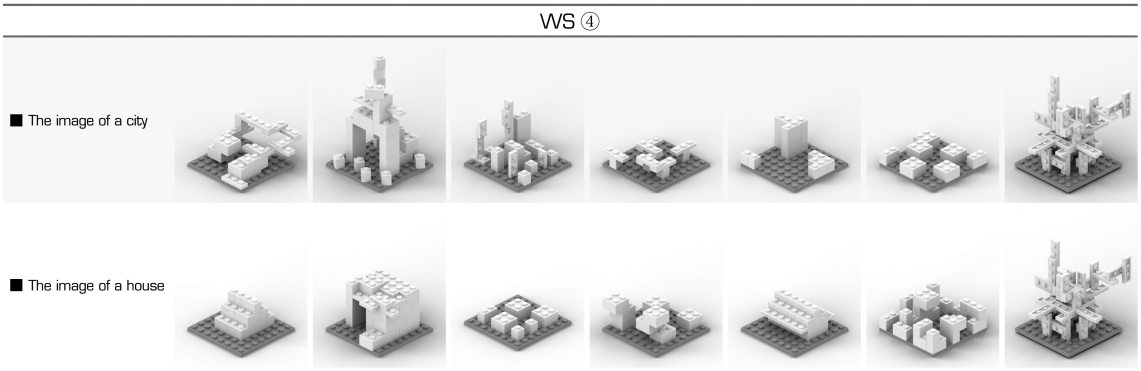

Figure 7: List of Brick Models in WS4.

aspects such as sturdy, strong, and gray zone are mentioned. Furthermore, in both cases, no descriptions of one's house appeared. Compared to the hypotheses, the overall description is only silhouetting, as in WS3.

This description confirmed that "elements" without "silhouettes" are represented. It can be concluded from this that educators in the field of architecture sometimes recognize buildings solely based on their "elements," without taking into account the whole picture, including "silhouettes" and "fragments."

From the above, educators outside of the field of architecture tends to express themselves directly from their experiences, while those in the field of architecture tends to express themselves by incorporating their thoughts into their own experiences. Even graduated people with different experiences (fields) have different images and descriptions of representations, and these differences in experience resulted in a difference in perception.

6 Scale analysis with brick toys

6.1 Differences in recognition to differences in motifs

Two different types of WS, WS1 and WS2, with clear objectives and WS3 and WS4 with obscure objectives, are conducted and analyzed. In this chapter, these two types of workshops will be analyzed within a single framework (regarding the representation of AA by brick toys).

First, in analyzing the WS, as mentioned earlier, the WS1 and the WS2 had a clear motif, while the WS3 and WS4 had obscure motifs. In this respect, despite significant differences in the WS methodology, the point of expression through brick toys remains the same, leading to the belief that focusing on this aspect can provide more insights. The limitation of a brick toy creates the necessity of the composition of the parts. Despite this limitation, no two works are perfectly identical. By focusing on this aspect, the following insights can be gained.

1. In both WS3 and WS4, the similar compositions of parts (elements) are repeated in the "image of city" exercise, and all works had similar part compositions (elements) but different "silhouettes." In the "image of a house" exercise, the tendency is halved among those who work in other fields. The same tendency is also observed in those working in specialized fields. In Figure 8, with drawing frames of the fragment, repetitions of the same or similar component configurations are depicted.
2. The "silhouettes" of the WS1 and WS2 had similar forms, although the composition of the part (elements) differed. Figure 9 shows the different ways of assembling the parts

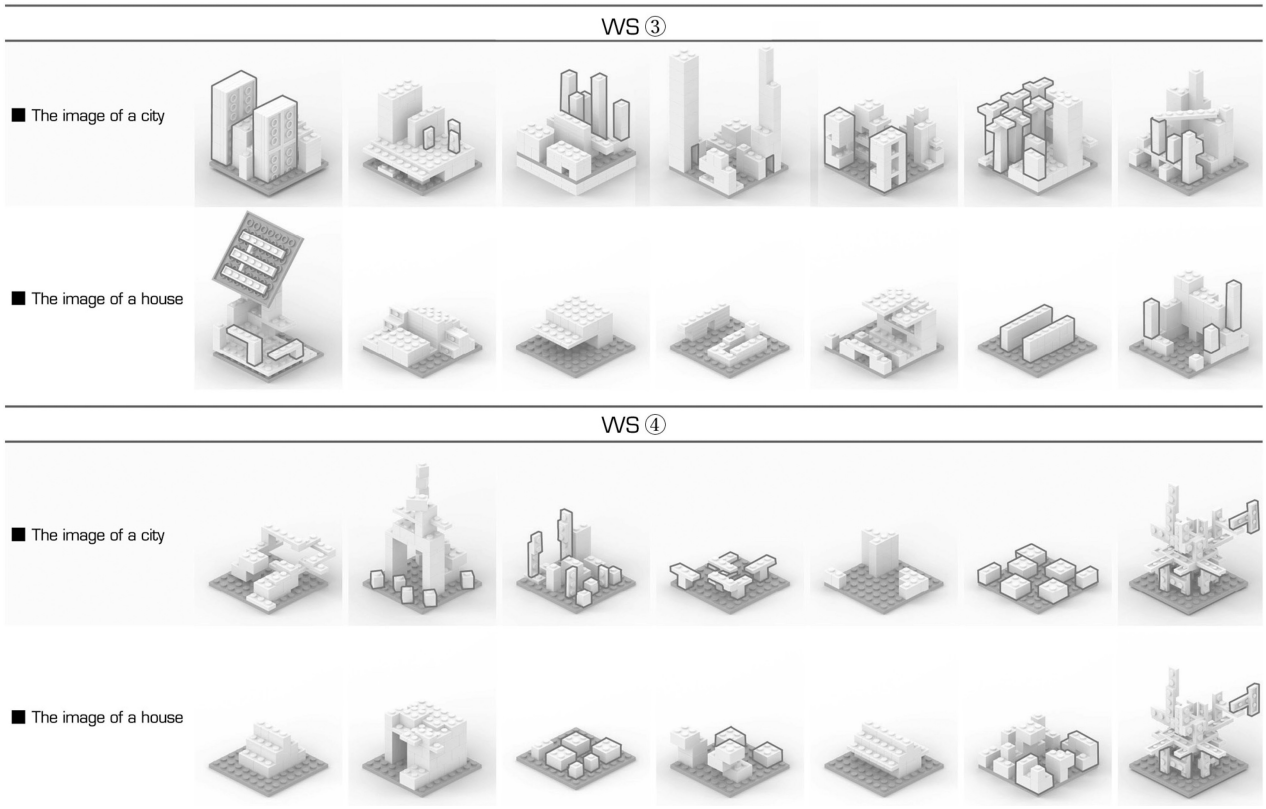

Figure 8: WS3 and WS4 part composition analysis.

Figure 9: WS1 and WS2 parts composition analysis.

of the Tokyo Tower by drawing frames of "fragments."

From the results above, It was established that when an motif appears obscure (with an unclear whole image), the image is broader and the "silhouettes" are various, whereas when the motif is clear (with a clear whole image), the "silhouettes" tend to be similar. When the motif is obscure, the elements tended to be similar, and conversely, the elements are identified

to be different. In other words, it is conceivable that not only differences in experience but also differences in the motif itself can bring about changes in the boundaries of recognition.

6.2 Differences in assembly and allometry

So far the perception of existing architecture has been explored along three axes. They found that the relationship among the three axes changes depending on the difference in motifs and experiences. In this chapter, the three relationships will be analyzed in terms of scale, considering Brick Toy's representation. While also considering differences in motifs and experience, the differences in the way each WS is assembled will be categorized, and what changes in the three axes these differences bring about will be clarified.

First, WS1 and WS2 are analyzed. For Tokyo Tower, the representations are classified into four-sided symmetry type, two-sided symmetry type, swastika type, four-sided symmetry type × swastika type congruence, and four-sided symmetry type × two-sided symmetry type. Byodoin Phoenix Hall, classified them into the following types: dispersed type, integrated type, central expression type, central = side type, central > side type, and central < side type. Villa Savoye mansion could be classified as a three-component, enclosure, or bias type.

In WS1, in every building, there are differences in the way the elements are assembled, but there is an overall order (unity) in the way each element is assembled, and similar "silhouettes" are constructed to some extent. In contrast, WS2 has similar "silhouettes," although the elements are assembled in different ways at key points and did not have an overall order (unity). In other words, with little learning experience, one can only recognize some of the fragment relationships, or elements, and with a certain amount of learning experience, one can recognize the fragment relationships (Figure 10).

Next, WS3 and WS4 are analyzed. By concentrating on the relationships between "fragments," three patterns of relationships were identified, namely the "equality type", "main/subtype," and "stand-alone type." In WS3, many elements are produced, and "silhouettes" are composed, resulting in various relationships of "fragments" and different "silhouettes," among which the main/subtypes are observed. Conversely, WS4 is expressed by a minimum number of "elements," indicating that the composition of "fragments" is clearly manifested (Figure 11).

From the above, through WS1 and WS2, students with more learning experience express more relationships among "fragments" and construct "silhouettes." Moreover, graduated people with more experience in architecture construct "silhouettes" by clarifying the relationships with fewer "fragments."

7 Conclusion and Discussion

7.1 Conclusion

The research results of this paper confirmed that the recognition of buildings in AA differs in potential images depending on differences in learning experiences and that there is a hierarchical relationship among the three variations of "silhouettes," "fragments," and "elements." Furthermore, it is confirmed that recognition judgments differed depending on differences in motifs and experiences. In other words, the hypothesis that the boundary of recognition exists only in one framework, that is, that the boundary of recognition exists in the mutual interference of "fragments," is not the case, but the balance of these three relationships changes

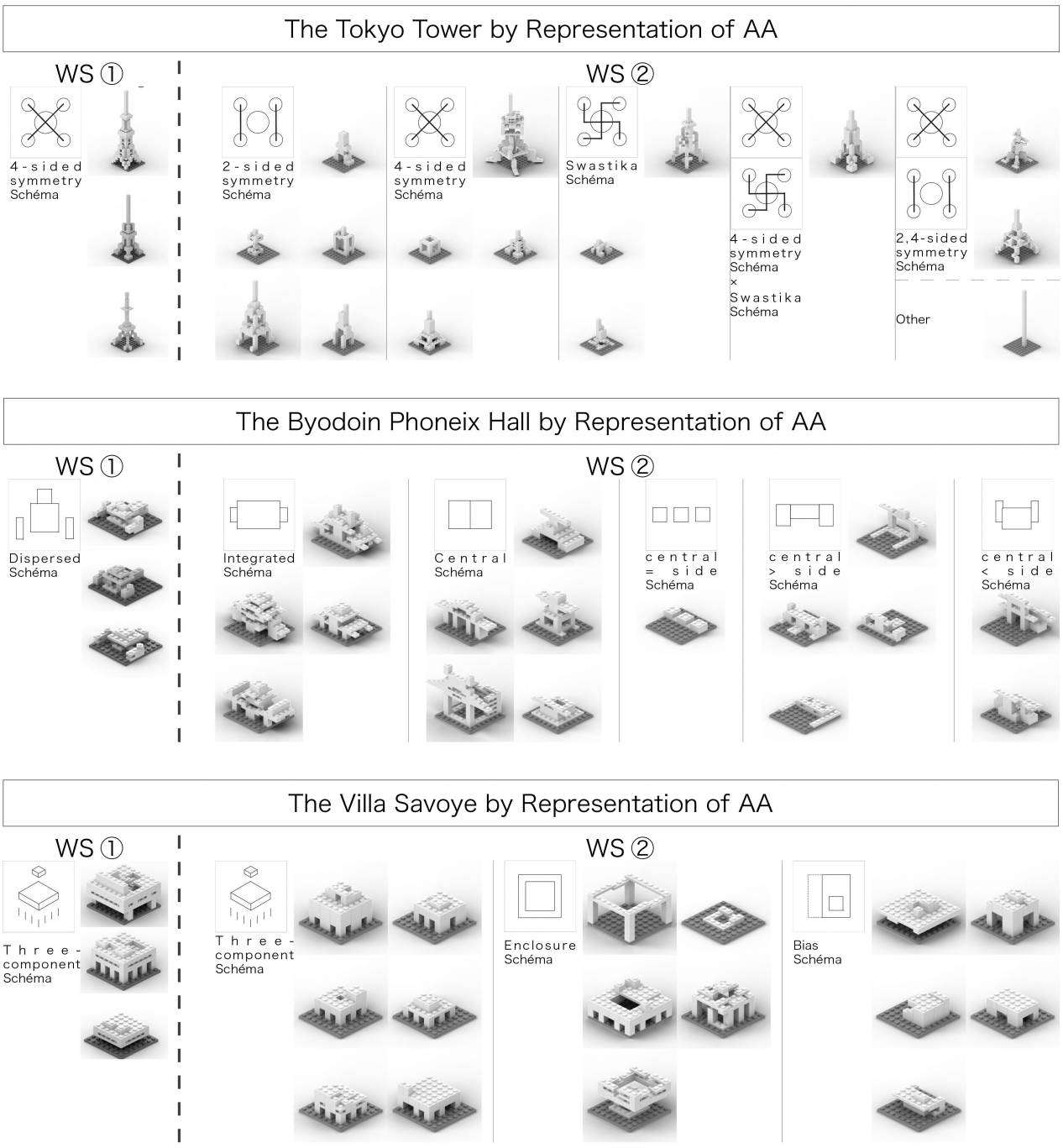

Figure 10: Classification of WS1 and WS2 by scale.

depending on differences in motifs and experiences and is thought to construct the boundary of recognition.

7.2 Discussion

We can say that these exemplifies how allometric relationship in architectural forms could be visualized. Following Takeuchi's [8] theory that architectural scale is manifested within an architectural form such as allometry between similar forms brought about by differences in the size of structure, function, vision, and thought from a system of dimensions that index various

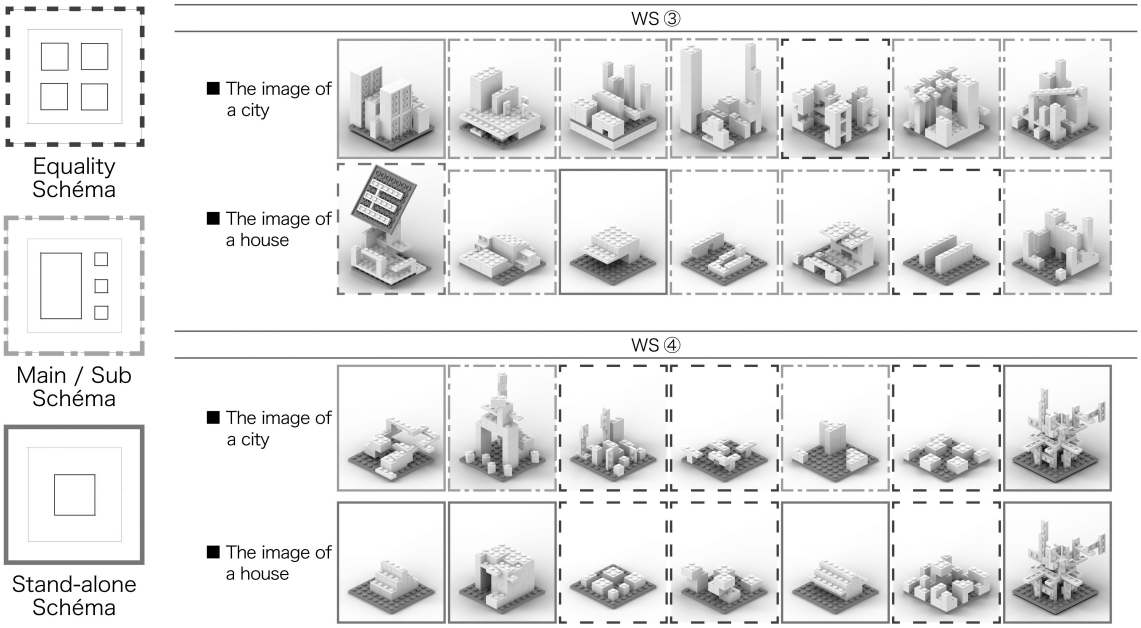

Figure 11: Classification of WS3 and WS4 by scale.

levels, the balance of these three relationships. By taking into account experience differences and analyzing the way block toys are assembled, the following differences are visualized in the allometry.

Allometry of different motifs.

- In the case of a definite motif:
  The "elements" are assembled in different ways, and the "silhouettes" are similar.
- In the case of ambiguous motif:
  The compositions of the "elements" are similar and "silhouettes" are different.

Allometry with different experiences.

- Students with some experience in architecture:
  The "fragments" are generally similar, and the "silhouettes" are similar.
- Students with limited architectural experience:
  The "fragments" are different, and the "silhouettes" are similar.
- Architectural educators in the universities:
  The "fragments" are expressed with a minimum of "elements" and "silhouettes" are constructed.
- Graduated people with no architectural experience:
  Relationships that express "fragments" and build "silhouettes" with several similar "elements."

The above relationships indicate that as students gain more experience, they tend to construct their "silhouettes" by expressing more "fragments," and as graduated people including architectural educators, they tend to construct their silhouettes with minimal "fragments."

In the future, more workshops will be analyzing the three hierarchical relationships in the future. How hierarchical relationships relate to cognition will be tested in a survey of participants.

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