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Multisensory Approach in Commercial Public Space Design in East Java, Indonesia

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Abstract

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Social interaction is an activity that can never be separated from human life. Public space is community place for social activities to occur. Along with its development, public space has transformed its function into a commercial area. Commercial activities require humans to continue to be active in an environment, including in public spaces. Public space is actually a space that can be accessed by anyone, and can provide a memorable space experience for its users, from all races, social statuses, to sensory capabilities (normal and people with disabilities). But unfortunately, commercial public spaces tend to only pay attention to visual experiences and ignore other sensory experiences in human senses. This study discusses the design criteria for commercial public spaces with a multisensory approach that uses literature review methods and case studies at the Pasar Induk Kota Batu, East Java, Indonesia. This study shows that Pasar Induk Batu has met several sensory experiences which are olfactory experiences, visual experiences, haptic experiences, and auditory experiences.

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Multisensory Approach in Commercial Public Space Design in East Java, Indonesia

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ABSTRACT

Social interaction is an activity that can never be separated from human life. Public space is community place for social activities to occur. Along with its development, public space has transformed its function into a commercial area. Commercial activities require humans to continue to be active in an environment, including in public spaces. Public space is actually a space that can be accessed by anyone, and can provide a memorable space experience for its users, from all races, social statuses, to sensory capabilities (normal and people with disabilities). But unfortunately, commercial public spaces tend to only pay attention to visual experiences and ignore other sensory experiences in human senses. This study discusses the design criteria for commercial public spaces with a multisensory approach that uses literature review methods and case studies at the Pasar Induk Kota Batu, East Java, Indonesia. This study shows that Pasar Induk Batu has met several sensory experiences which are olfactory experiences, visual experiences, haptic experiences, and auditory experiences.

Keywords: commercial area, multisensory, public spaces

1. Introduction

Human existence is inextricably linked to space. Urban spaces, in particular, are essential in shaping daily life, facilitating a variety of activities that include both communal and commercial functions. Public spaces, as key components of urban environments, are designed to be accessible and multifunctional. As Roger Scruton (1984) articulated, public spaces are places where individuals can meet unintentionally, fostering social interaction in a simple, open environment [1]. Additionally, according to Hakim (2003), public spaces serve social and ecological functions, acting as areas for interaction and environmental regulation [2].

Public spaces contribute significantly to the growth of cities. These spaces host activities related to trade, recreation, culture, and government services [2][3]. However, despite their importance, public spaces often focus predominantly on visual experiences, neglecting other sensory dimensions such as auditory, olfactory, and tactile elements. This neglect is especially noticeable in commercial public spaces, which demand more than just visual engagement for a comprehensive user experience [3].

As S. Carr et al. (1992) suggest, public space is defined as open areas outside buildings, such as roads, parks, and plazas [2]. It allows for social mobility and provides an environment conducive to various activities, from leisure to communication [2]. Furthermore, public spaces should support the city's residents by fostering dynamic interactions. As Jan Gehl (2010) observed, successful public spaces balance both static (sitting, viewing) and dynamic (communicating, socializing) activities [3]. The integration of commercial activities into these spaces further emphasizes the need for an environment that sustains both individual and collective actions.

The design of commercial public spaces must be sensitive to diverse user needs, promoting inclusivity through sensory-friendly approaches. The concept of multisensory design is crucial in enhancing public spaces by integrating visual, auditory, tactile, and olfactory elements. Unfortunately, many commercial spaces fail to consider how these sensory experiences can enhance the environment, leaving users with a limited spatial experience that centers primarily on sight. This research seeks to examine the role of multisensory design in commercial public spaces and explore how such approaches can transform the experience of space for urban residents, focusing on a case study of Pasar Induk Kota Batu in East Java.

This study aims to answer the following questions:

(a) What is a multisensory approach to design?

(b) What are the criteria for commercial public spaces designed with a multisensory approach?

(c) To what extent are these criteria reflected in the design of Pasar Induk Kota Batu?

The multisensory approach, often referred to as "VAKT" (Visual-Auditory-Kinesthetic-Tactile) [5], transcends visual and textual stimuli by incorporating other senses such as touch, smell, and taste. Spence (2020) highlights that multisensory experiences facilitate a deeper understanding of space by integrating sensory stimuli [6]. According to Heilig (1992), human sensory processing is predominantly visual (70%), followed by auditory (20%), tactile (5%), olfactory (4%), and taste (1%) [8].

For decades, architectural design has prioritized visual aesthetics, but increasingly, there is a recognition of the importance of multisensory engagement in shaping the experience of space [7]. This holistic approach not only makes the space more inclusive but also enhances its emotional and functional impact. By integrating sensory experiences—such as the scent of flowers, the sound of water, or the tactile sensation of materials—designers can create spaces that resonate with users on multiple levels. Figure 1 below illustrates the five human senses that are critical to understanding multisensory design:

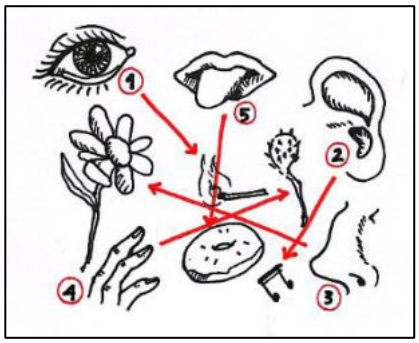


Figure 1. Human senses

(*Source: Author's illustration – redrawn from "Sense of Place: architecture for multisensory mind" Journal*)

Another important aspect of multisensory design is grouping the senses based on their interaction in space. Figure 2 presents a diagram showing how different sensory experiences can be grouped together, highlighting the interconnectedness between sight, sound, touch, and other sensory inputs.

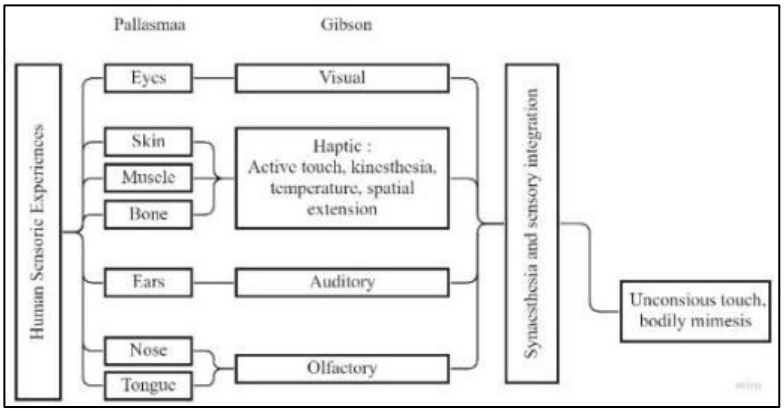


Figure 2. Human sense grouping diagram

(Source: Author's illustration from journal "Peran Pengalaman Multiindra dalam Ruang Interior Komersil, Neysha Adzhani, 2013")

In architectural design, the form and layout of spaces significantly influence sensory experiences. For instance, the arrangement of angled and curved rooms can affect both visual perception and movement within a space. Figure 3 demonstrates how such spatial forms can guide users and create more engaging experiences.

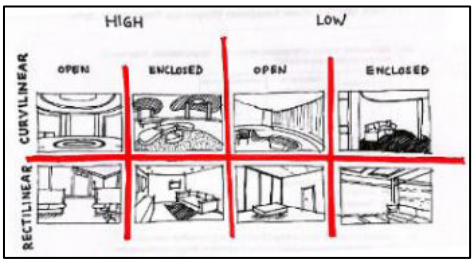


Figure 3. Visualitation of angled and curved rooms

(Source: Author's illustration from journal "Sense of Place: architecture for the multisensory mind")

Moreover, color plays an essential role in shaping the emotional atmosphere of a space. Colors are often categorized into warm and cool tones, which influence the psychological effects on individuals. Figure 4 provides insight into how different colors can affect the emotional and psychological responses of users in architectural spaces.

Figure 4. Psychology of colour

(Source: Author's illustration from journal "Psychology of Colours in Building Design", Akshara Jain, 2017)

Through these figures and examples, we see that incorporating multisensory experiences into commercial public spaces can vastly improve how users interact with and remember these environments. The upcoming sections will delve deeper into how these concepts apply to the case study of Pasar Induk Kota Batu and explore how the multisensory approach can enhance commercial public space design for a richer, more inclusive urban experience.

In the context of commercial public spaces, multisensory design plays a pivotal role in enhancing user experiences. The integration of sensory elements beyond visual aesthetics creates an environment that is more accessible and inclusive. Public spaces are not just visual experiences but are opportunities for multisensory engagement, where touch, sound, smell, and even taste contribute to creating meaningful environments. As D. Nurgandarum and C. F. Anjani (2020) emphasize in their study of historical city centers, the legibility and imageability of a place contribute significantly to its overall sensory appeal[4]. These elements influence how individuals perceive and interact with a space, highlighting the importance of sensory cues in urban environments.

N. Adzhani and E. Arvanda (2013) further emphasize the role of multisensory experiences in commercial interior spaces. Their work demonstrates how multisensory design can enhance commercial environments, creating spaces that resonate with users on multiple sensory levels [9]. The integration of these sensory elements makes spaces not only more functional but also more emotionally engaging, allowing for stronger connections between people and their surroundings. This is especially relevant in commercial spaces, such as marketplaces, where different sensory stimuli can guide, inform, and influence consumer behavior.

A key aspect of successful multisensory design lies in its application to various functions within commercial spaces. M. Marsh and K. Mueller (2017) discuss how multisensory design in workplace wellness environments contributes to improved wellbeing and productivity. This empathy-based design approach can also be extended to public spaces like Pasar Induk Kota Batu, where sensory elements such as sound, smell, and tactile experiences can be leveraged to create a more immersive and comfortable environment for visitors [10].

Furthermore, N. Setiawan et al. (2021) explore the importance of multisensory approaches for individuals with disabilities, particularly the visually impaired. Their study of park design underscores how sensory integration can be a transformative element in urban space planning [11]. Applying similar principles to commercial public spaces can ensure that these environments cater to a broader range of users, promoting inclusivity and accessibility for everyone, regardless of their sensory abilities.

Color, as a critical aspect of architectural design, plays an essential role in creating emotional atmospheres and guiding behavior within a space. M. Pereira (2018) delves into the psychological impact of color in architecture, illustrating how different hues can influence mood, comfort, and perception [12]. Figure 4, which illustrates the psychology of color, reinforces this notion by demonstrating how warm and cool colors can evoke distinct emotional responses. This knowledge is particularly valuable in commercial spaces, where color choices can enhance user engagement and even influence buying decisions [13].

In addition to color, the concept of Goethe's Theory of Colors (2015) provides valuable insight into how colors can affect human behavior. As described in his work, colors can create warmth or coolness, stimulate the senses, and shape the atmosphere of a space [14]. The strategic use of color in Pasar Induk Kota Batu could enhance both the visual and psychological comfort of visitors, making the space feel more welcoming and stimulating.

Finally, E. Lestari and A. Widyarthara (2012) address how sensory environments can be particularly impactful for people with visual impairments. Their study of spatial behavior for the blind highlights the importance of tactile and auditory cues in guiding and orienting individuals within built environments [15]. By integrating these sensory elements into the design of Pasar Induk Kota Batu, the space can be made more accessible to all, improving navigation and overall comfort. Figure 1, Figure 2, Figure 3, and Figure 4 present visual representations of key multisensory principles discussed above. The integration of these elements in

commercial public spaces can significantly enhance user interaction, providing a more holistic, memorable experience.

The application of multisensory design in commercial public spaces is not just about aesthetics but is central to creating spaces that are functional, inclusive, and emotionally resonant. Pasar Induk Kota Batu, as a case study, exemplifies how incorporating visual, auditory, olfactory, and tactile experiences can transform a public market into a more engaging, inclusive, and vibrant environment. By utilizing multisensory principles such as color theory, tactile feedback, and auditory cues, this market can better serve its community, offering a more dynamic and memorable experience for its visitors.

As urban spaces continue to evolve, it is essential that commercial public spaces like Pasar Induk Kota Batu embrace multisensory design. Future developments can incorporate these insights to create spaces that are more accessible, functional, and enjoyable for a diverse range of users, enhancing both their physical and emotional experiences within these environments.

2. Method

The method used in this study is a literature review, drawing data from scientific journals regarding commercial public spaces and a multisensory approach. Additionally, a case study was conducted at Pasar Induk Kota Batu, which serves as a focal point for this research. The data regarding Pasar Induk Kota Batu were collected from the author's documentation, including a site visit conducted in November 2021. Some additional images were taken from Google Earth to better illustrate the market's location and its surroundings.

Pasar Induk Kota Batu is a traditional market located on Jalan Dewi Sartika, Kelurahan Temas, Kota Batu, East Java, 65315 Indonesia. It functions as a strategic economic institution, contributing to the regional economy and serving as a significant source of employment [16]. Hua (2017) states that markets such as Pasar Induk Kota Batu play a vital role in human interaction across various social and economic classes, offering a space for communication and transactions between individuals from diverse backgrounds [6].

As the heart of city life, Pasar Induk Kota Batu must be accessible to all users, including people with disabilities, thereby fostering inclusivity. In this study, particular attention is given to the space used during the morning market (Pasar Pagi) from 05:00 to 08:00, when commercial activities are in full swing. The case study is focused on the public spaces used during Pasar Pagi, where vendors and buyers engage in transactions before the space transitions into a parking lot for motorcycles and cars after the market's operational hours.

Figure 5 illustrates the Pasar Induk Kota Batu and its surrounding functions, highlighting the commercial and residential zones that interact with the market. The market occupies an area of 43,573 m² and is bordered by residential and commercial buildings, creating a dynamic interaction between different urban functions.

Figure 5. Pasar Induk Kota Batu and its surrounding's function

(Source: Author's illustration from Google Earth)

Pasar Induk Kota Batu operates in two primary phases during the day: the Pasar Pagi (morning market) from 05:00 to 08:00, and the Pasar Induk (main market) from 08:00 to 16:00. The outer spaces of the market, which are used for Pasar Pagi, are repurposed as parking areas for motorbikes and cars once the market closes for the day. By examining this dual-use space, this study focuses on the Pasar Pagi as a public space, analyzing how its design and sensory elements influence the daily experiences of vendors, buyers, and visitors.

3. Results and Discussions

Public Space Criteria

According to Stephen Carr in his book Public Spaces (1992), public spaces have five key criteria: (a) Comfort: Providing psychological comfort such as weather, wind, sunlight factor, and adequate facilities that encourage everyone to use the space; (b) Relaxation: Including landscaping elements that contribute to a calming environment; (c) Passive Engagement: Supporting passive activities such as sitting, relaxing, and enjoying the view without interruption from other users; (d) Active Engagement: Facilitating social interactions by being a conducive environment for various types of social activities; (e) Discovery: Offering new experiences such as seasonal festivals or concerts [3]. Meanwhile, the Project for Public Spaces (PPS) highlights four main qualities a public space should possess, as described on their website http://sim.ciptakarya.pu.go.id/: (a) Accessible: Physically and visually well-connected to surrounding areas; (b) Encouraging Activities: The space should invite and encourage users' activities; (c) Comfortable: Including safety, hygiene, and seat availability; (d) Good Visual Appeal. In addition, Hamid Shirvani, in his book Urban Design Process, identifies five criteria for public space: (a) Livability; (b) Sense; (c) Views; (d) Access; (e) Identity[3]. From these different theoretical perspectives, Table 1 below filters these criteria and synthesizes the main elements that define an effective public space:

Table 1. Public Space Theories Conclusion

Stephen Carr	PPS	Hamid Shirvani	Public Space Criteria
Comfort	Comfortable	Livability	*Livable,*comfort
Relaxation	Visual	Sense	*Relax,* sensory comfort
Passive Engagement	Encouraging user's activities	Views	Appealing view to encourage passive activities
Active Engagement		Identity	Has a characteristic to encourage social interaction
Discovery	Accessible	Access	Accessible

According to Rapoport (1997), activities in public space can be categorized to four components: (a) Real Activities in public spaces can be categorized into four components: (a) Real Activities such as shopping, eating, walking, and drinking; (b) Specific Activities like shopping at a bazaar, drinking in a café, sitting on a park bench, and eating with friends; (c) Additional Activities such as shopping while talking to a friend or walking in a park while enjoying the view; and (d) Symbolic Activities. An activity can also consist of several sub-activities, known as the "system of activity," which relates to three main elements: (a) street vendors, which support the activities in an area; (b) parking, which facilitates movement and access; and (c) pedestrians, who are the primary users of public space. In terms of commercial spaces, the visual criteria of a commercial area include clarity, boldness, intimacy, flexibility, complexity, efficiency, and inventiveness[3]. Kaisher, Goldshack, and Chapin (1995) in Urban Land Use Planning also highlight criteria such as accessibility, activity range, infrastructure, and sustainable terrain[3]. These two theories are summarized and concluded in Table 2 below, which highlights the critical elements for both public and commercial spaces, providing a framework for understanding how activities and design criteria influence the effectiveness and appeal of such environments.

Commercial Public Space Criteria

Based on Table 1 and Table 2, the criteria for commercial public spaces can be derived and further detailed in Table 3. These criteria are fundamental to understanding the requirements of an effective commercial public space, ensuring that such environments meet both functional and aesthetic standards while providing a welcoming and engaging atmosphere for users.

The criteria outlined in the previous tables reflect the integration of various elements that influence the design and use of commercial spaces. The combination of comfort, accessibility, engagement, visual appeal, and activity support forms the foundation for developing a commercial public space that encourages participation, fosters community interactions, and provides a positive user experience. Table 3 below summarizes these criteria as identified in the Peningkatan Interaksi Publik melalui Penerapan Threshold Space pada Area Komersial di Kawasan Mangga Besar, Jakarta, Dikwatama, 2019, presenting a comprehensive view of the essential factors that contribute to a successful commercial public space.

Table 2. Commercial area theories conclusion

Buildings for Commerce and Industry	**Urban land use planning**	**Commercial Architecture (Journal, 2017)**	**Commercial Area Criteria**
Clarity Complexity		Strong Image	**Accessibility** : strategic and stand out
Boldness	Accesibility Activity Range	Location	**Activity Range :** offers a different types of activities **Visual :** interesting identity
Intimacy	Sustainable Terrain	Surrounding Condition	**Technology :** new innovation **Integration**, connectivity to
Inventiveness	Infrastructure	Tecnology	surrounding areas
Flexibility		Safety	Safety and Comfort

(Source : Peningkatan interaksi publik melalui penerapan threshold space pada area komersial di kawasan mangga besar, jakarta, dikwatama, 2019)

Table 3. Commercial public space criteria besar, jakarta, dikwatama, 2019

Public Space Criteria	Commercial Building/Area Criteria	Commercial Public Space Criteria
Accessible	Accessibility, strategic	**Accessibility,** main access, pedestrian access, circulation
Active contributin, social interaction	Activity range, offering different types of activities	**Activity and Function**, activity diversity, function, social interaction
Passive contribution, has an appealing view		
Identity	Visual, interesting identity	**Identity,** easily recognizable
	Technology	
	Integration	
Livable, comfort	Comfort, circulation flexibility	**Comfort,** connectivity to surrounding buildings and sensory comfort
Relax, sensory comfort	Safety	

(Source: Peningkatan interaksi publik melalui penerapan threshold space pada area komersial di Kawasan Mangga)

Multisensory Approach Principal

Peter Zumthor stated nine multisensory experience principals in architectural objects [17] : (a) The Body of Architecture. Architecture and human have similarity, they have body. The body anatomy of an architectural

object are ‘skin and organs’ (visible parts) and ‘anatomical systems or cells in the body’ (invisible parts); (b) Material Compatibility. Sensitive to the use of materials, each material is 'sustainable', flexible, and can be managed and used without restrictions; (c) The Sound of Space. Every architectural object has a ‘tone’ and ‘rhythm’ in each space. Interior arrangement becomes a sound-forming instrument in space and can be created through the use of certain materials; (d) The Temperatur of Space. There are two types of temperature, physical temperature, which is influenced by the material used and psychological temperature, namely the atmosphere of the room which affects the atmosphere and feelings of the room user; (e) Surroundings Objects. Objects around the building that can evoke atmosphere, imagination, beauty, or interest; (f) Between Composure and Seduction. Every architectural object has a 'groove' or 'sequence' which naturally 'guides', 'stimulates', and provides 'relaxation' so buildings direct the user’s behavior; (g) Tension Between Interior and Exterior. The relationship between indoor and outdoor spaces that represents each other; (h) Levels of Intimcay. Regards to the scale, size, dimensions of shape, space, and openings in the building which are factors for the existence of sequences so that the building seems to have a storyline that can affect the 'mood and feeling' of its users; (i) The Lights on Things. Buildings can be defined as a 'perforated pure mass of shadows' which then light is given. Paying attention to how light and shadow fall in the building, as well as the position and shape of light and shadow so that they can have their own effect and affect the spiritual quality of the building. Light in buildings can be natural light or artificial light.

Sensing Concept on Multisensory Approach Principle

Peter Zumthor’s principle of multisensory approach integrated with sensing concept in multisensory architecture is described in the figure 6.

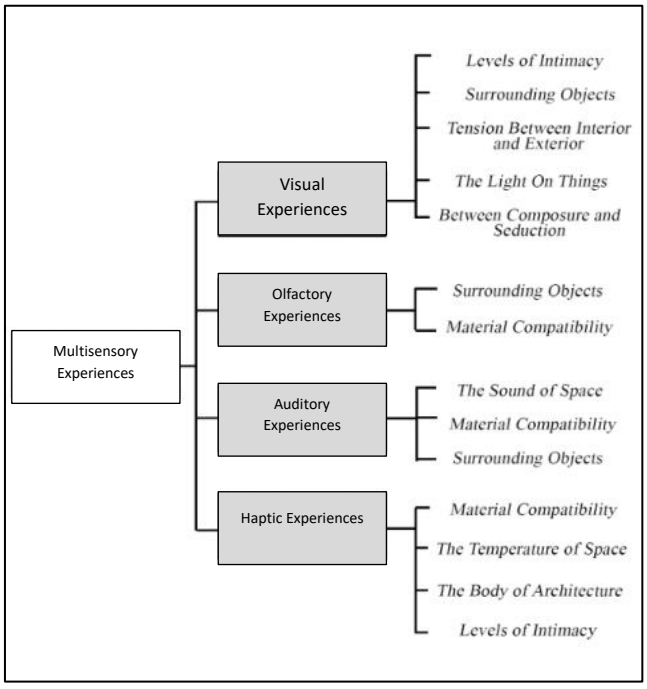


Figure 6. Sensing concept on multisensory approach

(Source : Author's illustration)

Commercial Public Space and Multisensory Approach

The commercial public space criteria which is concluded in Table 3 is combined with Multisensory Approach principles by Peter Zumthor and sensing concept in Multisensory Architecture. The following explanation is described in Table 4.

Table 4. Commercial public space and multisensory approach

Commercial Public Space Criteria	Multisensory Approach	Perceived Multisensory Experiences
1- Accessibility • Main Entrance Pedestrian Entrance Circulation	***The Body of Architecture*** Access veins that become an integral part of functions and buildings in public spaces	Haptic Experience
	Material Compatibility Using materials that provide both tactile and sound feedback such as of wood, natural stone, gravel and framing elements such as iron bollards, marble railings, and others.	Auditory and Haptic Experience
	Surrounding Objects Using outdoor elements as a 'frame' for main entrances or circulation paths such as bushes, tree, or bollard. The use of 'framing' elements that have a distinctive and significant aroma such as lavender plants, yellow flowers, eucalyptus plants, and others could also be the other option.	Visual and Olfactory Experience
	Between Composure and Seduction Circulation pattern that has a guiding and stimulating sequence that guides the user's movement	Visual Experience
	Levels of Intimacy Highlighting the main entry and the beginning of the sequence of the circulation flow after it	Haptic Experience
2- Activity and Function • Activity diversity • Function • Social activity	***The Sound of Space*** Sound manipulation based on function in commercial public spaces. For example, relaxation function can use ponds or fountains as an element of relaxation and the use of vegetation as noise suppression. Whereas for commercial function could use some type of materials with good acoustics (such as wood).	Auditory Experience
	Tension Between Int. & Ext. The façade describes the function inside, for example: canopy cover can be used as an element of function identification in the commercial area	Visual Experience
	Surrounding Objects The use of elements that have a distinctive aroma to identify the function of space, for example the aroma of coffee in the cafe's commercial area (stimulating to want to buy drinks at the café) and citrus aroma in the lavatory area (stimulates to maintain cleanliness).	Olfactory Experience
	Level of Intimacy The use of curvilinear and rectilinear shapes to differentiate functions, for example curvilinear elements that have an impression of 'welcoming shapes' can be placed at the entrance of public spaces and rectalinear elements (rectangles, triangles, etc.) can be used in commercial areas which can also facilitate navigation of motion formed by clear angles.	Visual Experience
	The Light on Things The use of warm and cool light to identify space functions, for example the use of warm light in commercial areas with relaxation functions such as cafes and the utilization of natural light to identify of public functions such as an atrium for communal spaces	Visual Experience

Commercial Public Space Criteria	Multisensory Approach	Perceived Multisensory Experiences
3- Identity • Easily recognizable	***Surrounding Objects*** Has a unique shape and is not monotonous from the surrounding buildings	Visual Experience
	Tension Between Int. & Exr. The relationship between the exterior appearance of the building and the interior space	Visual Experience
4-Comfort • Connectivity to Surrounding Buildings • Sensory comfort	***The Sound of Space*** Use of sound-absorbing elements such as vegetation to buffer sound against noise or the use of water for relaxation elements	Auditory Experience
	The Temperature of Space The use of vegetation with dense canopy as natural shade in public spaces	Haptic Experience

(Source: Author's conclusion)

Case Study: Pasar Induk Kota Batu

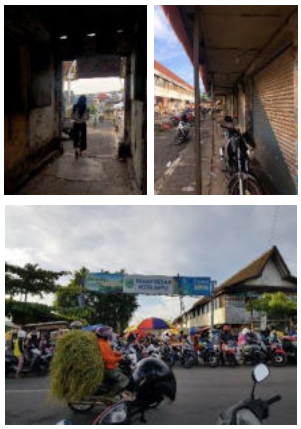
The criteria summarized in Table 4 provide a framework for analyzing Pasar Induk Kota Batu, specifically focusing on the public space used for Pasar Pagi activities that take place every day from 05:00 to 08:00. This market event is a vital part of the local community, where vendors gather to sell fresh produce, goods, and food, creating a unique opportunity to examine the sensory engagement and spatial qualities of the market. Table 5 outlines the key findings from the multisensory analysis of Pasar Pagi, showing that the market excels in terms of olfactory experience, thanks to the strong scents from fresh produce and local foods. However, there are areas for improvement in the visual and haptic experiences, particularly in the lighting and tactile qualities of the space. The market's vibrant visual atmosphere, driven by colorful stalls and signage, could be enhanced with better strategic lighting, especially in the evening, to improve navigation. Additionally, while the olfactory experience is rich, the arrangement of stalls could be optimized to create a more cohesive and immersive sensory environment.

To further explore these findings, Figures 7 through 11 provide additional context on the sensory experiences at Pasar Pagi. Figure 7 shows the visual vibrancy of the market but highlights the lack of lighting in certain areas. Figure 8 captures the strong olfactory experience from the market's fresh produce and spices, suggesting further optimization of stall arrangement. Figure 9 reveals the auditory dynamics of the space, proposing the addition of natural sound elements like water features to balance the bustling activity. Figure 10 focuses on the haptic experience of walking on asphalt paths, suggesting the use of tactile materials like cobblestones or wood to improve the tactile experience. Finally, Figure 11 emphasizes the need for better accessibility features, such as guiding blocks or textured pathways for individuals with visual impairments. These observations highlight that while Pasar Induk Kota Batu offers a vibrant sensory experience, there is significant potential to improve its multisensory engagement through enhancements in lighting, sound design, and tactile materials, creating a more inclusive and engaging environment for all users.

Table 5. Multisensory approach in pasar pagi pasar induk kota batu

Commercial Public Space Criteria	Pasar Induk Kota Batu	Multisensory Approach	Perceived Multisensory Experiences	Check list
1- Accessibility . Main Entrance Pedestrian Entrance Circulation	Main Entrance :    **Figure 7.** Different Main Entrances in Pasar Induk Batu (Source : Google Maps, Accessed July 29 2022) Pedestrian and Site Circulation :     **Figure 8.** Different Main Entrances in Pasar Induk Batu (Source : Google Maps, Accessed July 29 2022)	***The Body of Architecture*** The circulation has an enough wide for its function but does not have an 'invisible axis' to help users orientation ***Material Compatibility*** The material used in Pasar Induk Kota Batu was mainly asphalt which does not give acoustic feedback and the paths were not framed by fence, bollard, railing, or etc. ***Surrounding Objects*** The paths were not framed by any sort of fence, railing, bollard, and etc. However, the paths were formed between seller's stall during the Pasar Pagi activities. The seller's merchandise has an aromatic feedback (such as fish, poultry, fruits, etc.) but they were not arranged by categories so the feedback is vague. ***Between Composure and Seduction*** The site circulation was linear along the perimeter of the site. ***Levels of Intimacy*** Have a clear and easily identified signage for the main entrance.	Haptic Experience Auditory and Haptic Experience Visual and Olfactory Experience Visual Experience Haptic Experience	× × ✓ ✓ ✓

Commercial Public Space Criteria	Pasar Induk Kota Batu	Multisensory Approach	Perceived Multisensory Experiences	Check list
2- Activity and Function . Activity diversity . Function . Social activity	 **Figure 9.** Activities in Pasar Pagi Pasar Induk Kota Batu (Source : Author's Documentation, 2021)	***The Sound of Space*** The passive and active functions were not separated, in fact there was no relaxing space or park bench to sit around. The sounds mainly came from the vendor's voices	Auditory Experience	×
		Tension Between Int. & Ext. Several vendor's stall were equipped with canopy and even walls, but some just a single table.	Visual Experience	✓
		Surrounding Objects Although several seller's merchandise have variety of smells (fish, poultry, fruits), they were not arrange to give a meaningful aromatic feedback.	Olfactory Experience	✓
			Visual Experience	×
		Level of Intimacy The Pasar Pagi was arranged along the main road in the perimeter of the site. The angle appear only on the corner of the paths	Visual Experience	×
		The Light on Things The Pasar Pagi occurred in an outdoor area during daylight		
3- Identity Easily recognizable	 **Figure 10.** Pasar Pagi (Source : Author's Documentation, 2021)	***Surrounding Objects*** Easily identified by the colorful canopies and umbrellas from the vendor's stall	Visual Experience	✓
		Tension Between Int. & Ext. Does not have a building form, the space was formed between the vendor's stall.	Visual Experience	×

Commercial Public Space Criteria	Pasar Induk Kota Batu	Multisensory Approach	Perceived Multisensory Experiences	Check list
4-Comfort . Connectivity to Surrounding Buildings . Sensory comfort	 **Figure 11.** Connectivity of Pasar Induk Kota Batu (Source : Author's Documentation, 2021)	***The Sound of Space*** The main building (Pasar Induk) act as a sound buffer from the main street (Jl. Dewi Sartika). The auditory feedback only comes from the sound of people's conversation and the vendor's activities (coconut shredder, knives cutting, etc). ***The Temperature of Space*** The space was being shadowed by the main building (Pasar Induk) and some stalls have their own roof and canopies**.** The activities in this area were only occurred in the morning where the temperature is mainly cool. The use of vegetation is very minimal	Auditory Experience Haptic Experience	✓ ✓

(Source: Author's preparation, 2022)

The table above shows that Pasar Induk Kota Batu has met several sensory experiences which are :

(a) Visual experiences : 4/7* (57.1%)

(b) Olfactory experiences : 2/2* (100%)

(c) Auditory experiences : 1/3* (33.3%)

(d) Haptic experiences : 2/4* (50%)

*the total indicators are obtained from Table 4.

Pasar Induk Batu has plenty entrances (main entrance and pedestrian entrance) that can be easily identified from the front of the site. The entrances were indicated by a huge signage of the name of the market. These gives a good visual feedback to users. Despite the good visual experiences in terms of entrances, the auditory and haptic experience could have some improvement to help users identify the circulation. The paths mainly used asphalt for its material. Althought it gives a decent haptic feedback due to its rough texture, it cannot distinguish the different function for different activities in commercial public space. Wood, tile, or cobblestone could be a good use for differentiating the active and passive activities zone. Moreover, it gives auditory feedback. Guiding blocks also could be helpful for users with poor vision to navigate around the public space. In terms of olfactory experiences, it was quite all over the place. The merchandise sold in Pasar Pagi include fruits, fish, poultry, food and drinks, and household appliances. Unfortunately, they were not arranged by the types of merchandise so the auditory feedback were not well-memorized by the users. Arranging the merchandise by their types could leave a stronger auditory experiences for users.

Pasar Induk Kota Batu divided by two main activities. Pasar Pagi activities operates from 05.00-08.00 and Pasar Induk operates from 08.00-16.00. Most of the activities occurred in Pasar Pagi are active activities

(trading). Pasar Pagi used the public space outside the building, and it becomes a parking spots after its operation hour. Therefore, this space was formed on top of a large parking lot and it lacks space for passive activities (relaxing, enjoying the view, etc.) Adding some landscaping and vegetations give more visual and haptic experience for users. Besides giving an attractive view and relaxing feeling from the greeneries, vegetations can control the site temperature, give a cooler and comfortable environment, and can be used as home for birds, squirrels, and other small animals, adding an auditory experiences to the space. Aromatic flowers or plants could add auditory value and would be a memorable auditory experiences.

4. Conclusion

Public space is an open space for everyone that can be accessed by all levels of urban society, both from the economic aspect, gender, to the diversity of human physical abilities (normal users and people with disabilities). The physical form of commercial public space should be a friendly one to ensure both heterogeneity and difference or the right to be different. Therefore the concept of multisensory becomes an important approach in commercial public space design and management. Based on the results and discussion, Pasar Induk Kota Batu has met several sensory experiences which are olfactory experiences, visual experiences, haptic experiences, and auditory experiences. Eventhough all of the sensory experiences had been reflected on some of its elements, there could be a lot of additional changes that could be done to strengthen its sensory experiences. Therefore, it can be further improved in future development so the commercial public space in Pasar Induk Kota Batu can give a more memorable and diverse sensory experience, especially for users who have vision limitations so that it can help identify and give a deeper impression of a space in the expectation of supporting commercial activities.

5. Acknowledgements

We would like to express our gratitude to all the individuals and organizations that have supported this research. Special thanks to Pasar Induk Kota Batu for granting access to the site and allowing us to observe the Pasar Pagi activities. We would also like to acknowledge the insightful guidance provided by our mentors at Universitas Trisakti, especially the Department of Architecture. Additionally, we appreciate the support from our families and colleagues for their encouragement throughout this project. This study would not have been possible without the cooperation of various stakeholders who contributed their time and knowledge to this research.

6. Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this article. The research was conducted independently, and the findings presented here are free from any commercial or financial influence that could have biased the results or conclusions of the study.

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Multisensory Approach in Commercial Public Space Design in East Java, Indonesia

Abstract. Social interaction is an activity that can never be separated from human life. Public space is community place for social activities to occur. Along with its development, public space has transformed its function into a commercial area. Commercial activities require humans to continue to be active in an environment, including in public spaces. Public space is actually a space that can be accessed by anyone, and can provide a memorable space experience for its users, from all races, social statuses, to sensory capabilities (normal and people with disabilities). But unfortunately, commercial public spaces tend to only pay attention to visual experiences and ignore other sensory experiences in human senses. This study discusses the design criteria for commercial public spaces with a multisensory approach that uses literature review methods and case studies at the Pasar Induk Kota Batu, East Java, Indonesia. This study shows that Pasar Induk Batu has met several sensory experiences which are olfactory experiences, visual experiences, haptic experiences, and auditory experiences.

Keywords : multisensory, public spaces, commercial area

INTRODUCTION

Living things, especially human is inseparable with space. Urban space is an important part of people's lives. Various kinds of activities occur in urban life, including in public spaces. According to Chua Beng-Huat and Norman Edwards (1992), public space has a broad scope as quoted from Roger Scruton (1984) that "public space" is a term used to describe a place that is designed simply, where everyone can access and a place where unplanned meetings can occur between individuals [1]. Meanwhile, according to Hakim (2003), public space, with its simplicity, becomes a place for social and ecological functions [2]. Public space is a very prominent space for the city's growth, and is supported by trade, entertainment/recreational, cultural and government activities (Purwanto, 2014). As a place that is very close to citizen with diverse races, social status, to sensory capabilities (normal and disabled), public spaces often ignore the space experiences other than visual experiences, especially those that support commercial activities.

According to S. Carr, Francis, Rivlin, & Stone (1992), public space is an open space outside the building, including: roads, city parks, fields, and so on [2]. This is similar to Rob Krier's (1979) statement which states that public space is a space formed between building masses [2]. Meanwhile, Hakim (2003) stated that public space also functions as a place for human mobility to move from one place to another. He also stated that public space basically has two functions, namely social functions and ecological functions [2]. As a social function, public space facilitates activities such as sports, playing, environmental view, communication, and others. Meanwhile, as an ecological function, public space acts as environmental conditioning, rainwater absorption space, architectural maintainer, and others [2].

A city space should be a public space that can support the activities of city dwellers. According to Jan Gehl (2010), a public space can be successful if it has a combination of static and moving activities [3]. Static activities can be in the form of sitting, enjoying the scenery, enjoying cultural performances while active activities such as communicating and socializing with other people. Therefore, public space can provide a city identity that supports the activities of city dwellers in terms of social, economic, and cultural aspects. Public space and commercial activities have a close relationship with requiring humans to continue to be active in an environment [3].

The physical form of commercial public space should be a friendly one to ensure both heterogeneity and difference or the right to be different [4]. Therefore the concept of multisensory becomes an important approach in commercial public space design and management. As a place that is very close to the life of the urban community, in reality, public space often ignores human sensory experiences other than visual experiences. This study aims to review the multisensory approach in commercial public spaces design so that it can provide a memorable space experience that is more than just a visual experience, to support commercial activities in public spaces along with a case study at the Pasar Induk Kota Batu, East Java with some research questions:

a) What is a multisensory approach?
b) What are the criteria for commercial public spaces with a multisensory approach?
c) Have the criteria for commercial public spaces with a multisensory approach been applied to the Pasar Induk Kota Batu?

The multisensory approach known as "VAKT" (visual-auditory-kinesthetic-tactile) [5] is an approach that does not only rely on the relationship between images and writing, but also integrates touch, taste, and smell [6]. According to Spence (2020), multisensory provides relevant insight corcerning the rules governing sensory integration in the perception of objects and events. According to Selina Mason, multisensory designs provide a more meaningful relationship between ourselves and the surrounding environment, and have a restorative effect on the sounds, smells, textures, and beauty of the surrounding environment [7]. The multisensory approach combines the five human senses, namely the senses of smell, hearing, sight, taste, and taste. According to Heilig (1992), the percentage of the human sensory level is 70% visual, 20% auditory, 5% tactile, 4% smell, and 1% taste [8].

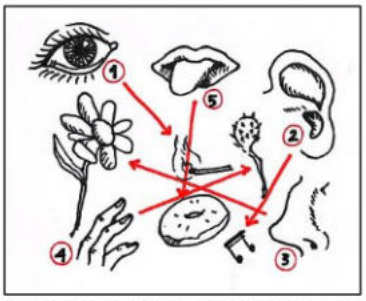

FIGURE 1. Human Senses (Source : Author's Illustration – Redraw from "Sense of Place : architecture for multisensory mind" Journal)

For decades, architecture has focused on creating designs that are pleasing to the eye but often ignore other human sensory reactions [7]. Whereas human experience various types of stimuli in their daily lives. For example, when we walk in the park, we are not only see the beauty of the landscape and the various colors of flowers, but we also hear birds chirping, the sound of fish ponds, the fragrance of flowers, and the cool breeze blowing. Those sensory experiences provide a rich spatial experience. Embedding these sensory experiences in a 'constructable form' can be defined as a multisensory architecture [7].

Adzani & Arvanda (2013) concluded that sensory experience according to Pallasmaa (2012) and Gibson becomes [9]:

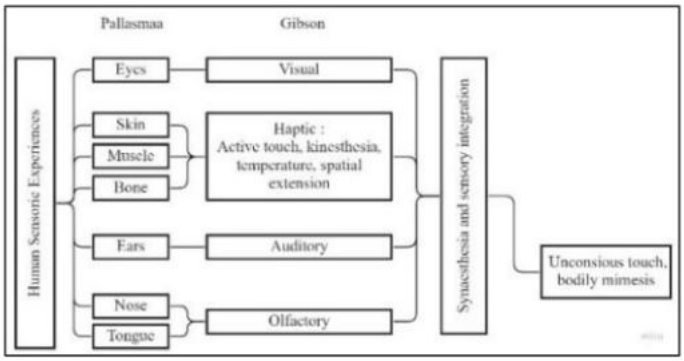

FIGURE 2. Human Sense Grouping Diagram (Source : Author's Illustration from Journal "Peran Pengalaman Multiindra dalam Ruang Interior Komersil, Neysha Adzhani, 2013)

i. Visual Experience

The sense of sight is defined as the main sensibility in architecture, which turns out to have more effect than aesthetics [10]. According to Lefton and Brannos (2002) in Steinfeld and Messel (2012), 70% of human sensory information comes from sight [11]. According to Spence (2020), people think that curved shapes tend to be more welcoming and easy to reach than rectangular shapes. Rectangular shapes, especially those with angles pointing directly at someone, give the impression of being "threatening" and triggering a rejection response [8]. For users who are partially blind or totally blind, spatial arrangement (corridor) with a curved shape should be avoided because it can make navigation difficult [11]. Corridors with clear angle gives easier orientation for the movement of the blinds.

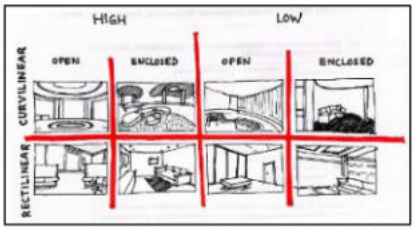

FIGURE 3. Visualitation of Angled and Curved Rooms (Source : Author's Illustration from Journal (Sense of Place : architecture for the multisensory mind)

Apart from form, visual perception can also be affected by color and lighting. Color can show the volume of space, construction details, or show certain aspects of a room, as well as being a medium for representing emotions and visual effects [12]. Color can also help in identifying the character, atmosphere, and spatial hierarchy of an architectural building. Color can strengthen or weaken spatial boundariesa and also define the surface and volume in a composition [13]. According to Wolfgang & Goethe, 2015 in the book "Goethe's Theory of Colors", colors are divided into two categories, which are divided into long waves colors and short waves colors [14]. Red, yellow, yellow-red, and red-yellow are included in the long wave colors that create a warm impression. Meanwhile, blue and green are short-wave colors that provide coolness and relaxation. Colors are also classified into warm colors and cool colors. Warm colors stimulate an increase in heart rate, respiration, and blood pressure while cool colors have the opposite effect [13]. The images below are the psychological effects of colors according to "*Psychology of Colours in Building Design"* by Jain (2017):

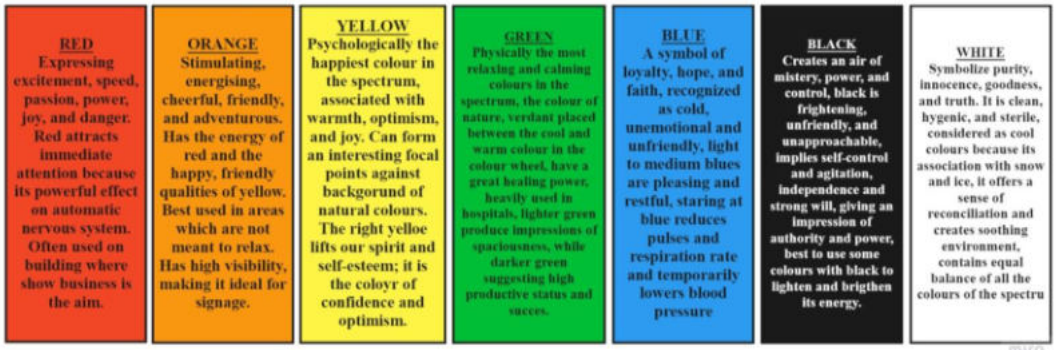

FIGURE 4. Psychology of Colour (Source : Author's Illustration from Journal "Psychology of Colours in Building Design", Akshara Jain, 2017)

ii. Olfactory Experience

The senses of smell and taste are often referred as chemical senses. According to Pallasmaa (1994), the strongest memory of a space is often its smell [8]. Architectural design that does not pay attention to "olfactory design" is often associated with Sick Building Syndrome (SBS). SBS can be attributed to poor air circulation and unusual odors [8]. Pennycook & Otsuji (2015) also stated that smell is an important element to represent space in shops and markets [6]. The use of materials with strong aromas in space, furniture, and other space elements can be a marker of space differences (Lestari & Widyarthara, 2012).

iii. Auditory Experience

Sound can be an element to identify the proportions of a space, even its function (Blesser & Salter (2007); Eberhard (2007); Robart & Rosenblum (2005) from [8]. However, designers are more focused on ways to eliminate or minimize disturbing noises such as city noise, vehicles, and others. The use of acoustic materials and floor materials that have different reflected sounds helps the activity of the total blind [15].

iv. Haptic Experience

Tactile elements in buildings are often ignored, even though they are the first things that users come into contact with when entering or leaving the building. The two key elements in tactile sensation are changes in temperature and changes in floor material [8]. For example, the temperature setting in a warm sauna room creates social attachment and a sense of closeness. Optimizing the texture on the surface of walls and furniture helps the mobility of the blind [15]. Tactile elements are fundamental elements in the multisensory experience in architectural buildings [8].

METHOD

The method used in this study is literature review by taking data from scientific journals regarding commercial public spaces and a multisensory approach and case study at the Pasar Induk Kota Batu. Pasar Induk Kota Batu is a traditional market located on Jalan Dewi Sartika, Kelurahan Temas, Kota Batu, East Java, 65315 Indonesia. The market functions as a strategic economic institution and as a contributor to the regional economy and a source of employment [16]. According to Hua (2017), the market defines human involvement with differences in race, social and economic class, ways of dressing, to differences in ways of communicating [6]. Pasar Induk Kota Batu which is a place for buyer-seller transactions as well as a node for the local economy. Pasar Induk Kota Batu as the heart of city life should be comfortably used by all users, including people with disabilities

FIGURE 5. Pasar Induk Kota Batu and its surrounding's function (Source : Author's Illustration from Google Earth)

Pasar Induk Kota Batu has a total area of 43,573 m2, surrounded by residential and commercial buildings. The operating hours of the Pasar Induk Kota Batu itself are divided into two main times, morning market (Pasar Pagi) activities at 05.00-08.00 and main market (Pasar Induk) activities at 08.00-16.00. The outer space of the market is used as a Pasar Pagi during its operating hours and after that it is used as a parking lot for motorbikes and cars. The case study in this study focuses on the public space that is functioned at pasar pagi.

RESULTS AND DISCUSSIONS

i. Public Space Criteria

According to Stephen Carr in his book *Public Spaces* (1992), public spaces have five criterias :

a. Comfort
   Providing psychological comfort such as weather, wind, sunlight factor, and also providing adequate facilities so that everyone is willing to use the public space
b. Relaxation
   Arranging landscaping elements
c. Passive Engagement
   Passive activities such as sitting, relaxing, enjoying the view without being interrupted by other users.
d. Active Engagement
   Being a condusive place for social interactions.
e. Discovery

Offering new experiences for users such as seasonal festival or concert.[3].

Meanwhile, according to PPS (Project for Public Spaces) from http://sim.ciptakarya.pu.go.id/ , public space has to have four main qualities :

a. Accessible, physically and visually well connected to surrounding areas.
b. Encouraging users activities and offers an inviting functions.
c. Comfortable, including safety, hygene, and seat availability.
d. Has a good visual.

Public space, according to Hamid Shirvani in the book *Urban Design Process,* is also has five criterias :

a. Livability
b. Sense
c. Views
d. Access
e. Identity[3]

From several different theories of public space criteria described above, table 1 filters those theories and come up with conclusion:

TABLE 1. Public Space Theories Conclusion

Stephen Carr	PPS	Hamid Shirvani	Public Space Criteria
Comfort	Comfortable	Livability	*Livable,*comfort
Relaxation	Visual	Sense	*Relax,* sensory comfort
Passive Engagement	Encouraging user's activities	Views	Appealing view to encourage passive activities
Active Engagement		Identity	Has a characteristic to encourage social interaction
Discovery	Accessible	Access	Accessible

(Source : Peningkatan Interaksi Publik Melalui Penerapan Threshold Space pada Area Komersial di Kawasan Mangga Besar, Jakarta, Dikwatama, 2019)

ii. Activities in Public Space

According to Rapoport (1997), activities in public space can be categorized to four components :

a. Real Activities (shopping, eating, walking, drinking)
b. Spesific Activities (shopping at a bazaar, drinking in a café, sitiing on a park bench, eating with friends)
c. Additional Activities (shopping at a bazaar while talking to a friend, walking in park while enjoying the view)
d. Symbolic Activities

Rapoport (1997) also stated that an activity can also consist of several sub-activities or also knows as "system of activity". System of activity in public space is related to three elements :

a. Street vendors (as an activity support of an area)
b. Parking
c. Pedestrians

iii. Commercial Building/Area Criteria

According to the book *Buildings for Commerce and Industry,* visual criteria of a commercial area are [3]:

a. Clarity
b. Boldness
c. Intimacy
d. Flexibility
e. Complexity
f. Efficiency
g. Inventiveness

According to Kaisher, Goldshack, and Chapin in *Urban Land Use Planning* (1995), stated the commercial area criterias [3]:

a. Accesibility

b. Activity Range
c. Infrastructure
d. Sustainable Terrain

Those two theories are concluded in Table 2.

TABLE 2. Commercial Area Theories Conclusion

Buildings for Commerce and Industry	***Urban land use planning***	**Arsitektur Komersial (Jurnal, 2017)**	**Kriteria Area Komersial**
Clarity		Strong Image	**Accessibility** : strategic and stand out
Complexity			
Boldness	Accesibility	Location	**Activity Range :** offers a different types of activities
	Activity Range		**Visual :** interesting identity
Intimacy	Sustainable Terrain	Surrounding Condition	**Technology :** new innovation
Inventiveness	Infrastructure	Tecnology	**Integration**, connectivity to surrounding areas
Flexibility		Safety	Safety and Comfort

(Source : Peningkatan Interaksi Publik Melalui Penerapan Threshold Space pada Area Komersial di Kawasan Mangga Besar, Jakarta, Dikwatama, 2019)

iv. Commercial Public Space Criteria

According to Table 1 and Table 2, the criteria for commercial public space can be obtained which are described in Table 3 below.

TABLE 3. Commercial Public Space Criteria

Public Space Criteria	**Commercial Building/Area Criteria**	**Commercial Public Space Criteria**
Accessible	Accessibility, strategic	**Accessibility,** main access, pedestrian access, circulation
Active contributin, social interaction	Activity range, offering different types of activities	**Activity and Function**, activity diversity, function, social interaction
Passive contribution, has an appealing view		
Identity	Visual, interesting identity	**Identity,** easily recognizable
	Technology	
	Integration	
Livable, comfort	Comfort, circulation flexibility	**Comfort,** connectivity to surrounding buildings and sensory comfort
Relax, sensory comfort	Safety	

(Source : Peningkatan Interaksi Publik Melalui Penerapan Threshold Space pada Area Komersial di Kawasan Mangga Besar, Jakarta, Dikwatama, 2019)

v. Multisensory Approach Principal

Peter Zumthor stated nine multisensory experience principals in architectural objects [17] :

a. The Body of Architecture
   Architecture and human have similarity, they have body. The body anatomy of an architectural object are 'skin and organs' (visible parts) and 'anatomical systems or cells in the body' (invisible parts).
b. Material Compatibility

Sensitive to the use of materials, each material is 'sustainable', flexible, and can be managed and used without restrictions.

c. The Sound of Space
Every architectural object has a 'tone' and 'rhythm' in each space. Interior arrangement becomes a sound-forming instrument in space and can be created through the use of certain materials.

d. The Temperatur of Space
There are two types of temperature, physical temperature, which is influenced by the material used and psychological temperature, namely the atmosphere of the room which affects the atmosphere and feelings of the room user.

e. Surroundings Objects
Objects around the building that can evoke atmosphere, imagination, beauty, or interest.

f. Between Composure and Seduction
Every architectural object has a 'groove' or 'sequence' which naturally 'guides', 'stimulates', and provides 'relaxation' so buildings direct the user's behavior.

g. Tension Between Interior and Exterior
The relationship between indoor and outdoor spaces that represents each other.

h. Levels of Intimcay
Regards to the scale, size, dimensions of shape, space, and openings in the building which are factors for the existence of sequences so that the building seems to have a storyline that can affect the 'mood and feeling' of its users.

i. The Lights on Things
Buildings can be defined as a 'perforated pure mass of shadows' which then light is given. Paying attention to how light and shadow fall in the building, as well as the position and shape of light and shadow so that they can have their own effect and affect the spiritual quality of the building. Light in buildings can be natural light or artificial light.

vi. Sensing Concept on Multisensory Approach Principle
Peter Zumthor's principle of multisensory approach integrated with sensing concept in multisensory architecture is described in the following diagram.

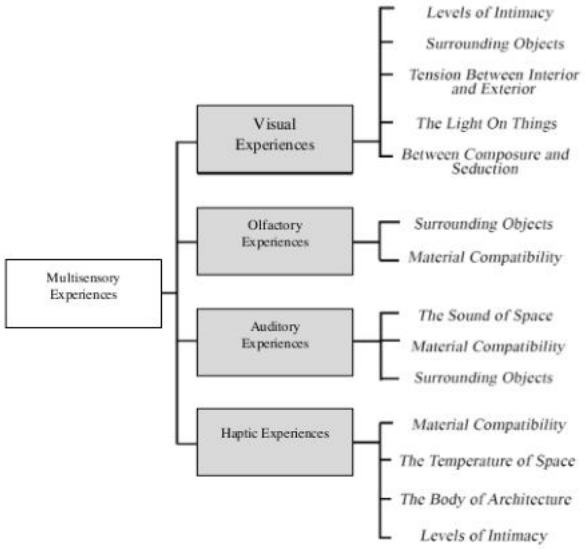

FIGURE 6. Sensing Concept on Multisensory Approach (Source : Author's Illustration)

vii. Commercial Public Space and Multisensory Approach

The commercial public space criteria which is concluded in Table 3 is combined with Multisensory Approach principles by Peter Zumthor and sensing concept in Multisensory Architecture. The following explanation is described in Table 4.

TABLE 4. Commercial Public Space and Multisensory Approach

Commercial Public Space Criteria	Multisensory Approach	Perceived Multisensory Experiences
1- Accessibility . Main Entrance Pedestrian Entrance Circulation	***The Body of Architecture*** • Access veins that become an integral part of functions and buildings in public spaces	Haptic Experience
	Material Compatibility • Using materials that provide both tactile and sound feedback such as of wood, natural stone, gravel and framing elements such as iron bollards, marble railings, and others.	Auditory and Haptic Experience
	Surrounding Objects • Using outdoor elements as a 'frame' for main entrances or circulation paths such as bushes, tree, or bollard. • The use of 'framing' elements that have a distinctive and significant aroma such as lavender plants, yellow flowers, eucalyptus plants, and others	Visual and Olfactory Experience
	Between Composure and Seduction • Circulation pattern that has a guiding and stimulating sequence that guides the user's movement	Visual Experience
	Levels of Intimacy • Highlighting the main entry and the beginning of the sequence of the circulation flow after it	Haptic Experience
2- Activity and Function . Activity diversity . Function . Social activity	***The Sound of Space*** • Sound manipulation based on function in commercial public spaces: - Relaxation function: use of ponds or fountains as an element of relaxation, use of vegetation as noise suppression - Commercial function: use of materials with good acoustics (such as wood)	Auditory Experience
	Tension Between Int. & Ext. - The façade describes the function inside, for example: canopy cover can be used as an element of function identification in the commercial area	Visual Experience
	Surrounding Objects The use of elements that have a distinctive aroma to identify the function of space, for example: - The aroma of coffee in the cafe's commercial area (stimulating to want to buy drinks at the café) - Citrus aroma in the lavatory area (stimulates to maintain cleanliness)	Olfactory Experience

Commercial Public Space Criteria	Multisensory Approach	Perceived Multisensory Experiences
	Level of Intimacy The use of curvilinear and rectilinear shapes to differentiate functions, for example: - curvilinear elements that have an impression of 'welcoming shapes' can be placed at the entrance of public spaces - rectalinear elements (rectangles, triangles, etc.) can be used in commercial areas which can also facilitate navigation of motion formed by clear angles.	Visual Experience
	The Light on Things The use of warm and cool light to identify space functions, for example: - Use of warm light in commercial areas with relaxation functions such as cafes - Utilization of natural light to identify of public functions such as an atrium for communal spaces	Visual Experience
3- Identity **Easily recognizable**	***Surrounding Objects*** • Has a unique shape and is not monotonous from the surrounding buildings	Visual Experience
	Tension Between Int. & Exr. • The relationship between the exterior appearance of the building and the interior space	Visual Experience
4-Comfort **. Connectivity to Surrounding Buildings** **. Sensory comfort**	***The Sound of Space*** • Use of sound-absorbing elements such as vegetation to buffer sound against noise • Water as relaxation element	Auditory Experience
	The Temperature of Space • The use of vegetation with dense canopy as natural shade in public spaces	Haptic Experience

(Source : Author's Conclusion)

viii. Case Study : Pasar Induk Kota Batu

The criteria concluded in Table 4 is used to analyze the condition in Pasar Induk Kota Batu. This analysis focuses on the public space used for pasar pagi activities which occurred everyday in Pasar Induk Kota Batu at 05.00-08.00. The analysis described in Table 5 below.

TABLE 5. Multisensory Approach in Pasar Pagi Pasar Induk Kota Batu

Commercial Public Space Criteria	Pasar Induk Kota Batu	Multisensory Approach	Perceived Multisensory Experiences	Check list
1- Accessibility . Main Entrance Pedestrian Entrance Circulation	Main Entrance :    **FIGURE 7.** Different Main Entrances in Pasar Induk Batu (Source : Google Maps, Accessed July 29 2022) Pedestrian and Site Circulation :   **FIGURE 8.** Different Main Entrances in Pasar Induk Batu (Source : Google Maps, Accessed July 29 2022)	***The Body of Architecture*** • The circulation has an enough wide for its function but does not have an 'invisible axis' to help users orientation	Haptic Experience	×
		Material Compatibility • The material used in Pasar Induk Kota Batu was mainly asphalt which does not give acoustic feedback and the paths were not framed by fence, bollard, railing, or etc.	Auditory and Haptic Experience	×
		Surrounding Objects • The paths were not framed by any sort of fence, railing, bollard, and etc. • The paths were formed between seller's stall during the Pasar Pagi activities • The seller's merchandise has an aromatic feedback (such as fish, poultry, fruits, etc.) but they were not arranged by categories so the feedback is vague.	Visual and Olfactory Experience	✓
		Between Composure and Seduction • The site circulation was linear along the perimeter of the site.	Visual Experience	✓
		Levels of Intimacy • Have a clear and easily identified signage for the main entrance.	Haptic Experience	✓

Commercial Public Space Criteria	Pasar Induk Kota Batu	Multisensory Approach	Perceived Multisensory Experiences	Check list
2- Activity and Function . Activity diversity . Function . Social activity	 **FIGURE 9.** Activities in Pasar Pagi Pasar Induk Kota Batu (Source : Author's Documentation, 2021)	***The Sound of Space*** • The passive and active functions were not separated, in fact there was no relaxing space or park bench to sit around. • The sounds mainly came from the vendor's voices	Auditory Experience	×
		Tension Between Int. & Ext. • Several vendor's stall were equipped with canopy and even walls, but some just a single table.	Visual Experience	✓
		Surrounding Objects • Although several seller's merchandise have variety of smells (fish, poultry, fruits), they were not arrange to give a meaningful aromatic feedback.	Olfactory Experience	✓
		Level of Intimacy • The Pasar Pagi was arranged along the main road in the perimeter of the site • The angle appear only on the corner of the paths	Visual Experience	×
		The Light on Things • The Pasar Pagi occurred in an outdoor area during daylight	Visual Experience	×
3- Identity Easily recognizable	 **FIGURE 10.** Pasar Pagi (Source : Author's Documentation, 2021)	***Surrounding Objects*** • Easily identified by the colorful canopies and umbrellas from the vendor's stall	Visual Experience	✓
		Tension Between Int. & Exr. • Does not have a building form, the space was formed between the vendor's stall.	Visual Experience	×

Commercial Public Space Criteria	Pasar Induk Kota Batu	Multisensory Approach	Perceived Multisensory Experiences	Check list
4-Comfort **. Connectivity to Surrounding Buildings** **. Sensory comfort**	  **FIGURE 11.** Connectivity of Pasar Induk Kota Batu (Source : Author's Documentation, 2021)	***The Sound of Space*** • The main building (Pasar Induk) act as a sound buffer from the main street (Jl. Dewi Sartika) • The auditory feedback only comes from the sound of people's conversation and the vendor's activities (coconut shredder, knives cutting, etc). ***The Temperature of Space*** • The space was being shadowed by the main building (Pasar Induk) and some stalls have their own roof and canopies. • The activities in this area were only occurred in the morning where the temperature is mainly cool. • The use of vegetation is very minimal	Auditory Experience Haptic Experience	✓ ✓

(Source : Author's preparation, 2022)

The table above shows that Pasar Induk Kota Batu has met several sensory experiences which are :

- Visual experiences : 4/7* (57.1%)
- Olfactory experiences : 2/2* (100%)
- Auditory experiences : 1/3* (33.3%)
- Haptic experiences : 2/4* (50%)

*the total indicators are obtained from Table 4.

Pasar Induk Batu has plenty entrances (main entrance and pedestrian entrance) that can be easily identified from the front of the site. The entrances were indicated by a huge signage of the name of the market. These gives a good visual feedback to users. Despite the good visual experiences in terms of entrances, the auditory and haptic experience could have some improvement to help users identify the circulation. The paths mainly used asphalt for its material. Althought it gives a decent haptic feedback due to its rough texture, it cannot distinguish the different function for different activities in commercial public space. Wood, tile, or cobblestone could be a good use for differentiating the active and passive activities zone. Moreover, it gives auditory feedback. Guiding blocks also could be helpful for users with poor vision to navigate around the public space. In terms of olfactory experiences, it was quite all over the place. The merchandise sold in Pasar Pagi include fruits, fish, poultry, food and drinks, and household appliances. Unfortunately, they were not arranged by the types of merchandise so the auditory feedback were not well-memorized by the users. Arranging the merchandise by their types could leave a stronger auditory experiences for users.

Pasar Induk Kota Batu divided by two main activities. Pasar Pagi activities operates from 05.00-08.00 and Pasar Induk operates from 08.00-16.00. Most of the activities occurred in Pasar Pagi are active activities (trading). Pasar Pagi used the public space outside the building, and it becomes a parking spots after its operation hour. Therefore, this space was formed on top of a large parking lot and it lacks space for passive activities (relaxing, enjoying the view, etc.) Adding some landscaping and vegetations give more visual and haptic experience for users. Besides giving an attractive view and relaxing feeling from the greeneries, vegetations can control the site temperature, give a cooler and comfortable environment, and can be used as home for birds, squirrels, and other small animals, adding an auditory

experiences to the space. Aromatic flowers or plants could add auditory value and would be a memorable auditory experiences.

CONCLUSION

Public space is an open space for everyone that can be accessed by all levels of urban society, both from the economic aspect, gender, to the diversity of human physical abilities (normal users and people with disabilities). The physical form of commercial public space should be a friendly one to ensure both heterogeneity and difference or the right to be different. Therefore the concept of multisensory becomes an important approach in commercial public space design and management. As a case study, Pasar Induk Kota Batu has met several sensory experiences which are olfactory experiences, visual experiences, haptic experiences, and auditory experiences. As an architectural object, public space is rich in visual experience. Multisensory approach gives a more memorable and diverse experience, especially for users who have limitations in visions. The addition of space experience to other human sensory elements can help identify and give a deeper impression of a space in the expectation of supporting commercial activities.

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