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VARIATIONS OF VISUAL IMPRESSION IN CORNER SPACE OF THE STOREFRONTS IN DAIKANYAMA, TOKYO

東京・代官山の店先にある隅の空間の視覚的印象

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This study aims to clarify the visual impression found in the corner space of the storefronts in Daikanyama, Tokyo. The data collection uses a combined method of mapping, photograph and questionnaire. Firstly, the combination of spatial components and visual proportion will illustrate the characteristics of spatial composition. Secondly, the combination of visual appeal and visual depth will construct the patterns of spatial perception. Finally, the types of visual impressions will emerge from the combination of spatial composition and perception. Further, their variation in the distribution between different areas will be discussed with the architectural group forms in the Daikanyama streetscape.

Keywords: *Visual Impression, Corner space, Storefront, Streetscape, Tokyo*
視覚的印象、隅の空間、店先、街並み、東京

1. Introduction

1.1. Background and purpose

With the current circumstances worldwide, the role of public space is again reaffirmed[i)] by increasing public health and well-being within compact and restricted cities. In Japan, along with the efforts to safely provide outdoor space, the urban restructuring is transforming public space into a product of cooperative design with more connectivity and interactive usage[ii)] to offer a space for people not only for lingering and gatherings but also a place for solitude and retreat. In the authors' previous publications[2),3)], such typology of space in Tokyo was investigated using a combined method to define the Spatial Quality. The previous research highlighted the reciprocal relationship of the human-space-environment to understand how the spatial composition could accommodate diverse experiences for the users under variations of setting such as time and weather conditions. However, the previous targets focused only on the case studies of open space belonging to an individual building, but not yet on the network of small open spaces. This typology of urban open space, which is adapted to human scale and experience, is the most unique trait with the finest details of the streetscape in Tokyo[4)].

The neighbourhood in the Tokyo metropolitan area is an ensemble of buildings organized around transportation hubs supplied by shops and eateries. Within these areas, a few streets have a name or local landmark with some particular corners considered as orientation points. Between the pattern of streets and the space between buildings, the streetscape is composed of narrow dimensions using a combination of small, arbitrate and ephemeral urban elements to make the most out of open spaces. Within these streetscapes, a perpetual negotiation between public and private properties by providing more space for the community and offering more usage and visibility for shops, cafes and other businesses has resulted in a distinct atmosphere in the eye of pedestrians[iii)]. Also, according to Ashihara[iv)], this configuration can be designed by the ingenious uses of the buildings inside and outside corners that make the corner spaces extremely diverse. In Tokyo, ranging from the pocket park at the high-end boulevard in Ginza to the pop-up eateries on the narrow back street in Shinjuku, the case of Daikanyama is a fascinated example. The urban environment of Daikanyama has evolved through a long process starting with the group form[v)] of Hillside Terrace and it seems to slowly inspire the design of other groups

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buildings like T-site and Log Road to further influence other buildings. According to Maki[7], the design process of Hillside Terrace strived for anonymity and diversity with consistency in the urban structure while articulating various forms and spaces independently to encompass time. Here, the general ambience would be seen through multiple visual graduations between public and private boundaries and perceived through the blurred limits between the facade and vegetation with the street furniture, adapted to human scale[vi]. This situation intrigues the question of how the composition of corner spaces differentiated between the group forms and others could affect the perception of pedestrians within the Daikanyama streetscape.

Besides, the literature research on the impression of the streetscape has oriented the focus to interpret what appears to be visually significant on an experiential level of the individuals. Firstly, Lynch[8] considers that visual objects of urban scenography contribute to apprehending the town identity. The concept of imageability, available for the shape, color and arrangement of elements within the environment, evokes a strong visual image for the pedestrians. Secondly, Nasar[9], in the research of spatial perception, used the method of visual cognition through aesthetic character created by the combination of visible boundaries between elements. Finally, Rapoport[10] defined the notion of visual complexity composing variable streetscape patterns processed through a mechanism of the perceived physical elements that influence whether or not a person considers the environment rich and meaningful. However, this research direction which focuses on the existence of cognitive aspects in visual perception or a semantic classification does not clarify the characteristic of the existence of elements affecting the visual impression in terms of the visual gradation of the streetscape. Hence, this study focuses on another aspect of the streetscape element, which investigates the corner space of the storefronts by focusing on the variation of the visual impression to understand how it affects Daikanyama's overall atmosphere.

1.2 Past studies and relevancy

Concerning the research about the Daikanyama area, Wu[11] described how the narrow network of the street creates the liveliness of urban lifestyle with a bustling distinctive atmosphere. Based on this scenery of the shopping district, Inoue[12] studied spatial characteristics and the usage of the street terrace seating to propose a guideline for urban regulations. These researches show that Daikanyama streetscape has a unique urban character lies in the spatial composition of its streetscape with storefronts.

Further, concerning the research on the spatial composition of Japanese streetscape with storefronts, Sato[13] analyzed the visual appeal and characteristics of storefronts as the essential aspect of street life while Arima[14] focused on the action trigger elements affecting the diversity of pedestrian activities. A particular study by Sawada[15] on the classification of Machikado through appearance tendencies of corner space. The research highlighted how the visual impression of corner space is influenced by the external attachments to raise the favorable rating in pedestrians' visual perception. These researches demonstrate the relevant effects of the storefronts with extended physical elements that influence pedestrian impression on the streetscape but did not explain the mechanism of how pedestrian perception could emerge from the characteristic of spatial composition.

Finally, in terms of analyzing the spatial perception emerging from the visual representation of space, Ando[16] studied the visual image to analyze its spatial distribution through the perception approach to component elements of streetscape. With a similar method using the visual image, Suzuki[17] developed the notion of differentiated static and dynamic streetscape with opinions from pedestrians targeting the sense of place and how to improve the quality of the streetscape. Also, with an approach using location mapping, Katayama[18] studied the environmental factors that influence pedestrian distance perception through location mapping. Another approach to evaluate streetscapes by Mansouri[19] focused on the complexity of streetscapes using photographs and questionnaires, but the results focused on the comparison between cognitive patterns of Japan and Algeria. The above researches illustrate the combined method to study the relationship between spatial composition and perception.

The above past research has contributed to clarifying the characteristics of physical elements, which influenced streetscape through visual representations for pedestrians. Different from these previous researches, this study introduces a combined method to understand the relationship between the spatial composition and perception of elements in the corner space that influences the variation in the visual impression of the pedestrian. Also, it is to note that the aims of this investigation are not to clarify the meaning aspect of streetscape elements but to provide an examination of the quality of Daikanyama streetscape in terms of variations and distribution of visual impression. Further, the expected findings would contribute to the research on the streetscape quality and the importance of street elements in enhancing pedestrians' experience of public spaces in Tokyo.

2. Method of study

2.1 Framework

The framework detailed in Fig.1 is structured in three steps corresponding to chapters 3, 4 and 5. Firstly, the analysis will combine data from mapping and photographs to illustrate the Spatial Composition from Spatial Component and Visual Proportion in chapter 3. Secondly, the analysis will combine data from questionnaires and photographs to define the Spatial Perception from Visual Appeal and Visual Depth in chapter 4. Finally, through a combination of Spatial Composition and

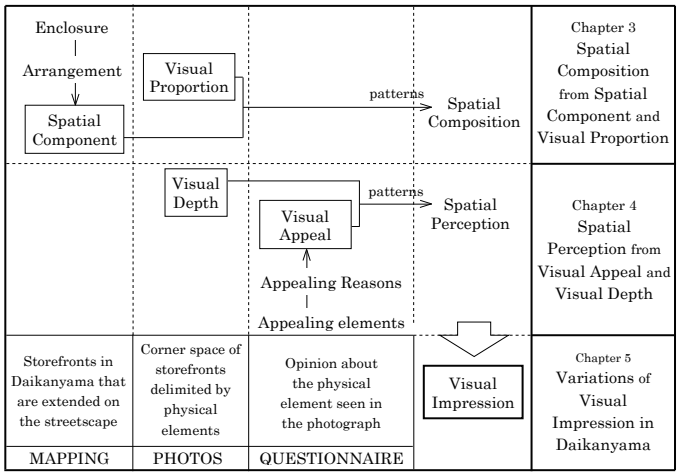


Fig.1 Framework

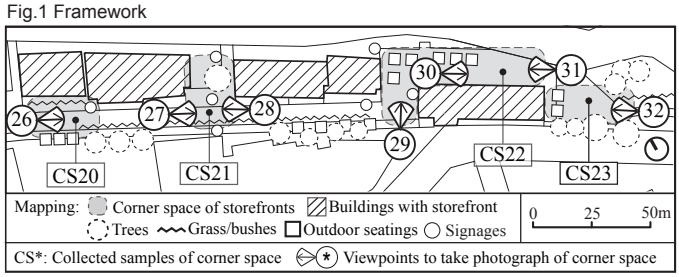
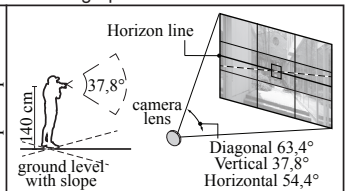


Fig.5 Example of mapping

Tab.1 Photograph

Viewpoint position			
Conditions	**103 photographs**		
	Area	猿楽町、代官山町、代官山駅	
	Date/ Time	13:00 - 16:30	15:00 -18:30
		2021/03/27	2021/05/14
		2021/04/24	2021/06/12
	Camera: Weather	Sunny weather	
	Camera: Model	Fujifilm XT-10, XF18-55 mm	
	Camera: Settings	Focal 35 mm - f/3,6 - ISO 250	
	Camera: Size	3456 pixels x 1944 pixels	

Tab.2 Questionnaire

50 Respondents	
Part 1: General Information	
Domicile: Japan, outside Japan Occupation: student, lecturer, architect Know about the area: visited once, visited several times, visit often, only see it online Visit duration: few hours, half day, one day Usual activities or intended activities: pass by, eat, shop, explore, hang out, sightseeing	
Part 2: Visual Perception	
Appealing Elements	Appealing Reasons
1. Building facade 2. Pavement 3. Street furniture 4. Vegetation	1. Contrast in light 2. Arrangement 3. Largest in size 4. Personal Preference
- For Part 2 of the questionnaire, the answering method is multiple choices. - Respondents of this questionnaire are from the Tokyo Institute Technology and the Sebelas Maret University (Indonesia).	

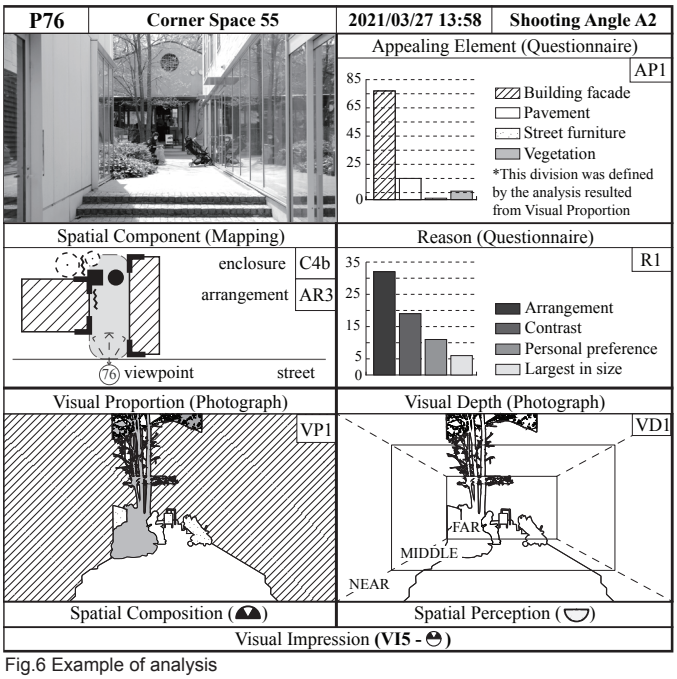


Fig.6 Example of analysis

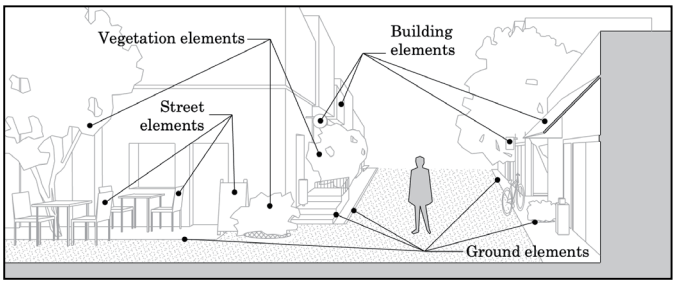
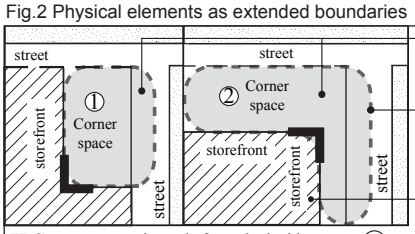


Fig.2 Physical elements as extended boundaries



An open space for lingering, within its area several parts extend toward the street via the storefront.
Physical boundaries are four types of elements which belong to building facade, pavement, street furniture and vegetation.
Stores are individual retail shops, cafe, restaurant, galleries

77 Corner spaces is made from the inside corner ① or the outside corner ② of buildings. Corner space are found around storefront as an extended space from the store to the street. The perimeter of corner space is defined by extended boundaries made by physical elements.

Fig.3 Corner spaces of storefront

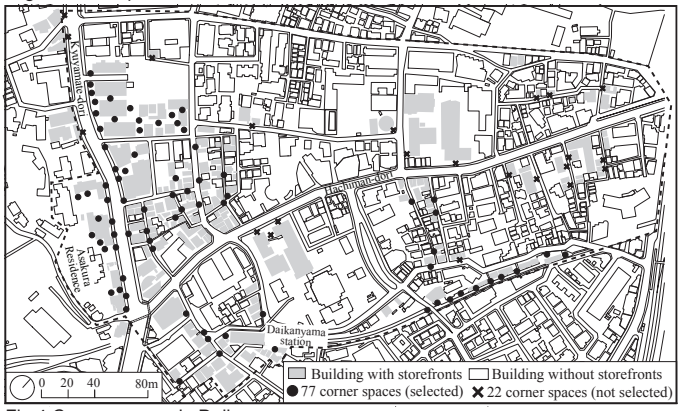
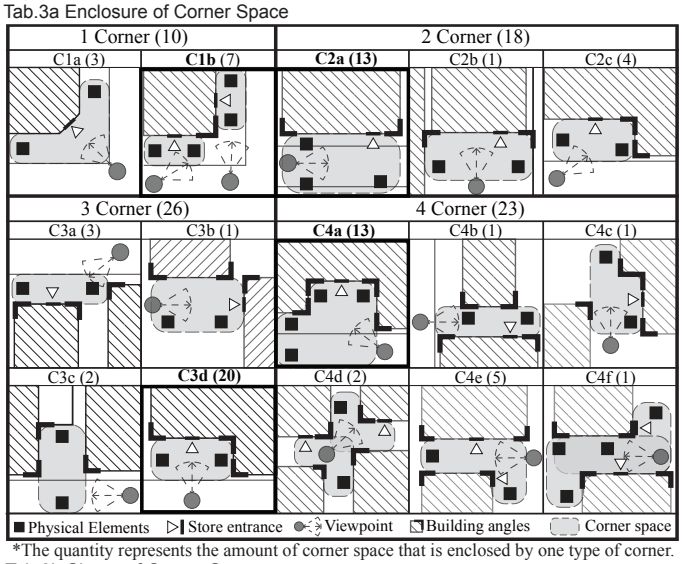


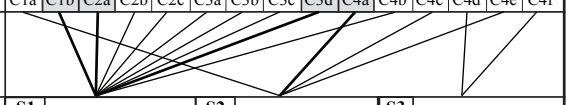
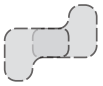
Fig.4 Corner spaces in Daikanyama

Tab.3a Enclosure of Corner Space



*The quantity represents the amount of corner space that is enclosed by one type of corner.

Tab.3b Shape of Corner Space

Corner(s)	1 corner	2 corners			3 corners				4 corners					
Enclosure	C1a	C1b	C2a	C2b	C2c	C3a	C3b	C3c	C3d	C4a	C4b	C4c	C4d	C4e	C4f
Relation															
Shape of corner space (77) Illustration	S1 (52) 					S2 (22) 							S3 (3) 		
Type	Simple												Complex		

Perception in chapter 5, the Visual Impression will emerge with variations in the storefronts of the Daikanyama area.

2.2 Corner space of the storefronts in Daikanyama

Daikanyama, consisting of a large part residential area, is a popular neighborhood for shopping with a lively and fashionable atmosphere. Land use in this area[vii] is mainly restricted to residential function by the use districts, thus for the urban development to build stores has been regulated to be smaller than a certain size, for example, the most area of the T-site plot is regulated within 150m^2 for the store's area. These points due to the city planning laws resulted in relatively small areas and low-rise buildings. Apart from the two large roads of Kyuyamate-Dori and Hachiman-Dori which are locating the Hillside Terrace and other mix-used buildings, the area is also well-known for its network of small streets and alleys with small and charming cafes, restaurants, galleries and retail stores.

Within these streetscapes, open spaces are found around the building corners within proximity of storefronts[viii] and having extended elements from the stores to the street positioning on both private and public properties. These various physical elements can be attached to the buildings, lied on the ground, placed on the streets or spilled out from the trees and vegetation (Fig.2). They become the extended boundaries of the open space around storefronts which are delimiting an area allowing people to eat, rest, shop and linger. Hence in this paper, these open spaces with physical elements as extended boundaries are defined as corner spaces of storefronts (Fig.3). Based on these characteristics, in the pre-survey of the Daikanyama area, 99 open spaces were collected as corner spaces of storefronts. Further, by considering the aims of this study as examining Daikanyama streetscape as an ensemble of storefronts and avoiding isolated case, only 77 corner space is selected for the analysis by focusing on their position being in the same building perimeter of at least three others (Fig.4).

2.3. Data collection

The data collection used a combined method on the corner space of storefronts. Firstly, the mapping collects a variety of physical elements such as trees, grass, seating, signage, etc. (Fig.5) and their position around the storefronts. These data are analyzed as spatial components of corner space. Secondly, 103 photographs, which privilege the entire view of 77 corner spaces[ix], were collected, following the position and conditions settings defined in Tab.1. This data will be analyzed by calculating the area occupied by the physical elements seen in the photographs to reveal the visual proportion and visual depth based on the physical elements, considered as the visual representation of corner space. Finally, a questionnaire using these photographs was conducted with 50 respondents in the architecture field knowing Daikanyama by visit or through online sources[x] (Tab.2). The collection method used an online survey form that collected 24 respondents in Japan and 26 respondents in Indonesia from 2021 April to June[xi]. This data,

Tab.4a Physical Elements

Facade elements (FE)		Paving elements (PE)			Street Furniture (SF)				Vegetations (V)		
					Fixed	Movable					
Eaves E (33)	Entrance EN (54)	Difference in floor level FD (64)	Stairs S (26)	Deck D (11)	Railing /Fence R/F (29)	Objects O (73)	Seating SE (41)	Signage SI (64)	Tree T (73)	Bush B (67)	Grass G (46)

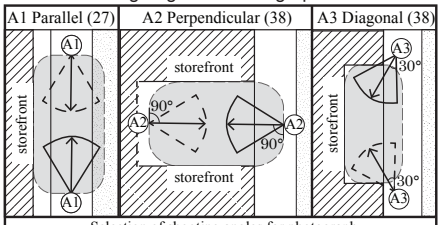
*In this table, objects are various embellishments of storefront (flower pots, bicycles, umbrellas, etc.)
*The number represents the quantity of elements found through mapping of each corner space.

Tab.4b Arrangement of Physical Elements

Corner spaces (77)	Physical Elements											Arrangement Pattern of Physical Elements
	FE		PE			SF				V		
	E	EN	FD	S	D	R/F	O	SE	SI	T	B	G	
OS25			○	○		○	●		●	○	○	○	None existence of FE (17) AR1
OS40			○	○	●	○	●	●	●	○	○		
OS43			○				●	●	●	○	○	○	
OS17	○	○					●	●		○	○	○	None existence of PE (12) AR2
OS44	○	○						●	●	○	○	○	
OS53	○	○				○	●		●	○	○	○	
OS50	○	○	○		●	○	●	●	●	○	○	○	Existence of All (48) AR3
OS55	○	○	○	○		○	●		●	○	○	○	
OS59	○	○	○	○		○	●	●	●	○		○	

* In this table, the symbol ○ indicates fixed elements and ● indicates the movable elements

Tab.5a Shooting Angles of Photographs



Selection of shooting angles for photograph
- One shot of (A1) is selected for space on the long side to the street.
- One shot of (A2) is selected for space on deep side to the street.
- More shots of (A1) or (A2) are set if one shot cannot get entire view.
- In case A1 or A2 couldn't capture the entire view, (A3) is selected.
- More shots of (A3) are set if one shot cannot get the entire view.

Tab.5b Photographs

Photograph by Shooting Angle (103)	Enclosure of corner space	1 corner	2 corners	3 corners	4 corners
A1 (27)	one shot	0	8	5	0
	more shots	6	2	4	2
A2 (38)	one shot	2	3	7	7
	more shots	2	0	3	14
A3 (38)	one shot	4	6	10	4
	more shots	0	0	0	14

*Classification of enclosure of corner spaces is referred to Tab.3a
*Shoot angles is defined in Tab.5a

Tab.5c Visual Proportion of physical element found in corner space

Sample (103)	Visual Proportion of Spatial Boundaries as Physical Elements	Visual Proportion Pattern
P03, P10, P31, P99		Large Area of BF (61) VP1
P27, P72		Large Area of V (16) VP2
P22, P24, P67, P103		Large Area of BF & V (26) VP3

Building facade Pavement Street furniture Vegetation
*The defined area of physical elements corresponded to the analysis example shown in Fig.6
*In this table, the quantity represents the collected samples of photograph.

Tab.6 Spatial Composition Pattern

Sample (103)	Spatial Component: Shape of Space S1	S2	S3	Arrangement AR1	AR2	AR3	Visual Proportion Pattern VP1	VP2	VP3	Spatial Composition Pattern
P09,P15,P18,P19,P20,P22, P23,P27,P28,P29,P30,P31, P35,P37,P39,P40,P41,P47, P50,P54,P55,P56,P57,P59, P72,P73,P74,P75,P82,P91, P102	○			○			○			Singular Composition in All (31)
P63, P66, P67, P68			●			●			●	Complex Composition in All (4)
P69, P94, P95, P96, P97			●			●	○			
P62			●			○	○			
P01,P02,P03,P04,P05,P10, P11,P13,P17,P32,P38,P42, P43,P45,P46,P48,P49,P52, P53,P70,P76,P77,P78,P79, P80,P81,P83,P84,P85,P86, P87,P88,P89,P90,P92,P93, P98,P99,P100,P101	○					●	○			Mixed Composition in Singular Proportion (46)
P06,P07,P08,P16,P26,P33, P34,P61,P64,P65,P71,P103	○					●			●	Mixed Composition in Complex Proportion (22)
P12,P14,P21,P24,P25,P36, P44,P51,P58,P60	○			○					●	

* ○ indicates the pattern containing only one element of spatial composition
● indicates the pattern containing a variety of elements of spatial composition
*Shape of space (S1-S3) is resulted from Tab.3b; Arrangement (AR1-AR3) is resulted from Tab.4b; Visual proportion pattern (VP1-VP3) is resulted from Tab.5c

relating to the perception of corner space, is analyzed as appealing elements and reasons. The combination of these above parameters will define the patterns of spatial composition and perception, and further, construct the visual impression (Fig.6).

3. Spatial Composition from Spatial Component and Visual Proportion

In this chapter, the analysis of collected data from mapping which represent the Spatial Component by Enclosure and Arrangement will be combined with the analysis of Visual Proportion[xii] from the photograph as a visual representation. This combination will reveal the Spatial Composition of the corner space of storefronts.

3.1 Spatial Component

3.1.1 Enclosure

As illustrated in Fig.3, corner space can be defined within the perimeter enclosed by one to four corners. Tab.3a then classifies 15 enclosure types from 77 corner spaces according to a similar shape and layout of the storefront's corners and the extended physical elements. Among them, the majority are found in four types of enclosure C1b (7/77), C2a (13/77), C3d (20/77) and C4a (13/77). Each type represents a majority of at least 5% of the total. Meanwhile, the rest are made from 11 different types of enclosures representing the diversity of corner spaces in Daikanyama. Then these 15 enclosure types are grouped into three types of shapes of corner space in Tab.3b. There are simple shapes S1, S2 and a complex shape S3. The majority shape is S1 (52/77) which includes all enclosure types of one to four corners. Meanwhile, S2 (22/77) and S3 (3/77) contain mostly four corners type.

3.1.2 Arrangement

As explained in Fig.3, the physical elements composing corner space were categorized into four kinds identified as facade elements (FE), paving elements (PE), street furniture (SF), and vegetation (V). Through mapping, as shown in Fig.5, these physical elements were collected and classified in Tab.4a. The classification takes into consideration the method of attachment, such as vertically for FE while horizontally for PE, and the spatial dimensional shape of elements, such as artificially for SF while naturally for V. Also, FE, PE and V consist of only fixed elements, while SF contains both. From this classification, three arrangement patterns of physical elements emerged (Tab.4b). In general, all patterns have at least three kinds. The majority of arrangements have an existence of all AR3 (48/77), while some corner spaces have a none existence of FE as AR1 (17/77) or non-existence of PE as AR2 (12/77). Also, all patterns contain SF as movable elements.

3.2 Visual Proportion

Photographs of corner space were classified based on the angle of shooting that follows the conditions of capturing the entire view of corner space with a minimum of photoshoots following three criteria as illustrated in Tab.5a. Firstly, to be able to define the

Tab.7 Appealing Elements

Sample (103)	Building facade (BF)	Pavement (P)	Street furniture (SF)	Vegetation (V)	Appealing Element Pattern
P01	●	○	○	○	AP1
P21	●	○	○	◐	BF is dominant in Appealing Elements (38)
P41	●	◐	○	○	
P61	●	○	◐	○	
P22	○	○	○	●	AP2
P25	◐	○	○	●	V is dominant in Appealing Elements (36)
P35	○	◐	○	●	
P20	○	○	◐	●	
P65	◐	◐	○	●	
P66	○	○	●	◐	AP3
P24	◐	○	●	○	SF and various elements are dominants in Appealing Elements (29)
P30	○	◐	●	○	
P28	◐	○	●	◐	
P63	○	◐	●	◐	
P56	◐	◐	●	○	
P58	◐	◐	●	◐	
P57	◐	●	◐	◐	

*◐ represents the significant of appealing element if it is chosen in the photograph by more than 50% of answers.
*● represents the dominant of significance if its quantity is at least 20% higher than the rest of elements in the same photo.

Tab.8 Appealing Reason

Sample (103)	Contrast	Arrangement	Largest in size	Personal preference	Pattern of Reason for Appealing element
P06	○	●	○	○	R1
P44	○	○	●	○	Only one majority of reason (40)
P98	●	○	○	○	
P40	●	◐	○	○	R2
P89	◐	◐	○	○	Two majorities of reason (34)
P67	◐	●	○	○	
P92	◐	○	◐	○	
P99	◐	○	○	◐	
P81	○	●	●	○	
P52	○	◐	●	○	
P80	○	●	◐	○	
P102	○	●	○	◐	
P03	○	◐	○	◐	
P54	●	◐	◐	○	R3
P69	◐	●	◐	○	More than two majorities of reason (29)
P55	◐	◐	◐	○	
P24	◐	●	○	◐	
P12	○	●	◐	◐	
P29	○	◐	◐	◐	
P93	◐	◐	◐	◐	

*◐ represents the significant of reason if it is chosen by more than 30% of answers
*● represents the dominant of significant reason if its quantity is at least 20% higher than the rest.

Tab.9 Visual Depth

Sample (103)	Near	Middle	Far	Visual Depth Pattern
P90				VD1
P76				BF is dominant and distribute in all (45)
P93				
P38				
P49				
P27				VD2
P25				V is dominant and distribute in all (18)
P22				
P21				
P57				VD3
P36				All elements equally distributed in all (40)
P68				
P53				

■ Building facade (BF) ▒ Vegetation (V) □ Street furniture, pavement and other elements
*The defined area corresponded to the analysis example shown in Fig.6
*Majority of each physical element represent at least 30% within each division of near-middle-far.
*In this table, the quantity represent the collected samples of photograph.

Tab.10 Spatial Perception Pattern

Sample (107)	Visual Appeal: Appealing Element AP1 / AP2	AP3	Appealing Reason R1	R2 / R3	Visual Depth Pattern VD1 / VD2	VD3	Spatial Perception Pattern
P06,P13,P19,P20,P34,P41, P46,P48,P50,P61,P72,P76, P77,P85, P91,P98	○		○		○		Singular Perception in All (16)
P15,P17,P29,P30,P54,P67, P99		●		●		●	
P03,P24,P37,P39		●		●	○		Complex Perception in All (7)
P02,P28,P31,P42,P56,P58, P63,P90		●	○		○		
P01,P04,P10,P11,P14,P21, P22,P23,P25,P26,P27,P38, P43,P45,P47,P49,P52,P55, P64,P74,P78,P79,P80,P83, P84,P86,P88,P92,P93,P94, P95,P96,P97,P100,P101	○			●	○		Mixed Perception in Singular Depth (47)
P07,P33,P44,P53,P65,P73	○		○			●	Mixed Perception in Complex Depth (33)
P05,P09,P16,P18,P32,P57, P59,P66,P70,P82	○			●		●	
P08,P12,P35,P36,P40,P51, P60,P62,P68,P69,P71,P75, P81,P87,P89,P102,P103		●	○			●	

* In this table, ○ indicates the pattern appear in singular element of perception and ● indicates the pattern appear in combination elements of perception
* Appealing element (AP1-AP3) is resulted from Tab.7; Appealing reason (R1-R3) is resulted from Tab.8; Visual depth pattern (VD1-VD3) is resulted from Tab.9

Tab.11 Visual Impression types

VI-1 (6)	VI-2 (8)	VI-3 (10)	VI-4 (3)	VI-5 (7)	VI-6 (11)	VI-7 (4)	VI-8 (9)	VI-9 (12)	VI-10 (27)	VI-11 (2)	VI-12 (2)	VI-13 (1)	VI-14 (1)
○	◔	◒	◔	◒	◒	◒	☢	☢	☢	◒	●	●	●

*In this table, the upper part ◠ is referred to Tab.6, while the lower part ◡ is referred to Tab.10

depth within the frame, criteria such as the relationship between foreground with background elements or the size, position of corner space regarding the width of the street are crucial for the selection of shooting angle. Secondly, the quantity of shots increases depending on how the physical elements were positioned in the corner space that does not hide the entire view. Thirdly, the selection of shooting angle privileges the parallel view A1 and the perpendicular view A2 than the diagonal view A3. According to the classification in Tab.5b, spaces made of one and two corners are found to be visible in mostly parallel view angles (A1), while spaces made of three and four corners are captured using mostly perpendicular (A2) and diagonal (A3) view angles. Further, the analysis divides the photograph into four areas related to elements of BF, P, SF, V, identified as the Visual Proportion of elements' visibility within the photograph (cf. Fig.6). Three patterns of Visual Proportions are illustrated in Tab.5c, with the majority in the Large area of BF (VP1, 61/103) representing more than 50% of samples. Following is the Large area of BF and V (VP3, 26/103) and the Large area of V (VP2, 16/103), respectively.

3.3 Spatial Composition patterns

The spatial composition pattern is classified from the Shape of space and Arrangement from the Spatial Component and Visual Proportion pattern (Tab.6). The patterns with only one element and the patterns with more elements are distinguished between them in terms of Shape of Space, Arrangement and Visual Proportion as S1/S2 and S3, AR1/AR2 and AR3, VP1/VP2 and VP3, respectively. Then, the Spatial Composition containing only patterns with single elements such as S1/S2, AR1/AR2 and VP1/VP2 is categorized as Singular Composition in All (31/103). On the other hand, the composition containing only S3, AR3 and VP3, as patterns with multiple elements, is categorized as Complex Composition in All (4/103). The rest are categorized as Mixed Compositions and are divided between the Singular Proportion (46/103) and Complex Proportion (22/103).

4. Spatial Perception from Visual Appeal and Visual Depth

In terms of perception of mise-en-scene[xiii] in the photograph, the appearance of elements will be emphasized based on features such as contrast, arrangement, position, etc. From this notion, the photographs of corner space are used in the questionnaire to define appealing elements[xiv]. Besides, since how the elements are perceived also depends on their visibility in the photo, their appeal could be influenced by their position within visual depth. Therefore, in this chapter, the analysis of data obtained, which represents the Visual Appeal by Appealing elements and Reason, will be combined with the analysis of photographs in the division of Visual Depth. This combination will reveal the Spatial Perception in the corner space of storefronts.

4.1 Visual Appeal

Visual Appeal characterizes the immediate user's responses that subconsciously happen when presented with stimuli. It is further associated with preference and influences visual impression[xv]. In this research, Visual Appeal is defined as the combination of appealing elements and appealing reasons.

4.1.1 Appealing Element

By focusing on the appeal aspects, elements categorized as BF, P, SF and V (cf.Tab.2) are selected in the questionnaire by a multiple-choice answering method. The data analysis firstly considers an element as significant if it was chosen in each photo by more than 50% of answers. Secondly, to define the dominant among the significances, its quantity has to be higher than the rest by 20%. Then, Tab.7 classified the collected data of appealing elements in the questionnaire into three Appealing Elements patterns. The higher quantity found in patterns of BF and V as dominant of Appealing Elements with near equal quantity as AP1 (38/103) and AP2 (36/103), respectively. Meanwhile, the third pattern is defined as AP3 (29/103) which is SF with various others.

4.1.2 Appealing Reason

By focusing on the relationship between elements within the visual array, the reason for selecting an element depends on the interaction between them such as contrast, arrangement and size[xvi]. Then, using the above method of classification, the analysis of the appealing reason firstly considers a reason to be significant if it was chosen by more than 30% of answers. Secondly, to define the dominant among the significances, its quantity has to be higher than the rest by 20%. Tab.8 classified the data from the questionnaire about Appealing Reasons into three patterns based on the quantity selected (cf.Tab.2). The highest quantity is found in R1 (40/103), with only one reason focusing on either contrast, largest size or arrangement of Appealing Elements. While R2 (34/103) and R3 (29/103) are patterns that combine several reasons with a diverse distribution among all categories.

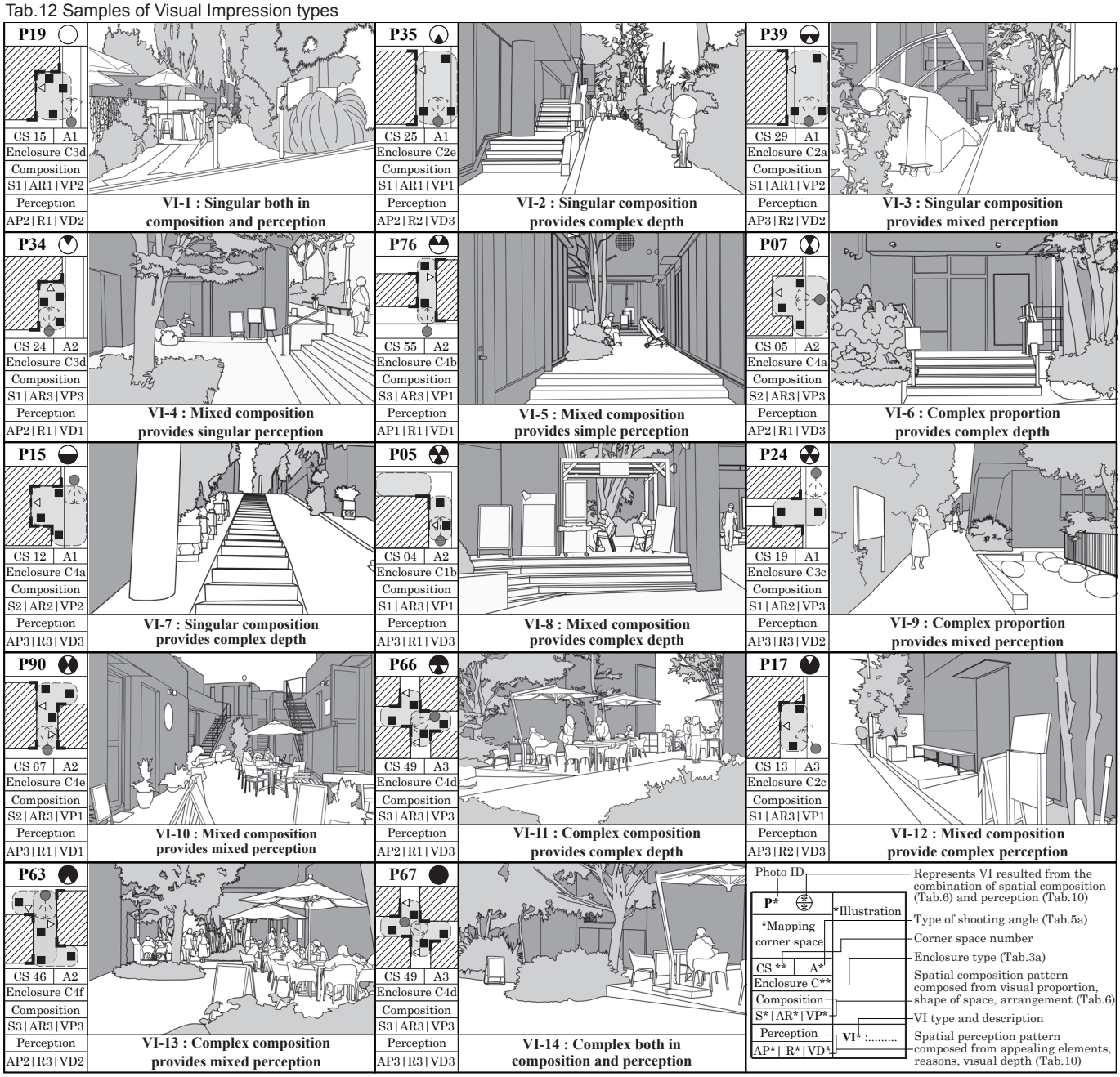
4.2 Visual Depth

Visual Depth is analyzed by defining the areas of physical elements of BF, P, SF and V within the visual division of near-middle-far defined in the photo (cf. Fig.6). As shown in Tab.9, the visual proportion of each element is classified by the order of dominant elements within each visual division, and three visual depth patterns have emerged. A higher quantity is found in patterns of BF distributed in all divisions (VD1, 45/103) or all elements evenly distributed in all divisions (VD3, 40/103). A third pattern is V distributed in all divisions (VD2, 18/103).

4.3 Spatial Perception patterns

Perception pattern is classified from Appealing element and Reason from Visual Appeal and Visual Depth pattern (Tab.10). The patterns with only one element and the patterns with more elements are distinguished between them in terms of Appealing Element, Reason and Visual Depth as AP1/AP2 and AP3, R1 and R2/R3, VD1/VD2 and VD3, respectively. Then, the Spatial Perception containing only patterns with a single element such as

Tab.12 Samples of Visual Impression types



AP1/AP2, R1 and VD1/VD2 is categorized as Singular Perception in All (16/103). On the other hand, the perception containing only AP3, R2/R3 and VD3 as patterns with multiple elements is categorized as Complex Perception in All (7/103). The rest are categorized as Mixed Perceptions and are divided between the Singular Depth (47/103) and Complex Depth (33/103).

5. Variations of Visual Impressions in Daikanyama

In this study, the Visual Impression (VI) is interpreted as the combination of Spatial Composition patterns and Spatial Perception patterns. From the above patterns, Tab.11 illustrates 14 types of VI ranging from the combination with more Singular patterns to the one with more Complex patterns. It can be observed a high quantity in VI-10(27) and distinctive ones like VI-13(1) and VI-14(1) while the rest present a large diversity. These VI types containing detailed descriptions of the parameters found in 14 photo samples are illustrated in Tab.12. Each illustration indicates the categorization of VI made by the singular, complex or mixed combination that consists of various parameters composing Spatial Composition (as of shape of space, arrangement and visual proportion) and Spatial Perception (as of appealing element, reason and visual depth). For instance, the [Singular] VI-1 has resulted from a combination of the single patterns of S1, AR1, and VP2 in Composition and the single patterns of AP2, R1, and VD2 in Perception. On the other hand, the [Mixed] VI-8 contains a mixed Composition between the single pattern S1, VP1 with the multiple patterns of AR3 and a mixed Perception between the single pattern R1 with the multiple patterns of AP3 and VD3.

Furthermore, the distribution of all VI types found in Daikanyama is illustrated in Fig.7. The distribution is divided into two areas

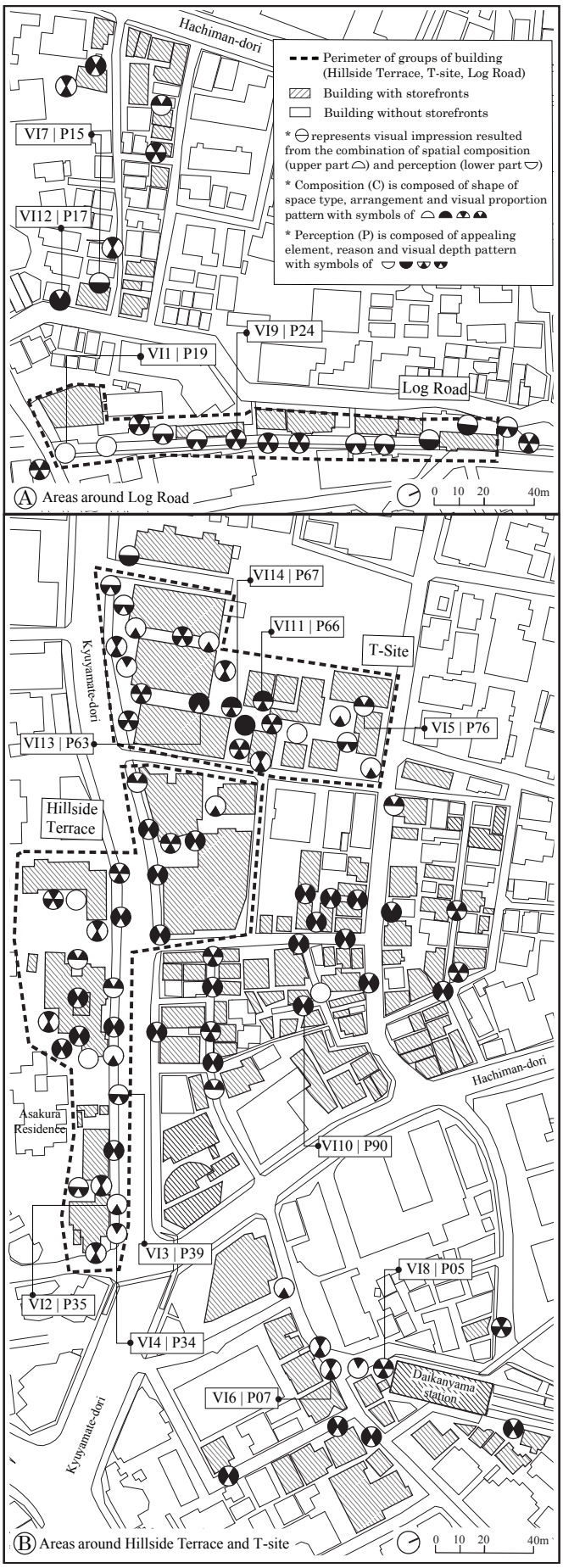


Fig.7 Distribution of Visual Impression in Daikanyama Area

that reflect the Daikanyama atmosphere associated with particular groups of buildings considered local architectural landmarks. Area A consists of VI found around Log Road and area B of VI around Hillside Terrace and T-site. Despite the diversity in the types, the VI distribution follows a specific order. Firstly, concerning the area distribution, in general, most of the VI exist in both zones. However, all of VI is present only in area B, which can be understood by the size of the area and the higher concentration of VI related to the diversity of corner space found in Hillside Terrace and T-site constituting a variety of combinations.

Secondly, concerning the order of distribution within the perimeter of building groups like Log Road in zone A and Hillside Terrace and T-site in zone B, the VI organizes in different ways. In the area of Log Road, the Singular combination VI-1 is found at the entrance, and it changes to a series of complex patterns like VI-3 or VI-9 in the middle of the linear pathway, then finally changes to the Singular on Spatial Composition VI-7 by the exit. On the other hand, in the case of T-site, mostly VI in combinations of Singular and Mixed patterns are found near the area border while combination patterns of Mixed and Complex VI-14, VI-13, VI-11 are found only in the center of the area. This distribution suggests a discontinuity in the VI distribution that could influence the sequence of pedestrians and enhance the impression of varieties of space. Notably remarkable is the distribution pattern of VI in Hillside Terrace. Here, the most diverse types of VI are present, but there is almost no repetition of the same VI next to each other. This aspect suggests an ingenious design of the corner space, not only in terms of spatial composition but also in perception. Also, it guarantees the non-repetition of VI between each building of Hillside Terrace, hence, the diversity in the visual impression would attract people to explore. Thirdly, by comparing the VI found inside the perimeter of the three group buildings and the rest of the VI, repetition in the distribution has emerged. Despite various VI scattering in these areas, VI-10 and VI-9 are found gathering in a group of large quantities in several neighboring streets. Also, about the tendency of distribution toward Hillside Terrace and T-site, it can be observed that the closer it is, the repetition of VI is higher in quantity and density. This finding would suggest that in the case of the pioneer architecture of Hillside Terrace that gradually developed over time, a subtle distribution exists around the areas of this landmark. This distribution is partly adopted in other group buildings in the case of T-site and Log Road despite existing in different orders, while it is inherited in disperse and in gradation within the rest of neighboring stores. Further, these variations of VI are creating the overall atmosphere of the Daikanyama streetscape that enhances the pedestrians' experience in the city.

6. Conclusion

Attempting to study the corner space of storefronts through a

combined method of survey, this study investigated the Visual Impressions through the combination of Spatial Composition and Perception. Also, it illustrates their variations in terms of types and distribution in Daikanyama as the relevant case study of Tokyo streetscape.

Firstly, in terms of Spatial Composition, the finding shows that the composition of corner space has a majority in simple Shapes within various Enclosures and Arrangements. Also, the Visual Proportion shows that the building facade is the dominant element among all. However, despite this majority, a diversity of different Spatial Compositions is found, which could be understood as characterizing the liveliness of the Daikanyama streetscape. Secondly, in terms of Spatial Perception, Reasons for Appealing Elements appear in a high quantity with various stimuli that reveal a finer detail of how the user recognizes the elements in the photograph. For instance, it is noticeable that vegetation is chosen as an Appealing Element despite being the least dominant in Visual Depth. Also, the presence of street furniture in the most division of Visual Depth despite being the minority in the pattern of the Appealing Elements. These findings show the varieties of Spatial Perception in the Daikanyama streetscape, which is appealing to people. Finally, in terms of Visual Impression, variations in terms of types and distribution are found. Visual Impression in Daikanyama is characterized by a diversity of types combined between Singular, Complex or Mixed patterns and order in distribution within the areas consisting of architectural landmarks and be adopted in disperse in neighboring stores. These variations found in corner spaces of storefronts could be interpreted as an inherited essence of spatial quality from the urbanism planning process of Hillside Terrace being the first architectural group form in Daikanyama. This design might have influenced the visual impression of other groups of buildings or individual buildings around the Daikanyama area that would attract people to explore. It could be understood from the above results that a neighborhood gradually developing, like the particular case of Daikanyama with Hillside Terrace, sustains various combinations in terms of composition and perception of the streetscape to diversify the network of small open spaces.

Besides, the whole approach shows the benefits and complexities related to research on the composite characteristics between spatial composition and perception. However, the quest to grasp the perception mechanism in terms of the sequence composition of the streetscape is left open for further discussions. The method of this study has confirmed the importance of each parameter discussed in the mentioned literature, especially the relationship between human parameters and their environment in urban space design. Furthermore, by positioning within the study on sustainable development for compact cities involving the authors' continuous previous research, where it is essential to consider the quality of streetscape in the urban restructuring strategy, the findings of this study would have useful contributions to enhance street livability. Finally, the scope of this study is limited to selected case studies in Tokyo, particularly the Daikanyama area. Whether this result may apply to other locations or situations under different conditions will need further investigation.

Acknowledgment

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Notes

i) Access to open space has become the new priority for urban living as shown by the percentage of visitors to outdoor spaces from February 2020 to September 2021 have increased by more than 150% in some parts of Europe, America and Africa (data retrieved from https://ourworldindata.org/grapher/change-visitors-parks-covid, website visited on 13/09/2021)

ii) In reference 1), various authors discuss the transformation and adaptation of Japanese public space to enhance urban living.

iii) In reference 5), Ashihara described the atmosphere of Japanese shopping streets dominated by signboards and advertisements. These temporary elements give the exterior space of the street an interior quality and increase the liveliness allowing intense human activities.

iv) In reference 6), pages 94-95, Ashihara mention one of the methods to design exterior space by the use of inside corner and outside corner of the building. This technique provides an interruption of the sequence vista or spatial monotony to provide rhythm and variety in space.

v) Group form is one of three approaches in Maki's theory of collective form, described in reference 7). This theory concerns groups of buildings with meaningful spatial forms in common between them.

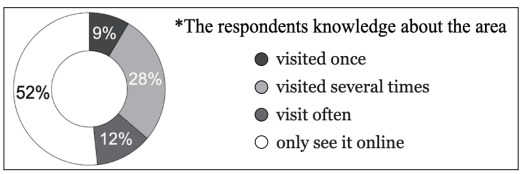
vi) Architect Fumihiko Maki described the atmosphere of Daikanyama in his interview with Greg Logan, Finding intimacy in the city, published 29/04/2018 (www.japantimes.co.jp/life/2018/04/29/style/architect-fumi-maki-finding-intimacy-in-the-city, article visited on 15/09/2021)

vii) Information retrieved from 渋谷区地図情報システム (www.city.shibuya.tokyo.jp/kankyo/toshi_keikaku/toshi_soudan.html, article visited on 01/03/2022)

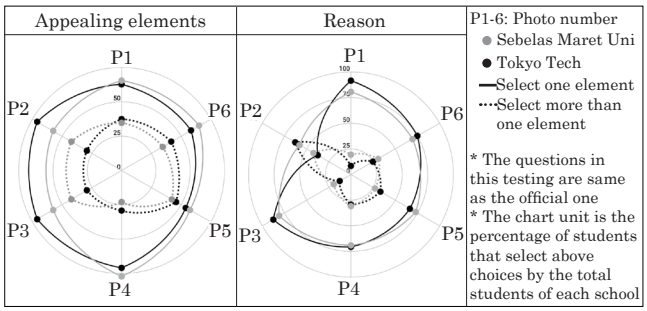
viii) The storefronts in Daikanyama differ from the traditional typology which only concentrated on the front facade, as illustrated in 20). In this area, the storefronts own a design influenced by neighboring stores.

ix) An entire view is considered to contain more varieties in terms of spatial elements which corresponds to the aims of this study to clarify the characteristics of Visual Impression in terms of variation.

x) In reference 21), a study on the evaluation of visual cognition in the photographs shows a similarity in the respondent of the architecture field compared to the general one. Based on this research, the criteria for respondents was firstly based on their background belonging to the same field of architecture. Secondly, despite the knowledge of the Daikanyama area among respondents varies, the percentage of people know-well Daikanyama is limited, as shown in the below graph, hence, this study using photographs is considered to be suitable in this diversity.



Furthermore, testing was done before the official one with the targeted respondents on a small sample of 6 photos of Daikanyama. The results show that, despite different backgrounds and nationalities, the rating from each school have some similarities, as shown in the graphs below.



xi) In this study, the questionnaire is given two times due to the number of photos. The details of each batch of photos are indicated as follows:

Photo batch	Period of collection	Quantity
1	11.04.2021 - 23.04.2021	46 photos
2	29.05.2021 - 20.06.2021	57 photos

xii) In reference 5), Ashihara described the effect of physical elements proportion within the pedestrians' visual vista of the streetscape.

xiii) In reference 4), several authors discuss the spatial depth as seen through the overlapping of spatial boundaries in the visual vista created by external layers of the streetscape. This sense of relative distance or depth is classified as near-middle-far in this research, corresponding to the order of foreground and background in photography mise-en-scene.

xiv) In reference 9) Nasar analyze the parameter of visual preference where the criteria of appealing are the highest-ranking of preference, which is relevant for the case of Daikanyama as a fashionable streetscape.

xv) In reference 10), Rapoport described the stimuli features that increase the appeal of the streetscape evaluation and enhance attractiveness.

xvi) In reference 19), Mansouri mentioned that elements within the visual array exist in continuous interaction, hence this study selects criteria that represent such relationships between elements of the streetscape as contrast, arrangement and size. Further, the criteria of personal preference is added to allow flexibility for respondents.

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和文要約

目的：本研究は、人間 - 空間 - 環境の相乗効果に関する筆者らによる既報の論文に続き、都市における街並みの質や歩行者の経験に関わる、街路の構成要素の重要性の実証を目指している。そこで本論文では、建物の入隅や出隅まわりにみられる、建物の部位や舗装、植栽、家具などの溢れ出しによって緩やかに領域化された屋外空間に着目し、これら店先の隅の空間の視覚的印象について、空間構成と知覚の組合せをもとに検討している。調査事例として選定された代官山の都市環境は、このエリアの都市化の先駆けであるヒルサイドテラスのように、群造形を形成する建物に多様な店先が属している。本研究の調査結果は、都市の再編戦略のための小さなオープンスペースのネットワークの重要性を示唆している。

方法と結果：対象地域から選定された 77 箇所の隅の空間のマッピング、これらの 103 枚の写真、さらに日本とインドネシアの 50 人の建築学生を対象に実施したアンケートにより得られたデータを組み合わせ、分析の資料とした。これらのデータをもとに、まず、空間の構成要素と視覚的な比率から空間構成について検討し、さらに、視覚的な興味および奥行きから空間の知覚について検討した。そして、各々のパターンの組合せから 14 種類の視覚的印象の型（VI）を導き、さらに、対象地域におけるこれらの型の分布を検討した。その結果、大半の VI の型が 2 つの対象エリアのいずれにも分布しており、エリア B には全種類がみられた。また、ログロード、ヒルサイドテラス、T-site という群造形を成す建物には、内包する VI の配置に異なる特徴がみられ、ヒルサイドテラスは決まった型が繰り返されることなく微妙な多様性を保持し、T-site は中央と周縁で型が異なり、ログロードは線形に型が推移している。さらに、これらの建物の外周の外側では、該当数が最も多い VI の型が繰り返されるという傾向がみられた。

Summary in English

Purpose of the study: Pursuit the authors' previous publications engaging in the synergy of human-space-environment, this study wants to demonstrate the importance of street elements for the quality of the streetscape and pedestrian's experience in the city. The study investigated the outdoor spaces around the inside and outside corners of buildings, which are subtlely invaded by the overflow of building parts, pavement, plants, furniture, etc. and aims to examine the visual impression of these storefront corner spaces based on the combination of spatial composition and perception. In the selected survey example of the urban environment of Daikanyama, various storefronts belong to the buildings that form a group, such as the Hillside Terrace, which is the pioneer of urbanization in this area. The findings suggest the importance of small open spaces networks for the urban restructuring strategy.

Method and findings: The research used a combined method of mapping 77 corner spaces, from which generated 103 photographs to be the questionnaire subject for 50 architecture students in Japan and Indonesia. Next, the combination of spatial components and visual proportion will illustrate the characteristics of spatial composition. Then the combination of visual appeal and visual depth will construct the patterns of spatial perception. Finally, these patterns are combined to illustrate the variations of visual impressions (VI) in terms of type and distribution. As a result, most VI types were distributed in both targeted areas, and all types were found in area B. In addition, the Log Road, Hillside Terrace, and T-site, which form group buildings, have different characteristics in the distribution of VI. The distribution in Hillside Terrace retains subtle diversity without repeating a fixed pattern, while T-site has different types at the centre and the periphery, and the Log Road changes linearly. Further, the distribution of VI found a tendency of repetition of the most popular types in the area outside of the perimeter of group buildings.

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