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What Draws People In: Behavioral and Visual Insights from Southeast Asia to Reimagine Japanese Street Stalls

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Abstract. A significant shift in street stall culture in contemporary Asian societies has impacted public engagement with these venues, Hakata City; iconic mobile street food stall culture in Japan, is experiencing declining interest from residents' due various factors. This presents a paradox, as innovative approaches in cities like Tokyo are encouraging the re-imagination of street stall culture to promote public gatherings. Several Southeast Asian countries successfully maintained their street stall culture during the pandemic and continue thriving post-pandemic era. This study investigates how spatial design and visual strategies influence public engagement with street stalls, comparing case studies from Southeast Asian countries and Japan. The research combines traditional and innovative methods to examine the street stalls experience. Spatial settings analysis illustrates behavior settings of street stall on the street while visual display analysis assesses visual appeal of design elements, display and signage. Visual attention collected through eye-tracking reveals visual cognition and attention depicting how users interpret and engage with stall elements. The outcome seeks to identify design strategies that enhance physical versatility and visual engagement, aiming to enhance street designs and encourage greater public participation, supporting the evolution of Japanese street stall culture while preserving its identity.

1. Introduction

Street food stalls represent an integral component of urban cultural landscapes across Asia, serving not only as venues for culinary experience but also as social hubs that foster community interaction. Driven by widespread fascination with Japanese cultural traditions, street food culture in Japan is predominantly found at festivals and along streets, characterized by distinctive functionality, strong identity, and attractive appearance that offers a unique customer experience through food, games, and a lively atmosphere [1]. Another form of daily street stall exists in Hakata, with over 100 stalls continue operating nightly along Nakasu river and Tenjin districts [2], not only as tourist attraction but also becoming an important part of supporting the local economy, had impacted on generating an annual economic value of 5.323 billion yen in 2013 [3]. Over time, street stalls have undergone a significant decline, driven by tighter regulations on sales practices and evolving efforts to maintain urban cleanliness and beautification, accompanied by broader societal shift such as consumer preferences change, urbanization patterns, and the continuous shift in public space perception. The regulations have been established aimed to balance cultural heritage preservation with modern urban management, also addressing



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licensing, hygiene, and spatial organization concerns [3]. Despite these efforts, contemporary Japanese street stall culture is experiencing declining interest from residents', although over 70% of Fukuoka residents had visited these stalls, only 30% are regular customers predominantly middle-aged men [4]. This issue was further complicated during the COVID-19 pandemic where heightening public health concerns regarding shared dining spaces and spatial configuration of traditional street stall became less suitable for physical distancing and disease prevention [1].

In contrast to Japan, street food cultures across Southeast Asian countries have demonstrated remarkable resilience throughout the pandemic period and into the post-pandemic era by implementing adaptive strategies that balance cultural preservation with contemporary needs. By combining a comparison of successful street stalls practices in Japan and Southeast Asia, this research aims to explore how spatial design, and visual strategies can enhance public engagement and examines how the design elements and visual display influence users' perception and interaction with the street stall. Differences in behavioral settings, visual appeal, and visual attention insights are expected to reveal key factors that contribute to the visual attractiveness of street stall in each context. Ultimately, the findings are expected to offer insights that enhance street livability and support the revitalization of traditional Japanese street stall culture by preserving its identity while adapting the contemporary urban needs.

2. Literature Review

2.1 Street stalls for livable streetscape:

The dynamic arrangement of urban spaces plays a crucial role in shaping public engagement, as highlighted in Cullen's townscape theory [5], where visual sequencing and spatial settings influence how individuals perceive and interact with their surroundings. Street stalls, as temporary yet expressive elements, contribute to street vibrancy through contrast, movement, and spontaneity. Jacobs [6] and Whyte [7] emphasized how well-designed public spaces; formal or informal, can foster social interaction and a sense of place. However, as Nasar [8] argues, people's affective responses to such environments; shaped by comfort, familiarity, and visual appeal, can influence how they engage with them over time. This perspective is especially relevant in this study. While Southeast Asian stalls often embrace adaptable and interactive layouts that respond to user needs, those in Japan tend to be more restrained in design and placement [9]. Understanding the emotional and spatial qualities that support positive user experiences can help identify design strategies to enhance the role of stalls in Japanese streetscapes.

2.2 Characteristics of street food in Southeast Asia:

In many Southeast Asian cities, street stalls are not only sources of daily necessities but also integral to the cultural identity and urban experience. In some contexts, they reflect the vibrancy of everyday life, while in others, regulations are reshaping how people interact with them. Whether temporary or permanent, the versatility and appeal of these street setups can be understood through four key parameters: flexible transformation, temporality of the streetscape, dynamic negotiation of public space and diversity in display strategies.

Street vending is deeply influenced by cultural, spatial, and regulatory contexts. In Vietnam, the presence of street vendors is closely tied to the colonial-era sidewalks, which have naturally become spaces for informal economic activities, creating sensory and nostalgic experiences for locals and visitors alike [10]. Despite facing increasing government regulations on public space use, these vendors remain a vital part of the urban landscape and contribute significantly to the informal economy [11]. In Indonesia, street food culture is shaped by the Javanese philosophy

“Eat or not eat, the important thing is to gather”, which emphasizes the importance of communal dining and togetherness [12]. Street food stalls have become a key feature of nightscapes, often aligning with community leisure hours and transforming public spaces into vibrant social hubs. Another strategy employed by street stalls is distinct visual strategies to attract customers and manipulate perception. In Thailand, street vendors rely on a variety of sensory and visual strategies to attract attention, particularly in space-constrained environments like university campuses [13]. These strategies, which include a mix of fixed and movable stall designs, create dynamic streetscapes that engage passersby [14]. In Malaysia, retail shop owners extend their merchandise onto the five-foot ways, covered walkways that connect shops to public spaces, thereby blurring the line between shop interiors and pedestrian paths [15]. In this context, the regulation of designated vending zones helps manage traffic and the use of public space [16], it also balanced the spatial organization and enhance visibility in customer engagement within the commercial streetscape [17]. While regulations here may limit such practices to control pedestrian flow, the fundamental approach using the immediate spatial context to visually engage and attract customers by extending the shop’s footprint demonstrates a shared principle of playing with visual perception in the commercial streetscape [17], where even within limited temporal patterns, it successfully creates an authentic atmospheric experience [16].

These Southeast Asian examples show how spatial flexibility and visual display enhance both the function and adaptability of street food stalls, insights that when viewed through Japan’s distinct spatial conditions, invite reflection on how such strategies might inform the future potential of its street stalls.

2.3 Situation of street stall in Japan

In Japan, Yatai 「屋台」 are lightweight, portable wooden food carts (approx. 1.35 × 2.05 m) that line up along streets, serving as mobile kitchens with counter seating, fostering intimate social interaction, and showcasing each vendor’s identity through visually appealing decorative lighting and compact, weather-protective designs [9]. Originating in Tokyo during the Edo period (1716–1736) and evolving into street storefronts by the Tianming era (1781–1789) [1], Yatai once thrived in Fukuoka with around 400 stalls, but strict pre-1964 Olympic regulations and urban beautification marked a turning point, reducing stalls nationwide and shifting public perception of street food culture [2]. As Japan’s economy grew, stall owners transitioned into formal businesses, supported by government systems with tax incentives and guidance to move indoors [1]. While post-pandemic shifts like dining restrictions [18], delivery trends [18], and stricter health rules [19], tightened regulations, and they also sparked new business models through social media trends [18,19], opening a new era for street stalls. Efforts to reimagine street livability have also emerged from academic and professional communities [20], explored how street-level interventions such as benches, mobile kiosks, and planters, can mediate between public behavior and urban systems to support more inclusive, flexible, and vibrant street life.

This research aims to objectify the focus zone in subjective assessments of visual attractiveness in street stalls by using eye-tracking technology, while also revealing substantial aspects of behavioral setting typology as a complement, highlighting how the visual attractiveness of street stall in foreign scenery might inform adaptive strategies for Japanese street stall revitalization while respecting their traditional spatial character and cultural significance.

3. Methodology

3.1 Framework:

This research investigates the visual attractiveness of street vendors by applying three steps framework that combines photo segmentation, visual assessment and eye-tracking, with a comparative lens between Southeast Asia and Japan. The study began with collecting and segmenting photographs from street vendor scenes to extract key spatial components of stalls and streetscape environment [21]. This visual database was used in a perception-based questionnaire using selected photos from the previous data set. The questionnaire involving students from Shimane University, with balance distribution of prior experience with Asian street food, personal interest in street food culture, and visits to well-known areas like Hakata Street food district. Participants shared their opinion about street food culture with many highlighted the liveness aspect of these stalls on the street, while also voicing concerns related to food hygiene, limited physical space, and messy surroundings. These responses were used to interpret behavioural settings and visual appraisal factors that influence overall appeal and appeal reason.

As the same time with the questionnaire, participant gaze was collected using eye tracker to identify visual hotspots and understand how participants' gaze patterns correspond to specific spatial arrangements and visual cues. The correlation of these three parameters will contribute to understanding how Visual Attractiveness of street stall is shaped by the spatial setting, visual display and attention, especially in comparison between Japanese context of Hakata and other countries. The outcome could be beneficial to new spatial and visual strategies that can help optimize engagement with street vendors and create more attractive and livable urban public spaces. Fig.1 summarizes the steps and parameters in each focus area.

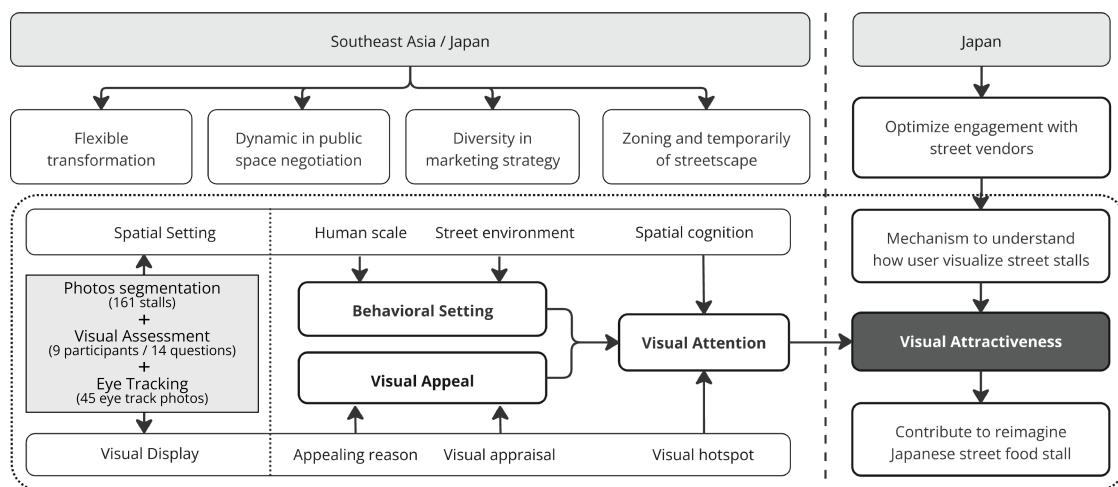


Figure 1. Framework

3.2 Photo segmentation and questionnaire:

The data collection process began with the compilation of 161 street stall scene photographs taken in Japan and four Southeast Asian countries: Vietnam, Thailand, Malaysia, and Indonesia (Figure 2). The number of street stall photo is equal between each country. These photographs were categorized into two primary groups: Street Environment (SE), which emphasizes the street stall's presence within the broader streetscape context, and Product Elements (PE), which focuses on the physical components of the stall related to accommodation and product information. Each image was manually segmented to isolate relevant visual elements such as streets, pavements, buildings, and other physical features for SE, and accommodation setups and signage for PE.



Figure 2. Representative examples of Southeast Asian street stall

The next stage involved the distribution of a structured questionnaire to nine participants. We prepared 4 photo sets, each set containing 2 photos of Hakata Street stalls and 8 photos of Southeast Asian Street stalls. Participants rotate between each set to answer questionnaire. Also, the photo set is divided equally between PE and SE to the 14-question survey, covering streetscape atmosphere topics like product variety, menu clarity, cleanliness, and food presentation. SE questions explored how stalls enhanced street liveliness and drew pedestrian attention, while PE questions focused on user comfort and information accessibility. The questionnaire first asks the participant to rate the photo then to give reason for their rating. Ratings were recorded using a five-point semantic differential scale, ranging from 1 (very negative) to 5 (very positive). Furthermore, the reasons given are categorized based framework of visual appeal proposed by Nasar: physical elements, referring to settings features; perceptual quality, which reflects emotional reactions to the surrounding; personal preferences, such as familiarity that contributes to cultural uniqueness; and composition, encompassing visual balance, contrast, and hierarchy. This categorization enabled a deeper exploration shape public perception of street stalls across diverse urban landscapes.

3.3 Eye tracking:

Traditional questionnaires often fail to fully capture the reasons behind choices, but eye tracking reveals subconscious responses through patterns of eye fixation. In consumer research, eye tracking can reveal subconscious thoughts and decisions influencing purchasing patterns, potentially becoming a mainstream marketing tool [22]. It is also found that human visual observation is closely related with interpretation [23], which could lead to deepen the understanding of evaluation of street stall. Using the eye tracking method, we aimed to capture how participants visually perceived a scene while responding to each topic in the questionnaire. Real-time heat maps were recorded and analyzed to visualize participants' eye movements and areas of focused visual attention during specific questions. Scan paths were also used to identify the exact spots each participant observed [24]. However, because scan paths can become cluttered with too many tracings, we combined both heat maps and scan paths in our analysis. By studying the segmented heat map videos alongside the scan paths, heat maps, and original photos, we aimed to uncover the underlying visual reasoning behind participants' evaluations, insights that are often rooted in subconscious perception.

4. Results and discussions

4.1 Behavioral Setting from human scale and street environment:

The behavioral setting emerging from street stalls reflects a dynamic interaction between physical space and human scale within the street environment. To examine the behavioral settings, our study employed systematic photo analysis by categorizing 161 photographs into two sets: street environment (SE, n=94) and product elements (PE, n=67). The SE set was used to identify

behavioral tendencies shaped by the spatial relationship between stall placement and surrounding physical attributes, while the PE set focused on the range of activities enabled by the design and accommodations of the stalls. As shown in Figure 3, the analysis revealed six distinct typologies, demonstrating how street vendors strategically position themselves within the urban fabric to maximize visibility and customer comfort. Street stalls in Hakata are categorized under BS1, positioned on pavement with unobstructed open spaces to create a distinctive identity by traditional designs modern commercial setting and portable furniture. Regarding PE, these stalls generally accommodate around 14 people in a tightly arranged seating layout encircling a central cooking zone. This compact configuration fosters a warm, intimate atmosphere that encourages direct social interaction, while modular eaves and screens enhance comfort.

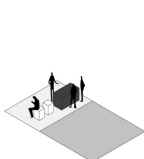
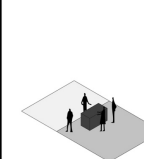
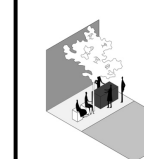
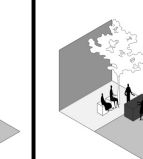
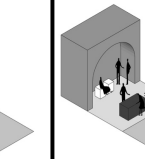
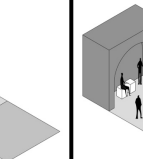
BS1			BS2			BS3			BS4			BS5			BS6		
																	
Number of Stall: 16	SE 12	PE 4	Number of Stall: 27	SE 16	PE 11	Number of Stall: 34	SE 18	PE 16	Number of Stall: 12	SE 8	PE 4	Number of Stall: 46	SE 23	PE 23	Number of Stall: 26	SE 17	PE 9

Figure 3. Typology of street stall behavioural setting

As demonstrated from previous research [11], street vendors demonstrate sophisticated adaptation to their surroundings. The basic street stall model BS1, located on the pavement, is often associated with more dynamic activity, particularly in areas with wide pedestrian routes that facilitate an informal vendor operation. BS5 utilizes architectural features such as building canopies or small overhangs for shade and shelter. BS3 stalls are positioned near trees scattered along streets intentionally seek cooler atmospheres. Roadside vendors typically operate within clearly defined boundaries, either due to government regulations or in areas with low vehicular traffic [15]. As outlined in BS2, these vendors typically do not offer on-site dining, as the limited safe zone for pedestrians must also accommodate individuals waiting for their order in front of the street stall. To improve the leisure from BS2, street stalls categorized under BS4 and BS6 typologies utilize shaded areas such as tree canopies and building overhangs as designated seating area, this arrangement emphasize the strategic use of additional space to enhance convenience, without disrupting pedestrian circulation along the sidewalk while continuing to prioritize customer safety on the roadside.

These findings reveal a clear tendency that human interaction in street environment (SE) tends to concentrate in shaded, unobstructed, and spatially accessible areas, where comfort and safety align with pedestrian circulation. Regarding product elements (PE), street stalls tend to operate in shaded areas to maintain the quality of their goods and to provide comfort for space users from direct sunlight and light rain. The diversity of behavioral setting patterns observed through the lens of SE and PE sparks deeper curiosity about which specific parts of the street stalls successfully capture people's attention and motivate them to engage in activities there.

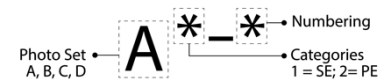
4.2 Visual Appeal from visual appraisal and appealing reason:

Display strategy plays a key role in attracting attention beyond spatial layout and positioning. Vendors often extend their merchandise into terrace arcades to enhance visibility without

disruption to pedestrian flow and visual sightlines [15]. Additional strategies involve employing visual contrast, ensuring transparency during food presentation to convey hygiene and freshness, and utilizing locked transparent window display to maintain product visibility beyond operating hours, optimizing appeal within temporally and spatially constrained public settings [14].

	Sample (40)	Rating		Appealing Reason
		DS	DI	
SE	B1-1, C1-1, D1-1	●	●	latern, unique atmosphere, variety of food, seating area, bright, lively, rain protection,
	D1-5, B1-4, B1-3	●	◎	hygienic, clear product, delicious, curtain, matches atmosphere, clean, roof, people, seating
	A1-1, B1-2, C1-2, C1-3, D1-1, D1-2	◎	●	unclear menu, raw food, brighten the atmosphere, colorful picture, fresh, clean, visible sign, unique, hygienic, display case
	B1-5, C1-4, D1-3	◎	◎	eye-catching stall, dark, latern, sign, blocks the way, unclear product, beautiful, closed
	A1-2, A1-3, A1-5, D1-4	◎	○	not clean, colorful, case, no product name, curious about the atmosphere, blends into city
	A1-4	○	◎	scary atmosphere, unique product, dirty accomodation, not lively
PE	A2-1, B2-1, C2-1, D2-1,	●	◎	readability menu, cooler box, cooked food, hygiene, on-site cooking, dining, variety dishes
	A2-3, A2-4, B2-2, B2-3, B2-4, B2-5, C2-3, D2-3	◎	●	no product name, food, stall, trays, nearly arranged, common, clean, cheap, unreadable menu, variety, storage, elaborate dish, on-site cooking
	C2-4	◎	◎	yakitori, people sitting, unreadable, visible, sign pictures, easy to understand, vibe, bad taste
	A2-5, C2-2, C2-5, D2-2	◎	○	unreadable text, not clear, display, title, door, hygiene, ingredients, delicious, taste
	A2-2	○	◎	scary, food, no information, no price, no products, unappealing display, not neat.

Figure 4. Visual Appeal from visual appraisal and appealing reason. The first dominant option was identified based on significance (DS), while secondary preferences were considered under dominance inclusion (DI). Significance symbol: ● Good, ◎ Moderate, ○ Bad.



The analysis was conducted in two stages. Firstly, the 5-point Likert scale was simplified into three categories; good, moderate, and bad, to reduce subjectivity and maintain rating balance on appealing reason. Secondly, evaluation significance was determined for parameters in each photo based on responses by more than 50%. Figure 4 illustrates respondents' evaluation regarding the visual appeal of street stall scenes. In SE set, a significance at the poor level (1/20) reflects the presence of unhygienic accommodations within an unsupportive surrounding environment discouraging visitors, while at the moderate level (13/20) suggests that although the lack of legibility and hygiene, the visual elements and a lively atmosphere sparks the curiosity to explore more. Furthermore, at good level (6/20), a balance achieved through the provision of clear information, decent accommodation, product presentation quality, offering unique dining or shopping experience that contributes positively to the rating. In PE set, the bad level (1/20) is influenced by the lack of basic information and an overall untidy and unappealing appearance. At the moderate level (13/20), mixed perception between ineffective visual and functional values indicate that practical value can offset visual limitations. In contrast, good level (6/20) highlights the importance of readable menus and visible food preparation in perception of quality and hygiene significantly contribute to overall attractiveness. Hakata street stalls rated at good level in both SE and PE categories, the presence of these establishments within the lively atmosphere of Japanese urban environments, along with legible signage, familiar products, and evident hygiene standards, indicates that Japanese respondents have become more critical and observant in their evaluation of street stalls, even while continuing to rate positively overall. Furthermore, the distribution of keyword frequencies reveals the tendency of large groups in each photo set. SE set has a tendency toward the *Atmosphere* and *Quality*, while in PE it is *Quality* and *Legibility*.

4.3 Visual Attention from spatial cognition and visual hotspot:

We analysed changes in visual attention by examining participants' visual hotspots while they answered the questionnaire, focusing specifically on gaze segments related to the set of tendency

mentioned above. By overlapping the scan paths recorded for each participant with segmented photos, we observed shifts in attention patterns that revealed how the nine participants directed their visual attention when viewing a Japanese street stall scene. Their attention tendencies are summarized in Figure 5, where four common patterns were identified, as defined in the accompanying explanation. These tendencies varied depending on whether the visual hotspots fully or partially overlapped with the areas of interest mentioned in the questionnaire. This variation, especially when considered alongside questionnaire responses, highlights how participants interpreted street stalls, some based their evaluations solely on stall-specific elements, while others considered the broader streetscape context.

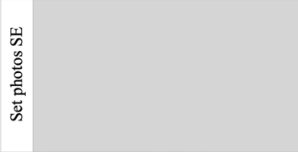










	Tendency 1	Tendency 2	Tendency 3	Tendency 4
Definition	Most key interest area are overlaps with the rest of visual attention throughout the whole questionnaire	Some key interest area are overlaps with the visual attention of the rest of questionnaire	There is a diversity in overlapping between key interest area and between key interest and the rest	Separated topic of key interest are overlaps with the rest of visual attention
Set photos SE				
Set photos PE				
	 All key interest area overlaps with the rest  Only one key interest area overlaps with the rest  No key interest area overlaps with the rest			

Figure 5. Visual Attention tendency of Hakata Street Stall

Building on these observations, we explored how visual attention tendencies shifted when participants viewed a foreign streetscape. We assumed that unfamiliar environments would prompt greater reliance on additional contextual cues such as vendors, displays, and decorations [25]. The resulting changes in visual attention are also presented in Figure 6. In both PE and SE categories, whether the tendency remained consistent or changed depended on the individual participant. Notably, when visualize a Japanese streetscape, participants tend to observe diverse elements around the street stalls (Tendency 3) while for the Southeast Asian Street stall, people tend to focus on particular area to collect information (Tendency 2). It could be understood because of the difference between the unfamiliar scenery and unknown information on the products and the scenery that people are used to seeing. Also, for some participants, the amount of visual information present in the streetscape photos significantly influenced their attention tendencies. For instance, in the case of P6 of SE, limited stall information—such as the absence of readable text or clear product photos—prompted the participant to shift attention toward peripheral elements like the vendor’s face or hand gestures. Conversely, in P6 of PE, where the display included Chinese characters and larger product images, the participant’s attention tendency more closely matched that observed in the Japanese streetscape scene. This suggests that richer visual cues support more consistent and directed visual attention across different environments. Furthermore, tracing down to the background of participant concerning their experience and preference with street food culture, we can observe some consistency in tendency of visual attention when it comes to person without an oversea experience (P3, P8) when their tendency remain the same between different streetscape and street environment. Notably, a person with certain experience tends to have some prejudice about the environment which makes

their attention tendency focus on predefine area (banners, food display, what other clients are eating) when it comes to key interest area such as Quality and Atmosphere.

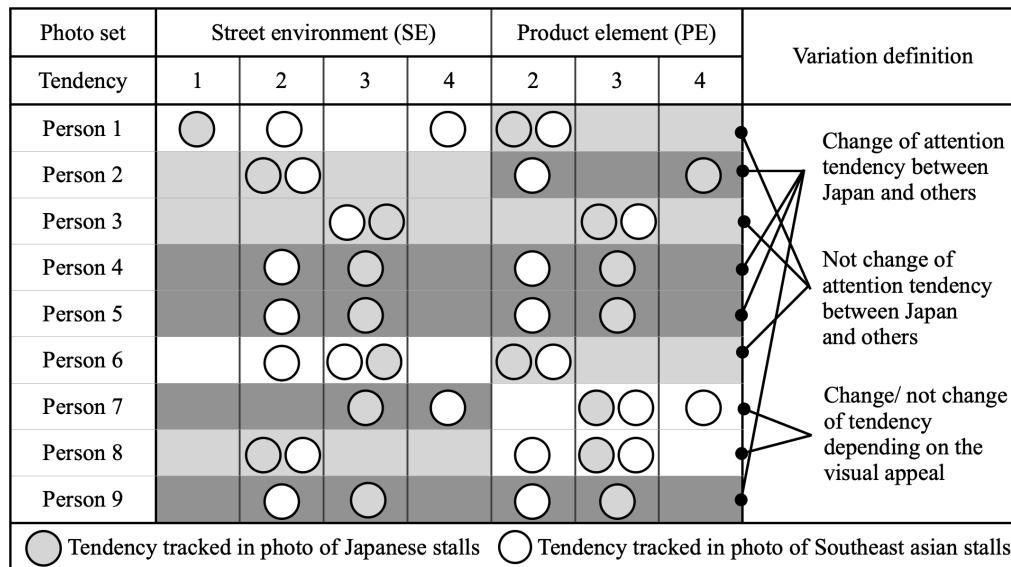


Figure 6. Variation of tendency in user' attention

5. Conclusion

This study investigates the visual attractiveness and spatial dynamics of street stall by comparing practices between Japan and Southeast Asian countries, focusing on revitalizing Japanese street stall culture while preserving its identity. The findings shows that the attractiveness of street stalls is formed through the interconnection between spatial configuration, visual display, and user attention patterns. Responsive spatial layouts such as the use of sidewalks, shaded areas, and seating arrangements surrounding the cooking zone can foster more intense social interaction. Regardless of linguistic comprehension, the presence of clean visuals, clearly legible menus with images, and open food displays has been shown to enhance perceived quality and capture user attention. Eye-tracking data further indicates that visual attention tends to concentrate on informative and aesthetically pleasing elements, particularly in unfamiliar settings, while users exhibit more critical observation in familiar environments. These findings suggest that user experience is influenced by physical design, visual and cultural perception. Accordingly, efforts to revitalize Japanese street stall culture should prioritize spatial flexibility and visual clarity to ensure relevance in contemporary urban contexts, while maintaining its traditional identity.

While respondents offered varied preferences, the limited sample size may not sufficiently reflect the full spectrum of user perspectives across age groups and cultural backgrounds. To gain deeper insights, future studies may adopt interdisciplinary approaches in the development of virtual environments, such as applying rendering based on user feedback, and include broader participant groups, particularly those from foreign cultural backgrounds. This broadened lens from multiple viewpoints will contribute to the conservation of adaptive street stall presence as an integral component of historical urban value and evolving contemporary preferences.

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