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Spatial Behavior in Urban Park Seating: Distinct Explanatory Patterns of Interpersonal Distance and Body Orientation in Nagano City, Japan

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Abstract

Interpersonal distance and body orientation are theoretically related but non-interchangeable dimensions of spatial behavior. However, park-sitting studies have generally examined them separately, leaving limited evidence on whether the same human, spatial, and contextual conditions are associated with each behavior differently. This observational case study examined and directly compared these associations in two urban parks in Nagano, Japan. Systematic observations using video recording produced 1422 sitting instances, each representing a solitary user or seated group. Separate hierarchical multinomial logistic regression models were applied to both behavioral dimensions using the same set of variables. Separated sitting (47.0%) and pathway-facing orientation (58.7%) were the most common patterns. Adding contextual factors produced the greatest improvement in model fit for interpersonal distance, particularly through park setting, day type, and time of day. In contrast, body orientation was more strongly associated with immediate spatial conditions, especially seating constraints and spatial openness. These findings extend the theoretical distinction between distance and orientation to naturally occurring park behavior and demonstrate that they should not be treated as interchangeable indicators. Park design should therefore provide both proximity and directional choices through distributed and varied seating configurations adapted to site-specific conditions.

Keywords: public seating; sitting behavior; park usage; social engagement; environmental engagement

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1. Introduction

1.1. Interpersonal Distance and Body Orientation in Public Park Sitting Behavior

Sitting in an urban park is an activity that involves more than occupying an available seat. Seated users position themselves in relation to companions, unfamiliar users, pedestrian activity, and surrounding environmental features. Research on public benches has shown that sitting involves decisions about where and with whom to sit, practices of watching others, and responses to the physical and environmental conditions of the setting [1,2]. These different ways of occupying a sitting space suggest that park sitting is a spatially organized behavior involving both users' proximity to others and their bodily orientation toward the surrounding setting. In spatial behavior studies, interpersonal distance and body orientation have been treated as distinct observable dimensions of how

people organize interaction in a space [3–5]. Although these two dimensions often appear together, they should not be treated as interchangeable indicators. Gifford and O'Connor [6] showed that seating distance and orientation play different roles in nonverbal behavior. Distance was more strongly related to perceived intimacy, whereas orientation appeared to function more as a means of regulating interaction. This distinction suggests that how close people sit to others and where they direct their bodies in urban parks may reflect different dimensions of spatial behavior.

Interpersonal distance in the perspective of proxemics, personal space, and privacy theories is explained as a way of regulating social interaction and access to the self [7–9]. Later reviews further emphasize that personal space is not fixed, but varies according to social, cultural, personal, and situational factors [10–13]. In the public sitting studies, Burgess [14] found that companions tended to stay close together, whereas spacing from the nearest strangers was largely random and less predictable. In a Japanese public sitting setting, however, Yoshida et al. [15] identified more recognizable patterns among unrelated individuals and groups seated along a linear urban open space in Tokyo. Users maintained greater distances under low-density conditions, while increasing occupancy reduced the distance they could maintain. This suggests that spacing among unrelated seated users may not be entirely random but may adjust to the availability of space and surrounding occupancy.

Body orientation represents another important aspect of public sitting behavior because it indicates the direction of users' attention, interaction, and engagement with their surroundings. In studies of nonverbal and spatial behavior, body orientation has been discussed together with interpersonal distance, gaze, and posture as part of how people organize social encounters [8,9,16–18]. In public spaces, however, orientation is not only related to direct social interaction. People may also orient themselves toward pedestrian movement, surrounding activity, greenery, open spaces, or views, reflecting passive engagement with public life and the surrounding environment [19–21]. Experimental research in Japan found that how users direct their body while sitting on a public bench affects sitting preference [22,23]. A specific study in a park bench setting in Osaka, Japan found that how users orient their bodies depends on the social form and activities performed [24]. Sitting toward the environment features, particularly the pond, was associated with more individual activities, such as eating, reading, smoking, or viewing scenery, whereas sitting in the sidewalk direction was associated with more social activities among the elderly. This indicates that body orientation can shape the functional, social meaning, and preference of a seating place. Thus, body orientation can help explain not only where people sit, but also what they attend to while occupying park seating spaces.

The selection of these two variables is further supported by observational research in urban design. Aelbrecht [25] applied body-language methods to analyze the spatiality of informal interactions in public settings through body orientation, social distance, and tie-signs. The present study focuses on distance and orientation since they directly represent two complementary positional dimensions of sitting behavior: how users are spaced and how their bodies are directed within the seating setting. Tie-signs were not included because they primarily indicate affiliation or cooperation and require observable interaction, making them less applicable to park sitting situations that often involve individual use and to instances in which users orient toward environmental features rather than other people. Similarly, other micro-behaviors, such as posture, gaze, gestures, and duration of stay, represent postural, attentional, communicative, or temporal dimensions beyond the present analytical focus.

Understanding these two dimensions is relevant not only for describing spatial behavior but also for explaining how seating micro-settings support different forms of public

space use. Gehl distinguished optional and social activities from necessary activities and argued that favorable physical conditions encourage people to remain in public spaces, thereby increasing opportunities for seeing, hearing, and encountering others [20]. From an urban health perspective, the built environment can influence health and well-being indirectly by shaping behavior, with proximity, healthy lifestyles, and inclusion identified as important dimensions of healthy neighborhoods [26]. More specifically, urban furniture, including seating, can support rest, informal meetings, social relationships, and inclusive participation in everyday public life [27]. From this perspective, interpersonal distance and body orientation provide observable indications of how park seating micro-settings accommodate privacy, co-presence, social interaction, and engagement with the surrounding environment. Although the present study does not measure health outcomes, it examines behavioral mechanisms through which park seating environments may contribute to socially supportive public spaces.

1.2. Factors Associated with Sitting Behavior in Japanese Parks and Public Spaces

The categorization of explanatory variables into human, spatial, and contextual factors was developed as an analytical synthesis of the literature reviewed in this section and was not adopted from a single observational tool. This organization is broadly consistent with Han et al. [28], whose systematic review of behavior in public open spaces distinguished factors related to people's backgrounds, environmental components, location and context, and climatic conditions. For the present study, human factors describe users' social composition, attributes, and activities; spatial factors describe the immediate physical conditions of the seating environment; and contextual factors describe the broader park and temporal conditions under which sitting behavior occurs. These categories are intended as broad analytical domains rather than a universal taxonomy; their specific variables and category boundaries reflect the Japanese literature and study settings and may require adaptation across cultural, socio-demographic, climatic, and regional contexts [5,10–13,28].

1.2.1. Human Factors

Human factors shape sitting behavior because seated users occupy public spaces with different social compositions, attributes, and activity purposes. Group size reflects the social arrangement of sitting behavior, from sitting alone to sharing space, interacting with others, or sitting in larger groups. Observation on bench use in Tokyo varied according to whether users sat alone, shared space with others, or engaged in social interaction with companions [29–31]. Endo et al. [32] also observed users in an urban main street in Osaka sitting alone, as a couple or dyad, and in groups with family and friends, indicating that group attributes are commonly used to describe differences in behavior in public spaces. Gender and age are also relevant because sitting behavior in parks in Osaka has been reported to vary according to user attributes, particularly age and gender groups [24]. Activity type reflects what users do while occupying a seating space and may shape their spatial requirements and engagement with companions, other users, and the surrounding environment. Observational studies of Japanese parks and public spaces have documented diverse activities among seated users, including resting [24,33,34], eating and drinking and smoking [15,24,34], reading and mobile-phone use [24,34], conversing [24,29,33,34], waiting [15], and observing the surroundings [33]. Other setting-specific activities, including sleeping, playing shogi, exercising, and caring for pets, have also been reported [24,34]. Together, these human factors may influence both the proximity users maintain while sitting and whether they direct their attention toward companions, public activity, or environmental features.

1.2.2. Spatial Factors

Previous studies suggest that the spatial conditions associated with public sitting behavior can be organized into four recurring aspects: seating constraint, spatial openness, social exposure, and thermal exposure. These aspects are discussed below and subsequently used to structure the spatial variables examined in this study. Seating constraint refers to the extent to which the form and arrangement of sitting facilities limit or enable users' possible positions and orientations. Backrests influence the affordances and constraints of bench use. While they provide physical support and may improve the perceived suitability of benches for resting, particularly among older users, they also restrict the directions in which users can sit. In contrast, backless benches provide greater flexibility in sitting orientation [24,35]. Spatial openness reflects the degree of visual access, enclosure, privacy, and comfort provided by the setting. Studies in Japanese parks have shown that visually separated areas, tree canopies, and vegetation can encourage sitting behavior by creating more comfortable and protected spaces [33,36]. Social exposure refers to how strongly seated users are exposed to pedestrian flow, crowdedness, and visibility from others. Places near pedestrian corridors within public open spaces have been associated with more frequent sedentary behavior [37]. Users have been shown to choose sitting places depending on surrounding atmosphere, such as whether the place is crowded or calm, close to pedestrians, or visible to many people [15,38], while elements that obstruct lines of sight can also support sitting behavior [36]. Thermal exposure also affects sitting behavior because shade and sunlight influence the comfort and attractiveness of sitting places. Shaded areas and benches under trees have been reported as popular or differently used sitting places in Japanese urban parks [24,33,39,40]. Furthermore, sun exposure may mitigate reductions in sitting activity as temperatures decrease [41].

Taken together, previous studies indicate that these four spatial conditions are relevant to the selection and use of sitting places. From an affordance perspective, Gibson conceptualized affordances as what the environment offers or provides to an actor [42], while Withagen et al. further argued that affordances can invite behavior [43]. Applying this perspective, seating constraints are understood as affecting which positions and directions are physically available, whereas spatial openness, social exposure, and thermal exposure may affect which of these options appear attractive, appropriate, or comfortable. Interpersonal distance and body orientation are therefore examined as observable positional responses through which users adapt to these spatial possibilities.

1.2.3. Contextual Factors

Contextual factors explain variation in sitting behavior according to when and where the behavior occurs. Time of day and day type affect park use because people visit and occupy seating spaces differently across daily routines, such as morning, noon, and afternoon, as well as between weekdays and weekends. Research on bench sitting behavior in an Osaka park observed users across different times of day and between weekdays and holidays, showing that sitting behavior varies according to temporal conditions [24]. Park differences are also important because each park has different spatial settings, facilities, accessibility, vegetation, seating distribution, and surrounding atmospheres. Studies of Japanese parks in Kitakyushu have shown that sitting and bench usage vary across parks in relation to spatial layout, facility distribution, and surrounding urban context [33]. Season further shapes sitting behavior because thermal conditions, sunlight, shade, and vegetation change between summer and autumn. Previous studies of Japanese parks have examined sitting and staying behavior in summer and autumn and reported that users' behavior, spatial distribution, and preferred areas vary according to seasonal conditions [15,33,39]. These conditions may alter the availability, density, and social at-

mosphere of seating areas, thereby changing how users position themselves in relation to others and their surroundings.

1.3. Research Gap and the Current Study

Interpersonal distance and body orientation are theoretically related but non-interchangeable dimensions of spatial behavior. Distance primarily regulates proximity, privacy, and perceived intimacy, whereas orientation helps regulate social interaction and attention to the surrounding environment [6–9]. However, studies of public sitting behavior, including those conducted in Japanese parks and public spaces, have generally examined these dimensions separately or as components of broader outcomes such as park use, staying behavior, seat choice, and seating facility use. Consequently, limited empirical evidence exists on whether their theoretical distinction is also reflected in everyday park settings when the same human, spatial, and contextual factors are considered.

This gap is important because treating interpersonal distance and body orientation as interchangeable indicators may conceal how seated users respond differently to social and physical conditions. A seating environment that enables users to regulate proximity may not necessarily provide equivalent flexibility in orientation and environmental engagement, and vice versa. Comparing the two behaviors using a consistent set of explanatory factors and analytical procedures can therefore clarify their respective patterns and inform more behaviorally responsive park seating design.

To address this gap, this observational study examines sitting behavior in two urban parks in Nagano City, Japan. Its primary objective is to examine and compare how interpersonal distance and body orientation are associated with human, spatial, and contextual factors under the same empirical conditions. Applying the same variables and modelling sequence to both behavioral dimensions enables a direct comparison of their explanatory patterns. Beyond documenting sitting behavior, this comparison provides an empirical basis for considering distance and orientation separately when selecting and arranging seating facilities and their immediate surroundings in new park projects and park-renewal processes. Based on this approach, this study addresses the following research questions: (1) What are the characteristics of interpersonal distance and body orientation while sitting in urban parks? (2) What human, spatial, and contextual factors are associated with interpersonal distance and body orientation in public park sitting behavior? (3) Do interpersonal distance and body orientation show different patterns of association across hierarchical models?

2. Materials and Methods

This study forms part of a broader doctoral research program examining human–environment relationships in green spaces through observational and experimental investigations of sitting behavior. The present paper specifically focuses on naturally occurring interpersonal distance and body orientation in urban park seating. The research workflow for the present study is presented in Figure 1.

2.1. Study Site

This research was conducted in Wakasato Park and Joyama Park in Nagano City, Japan. The two parks were purposively selected based on three criteria: (1) public accessibility and regular use for everyday activities, including sitting; (2) the presence of multiple seating areas with varied immediate spatial conditions relevant to the study variables; and (3) accessibility for repeated observations across different days, times, and seasons using a consistent field protocol. Both sites are relatively large, multifunctional urban parks, but differ in their broader spatial and functional contexts. Their selection therefore provided

varied sitting settings for examining the human, spatial, and contextual factors associated with interpersonal distance and body orientation.

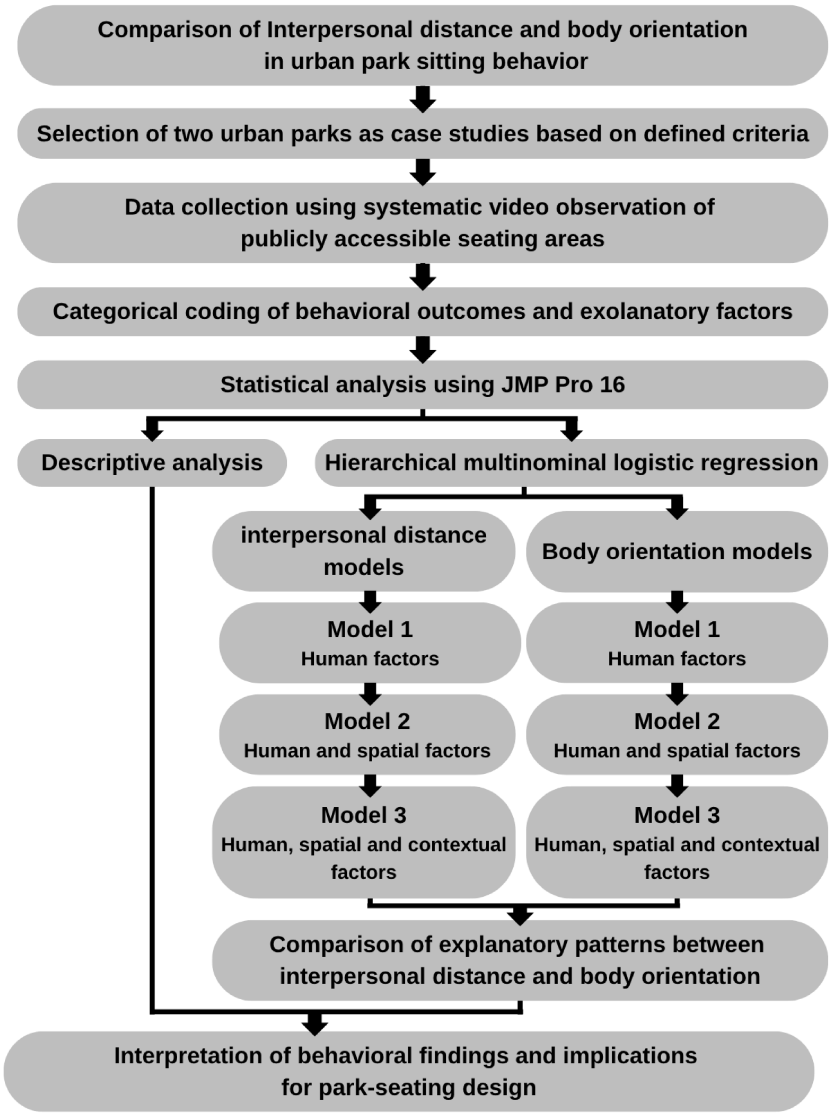


Figure 1. Research workflow.

Wakasato Park is a prefectural urban park covering approximately 0.058 km^2. Located in a relatively dense residential area, it is surrounded by public and cultural facilities, including the Nagano Prefectural Library and Hokuto Culture Hall. The park has a relatively open and everyday-use character, with a large lawn, playgrounds, walking paths, and seating areas distributed around green and open spaces. Joyama Park is a municipal comprehensive park located near major roads and the Zenkoji Temple area and associated with recreational and cultural facilities, including the Nagano Prefectural Art Museum. The study area within Joyama Park covered approximately 0.049 km^2, as delineated in Figure 2, and included the public open spaces and seating settings examined in this study. Compared with Wakasato Park, the observed area has a more destination-oriented character and receives visitors associated with nearby recreational, cultural, and tourism activities. Thus, the two sites provided contrasting broader park contexts as well as varied immediate seating-area conditions relevant to the research questions. The locations of the seating areas observed in each park are shown in Figure 3.

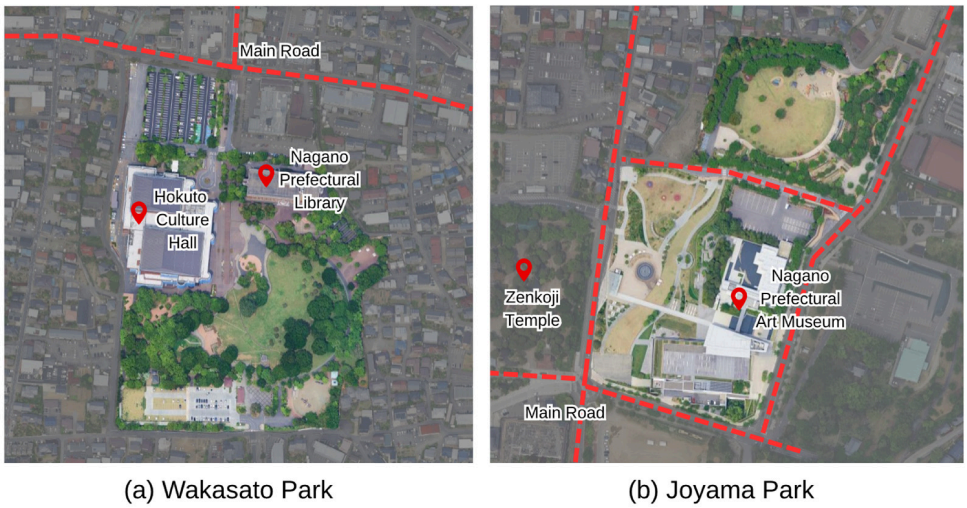


Figure 2. Locations and surrounding context of the study sites.

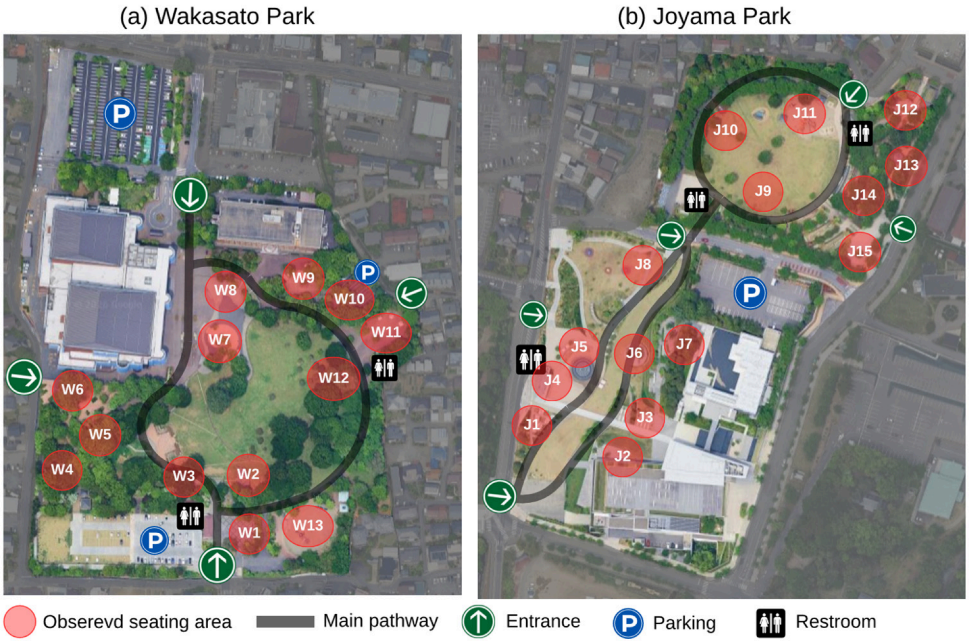


Figure 3. Locations of the observed seating areas.

2.2. Measurement of Variables

This study examined sitting behavior through two outcome variables: interpersonal distance and body orientation. Interpersonal distance was coded into three categories: adjacent, near, and separate. Interpersonal distance represented the observable separation between a seated individual or group and the nearest unrelated user or group and was classified as adjacent, near, or separate. The classification was informed by the broader logic of Yoshida et al. [15], who examined interpersonal separation among unrelated seated users under different occupancy conditions. Since the seating areas differed in form, size, and arrangement, distance was represented categorically rather than through a single metric threshold. A seating area was defined as a visually and functionally identifiable cluster of benches or stools sharing the same immediate spatial setting. Body orientation represented the principal direction faced by seated users and was classified as facing inward, facing the pathway, or facing the view, reflecting orientations toward companions, public activity, and environmental features identified in previous park-seating research [24]. However, all these categories created were operational classifications based on observable spatial relation-

ships within the seating facilities and were not intended to represent universal proxemic distance thresholds.

Figure 4 illustrates the interpersonal distance categories, while Figure 5 illustrates the three categories of body orientation used in the analysis. The complete coding criteria for both outcomes are provided in Table 1.

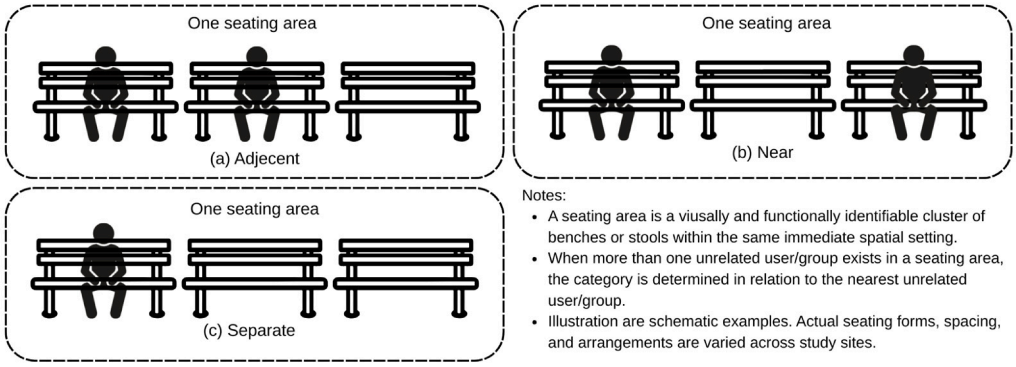


Figure 4. Schematic illustration of interpersonal distance categories used in the observation.

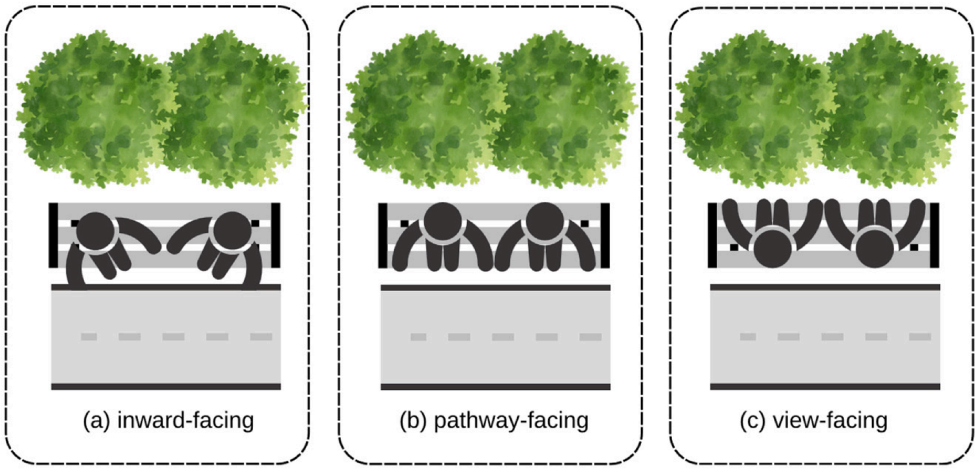


Figure 5. Schematic illustration of body orientation categories used in the observation.

Table 1. Operational definitions and coding criteria for the study variables.

Variable Group	Variable	Category	Coding Criteria
Sitting behavior	Distance	Adjacent	The focal user or group occupied a sitting position directly neighboring another unrelated user or group, without a clear spatial gap between them.
		Near	The focal user or group occupied the same seating area as another unrelated user or group, but a clear spatial gap was present because of vacant sitting space, wider spacing between sitting units, or seating arrangement.
		Separate	The focal user or group occupied the seating area without other unrelated users or groups.
	Orientation	Facing inward	Users orient their bodies toward companions or toward the inside of their group arrangement. This category applies only to dyads or groups.
		Facing pathway	Users orient their bodies toward pedestrian movement, circulation paths, or surrounding public activity.
		Facing view	Users orient their bodies toward landscape elements, open green space, or environmental views rather than toward pathways or other users.

Table 1. *Cont.*

Variable Group	Variable	Category	Coding Criteria
Human factors	Group size	Alone	One seated user
		Dyad	Two seated users sitting together
		Group [r]	Three or more seated users sitting together
	Gender composition	Male	All observed seated users are male
		Female	All observed seated users are female
		Mixed [r]	Seated users include both male and female users
	Age composition	Young [r]	Seated users or all visible group members appeared to belong to a younger age group, including children, teenagers, students, or young adults
		Adult	Seated users or all visible group members appeared to belong to an adult age group
		Older	Seated user or all visible group members appeared to belong to an older adult age group
		Mixed	Visible group members appeared to belong to more than one age group
	Activity type	Social [r]	Users are engaged in active social interaction, such as talking or interacting with companions
		Passive	Users are engaged in low-interaction sitting behavior, such as resting, waiting, or observing surroundings.
		Functional	Users are engaged in other individual or incidental activities, such as eating, reading, using the phone, or taking care of children.
Spatial factors	Seating constraint	High [r]	Seating form strongly limits sitting direction or body orientation, such as benches with fixed backrests.
		Medium	Seating environment allows some flexibility but is partly influenced by physical elements such as tables, roofs, or surrounding features.
		Low	Seating form has no fixed directional limitation and allows users greater freedom to choose sitting position and orientation.
	Spatial openness	Open	Seating area has broad visual access to the surrounding space and limited physical or vegetative enclosure.
		Semi-enclosed [r]	Seating area has partial enclosure by vegetation, structures, or other spatial elements, while still maintaining moderate visual access to the surrounding space.
		Enclosed	Seating area is substantially surrounded by vegetation, structures, or other spatial elements that limit visual access and create a more enclosed seating condition.
	Social exposure	High [r]	Seating area is directly beside pathways, central activity areas, or open locations where seated users are clearly visible to others.
		Medium	Seating area has moderate visibility and occasional exposure to surrounding users or activities.
		Low	Seating area is relatively hidden or less exposed to pedestrian movement and public activity.
	Thermal exposure	High [r]	Seating area has strong direct sunlight exposure and limited shade.
		Medium	Seating area has partial shade or moderate sunlight exposure.
		Low	Seating area is mostly shaded or protected from direct sun exposure.
Contextual factors	Park	Wakasato Park [r]	Observation conducted in Wakasato Park.
		Joyama Park	Observation conducted in Joyama Park.
	Season	Summer [r]	Observations conducted on days selected in advance when the forecasted daytime temperature exceeded 25 °C in August-October 2025.
		Autumn	Observations conducted on days selected in advance when the forecasted daytime temperature was below 15 °C in October–November 2025.
	Day type	Weekday	Monday–Friday.
		Weekend [r]	Saturday–Sunday.

Table 1. *Cont.*

Variable Group	Variable	Category	Coding Criteria
Contextual factors	Time of day	Morning	07:00–09:00
		Noon [r]	11:00–13:00
		Afternoon	15:00–17:00

Note: [r] refers to reference category, i.e., the category against which the other categories are referenced in the multinomial logistic regression.

Based on the factors reviewed in Section 1.2, the explanatory variables were organized into human, spatial, and contextual factors. Human factors described the observable composition and activity of each seated individual or group and were coded for every observation unit. Spatial factors described the seating facility and its immediate environmental setting. Seating constraint, spatial openness, and social exposure were assigned to each predefined seating area before the video-based behavioral coding because they represented relatively stable spatial characteristics. Seating constraint was classified according to whether the seating form restricted users to a dominant sitting direction or allowed multiple sitting directions. Spatial openness was assessed according to visual access and the extent to which vegetation, structures, and other physical elements formed visible boundaries around the seating area, informed by previous classifications of visual and physical enclosure [44]. Social exposure was classified according to the seating area's position relative to main pedestrian routes and its direct exposure to passing users. Thermal exposure was coded separately for each observation according to the degree of direct sunlight and shade, because these conditions could change over time. Figure 6 presents selected examples of seating areas with different spatial conditions.

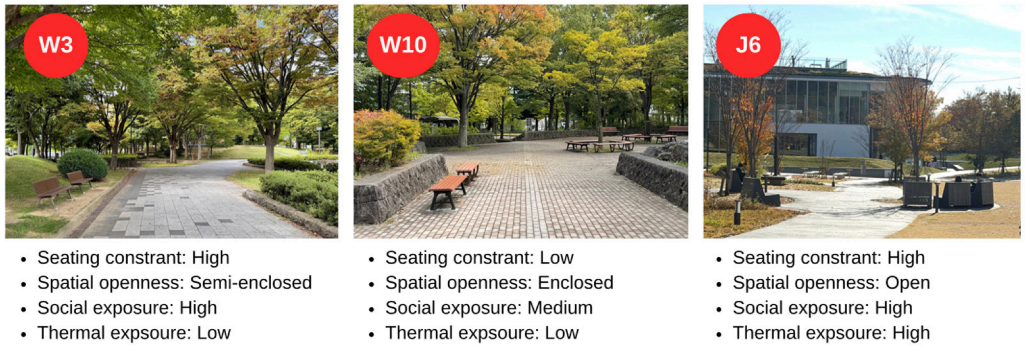


Figure 6. Examples of seating areas with different spatial conditions.

Contextual factors recorded the broader circumstances in which each observation occurred, comprising the park, season, day type, and time of day. Park, day type, and time were recorded directly according to the observation site and schedule, while the seasonal observation periods were distinguished using the predefined temperature-based criteria presented in Table 1. The definitions, categories, and coding criteria for all outcome and explanatory variables are summarized in Table 1.

2.3. Data Collection and Analysis

This study adopted a quantitative observational case-study strategy combining systematic observation using video recording, categorical behavioral coding, and statistical modeling. Systematic observation was selected because interpersonal distance and body orientation are naturally occurring, visually observable behaviors that can be documented without relying on self-reports. This approach is consistent with previous park-seating research documenting naturally occurring sitting behavior through repeated observation [24] and established public-life observation methods [45]. Video recording

allowed the observed situations to be reviewed repeatedly during coding. Similar video-based approaches have been used to document park users with wearable video devices [46] and to assess observable behaviors in outdoor public spaces [47].

Field observations were recorded using a chest-mounted GoPro camera (GoPro, Inc., San Mateo, CA, USA), allowing the recorded situations to be reviewed during coding. All publicly accessible benches and stools within the study areas were included. Observations were conducted during summer and autumn for four days per park in each season, comprising two weekdays and two weekend days. The fieldwork therefore covered 16 observation days. Each day was divided into morning, noon, and afternoon periods, as defined in Table 1. During each period, the researcher followed a consistent route and recorded the seating areas at 20-min intervals, producing 288 observation rounds. The unit of analysis was one seated individual or group observed during each observation round. All video recordings were reviewed and coded by the first author using the criteria presented in Table 1. When the same individual or group appeared in a subsequent observation round, the case was recorded again as a separate observational instance. Cases that could not be clearly identified because of obstruction, temporary movement, or camera angle were excluded.

Descriptive analysis was first used to summarize sitting behavior across parks, seasons, day types, and time periods. Two sets of regression models were then conducted separately, with interpersonal distance and body orientation as the dependent variables. The independent variables comprised human factors (group size, gender composition, age composition, and activity type), spatial factors (seating constraint, spatial openness, social exposure, and thermal exposure), and contextual factors (park, season, day type, and time of day). Because each dependent variable consisted of three unordered nominal categories, multinomial logistic regression was used [48]. This method estimates the association between the independent variables and the likelihood of each outcome category relative to a reference outcome and has previously been applied to categorical park-visitation and park-based activity outcomes [49,50].

The models were estimated in JMP Pro 16 (SAS Institute Inc., Cary, NC, USA) using the Fit Model platform with the Nominal Logistic personality. JMP treated separate sitting and facing view as the reference outcomes for interpersonal distance and body orientation, respectively, based on its response-level ordering; the reference categories for the independent variables are indicated in Table 1. For each dependent variable, three models were constructed hierarchically to investigate the association between variables and the relative importance of factors in specific categories [51]. Model 1 included human factors, Model 2 added spatial factors, and Model 3 added contextual factors. Here, "hierarchical" refers to sequential block entry rather than a multilevel model. Model fit was assessed using RSquare (U), predictor contributions using likelihood-ratio chi-square tests, and association directions using parameter estimates. Statistical significance was set at $p < 0.05$.

3. Results

3.1. Descriptive Analysis

A total of 1422 sitting observations were recorded across Joyama Park and Wakasato Park during the observation period. Figure 7 shows the distribution of observations by park, day type, and time of day. Overall, sitting observations were more frequently recorded in Wakasato Park than in Joyama Park across most observation periods. The highest frequency of sitting observations was found during weekend noon periods, particularly in Wakasato Park, whereas weekday morning periods showed the lowest frequency of observed sitting behavior.

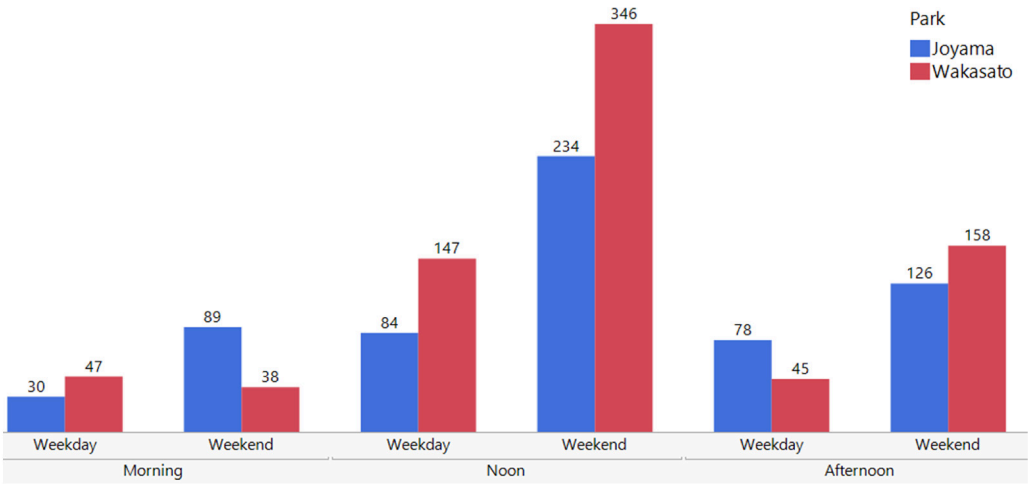


Figure 7. Distribution of sitting observations in Joyama Park and Wakasato Park by day type and time of day.

Figure 8 presents the overall distribution of interpersonal distance and body orientation. For interpersonal distance, separated sitting was the most frequently observed category (47.0%), followed by adjacent sitting (36.5%) and near sitting (16.5%). For body orientation, facing pathway was the most common orientation pattern (58.7%), followed by facing view (32.1%), while facing inward was relatively uncommon (9.1%). These descriptive results indicate that public park sitting behavior in the observed settings was generally characterized by spatial separation and outward-facing orientation rather than close distance and inward-facing group arrangements.

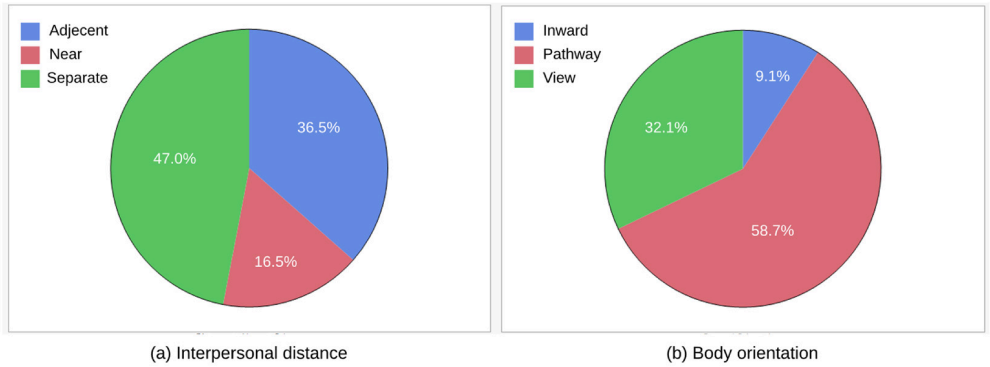


Figure 8. Distribution of observed sitting behavior.

3.2. Factors Associated with Interpersonal Distance

Table 2 presents the hierarchical multinomial logistic regression results for interpersonal distance, including parameter estimates and RSquare(U) values, while Table 3 summarizes the likelihood ratio tests for each predictor. Model 1 included human factors, Model 2 added spatial factors, and Model 3 added contextual factors. As shown by the RSquare(U) values, model fit improved from Model 1 to Model 2 after spatial factors were added and improved further in Model 3 after contextual factors were included, indicating the effectiveness of the approach in enhancing the model's performance [52].

Table 2. Parameter estimates of the hierarchical multinomial logistic regression models for interpersonal distance.

	Adjacent vs. Separate			Near vs. Separate		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
Human factors						
Group size (Alone)	−0.4775 **	−0.4627 **	−0.3115	0.2057	0.2129	0.3674
Gender (Female)	0.3287 ***	0.3656 ***	0.2982 **	0.0830	0.0607	0.0429
Gender (Male)	0.05344	0.0983	0.2010	−0.4350 **	−0.4002 **	−0.3188 *
Age (Adult)	0.1969	0.0126	0.0911	0.3435 *	0.3102 *	0.3414 *
Age (older)	0.2356	0.1576	0.2037	−0.4211 *	−0.4201 *	−0.4339 *
Activity (Passive)	−0.3611 **	−0.3657 **	−0.2553	−0.2596	−0.2798	−0.2011
Spatial Factors						
Openness (Open)		−0.3320 *	−0.2784		−0.1027	0.1412
Openness (Enclosed)		0.9575 ***	0.9681***		0.6826 ***	0.4242 ***
Social exposure (medium)		0.2826 **	0.4367**		0.1068	0.1391
Social exposure (Low)		−1.0846 ***	−1.2551***		−0.2446	−0.0641
Seating constraint (Medium)		0.2565 *	0.2087		0.3867 **	0.3348 *
Thermal exposure (Medium)		0.0722	0.1459		−0.3091 *	−0.2992 *
Thermal exposure (low)		−0.1633	−0.3036 **		−0.1060	0.0020
Contextual Factors						
Weekday			−0.6346 ***			−0.4335 ***
Morning			−0.6803 ***			−0.1679
Park (Joyama)			−0.5594 ***			−0.1863 *
Season (autumn)			0.1164			0.2121 *
RSquare(U)	0.0316	0.0709	0.1417	0.0316	0.0709	0.1417

Note: Only predictor categories with at least one statistically significant parameter estimate in either outcome comparison across Models 1–3 are presented. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 3. Likelihood ratio test for the hierarchical models of interpersonal distance.

	Model 1 (χ^2)	**Model 2 (χ^2)**	**Model 3 (χ^2)**
Human factors			
Group size	16.1210 **	13.9247 **	10.2157 *
Activity type	10.4854 *	9.4590	4.8748
Gender composition	35.0138 ***	31.6957 ***	25.4872 ***
Age composition	37.4958 ***	26.3135 **	26.8684 **
Spatial factors			
Seating constraint		25.1557 ***	10.9456 *
Spatial openness		39.6635 ***	37.6070 ***
Social exposure		43.8591 ***	44.7593 ***
Thermal exposure		15.0227 **	15.3074 **
Contextual factors			
Park			58.2017 ***
Season			4.7262
Day type			77.2151 ***
Time of day			77.2151 ***

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

In Model 1, the likelihood ratio tests indicate that all human factors were significantly associated with interpersonal distance. Among these variables, gender composition and age group showed particularly strong associations. The parameter estimates suggest that female users were more likely to be observed in adjacent sitting configurations. Age group also showed a graded pattern, with younger users more likely to sit in closer proximity, adults showing an intermediate pattern, and older users more likely to be associated with separated sitting.

After spatial factors were added in Model 2, all four spatial factors were significantly associated with interpersonal distance, with social exposure and spatial openness showing the strongest associations. Seating areas with lower levels of social exposure were associated with a lower likelihood of adjacent sitting. In contrast, enclosed seating areas were associated with higher likelihoods of adjacent and near sitting compared with separated sitting.

In the final model, contextual factors were added to the analysis. Day type, park, and time of day were significantly associated with interpersonal distance, while season did not show a significant association. The parameter estimates indicate that sitting observations in Joyama Park, weekday observations, and morning observations were more strongly associated with separated sitting configurations. The inclusion of contextual variables strengthened the model and changed the explanatory pattern of interpersonal distance. Overall, the final model indicates that interpersonal distance was strongly associated with contextual variation, especially differences in park setting, temporal period, and weekday–weekend use patterns.

3.3. Factors Associated with Body Orientation

Table 4 presents the hierarchical multinomial logistic regression results for body orientation, including parameter estimates and RSquare(U) values, while Table 5 summarizes the likelihood ratio tests for each predictor. Model 1 included human factors, Model 2 added spatial factors, and Model 3 added contextual factors. As shown by the RSquare(U) values, model fit improved from Model 1 to Model 2 after spatial factors were added. The addition of contextual factors in Model 3 further improved model fit, although the increase was smaller than the improvement from Model 1 to Model 2.

Table 4. Parameter estimates of the hierarchical multinomial logistic regression models for body orientation.

	Inward vs. View			**Pathway vs. View**		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
Human factors						
Gender (Female)	0.3574	0.8120 **	1.0501 ***	−0.2432 **	−0.1971 *	−0.234 *
Gender (Male)	0.0562	−0.3312	−0.6711 *	0.3279 **	0.2499 *	0.1675
Age (Adult)	0.0053	0.2327	0.2188	−0.4083 **	−0.2407	−0.2255
Age (older)	0.0370	0.3674	0.3145	−0.0156	−0.0757	−0.0151
Activity (functional)	−0.2533	−0.1830	−0.1651	−0.3651 **	−0.31852 **	−0.2957 **
Activity (Passive)	−0.1051	−0.2542	−0.1148	0.6785 ***	0.6547 ***	0.6963 ***
Spatial Factors						
Openness (Open)		−1.4477 ***	−1.7906 ***		−0.5414 **	−0.6717 ***
Openness (Enclosed)		0.6447	0.9850 **		−0.5537 **	−0.5124 **
Social exposure (medium)		−0.2394	−0.3284		−0.5662 ***	−0.4774 ***
Social exposure (Low)		0.1853	−0.1061		−0.0291	−0.2102
Seating constraint (Medium)		0.5314 *	0.6437 **		−0.3633 **	−0.4396 **
Seating constraint (Low)		−0.6146 **	−0.5151 *		−0.6044 ***	−0.6626 ***
Thermal exposure (Medium)		0.6435 **	0.6672 **		−0.2172 *	−0.2120
Thermal exposure (low)		0.0028	−0.2638		0.2182 *	0.0406
Contextual Factors						
Weekday			0.3068			0.0297
Morning			−0.0225			0.2131
Park (Joyama)			0.3759 *			−0.5098 ***
Season (autumn)			−0.3082			−0.0979
RSquare(U)	0.1039	0.2792	0.3136	0.1039	0.2792	0.3136

Note: Only predictor categories with at least one statistically significant parameter estimate in either outcome comparison across Models 1–3 are presented. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

In Model 1, the likelihood ratio tests show that all human factors were significantly associated with body orientation, with group size showing the strongest overall association. However, because solitary users could not be coded as facing inward, the parameter estimates for group size should be interpreted with caution. The parameter estimates indicate that adult users and functional activities were more strongly associated with view-facing than pathway-facing orientation, whereas passive activities were more strongly associated with pathway-facing orientation. Gender composition showed different patterns across the two outcome comparisons.

Table 5. Likelihood ratio test for the hierarchical models of body orientation.

	Model 1 (χ^2)	Model 2 (χ^2)	Model 3 (χ^2)
Human factors			
Group size	121.4582 ***	110.4780 ***	115.2906 ***
Activity type	35.7262 ***	26.1940 ***	24.4262 ***
Gender composition	28.3241 ***	30.4359 ***	34.5685 ***
Age composition	24.3442 **	20.5453 **	15.2603 *
Spatial factors			
Seating constraint		130.3930 ***	152.2696 ***
Spatial openness		104.5462 ***	122.9688 ***
Social exposure		48.2830 ***	42.6598 ***
Thermal exposure		20.5622 **	17.5183 *
Contextual factors			
Park			65.9295 ***
Season			3.3718
Day type			3.0371
Time of day			2.9131

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

After spatial factors were added in Model 2, all four spatial factors were significantly associated with body orientation. Among them, seating constraint and spatial openness showed the strongest associations. Among the spatial variables, seating constraint and spatial openness showed the strongest associations. The parameter estimates indicate that open settings, medium levels of social exposure, and low seating constraint were associated with a higher likelihood of view-facing orientation. Additional significant associations were also observed for thermal exposure and gender composition.

In the final model, contextual factors were incorporated into the analysis. Seating constraint and spatial openness remained strongly associated with body orientation, while social exposure and park setting also showed significant associations. In contrast, season, day type, and time of day did not show significant associations. The parameter estimates in the final model show that low seating constraint and open spatial conditions were associated with a higher likelihood of view-facing orientation. Overall, the final model shows that body orientation was associated mainly with spatial factors, particularly seating constraint and spatial openness, while contextual variables showed more limited associations.

4. Discussion

4.1. Interpersonal Distance

Separated sitting was the most frequently observed interpersonal distance pattern in two urban parks in Nagano City, Japan, indicating that users commonly organized co-presence by occupying different seating areas rather than sharing the same seating setting. This supports previous interpretations of interpersonal distance as a means of regulating privacy and co-presence in public space [7–9]. It also complements Yoshida et al. [15], who showed that interpersonal spacing among unrelated users on linear public seating varied according to occupancy density.

Human factors were significantly associated with interpersonal distance, particularly gender and age composition. Female and younger users were more frequently associated with adjacent sitting, whereas older users were more strongly associated with separated sitting. These findings extend previous research [24], which reported that bench usage in Japanese parks varies according to age and gender. This study further indicates that how users regulate their distance from other groups while sitting in parks varies according to gender and age composition. They also complement studies showing differences in public space use between solitary users, pairs, and larger groups [29,32]. However, these findings should not be interpreted as direct demographic preferences for a particular

distance, because the study observed naturally occurring sitting configurations rather than individual distance preferences.

Spatial conditions further influenced interpersonal distance. Enclosed seating areas were associated with higher likelihoods of adjacent and near sitting than separated sitting. This is consistent with Japanese studies showing that vegetation, visual shielding, and spatial protection can support sitting by creating more comfortable and protected environments [33,36]. This study suggests that enclosure may influence not only whether a seating area is used, but also how closely users position themselves within it. Visual protection from the wider park may reduce external exposure and make closer co-presence more acceptable. In contrast, low social exposure was associated with a lower likelihood of adjacent sitting. This suggests that seating areas removed from pedestrian movement and public activity may be used more for withdrawal or quiet individual occupation. The finding extends previous research [38], which showed that users select sitting places according to surrounding calmness, visibility, and proximity to pedestrians.

Contextual factors became particularly important in the final model. Separated sitting was more strongly associated with Joyama Park, weekdays, and morning periods. The weekday and morning patterns are broadly consistent with Yoshida et al. [15], who found that wider spacing was maintained under lower-occupancy conditions. Although occupancy was not measured directly in the present study, quieter periods may have provided more unoccupied seating alternatives, enabling users to maintain separation. Context may therefore influence interpersonal distance by changing the opportunity to occupy space separately. The park difference also supports previous research [33], which reported variation in sitting and bench use across Japanese parks with different spatial characteristics and surrounding contexts. This suggests that interpersonal distance is embedded in site-specific patterns of use that are not fully explained by immediate seating characteristics alone.

Season and thermal exposure were not significantly associated with interpersonal distance. This differs from Japanese studies reporting seasonal differences and shade conditions in park usage, preferred locations, and spatial distributions of staying behavior [33,39]. The difference may arise because those studies primarily examined whether and where people used park spaces, whereas the present study examined the interpersonal arrangement of users who were already seated. Seasonal conditions and thermal exposure may affect attendance and seat selection without independently changing whether users sit adjacent, near, or separately.

Overall, interpersonal distance was associated with human, spatial, and contextual factors, but the clearest explanatory pattern emerged after contextual factors were included in the final model. This suggests that proximity in public park seating was shaped not only by user composition and the immediate seating environment, but also by broader conditions of park use. Interpersonal distance can therefore be understood as a context-sensitive form of proximity regulation. From a leisure perspective, this pattern indicates that the opportunity to occupy a park socially or separately partly depends on the spatial availability created by times and settings. Separated sitting should not necessarily be interpreted as social avoidance; it may also represent one way of maintaining privacy and solitude while remaining present in a shared public environment.

4.2. Body Orientation

Facing pathway was the most frequently observed orientation, followed by facing view, while facing inward was relatively uncommon. This indicates that sitting behavior in the two parks was generally directed outward toward pedestrian movement, public activity, and the surrounding environment rather than inward toward companions. This pattern supports previous observations that people in public spaces often orient themselves

toward opportunities for watching public life or engaging visually with environmental features [19,20,24].

Among the human factors, group size showed the strongest association with body orientation. However, this finding should be interpreted cautiously because solitary users could not be coded as facing inward. The strong relationship therefore partly reflects the structure of the coding categories rather than a purely independent behavioral effect. Activity type also showed a meaningful pattern. Functional activities were more strongly associated with view-facing orientation, whereas passive activities were more closely associated with pathway-facing orientation. This supports previous research [24], which found that users facing environmental features were often engaged in individual activities, while orientation toward sidewalks was associated with engagement with surrounding public activity. It also extends previous research [38] by suggesting that activity purpose influences not only where users sit, but also the direction they adopt after sitting.

Spatial factors provided the clearest explanation of body orientation. Low seating constraint was associated with a higher likelihood of view-facing orientation, indicating that flexible seating forms allowed users to direct their bodies toward environmental features rather than follow a predetermined direction. This extends previous research on sitting apparatus in Japanese public spaces by showing that seating form affects not only seat selection but also directional freedom after occupation [38]. Spatial openness was also associated with view-facing orientation, which is consistent with studies showing that visual access to greenery, open space, and landscape features influences how users engage with park environments [21,24].

In contrast, season, day type, and time of day were not significantly associated with body orientation in the final model, although park setting remained significant. This differs from studies reporting temporal and seasonal variation in general park use and spatial distribution [24,33,39]. The difference may be explained by the outcome examined. Temporal and seasonal conditions may affect who visits the park and which seats are occupied, whereas the direction users face is more directly shaped by seating form and the visual structure of the immediate setting.

Overall, body orientation was associated with human, spatial, and contextual factors, but the strongest explanatory pattern emerged after spatial factors were added. Body orientation can therefore be understood as a spatially constrained form of directional behavior, reflecting what users were physically able and visually encouraged to face while seated. In the context of everyday park usage, this directional choice may support different forms of engagement, including interaction with companions, observation of public activity, and visual engagement with environmental features. The predominance of outward-facing orientations therefore does not necessarily indicate social disengagement but may reflect participation in park life through watching and environmental attention rather than direct interaction.

4.3. Different Explanatory Patterns of Interpersonal Distance and Body Orientation

The different model patterns indicate that interpersonal distance and body orientation represent distinct dimensions of public sitting behavior. Interpersonal distance appeared to be more context-sensitive, whereas body orientation was more closely anchored in immediate spatial conditions, particularly seating constraint and spatial openness. These findings support and extend Gifford and O'Connor's [6] argument that distance and orientation should not be treated as interchangeable indicators of social behavior. Their work clarified that seating distance and orientation play different roles in nonverbal intimacy. The present study extends this distinction to public park sitting behavior by showing that interpersonal distance and body orientation were associated with different sets of explanatory factors.

Interpersonal distance appears to be more context-sensitive because users' ability to maintain separation depends on the conditions under which seating is used. The associations with park setting, day type, and time of day may reflect variations in occupancy and the availability of alternative seating areas across observation contexts. Thus, contextual conditions may not directly determine a preferred distance, but they influence the opportunity to express separation. This is consistent with Yoshida et al. [15], who showed that interpersonal spacing among seated users varied according to occupancy conditions.

Body orientation, in contrast, appears to be more strongly anchored in the immediate seating environment. Users may prefer to face a pathway, a view, or their companions, but this preference can only be expressed when the seating form and surrounding visual structure allow it. Fixed seating may prescribe a dominant direction, while low-constraint seating provides greater directional flexibility. Similarly, open settings make environmental views more visually accessible. This may help explain why seating constraint and spatial openness remained more important than temporal conditions in the orientation model.

The contrasting role of spatial openness further illustrates the difference between the two behaviors. Enclosed seating areas were more strongly associated with closer sitting, whereas open seating areas were more strongly associated with view-facing orientation. This indicates that enclosure may influence how users position themselves relative to others, while openness may influence what they are able to face. Overall, interpersonal distance reflects how users regulate closeness and separation under changing conditions of park use, whereas body orientation reflects how users direct their attention within the possibilities and constraints of the immediate seating environment. Examining both outcomes separately therefore provides a more precise understanding of how users negotiate social and environmental relationships while sitting in public parks.

4.4. Design Implications

The distinct patterns found for interpersonal distance and body orientation suggest two complementary design tasks: providing alternatives that allow users to regulate distance and enabling flexibility in seating orientation. Since interpersonal distance varied across contextual conditions, parks should provide a distributed range of seating configurations rather than rely on a single arrangement. Individual seats can support separation, shared benches can accommodate co-presence among unrelated users, and grouped seating can support interaction among companions. Providing these alternatives across the park may allow users to regulate their distance under different conditions of use [15]. Because patterns also differed between the two parks, these recommendations should be interpreted as context-sensitive design considerations rather than universal standards, and the appropriate combination should be evaluated against local patterns of use, user characteristics, climatic conditions, and park settings before implementation.

At the seating micro-setting scale, seating form should be coordinated with surrounding pathways, views, vegetation, shelters, and degrees of enclosure. Fixed-direction benches can be positioned toward intended pathways or landscape views, while backless or less constrained seating can allow users to choose whether to face companions, public activity, or environmental features [24,38]. Because backrests also provide physical support, particularly for older users [35], parks should combine supported fixed-direction seating with more directionally flexible alternatives. Accordingly, seating proposals should be evaluated using two separate but complementary criteria: whether users can regulate their proximity to others and whether they can comfortably choose or adopt orientations toward companions, public activity, or environmental features.

These implications are most directly relevant to landscape architecture, urban design, park planning, and street-furniture design. Previous research has shown that interpersonal

distance and body orientation can help urban designers evaluate the social and interactional potential of public spaces [25], while seating location and orientation can inform sidewalk and street-furniture design [53]. In the present study, interpersonal distance findings support varied separation options rather than a single prescribed spacing, whereas orientation findings directly inform seat alignment, directional flexibility, and relationships with pathways, views, and surrounding openness. Accordingly, landscape architects and park planners can apply the findings to seating distribution and its integration with the wider park setting, while urban and street-furniture designers can apply them to the form and orientation of individual seating facilities.

Whereas existing urban-health frameworks provide broader principles and strategies concerning inclusion, proximity, healthy lifestyles, and urban furniture [26,27], the present study contributes an empirically grounded micro-spatial perspective by distinguishing users' regulation of interpersonal distance from their selection of body orientation. These two observable criteria can support more behavior-sensitive decisions about seating configuration and post-occupancy evaluation. Applied to new park design, park renovation, and street-furniture improvement, these considerations may support rest, privacy, co-presence, informal encounters, and social participation, thereby contributing to socially inclusive and health-supportive public spaces [1,20,26,27]. However, since health outcomes were not measured, this relationship represents a theoretical implication rather than a demonstrated health effect. The findings should not be treated as fixed design prescriptions, as the appropriate seating configuration may vary according to local needs and sociocultural conditions. Consistent with the participatory and co-design approach proposed by Rinaldi et al. [27], the observed behavioral patterns can provide an evidence base for engaging local users and communities in evaluating and adapting seating proposals to their specific contexts.

4.5. Limitations and Future Research

Several limitations should be considered. Interpersonal distance was classified according to observable relationships between seating areas rather than measured metrically. This approach allowed comparison across seating facilities with different forms and arrangements, but it did not capture precise physical distances. Age and gender composition were also estimated visually, and the relationships or degree of familiarity among seated users could not be confirmed. In addition, the association between group size and inward-facing orientation was partly influenced by the coding structure because solitary users could not be classified as facing inward.

The observational design also limits causal interpretation. Although the results indicate associations between sitting behavior and human, spatial, and contextual conditions, they cannot establish whether seating environments shaped behavior or whether users selected seating environments that matched their intended activities and preferred spatial relationships. This distinction is important because previous Japanese research has shown that users actively select sitting places and apparatus according to activity purposes and surrounding environmental conditions [38], while the present study also indicates that seating characteristics constrain the behaviors that can occur after a place has been selected. Furthermore, the study was limited to two relatively large, multifunctional parks in Nagano and two seasonal periods. The frequencies and specific patterns observed may reflect Japanese norms of public conduct and interpersonal spacing, as well as the climatic, geographical, park management, and functional characteristics of the study sites. Consequently, these results should not be directly generalized to smaller neighborhoods or pocket parks, specialized park settings, or different cultural contexts. Nevertheless, the broader distinction between context-sensitive proximity regulation and spatially con-

strained directional behavior provides a proposition that can be examined in other public-space settings.

The study did not examine detailed seating characteristics such as materials, dimensions, surface conditions, or the specific relationship of seating to facilities such as children's playgrounds. Future research should incorporate these variables and compare a wider range of park types, cities, cultural contexts, and seasons. Combining behavioral observation with interviews or surveys could clarify users' familiarity, perceived privacy, comfort, and reasons for seat selection. More precise distance measurements, detailed visual-spatial documentation, and behavioral mapping could also clarify how seating arrangements and surrounding environmental elements facilitate or constrain distance and orientation choices. Experimental manipulation of seating constraint, spatial openness, and social exposure would help distinguish whether users' behavior is produced by spatial design or by self-selection into preferred settings.

5. Conclusions

This study compared interpersonal distance and body orientation as separate dimensions of sitting behavior using the same set of human, spatial, and contextual variables in two urban parks in Nagano, Japan. The analysis showed distinct patterns of association: the addition of contextual factors produced the greatest improvement in explaining interpersonal distance, whereas body orientation was more strongly associated with the immediate spatial conditions of seating. The study therefore extends the theoretical distinction between distance and orientation from nonverbal communication research to naturally occurring public park behavior. Its contribution lies not only in documenting these behaviors but also in demonstrating that they should not be treated as interchangeable indicators when examining how people occupy public seating environments.

For park design, the findings suggest providing a distributed combination of individual, shared, and grouped seating, together with both fixed-direction and more directionally flexible facilities. Such provision can offer users choices concerning both distance to others and orientation toward companions, public activity, or environmental features. These considerations can be applied during site analysis and seating-layout development in new park projects, park-renewal processes, and small-scale seating interventions. In this sense, the success of park seating should be assessed not only by whether it is occupied but also by whether it accommodates different ways of resting, sharing space, interacting, and engaging with the surrounding environment. By supporting privacy, co-presence, and social participation, such settings may contribute to socially supportive public spaces. Since the study was observational and limited to two relatively large parks, these implications should be interpreted as evidence-informed considerations rather than universal design standards. Future studies should examine detailed seating characteristics, including materials and dimensions, and compare additional park types, cultural contexts, and environmental conditions using observational, visual-spatial, survey, and experimental methods.

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Informed Consent Statement: Not applicable. The study involved unobtrusive observation in publicly accessible spaces without direct participant involvement, and no information enabling individual identification was recorded or reported.

Data Availability Statement: The anonymized coded data supporting the findings of this study are available from the corresponding author upon reasonable request. The original video recordings are not publicly available due to privacy considerations associated with observations conducted in public spaces.

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