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The influence of spatial affordances of urban design on pedestrian behaviour in public spaces: A food market in Lund, Sweden

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Abstract

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Every year, the main public space in Lund, Sweden, hosts the International Food Market. It attracts pedestrians from near and far who come to enjoy the food and street life; the design features of the space play a significant role in that. This study focuses on how pedestrians interact with the physical aspects of the public spaces during this event. To identify key urban design features that this space affords, two methods are used: observation and photography, to capture movement patterns and social behaviour. The study shows how specific design features influence spatial affordances that enable social interaction within public space. In addition, this study highlights the importance of integrating urban design and pedestrian behavior by offering conceptual tools that provide urban designers with a deeper understanding of users' needs.

Keywords: urban design; public spaces; pedestrian behaviour; affordance; food market

1. Introduction

Public spaces offer countless opportunities for people to gather, meet, exercise, and socialise; cities provide valuable ways for people to spend time with others for both pleasure and the necessities of life. Urban design's function and how the creation of physical space interacts with city people is still a subject of significance in study (Amen, Afara, and Nia 2023; Aziz Amen 2022; Amen and Nia 2020). Developing conceptual tools for this interaction will help us to understand and implement the spaces and spatial infrastructure that can support social interaction, including its dynamic and transforming qualities.

Central urban areas in larger cities are becoming economic hubs due to growing urban populations, and there are notable pedestrian flows of residents, workers, and travellers using city services and amenities. Traffic and pollution lead to an increase in population density, which significantly impacts the living conditions and lifestyles of the city's residents. Therefore, research should focus on open public spaces in cities and how to improve urban planning to accommodate city social life while also managing different kinds of crowding. Better understanding of crowds and human flows may aid in the design of areas that support the daily, monthly, and seasonal rhythms of space use while offering more recreational opportunities and better time management for gatherings. As Husain and Salem (2024) observe, Public spaces created or reshaped through tactical interventions encouraged new patterns of social interaction, particularly among pedestrians and youth groups (Husain & Salem, 2024).

One way to explore the quality of public spaces in relation to gathering and social interaction, and how to improve it, is to study social behaviour by looking at how pedestrians interact with each other and the materiality of the space design features: the tendency of individuals to move, stand, and sit close together, and how these vary. The switch from movement (moving pedestrians) to immobility (motionless pedestrians) and vice versa. In a pioneering article, Ryave and Schenkein (1974) investigate the social dynamics of walking groups, highlighting how pedestrians walk and under which circumstances they walk alone or together. The factors that impact the comfort of walking in groups are pace, direction, and proximity (Ryave & Schenkein, 1974). More recent studies on group formation have primarily employed quantitative approach (Aiello, 1987; Costa, 2010; Hall et al., 2005; Holmes, 1992). However, none of these studies has examined the influence of the built environment or how spatial design and materiality can affect social interaction. In

addition, Past studies have not sufficiently explored the influence of affordances of urban components on pedestrian grouping.

There have been studies of grouping by age, gender, and the number of people in each group, but as part of the quantifiable modelling of attraction, behaviour, etc. For example, studies in social communication and environmental psychology have shown that younger people group more than older people (Aiello, 1987), and that women form more intimate groups and show stronger tendencies towards socialisation than men (Hall, 1984). More recent work on environmental psychology shows that similarities in race, culture, and religion (Bell et al., 2001), and friendship and familiarity (Holmes, 1992) are factors that make interpersonal space closer between pedestrians. Other factors include cross-cultural variations, while proxemics (studies of communicational distances between people) was quick to show that people from high-contact cultures interact at closer distances than those from non-contact cultures (Hall, 1966). Although current studies on how materiality of urban design affect pedestrian grouping and interaction in actual public environments are few, existing literature thoroughly investigates pedestrian behaviour using quantitative tools including proxemics and group spacing.

2. People flow and space affordance

There are few studies of the impact of materiality and urban design on grouping. a study relates to my investigation is Magnusson's Clustering Architectures (2016), which considers how different materialities contribute to how people socialise in public space.

2.1 public spaces

The Project for Public Spaces (2019) provides ratings and descriptions of over 600 public spaces, highlighting the importance of grouping nodes and social engagement in everyday life. Some public spaces, like the Piazza del Campo in Italy and Rittenhouse Square Park in Philadelphia, offer pleasant environments for social interaction. Conversely, some spaces, like the Place de la Concorde in Paris, have undesirable designs that hinder pedestrian flow and make it difficult to create groups or travel between areas. Pershing Square in Los Angeles is an example of a dreary open public space surrounded by office buildings and busy roads. The study focuses on how groups of people engage in public spaces and the influence of urban design on social interaction, examining urban form features and the materiality of the built environment.

2.2 affordance theory

James Gibson developed the concept of "affordance theory," which examines the options for action that people's surroundings present. It implies that rather than the shape or spatial arrangement of various objects or structures, how the world is perceived depends on the actions that objects provide in relation to the perceiver (Gibson, 1979; Alibrahim, 2017; Ibrahim, M., 2019; Alrabadi, S., 2020). According to Gibson's ecological viewpoint, affordances explain why we directly perceive the values and meanings of objects in our environment, highlighting the complementarity of the environment and animals. The layout and appearance of surfaces in urban areas can influence people's behaviour in a variety of ways. Gather-on-able surfaces, like clean, hard, horizontal concrete objects, for instance, encouraged people to congregate and form groups, offering refuge and leisure. We can better comprehend crowds and crowding in public areas by comprehending affordance in urban design.

Urban planning and design have made use of Gibson's affordance theory, which has its roots in perceptual psychology. Its main objectives are to reduce future failures, analyse the form and spatial layout of the built environment, and comprehend the relationship between users and the environment. The relationship between crowds and spaces, as well as the usability of the designed object, have been examined using the theory of affordability. Donald Norman, a follower of Gibson, critiques and uses affordance in design, contending that what matters more than what an object may or may not afford is how a user perceives the actions that the physical object allows. This viewpoint aids in explaining the connections between people and the built environment and the reasons behind the actions of its occupants (Softaoğlu, 2019; Softaoğlu, 2021). The concept of actual affordances and how they vary among users has been used by architectural researchers to examine lobbies in buildings, identify affordances in computer-aided architectural design software, and apply affordance theory to particular building elements.

Gibson's affordance theory has been used in a number of domains, such as urban planning, architecture, and design. It helps with the design process, provides a conceptual framework for comprehending the relationship between people and the built environment, and can be used as an evaluation tool to examine the connection between usability and design goals (Gibson, 1979; Alibrahim, M.M., Aldeek, Z.A.O., 2022; Alibrahim, M.M., Rababah, A., 2023). Four types of affordance are suggested by Hartson (2003) in his usability-oriented typology: sensory, cognitive, physical, and functional. When examining how surfaces cooperate to support clustering and declustering, Gaver's concept of sequential or nested affordances is helpful. When it comes to comprehending the crowd-oriented affordance of perceivable qualities in urban settings, crowdability studies can be especially helpful.

3. Material and Methods

The study focusses on Lund, Sweden, and examines how urban design affects pedestrian groups and social interaction in public areas. The researcher has examined various facets of social interaction in public settings using ethnography-inspired observations, which is a qualitative method for examining social practices. Social interaction is made possible by the materiality of urban design, and the study provides a deeper comprehension of how the built environment shapes pedestrian groups in public areas.

Instead of focusing on theories based on presumptive categories, the selected ethnographic methods concentrate on social phenomena as they seem to the observer. They concentrate on examining members of a particular group or culture and how they interact with one another over time in a thorough descriptive manner. The analysis of empirical data includes elucidating the underlying meanings of pedestrian behaviour, and the observations are made without the use of presumptions that could conflict with natural norms.

The study was carried out in 2022 at a food festival in Lund, a mediaeval city with a sizable regional hospital (Skånes universitetssjukhus Lund) and a significant cathedral (Lunds domkyrka).

The association between pedestrian grouping and the physical aspects of urban design was examined through photographic observations (Pink, 2013). The Project for Public Spaces emphasises the value of grouping nodes in daily life by rating and describing more than 600 public spaces. While some public areas, such as the Rittenhouse Square Park in Philadelphia and the Piazza del Campo in Italy, provide pleasant settings for social interaction, others, such as the Place de la Concorde in Paris, have unwelcome designs that make it challenging to move between areas or form groups.

3.2 Study implication

Examining urban form elements and the materiality of the built environment, the study focusses on how groups congregate and disperse in public areas as well as how urban design affects social interaction. The Project for Public Spaces emphasises the value of grouping nodes in daily life by rating and describing more than 600 public spaces. Rittenhouse Square Park in Philadelphia and the Piazza del Campo in Italy are two examples of public areas that provide welcoming settings for social interaction. On the other hand, some areas, such as Paris' Place de la Concorde, have unfavourable layouts that impede pedestrian traffic and make it challenging to form groups or move between locations. One example of a gloomy open public area encircled by busy roads and office buildings is Pershing Square in Los Angeles. Examining urban form elements and the materiality of the built environment, the study focusses on how groups congregate and disperse in public areas as well as how urban design affects social interaction.

3.2 Case study

This study mainly uses photographic observations to examine the connection between pedestrian interactions with the physical components of urban design. Big efforts are made to document in photographs how urban design materials impact social interaction spaces at any given time at Lund's main public square.



Figure 1. Mårtenstorget, the location of the annual Lund International Food Festival. Source: Google Maps, 2025.

Mårtenstorget, one of Lund's main public squares, is the site of the city's yearly food festival (Fig. 1 ,2 & 3). It is encircled by historic buildings that house stores, coffee houses, restaurants, bars, Konsthallen (the public art gallery), a supermarket (Coop), and other amenities. Krognoshuset, a three-story brick structure that is a city landmark and reportedly the oldest in Lund, is located in the northwest corner of the square. Mårtenstorget offers two daily rhythm activities on a typical day. The first is the morning rhythm, when the square is transformed into an outdoor market with vendors offering fresh produce, fish, flowers, and other items.

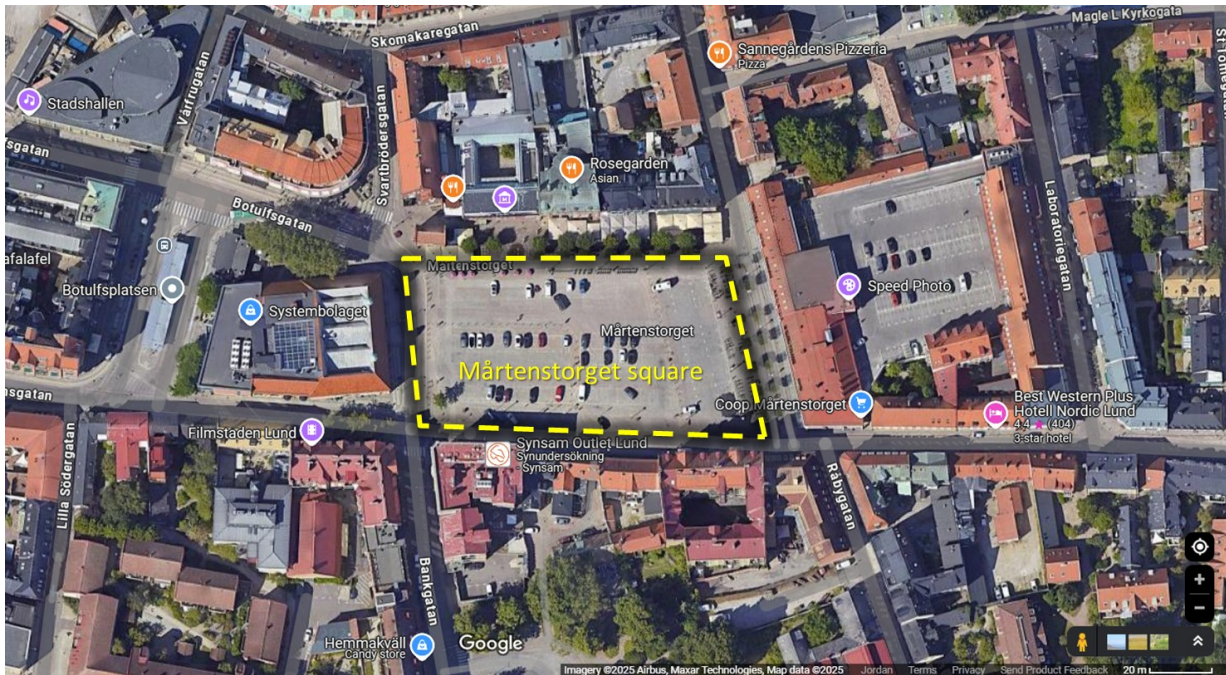


Figure 2. Mårtensstorget, the location of the annual Lund International Food Festival. Source: Google Maps, 2022.

Occasionally, there is also a flea market. All of the vendors must depart at 14.00, marking the end of the market. The second rhythm, which begins at 15.00 and lasts until the following morning, when a sizable portion of the square is turned into a parking lot, is the late afternoon and evening rhythm. On the other hand, Mårtensstorget hosts an annual event called the International Food Festival.



Figure 3. Mårtensstorget square . Source: Google Maps, 2022.

The food festival's layout fills nearly the entire square with multiple rows of food stalls spaced about 2.5 meters apart. The case study was carried out in the spring of 2022. The temperature ranged from 8 to 14° C, with cloudy atmosphere interspersed with sunny intervals.

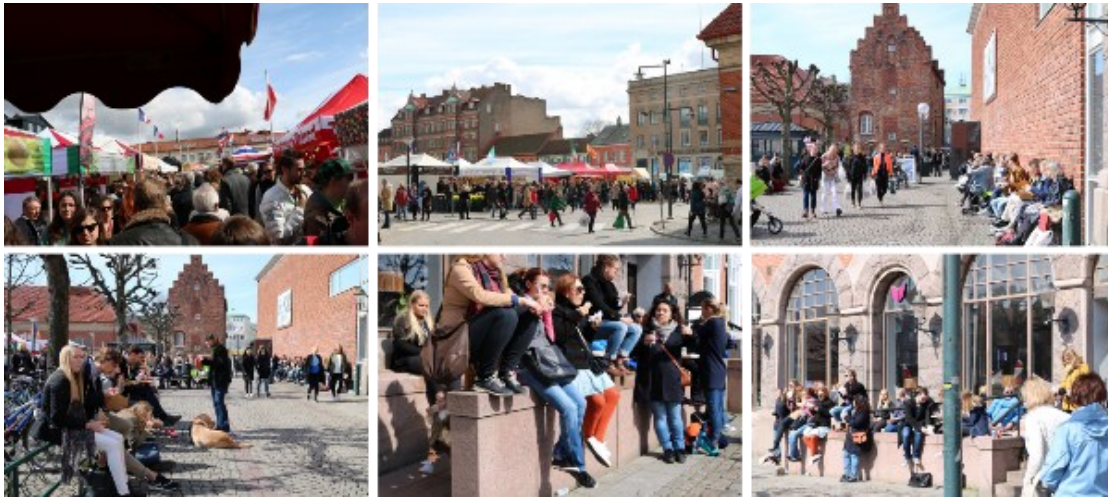


Figure 4. The Lund International Food Festival. 2022. Photos by the author.

4. Findings and discussion

4.1 Social interaction at the Lund food festival

A number of pictures are taken to document firsthand observations of the Lund food festival. A concrete parapet or base with a railing is utilised as casual seating in the first image (Fig. 5). The image displays the food festival and the entrance to the RoseGarden restaurant on the north side of Mårtenstorget. The entrance ramp faces south and receives full sun. It provided some social interaction by acting as casual seating for attendees of the event. The first person or pioneer to sit on the wall is not identified in the pictures, but it is evident from comparing the first and second that the pioneer's action had a lasting impact on those in the vicinity, encouraging more people to use the wall as a casual seating area and to form nodes around that particular area (Alrabadi, S., 2020). It can be more logical to think of this process of increased interaction as a contagious effect, even though there may have once been a pioneer who somehow persuaded others to see the wall as a place to sit.



Figure 5. The Lund International Food Festival, 2022. Photo by the author.

At the time, we were interested in the scene in the following image (Fig. 6). It depicts a sun-dappled area on the north side of Mårtenstorget with more advanced urban design elements than the rest of the square. Observe the group of people eating and chatting while seated on the bike stands, as well as the dog and his owner. Given how crowded the event centre was, we imagine the dog owner found it difficult to navigate with her dog. As a result, she decided to move outside the festival and join the same group.



Figure 6. The Lund International Food Festival, 2022. Photo by the author.

I was still on the north side of Mårtenstorget in the following image (Fig. 7). The event organisers nailed the red cabinet, which served as a temporary power source, to the tree trunk. It was put in place to provide electricity to the food stalls, but for safety, they covered it with a wooden board, creating an unofficial table that the first group on the left was welcome to stand by and use for their food and beverages. The second group on the right quickly followed this pioneer group, forming a larger group around the tree.



Figure 7. The Lund International Food Festival, 2022. Photo by the author.

Markets are a part of our daily routine because the square is typically used for an open-air market in the mornings and a parking lot otherwise. The food festival is a seasonal event, so the event organisers temporarily altered the square's infrastructure with permission from Lund City Council. This was done to avoid any conflicts between the food festival event and the square's basic functions. An illustration of this is shown in the following image (Fig. 8), where the event organisers covered the permanent signage system with bin liners to disable it. This keeps the signs from interfering with the new event's activities while simultaneously warning attendees that they are temporary. A "function blocker" is an action that prevents a particular affordance by disabling a particular function of an urban element. It indicates that something is unusual.



Figure 8. The existing street signage, covered over for the Lund International Food Festival, 2022. Photo by the author.

There are then small groups of people (Fig. 9). The straight white line on the ground that denoted the original space's parking bays is clearly one aspect of the urban design that now stands out as a border. Despite being unofficial, this border appears to be recognised and utilised by the guests as they adjust their placements within the square. I noticed a number of instances where people appeared to congregate right next to it. Because pedestrians see and use the white line as a means of defining the crowd's edge, it gives them the ability to control the crowd's shape. Thus, this type of element serves as a "formal group border."

The following series of images (Fig. 10) provides details on the intimate connection between specific urban design components and small-scale groups. Here, we can observe how the slightly elevated cable ramps visually separate visitor groups and, on a smaller scale, influence how people group and ungroup. Additionally, they alter the speed at which people cross them, causing groups to momentarily disperse. Another point is that some individuals who lost their groups in the crowd stood on the cable ramps to gain some height in the hopes of locating their missing group members. Once more, we would contend that the cable ramps gave some pedestrians who were moving the chance to decluster as they crossed them, while others were able to (passively) group in search of lost friends or simply to get a better view. Similar to the parking lines, they served as unofficial group borders, drawing distinct lines that marked the boundaries of particular groups.

Figure 9. Crowd edges affected by urban design elements at the Lund International Food Festival, 2022. Photos



by the author.



Figure 10. Crowds walking or pausing, affected by urban design elements (cable ramps) at the Lund International Food Festival, 2022. Photos by the author.

Part of a row of city rental bicycles in Lund is depicted in the following image (Fig. 11). They are usually affixed to their stands on the square's north side, but for the duration of this event, the majority were taken down to make room for the food stalls. However, a few bicycles were left in their original locations, in their stands, forming a physical barrier that prevented people from moving between the festival's inside and outside. However, the bikes also created a distinct informal grouping border (Alrabadi, S., 2020).

Figure 11. Bicycle racks affecting the crowd's border at the Lund International Food Festival, 2022. Photo by the



author.

The following pictures show a sculpture in the square (Fig. 12). It was initially constructed as a work of art and a summertime water play area for children. By using it as a place to stop and eat in the sunshine during the event and as a casual seating area, visitors actively brought the sculpture into the public eye. It was more than just a decorative accent; it provided a spontaneous, informal seating area and a place for guests to gather.



Figure 12. Urban design elements afford informal seating where people can gather and crowd, here at the Lund International Food Festival, 2022. Photos by the author.

4.2 Findings from the Lund food festival

The findings from the Lund International Food Festival study are more concentrated on urban design components and can be summed up by their relationship to affordance. The affordance situations and related types of affordances were particularly evident.

Grouping can be linked to new affordances created by crowding and new elements. Compared to other areas of the square, the area on the north side of Mårtenstorget appeared to allow for more grouping. This was due to the location's increased sun exposure and pedestrian-friendly urban design elements, which also make it more appealing for people to congregate and relax there. City planners likely picked this sunny spot on the square's edge because it offers more pedestrian and urban landscape features. These design features, in our point of view, improve the atmosphere by incorporating particular aspects of the site, making it a more comfortable place to sit, and making it more groupable..

There were artefacts in Mårtenstorget that either acted as group borders or in some other way assisted people in managing the edge of the crowd. These can be informal or formal. When big groups of people congregate, metal fences or barriers are frequently erected around the area to delineate it, keep people out, or guide them to specific entry points (formal crowding or group borders). People used unofficial features, like painted lines or cable ramps that weren't meant to control crowds or groups, to define the boundaries of grouping during the Mårtenstorget food festival, resulting in unofficial group borders.

In this research, a variety of affordance types are identified as well as connected to affordances in some way. The first is a particular type of function blocker that prevented some signs from being seen. Function blockers, on the other hand, could also be features incorporated into an urban area to either prevent or shield grouping—for instance, in connection with anti-terror measures where big crowds are viewed as a danger or when cars are barred from entering pedestrian-only areas. Installing distancing elements is another way to stop the spread of infection. Function blockers are essentially transient affordances that begin at a certain point in time and end at a conditional point in time. As long as the sun is shining, people can crowd and sit in open spaces. In the examples, the sun breaking through the cloud and then disappearing again was just one example of a temporary, conditional affordance.

Conditional affordances, or affordances that only manifest under particular circumstances, are another type of affordance. As demonstrated by the weather example, a conditional affordance can resemble a temporary affordance in many ways, but time is not the only consideration. Think about people sitting outside a restaurant in the sun, for instance. It would normally be unacceptable for them to eat food while sitting on the steps, but because of the food festival, it was permitted on that specific occasion. It provided additional instances of how urban materials that are typically utilised for different purposes, like bike stands and sculptures, were transformed into unofficial seating during the event by the crowd. Such behaviour would be uncommon on a typical day because people who use the informal seating would be obstructing a restaurant's entrance or might feel vulnerable if they were sitting on a statue in the centre of a public square. This demonstrates how public space is continuously constructed and integrated with different understandings of the situation at any given moment. What might have been unacceptable in an everyday rhythm suddenly became possible.

Additionally, there were instances of what I would call "integrated affordances." When several elements and features work together to afford a particular kind of action, each element maintains its own affordance aspect, resulting in an integrated affordance. This was clear from the positive "atmosphere enhancers" observed at the Lund food festival. As more people discovered appealing features and circumstances, they merged more to give people the chance to congregate due to the space's improved sensory experience. As a result, while the presence of these components may not be contingent on a crowding affordance per se, it does have an effect by raising or lowering the likelihood of that action.

In addition to this at last, I would also contend that there were "combined affordances," which occur when two or more components come together to produce new aspects that would not be possible without this combination, making new actions possible. The red electricity cabinet served as an illustration of this since it combined several

features and elements: first, it was fastened to a tree trunk; second, a wooden board was placed over it for protection; and third, the board was positioned horizontally. Together, these three components produced a new affordance that would not have been possible if they had been installed differently. A crowd gathered there as a result of the new combined affordance, which allowed items to be positioned on the board like a table. the next table summarize the types of affordances observed in the this study depending on social interaction of grouping behavior.

Table 1. the types of affordances observed in the this study depending on social interaction of grouping behavior.

Affordance Type	Definition	Example from Festival	Design Implication
Conditional	Affords action only under certain conditions	People gather in sunny spots; sculpture becomes usable seating	Maximize flexible use under changing conditions
Function Blockers	Temporarily disable affordance to change behavior	Bin liners over signage during festival	Design reversible interventions
Integrated	Multiple elements collectively afford behavior	Sculpture + sunlight = attractive seating	Combine elements to enhance sensory experience
Combined	Combination creates a new affordance not possible individually	Red cabinet + tree + board = informal table	Explore hybrid design for multi-functionality
Formal/Informal Borders	Elements used to define group space boundaries	Painted lines, cable ramps, bike racks	Use subtle markers to manage crowd flow naturally

5. Conclusions

The purpose of this study is to give planners and urban designers useful data and conceptual tools, so they can better understand pedestrian needs and the causes of grouping and ungrouping in public areas. The results point to designs that encourage grouping behaviour, which increases adaptability and resilience in dynamic public life. These ideas can be used to study how crowds are formed by the grouping and ungrouping of pedestrians, as well as the importance of the situation and sociomaterial factors in that process. Allowing for some complexity in the composition of public life and acknowledging the potential for groups of pedestrians to fluctuate could contribute to the creation of more usable architectural elements and urban spaces.

Although a design's goal for social interaction and behavioural patterns will vary, five options are proposed: promoting various sharing scenarios, regulating the speed of people's movements, forming the physical contours of potential crowds, influencing the distances between grouping members by designing spatial facilities that support both tight and loose groups, and organising or supporting the rhythms of movement required where crowds continuously adapt by going through various grouping and ungrouping sequences.

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Conflict of Interests

The Authors declare that there is no conflict of interest.

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