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VISUAL PREFERENCE OF PEDESTRIANS' WAYFINDING SIGNAGES: A SYSTEMATIC LITERATURE REVIEW

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ABSTRACT

Urban spaces are often crowded and complex, posing a significant challenge for pedestrians navigating a city. Enhancing walking facilities requires a comprehensive understanding of pedestrians' visual preference for wayfinding signage and the evaluation methods applied. This paper presents a systematic review of 80 studies using the PRISMA methodology, delving into the philosophical background, benefits, evaluation methods, and influencing factors related to wayfinding signage visual preference while identifying existing research gaps. The results underscore the substantial influence of wayfinding signage visual preference by both its physical characteristics and aesthetic perception. These findings lay the foundation for a comprehensive research framework for assessing visual preference. This study suggests that urban wayfinding signage design should intricately consider the interplay between signage's physical characteristics and aesthetic perception, integrate spatial function and visual effect, balance personalised and standardised needs, and improve signage function and aesthetic quality. The findings fill a critical gap in the existing literature about the visual preference of wayfinding signages and offer valuable insights and guidance for future research endeavours.

1. INTRODUCTION

Urban spaces are often characterised by congestion and complexity, posing significant challenges for pedestrian wayfinding. Wayfinding signage is a common walking facility providing direction and information to pedestrians, facilitating safe, swift and comfortable navigation within the city (Calori, 2015; Garg & Dewan, 2022; Hu & Xu, 2023; Su et al., 2021). However, wayfinding signage is more than just a functional tool; it is also a visual element. Its design should encompass not only content, form, and location but also considerations of colour, style, and emotional appeal, among other aesthetic features (Bin Zolkefil & Talib, 2022; Greenroyd et al., 2017; Lee et al., 2020; Zolkefil & Talib, 2022). These features significantly influence the pedestrians' visual preference and wayfinding behaviour of wayfinding signage, thereby shaping their overall walking experience (Gresham et al., 2019; Hui et al., 2014; Neves et al., 2021).

Visual preference represents a subjective and multidimensional psychological phenomenon which refers to the degree of aesthetic preference of an individual for a visual object or scene (Mahdieh et al., 2011; Wang et al., 2016). Various factors, including individual, social, cultural, and environmental elements, influence visual preference (Mahdieh et al., 2011; Wang et al., 2016). Therefore, evaluating the visual preference of pedestrians for wayfinding signage is a challenging task. It becomes imperative to develop a structured framework for systematically assessing the visual preference of pedestrians for wayfinding signage and provide guidance and suggestions for urban design and planning.

This study adopted a systematic review method to analyse the relevant literature thoroughly. A systematic review is a review method that uses a relatively standardised analysis step to review the existing literature topics, which can integrate the research topics into a specific field, summarise the research results, and identify the knowledge gaps (Moher et al., 2009). This study used the PRISMA methodology to conduct a systematic review of 80 studies, answering the following four questions:

(1) What is the definition and significance of pedestrian wayfinding signage visual preference?

(2) What is the theoretical basis of pedestrian wayfinding signage visual preference evaluation?

(3) What are pedestrian wayfinding signage visual preference evaluation methods and techniques?

(4) What factors influence the pedestrians' visual preference of wayfinding signages?

The primary objective of this review is to establish a framework for evaluating pedestrian wayfinding signage visual preference and offer new perspectives and suggestions for urban wayfinding signage design. The significant contribution of this study lies in bridging existing gaps and providing direction and inspiration for future research endeavours.

2. SYSTEMATIC LITERATURE REVIEW METHOD

A systematic literature review summarises the existing evidence on a specific topic or field within a defined period, identifies research gaps, and proposes future research directions (Page et al., 2021). It delineates the current academic boundaries and distinguishes itself from narrative reviews by its systematic approach. This approach includes a detailed account of the methods used for literature selection, search, and analysis to reduce bias and enhance reliability (Siddaway et al., 2019). The search process adheres to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) framework (Page et al., 2021), which employs a four-step flowchart to ensure the comprehensiveness and quality of the literature (see Figure 1).
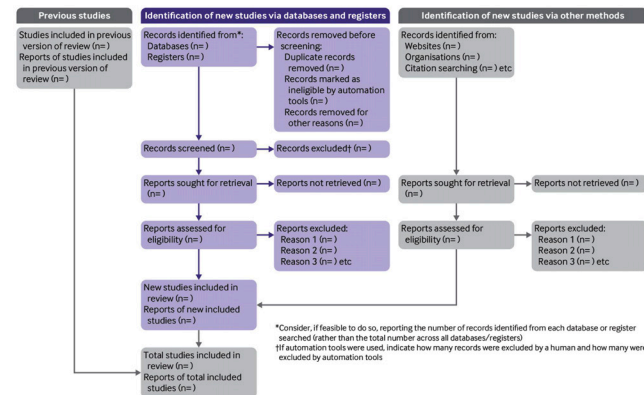

Figure 1: PRISMA 2020 diagram template Adapted from Page et al., 2021

2.1 Keyword Selection

For our literature retrieval, we utilised the Scopus database and employed a set of keywords derived from three key aspects: visual preference, pedestrian signage, and pedestrian wayfinding.

Visual preference, at the core concept of this study, encompasses psychological processes related to aesthetics, aesthetic judgment, and emotional response. Pedestrian signage serves as the main object of this study, which is a walking facility that provides orientation information for pedestrians. Meanwhile, pedestrian wayfinding

forms the main background of this study, representing the activity of individuals to perform effective and enjoyable walking in complex environments.

This study selected different terms as keywords according to these three aspects to increase the flexibility, accuracy, relevance, and depth of the search. Specifically, our keyword selection encompassed the following:Visual preference: aesthetic perception, visual perception, aesthetic quality, visual quality, aesthetic preference, visual preference

Pedestrian signage: pedestrian signage, pedestrian signs, pedestrian sign, walking signage, walking signs, walking sign.

Pedestrian wayfinding: pedestrian wayfinding, pedestrian wayfinding, pedestrian wayfinding, pedestrian navigation, pedestrian navigating, pedestrian orientation.

Finally, this study connected these three groups of keywords with the AND operator, forming the final search string: ("aesthetic perception" OR "visual perception" OR "aesthetic quality" OR "visual quality" OR "aesthetic preference" OR "visual preference") AND ("pedestrian signage" OR "pedestrian signs" OR "pedestrian sign" OR "walking signage" OR "walking signs" OR "walking sign") AND ("pedestrian wayfinding" OR "pedestrian way-finding" OR "pedestrian wayfinding" OR "pedestrian navigation" OR "pedestrian navigating" OR "pedestrian orientation") AND (PUBYEAR > 2012 AND PUBYEAR < 2024).

2.2 Literature Selection

The literature selection method followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021).
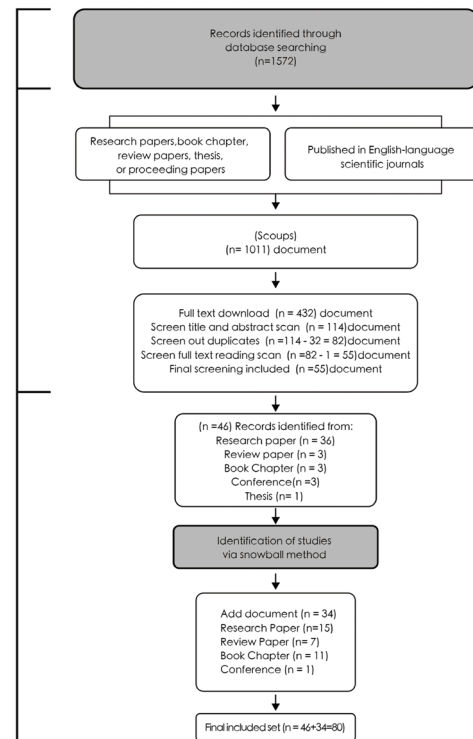

Figure 2: Prisma flow diagram of the study selection process Created by the author

As described in Figure 2, our initial step involved a keyword search using the Scopus database, generating an initial list of articles. Scopus is the world's largest peer-reviewed literature abstract and citation database (Mongeon & Paul-Hus, 2015), which covers information from all categories, more than 20,000 journals and more unique articles than WOS (Falagas et al., 2008). Following this, we applied our chosen keywords to conduct the search, focusing on English-language literature published between 2010 and 2023. Our selection process adhered to the inclusion and exclusion criteria outlined in Table 1.We also added some additional literature by using the snowballing method, that is, looking for literature that meets the inclusion and exclusion criteria from the reference lists of the selected literature and checking whether they had been cited in other selected literature. In the end, we obtained 80 pieces of literature as our dataset.

Table 1: Inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
Literature type	Research papers, book chapters, review papers, theses, or proceeding papers	Other types, such as web pages, patents, reports, etc.
Language	English	Non-English
Publication year	2012 to 2022	2011 and before
Research topic	Studies related or relevant to the aesthetics of urban pedestrian wayfinding signage	Studies unrelated or irrelevant to the aesthetics of urban pedestrian wayfinding signage, such as car wayfinding, natural orientation, traffic guidance, etc.
Research focus	The article takes pedestrian wayfinding signage as the core research focus.	The article only briefly mentions pedestrian wayfinding signage without in-depth analysis or discussion.
Research question	The article discusses issues related to visual preference or aesthetic perception.	The article does not discuss issues related to visual preference or aesthetic perception.
Literature availability	The article provides a link for full-text download or online reading	The article only provides an abstract or title without a connection to full-text

Using such a literature selection method, we obtained a comprehensive and representative dataset covering various topics and perspectives on urban pedestrian wayfinding signage visual preference. These datasets provided a solid foundation to analyse further and summarise the pedestrian wayfinding signage visual preference evaluation framework.

2.3 Data Collection

To conduct a comprehensive analysis of the documents that met the inclusion criteria, this paper carefully read their full texts and organised the data extracted from them into an electronic spreadsheet (WPS OFFICE 2022). The data we collected covered the following aspects: article type, author name, publication year, journal name, research method, and research scope. As well as the research gaps and future directions that were summarised from the 80 documents.

3.   RESULT

3.1 An Overview of the Definition of Pedestrian Wayfinding Signage Visual Preferenc

Visual preference is a research topic that involves multiple aspects of issues, and different fields may have various interpretations. To avoid misunderstanding and focus on the subject of pedestrian wayfinding signage, we use the term pedestrian wayfinding signage visual preference to refer to the pleasure that humans obtain from viewing signage (Fishwick, 2004; Nasar, 1997a). Several studies have shown that well-designed pedestrian wayfinding signage can add vitality and optimism to people's wayfinding and enhance their walking energy and performance levels by improving their mindset (Jellinger, 2000; Kitchin & Blades, 2002; D. Montello & Sas, 2006). Similarly, pedestrian wayfinding signage visual preference can be defined as the feelings that give people a positive walking attitude and make them feel more energetic and optimistic (Guyer, 2008). A highly aesthetic environment can affect psychology and human behaviour by influencing one's vision. In addition to the direct role of shaping emotions, aesthetic principles also play a relevant role in influencing the attractiveness of pedestrian wayfinding signage. In some urban environment aesthetic studies, people gave high scores and positive responses to the signage they liked, such as simplicity, clarity, and cultural background. They gave low scores and negative responses to those that looked complex, vague, and discordant (Iftikhar et al., 2021; Meng et al., 2023).

The word aesthetics was first proposed by the German philosopher Alexander Baumgarten in the 18th century, which originated from the Greek word aesthesis, meaning sensation or perception (Guyer, 2008). Baumgarten believed that aesthetics is a science that studies how humans perceive and enjoy beautiful things or phenomena (Wicks, 1995). Therefore, aesthetics is a subjective beauty, which varies from person to person, depending on personal values (Guyer, 2008). Then, is the interaction between people and scenes fixed by physical characteristics or relative aesthetics that vary depending on personal values based on personal values? There are already some studies that show that pedestrian wayfinding signage has objective physical characteristics, which occupy a large part of the public's difference in visual preference evaluation. In this sense, the physical elements of pedestrian wayfinding signage are the main key to perceiving and evaluating pedestrian wayfinding signage visual preference (Bar & Neta, 2007; Pan et al., 2022; Qiu et al., 2021). However, some studies show that the social and cultural personality characteristics of observers will affect the landscape aesthetics and pedestrian wayfinding signage visual preference evaluation (Bao et al., 2016; Iftikhar et al., 2021). The question remains: is the interaction between pedestrians and wayfinding signage fixed by physical characteristics or relative aesthetics that vary depending on personal values?

3.2 An Overview of the Benefit of Pedestrian Wayfinding Signage Visual Preference

Table 2 outlines the significance of pedestrian wayfinding signage visual preference, including the benefits of walking, planning, aesthetics, and economy.

Table 2: Overview of benefits of wayfinding signage visual preference.

Benefit	Descriptions
Walking	Stimulate people's interest and motivation for walking.
	Increase the proportion and frequency of walking trips.
	Increase satisfaction and happiness with walking.
	Alleviate wayfinding pressure
	Improve attention
Planning	Enhance pedestrians' evaluation and identification of the urban environment and their abilities.
	Increase readability and accessibility of urban spatial structure and transportation modes.
	Improve urban functionality and efficiency.
	Promote optimisation and integration of urban space.
Aesthetics	Increase the visual quality and attractiveness of urban landscapes.
	Enhance urban image and quality, reflecting the city's culture, history, and characteristics.
Economic	Increase city recognition and memorability.
	Enhance city competitiveness and influence.
	Attract more tourists and investors.
	Increase exposure and attractiveness of commercial pedestrian areas.
	Increase the attractiveness of tourist attractions.

The impact on walking safety: Pedestrian wayfinding signage that meets pedestrian visual preferences can have a positive impact on walking safety. It increases pedestrian attention and trust in signage, reduces cognitive load and attention distraction when reading and understanding signage, improves pedestrian alertness to surrounding traffic conditions and risk factors, and reduces the risk of accidents and injuries (Colley et al., 2020; Li et al., 2021; Oh et al., 2017). For example, Vilar et al. (2015) found that pedestrians preferred simple, clear, obvious, and consistent signage design. They thought such signage was easier to identify and understand, making it more conducive to ensuring walking safety.

The impact on walking efficiency: Pedestrian wayfinding signage that meets pedestrian visual preferences can have a significant impact on walking efficiency. It increases pedestrian satisfaction and acceptance of signage, improves pedestrian decision speed and accuracy in the wayfinding process, reduces the possibility of pedestrians going the wrong way or getting lost, and shortens the time and distance required for pedestrians to reach their destination (Feng & Duives, 2023; Hölscher et al., 2006; Willis et al., 2009). If signage lacks systematisation and standardisation, it will lead to information redundancy or missing, making it difficult for people to construct a clear mental map, thereby increasing their time, distance, and cost of walking in the city (Hölscher et al., 2006; Li et al., 2021).

The impact on walking pleasure: Pedestrian wayfinding signage that meets pedestrian visual preferences can enhance the pleasure of walking. It increases pedestrian liking and appreciation of signage, improves pedestrian confidence and satisfaction in the wayfinding process, reduces pedestrian anxiety and frustration, and improves pedestrian evaluation and identification of the urban environment and their abilities (Vilar et al., 2015; Willis et al., 2009). For example, Colley et al. (2020) evaluated the newly established WalkNYC pedestrian wayfinding signage system in downtown New York City. They found that the system successfully increased the pleasure of pedestrians exploring and enjoying the city by providing interesting, informative, and narrative information.

The impact on urban aesthetics: Pedestrian wayfinding signage that meets pedestrian visual preferences can have a profound influence on urban aesthetics. It can increase the visual quality and attractiveness of urban landscapes, improve urban image and quality, and reflect urban culture, history and characteristics (Vilar et al., 2015; Li et al., 2021). For example, Namba et al. (2005) studied the pedestrian wayfinding signage system in Kyoto City, Japan. They found that the system successfully showed the unique charm and atmosphere of Kyoto City by adopting traditional Japanese style and symbols, as well as providing rich cultural and historical information, increasing the satisfaction and loyalty of tourists.

The impact on urban planning and design: Pedestrian wayfinding signage that meets pedestrian visual preferences can have a profound influence on urban planning and design. It enhances the readability and accessibility of urban spatial structure and transportation mode, improves urban function and efficiency, and promotes the optimisation and integration of urban space (Bhowmick et al., 2020; Feng & Duives, 2023). For example, an evaluation study of the pedestrian wayfinding signage systems in four large Chinese cities, Beijing, Shanghai, Guangzhou, and Shenzhen, found that these cities' signage generally had problems such as insufficient quantity, unreasonable location, incomplete content, and inconsistent format. These issues led to instances of pedestrians frequently getting lost or taking unnecessary detours within the city (Li et al., 2021).

The impact on urban economic income: Pedestrian wayfinding signage that aligns with pedestrian visual preference can have a profound effect on urban economic income. It can promote walking trips, increase the exposure and attractiveness of commercial areas, stimulate pedestrians' shopping desire and consumption willingness, and increase commercial activity and consumption levels (Litman, 2003; Clifton et al., 2007). For example, an economic impact analysis of pedestrian-friendly projects in several U.S. cities found that improving pedestrian wayfinding signage systems can lead to significant increases in sales tax revenue, housing prices, rents, and employment rates in commercial areas (*The Business Case for Better Streets and Places*, n.d.).

The impact on urban attractiveness: Pedestrian wayfinding signage that meets pedestrian visual preferences can improve urban attractiveness. It increases the recognition and memory of the city, improve urban competitiveness and influence, and attracts more tourists and investors (Arthur & Passini, 1992; Willis et al., 2009). For example, Colley et al. (2020) evaluated the newly established Walk NYC pedestrian wayfinding signage system in downtown New York City. They found that the system increased pedestrians' perception and appreciation of urban space and culture by providing engaging, informative, and storytelling information, thus attracting more tourists and investors.

In summary, wayfinding signage visual preference has a positive impact on the walking experience and urban residents' happiness, improving walking safety, efficiency, and pleasure, as well as urban

aesthetics, planning, economy, and attractiveness. Therefore, in urban walking promotion, wayfinding signage design has become a topic of great attention.

3.3 An Overview of the Philosophical Background of Pedestrian Wayfinding Signage Visual Preference

When evaluating the visual preference of pedestrian wayfinding signage, it is essential to consider aesthetic factors. Aesthetics is a philosophical discipline that delves into value judgments related to beauty and ugliness, pleasure, and pain (Dewey, 2010). It encompasses personal and societal values, emotions, cognition, culture, and background. Different individuals may have diverse evaluations and reactions to the same wayfinding signage, evaluating visual preferences complex and varied. To comprehend and elucidate the visual preferences of pedestrian wayfinding signage, this paper leverages the philosophical and evaluation background of landscape aesthetics. It employs it as a framework to study the visual elements within urban space.

Landscape aesthetics is a discipline that delves into the beauty found in both natural and artificial landscapes (Costa, 2022; Herzog & Kropscott, 2004). This field encompasses various areas, including landscape design, planning, management, protection, education and more. The philosophical foundation of landscape aesthetics can be traced back to ancient Greece. Plato advocated that beauty transcends the senses, representing an idea beyond the tangible, while Aristotle posited that beauty comprises both form and matter. Over time, the philosophical thoughts of landscape aesthetics evolved, giving rise to different schools and theories.

Based on varying views of aesthetic philosophers on the nature and source of beauty, two paradigms of objectivism and subjectivism emerged to understand and evaluate landscape preference (de la Fuente de Val et al., 2006; Lothian, 1999). These paradigms can be characterised as follows:

Objectivism holds that beauty is an inherent, universal, immutable, and measurable attribute within a landscape, independent of the observer's feelings, emotions and judgments (Gobster et al., 2007, 2019). The representative figures of objectivism include Kant, Hume, and Burke, who endeavoured to establish a set of objective, scientific and universal aesthetic standards and principles to evaluate different types and styles of landscapes. Objectivism's evaluation approach primarily employs quantitative, statistical, and analytical means, such as mathematical models, geometric shapes, proportional scales, and colour contrast, to measure the aesthetic aspects of landscapes.

Subjectivism, in contrast, holds that beauty is a relative, individual, variable, and immeasurable attribute that exists in the observer's mind and does not depend on the landscape itself (de la Fuente de Val et al., 2006; Lothian, 1999; Palmer & Hoffman, 2001). The representative figures of subjectivism include Plato, Aristotle, and Nietzsche, who emphasised the role of personal sensibility, emotion, imagination, and creativity in the aesthetic process and believed that everyone has unique aesthetic tastes and preferences. The evaluation method of subjectivism mainly adopts qualitative, descriptive, and interpretive means, such as questionnaires, interviews, storytelling, picture sorting, and more, to understand the observer's feelings and meanings of landscapes (Dupont et al., 2014).

Aesthetic philosophers ultimately established the paradigms of objectivism and subjectivism to comprehend and evaluate landscape visual preference. These two paradigms have a long and rich history, with their roots in the contributions of philosophers spanning many centuries. In this study, the philosophy of landscape aesthetics serves as a paradigm for pedestrian wayfinding signage visual preference. Therefore, two philosophical modes for evaluating and managing pedestrian wayfinding signage visual preference can be identified: objective and subjective paradigms.

Methods for Evaluating Pedestrian Wayfinding Signage Visual Preference

While aesthetics is divided into objectivism and subjectivism paradigms, experts in the field of aesthetic preference evaluation believe that there may be a correlation between the physical characteristics of pedestrian wayfinding signage and the psychological responses of individuals who perceive such signage (Tveit, 2009; Wang et al., 2016). Visual preference evaluation predominantly relies on a visual foundation for evaluation in most methodologies (Wang et al., 2016). Based on the systematic review, most research papers that adhere to the aesthetic paradigm philosophy use physical characteristics or visual criteria to evaluate urban landscapes. Notably, reference literature by Daniel (2001) categorises visual preference evaluation methods into two categories: expert (objectivist) methods and public (subjectivist) methods.

We will compare these two methods in terms of landscape perception, discussing their respective advantages, disadvantages, and applicability conditions (Table 3).

Table 3: Summary of methods for evaluating Pedestrian wayfinding signage Visual preference.

Evaluation Criteria	Expert Method	Public Method
Basic Paradigm	Objective Paradigm	Subjective Paradigm
Evaluating Entity	Experts	Public
Evaluation Methods	Qualitative: focus groups, interviews, case studies, etc.	Quantitative: surveys, psychological experiments, eye-tracking, experiments, etc.
Evaluation Results	Guide design and planning; reflect expert judgment; subject to personal differences or biases	Reflect public needs and perceptions; increase democracy and participation; have replicability and comparability.
Replicability	Low	High
Advantages	Easy to manage; save time and effort; enhance objectivity and scientific rigour	Reflect public opinions; increase public participation; improve accuracy, effectiveness, and reliability.
Disadvantages	Neglect public opinions; lack public participation; reduce accuracy, effectiveness, and reliability.	Time-consuming and labour-intensive; low efficiency;

The expert method is grounded in the objectivism paradigm as it aims to assess signage visual preference from an objective perspective. This method relies on experts with professional knowledge and

experience to determine the evaluation indicators, weights and results without considering the opinions or involvement of the public (Zhang et al., 2021). Expert evaluation typically involves fewer individuals, making them easier to manage, less time-consuming, and more efficient (Han et al., 2021).

The expert-based method systematically evaluates the physical characteristics of pedestrian wayfinding signage (e.g. font, shape, and colour) and the relationships between these characteristics (e.g. unity and uniqueness). The data collected by experts for evaluating pedestrian wayfinding signage visual preference are largely based on qualitative methods, which can guide signage design and planning and improve its functionality and efficiency. Leveraging experts' knowledge and experience improves the objectivity and scientific of data; evaluation methods usually use focus groups, interviews, case studies, and other methods to determine the aesthetic quality or visual preference of signage.

Nevertheless, Morgan (2014) pointed out that experts' judgments may also be influenced by one's previous understanding and experience. These understandings and experiences are related to the nature and elements of evaluating wayfinding signage importance (de la Fuente de la Val et al., 2006). Morgan (2014) found that different experts may significantly differ in their evaluations of the same project. Therefore, expert evaluation of pedestrian wayfinding signage visual preference has been criticised for its accuracy, validity and reliability. The lack of precise analysis and decision-making processes puts pedestrian wayfinding signage visual preference evaluation at a significant disadvantage . In this case, if repeated surveys are conducted, the evaluation results are unlikely to be consistent.

The public method is rooted in the subjectivism paradigm (subjectivism) because it seeks to assess signage visual preference from a subjective perspective. This approach involves gathering feedback from the general public or target audience regarding their preferences, perceptions, emotions, and signage aesthetics without relying on expert judgments or interventions (Xu & Shen, 2023). The public method demands more time and effort than the expert method. However, it captures the genuine sentiments and needs of the public, promoting democracy and public participation in the evaluation process.

The public method for assessing pedestrian wayfinding signage visual preference relies on quantitative methods. Evaluation methods usually involve the use of questionnaires, psychological experiments, eye tracking, experiments and other methods to gather public ratings or rankings of different types or scenarios of signage aesthetics (Iftikhar et al., 2020, 2021; Yu et al., 2023). Perception-based visual aesthetic evaluation has always been highly reliable. The results produced by this method are more significant than those observed by a single person (Morgan 2014) . In terms of quality, visual preference has reasonable subjectivity; regardless of how cross-domain large-scale studies are conducted, applying visual preference evaluation is still a challenge (Xu & Shen, 2023). Nevertheless, based on public evaluation, it has been widely recognised for its accuracy, validity, and reliability because it has strong replicability, although there are significant differences among the public.

In summary, the expert and public methods represent two common

methods for evaluating pedestrian wayfinding signage visual preference. These methods are based on the objectivism paradigm and subjectivism paradigm, each with its own sets of advantages and disadvantages. The expert method relies on professional knowledge and experience and can improve the objectivity and science of evaluation. However, it can be susceptible to personal biases and subjectivity, lacks public opinion and participation, and may raise questions about the accuracy, validity, and reliability of evaluation results.

On the other hand, the public method captures the public's real feelings and needs, increases democracy and public participation in the evaluation process, uses quantitative methods to collect and analyse data, and improves the replicability and comparability of evaluation results, which is important for pedestrian wayfinding signage visual preference evaluation. This is particularly valuable because not every project in every location can readily find suitable and sufficient experts for evaluation, a gap well addressed by the public method.

Upon weighing the pros and cons of these two methods, this paper contends that the public method is more suitable for evaluating pedestrian wayfinding signage visual preference because it can better reflect the public's needs and feelings and improve the credibility and operability of evaluation results. However, this does not diminish the value of the expert method., but should choose the appropriate method according to different situations and purposes.

3.4 Pedestrian wayfinding signage Variables overview

The assessment of visual preference can be challenging, primarily due to the complexity of knowledge, background and variable changes. Some reviewed studies suggest that the concept's origin centres around evaluating the physical characteristics of pedestrian wayfinding signage (Calori, 2015). This pertains to all physical elements and their combination methods within the signage project. Additionally, other studies suggest that assessment should be based on the principles of aesthetic perception (Lothian, 1999). Aesthetic perception refers to the subjective evaluation and emotional response people have toward the signage project. Both these sets of variables not only influence pedestrians' preference and satisfaction with wayfinding signage but also mirror their cognition and understanding of the function and culture of wayfinding signage.

This section provides an overview of the relevant variables for pedestrian wayfinding signage visual preference assessment from these two aspects. It introduces two existing models adopted by this study: the signage pyramid method (Calori, 2015) and the landscape perception model (Berlyne, 1974). These models systematically describe and evaluate the physical characteristics and aesthetic perception of pedestrian wayfinding signage, offering valuable references for subsequent research.

3.5 Pedestrian wayfinding signage of Physical characteristics

Calori & Vanden-Eynden (2015) introduced the signage pyramid method, which divides the physical characteristics of wayfinding signage into three levels: information system, graphic system and hardware system. The information system refers to all information content within the signage project, along with their relationships

and hierarchies. The graphic system comprises all graphic elements used in the signage project, focusing on their coordination and consistency. The hardware system includes all physical elements incorporated into the signage project, emphasising their connections and stability (Calori & Vanden-Eynden, 2015). These three systems are mutually dependent and collectively form a comprehensive wayfinding signage.

Building upon this method, this study conducts a literature review from the perspectives of information systems, graphic systems and hardware systems. It summarises the key variables that influence the physical characteristics of wayfinding signage, as shown in Table 4.

Table 4: Wayfinding signage physical characteristics variables were obtained from the systematic review.

Wayfinding signage Physical characteristics	Wayfinding signage design elements	Synonyms	References
Information system	Text	Content, Message, Copy	(Uebele, 2010:Calori, 2015: Muekthong & Chotikakamthorn, 2021;Rodrigues et al., 2020;N.N., 2005;Zhang & Li, 2019;Symonds, 2016;Travel Wayfinding, 2023) (Calori, 2015; Muekthong, 2021; N.N., 2005; Rodrigues et al., 2020; Uebele, 2010)
	Text size	Character height, Letter size, Font size	
	Text Layout	Text arrangement, Text configuration, Text format	
	Font	Typeface, Typestyle, Typography	
	Foreign languages	Non-native languages, Additional languages, Multilingual languages	
Graphics system	Graphics	Patterns, Motifs, Decorations, Ornaments, Logos	(Calori, 2015; Gan & Feng, 2018; Gillard et al., 2018; Goodwin-Wilson et al., 2020; Y. Han & Lee, 2020; Meng et al., 2023; Mijksenaar & Westendorp, 1999; Simpson, 2021; Troncoso, n.d.)
	Arrows	Pointers, Markers, Indicators, Directions	
	Graphic layout	Graphic design, Graphic composition, Graphic arrangement, Graphic configuration, Graphic format	
	Destination icons	Destination symbols, Destination markers, Destination indicators, Destination logos, Icons, Symbols,	
	Ads	Advertisements, Promotions, Commercials, Marketing	
	Map	Scale bars, Map scales, Distance scales, Linear scale	

Wayfinding signage Physical characteristics	Wayfinding signage design elements	Synonyms	References
Hardware system	Colour	Hue, Tint, Shade, Tone, Chroma	(Calori, 2015; Lee et al., 2020; Shi et al., 2020; Su et al., 2021; Zedda et al., 2016)
	Colour coding	Color scheme, Color system,	
	Size	Dimension, Scale, Proportion, Magnitude, Measurement	
	Shape	Form, Configuration, Contour, Outline	
	Material	Substance, Medium, Fabric	

3.6 Pedestrian wayfinding signage of Aesthetic perception

Berlyne (1974) proposed a landscape perception model that categorises the aesthetic perception of wayfinding signage into three levels: sensory perception, cognition and meaning. Sensory perception refers to an individual's direct assessment of the beauty of wayfinding signage. Cognition involves people's indirect understanding of the spatial information conveyed by wayfinding signage, while meaning encompasses the profound interpretation of the cultural aspects presented by wayfinding signage (Berlyne, 1974). These three levels interact with one another, collectively forming a dynamic aesthetic experience process. Building upon this model, this study reviews the pertinent literature through the lenses of sensory perception, cognition, and meaning. It consolidates the key variables influencing the aesthetic perception of wayfinding signage, as illustrated in Table 5.

Table 5: Aesthetic perception of pedestrian wayfinding signage variables were obtained from the systematic review

Visual preference variables	Wayfinding signage visual characteristics	Synonyms	References
Sensory Perception	Uniformity	Consistency, Coherence, Harmony, Order, Balance	(Calori, 2015; Greenroyd et al., 2017; Marquardt, 2011; Tveit, 2009; Uebele, 2010; Zhang et al., 2020)
	Uniqueness	Distinctiveness, Originality, Character, Identity, Style	
	Decoration	Beauty, Grace, Style,	
Cognition	Readability	Comprehensibility, Understandability, Clarity, Legibility, Intelligibility	(Amabile et al., 2018; Calori, 2015; Chapman & Lynch, 1960; Csikszentmihalyi, 1996; Dewar & Pronin, 2023; Jellinger, 2000; Marquardt, 2011; Montello, 2009; Montello & Sas, 2006; Rodrigues et al., 2020; Saginova et al., 2021; Supasumond et al., 2021; Wan, 2022; Zhang et al., 2020; Zolkefil & Talib, 2022)
	Accessibility	Acceptability, Usability, Suitability, Affordability, Desirability	
	Accuracy	Precision, Correctness, Exactness, Truthfulness, Validity	
	Security	Safety, Protection, Assurance, Confidence, Comfort	

Visual preference variables	Wayfinding signage visual characteristics	Synonyms	References
Meaning	Local culture	Native culture, Regional culture, Indigenous culture, Geographical culture, Urban culture	(Chapman & Lynch, 1960; Jellinger, 2000; Montello, 2009; Montello & Sas, 2006; Muekthong, 2021; Sorrows & Hirtle, 1999; Supasumond et al., 2021; Tzeng & Huang, 2018; Wan, 2022; Zhang et al., 2020)
	Local history	Native history, Regional history, Provincial history, Civic history, Geographical History	
	Landmark	Icon, Symbol, Marker, Indicator, Point of interest	

3.7 Visual preference evaluation framework for pedestrian wayfinding signage

Pedestrian wayfinding signage serves as a crucial facility in urban environments, providing direction and information that significantly impacts travel efficiency, safety and the overall image and quality of the city (Calori, 2015). Therefore, studying pedestrians' visual preference for wayfinding signage is not only meaningful but also practical, with the potential to enhance their satisfaction and the city's aesthetic appeal. However, current research on visual preference assessment of pedestrian wayfinding signage remains relatively limited, lacking a unified and systematic theoretical framework.

The Visual preference of pedestrian wayfinding signage is influenced by two primary factors: the physical characteristics of signage (e.g. shape, colour, font, icon) and the aesthetic perception (e.g. unity, decoration, safety).Understanding how these factors affect pedestrians' visual preference for wayfinding signage and how to quantify these effects is an area that requires further exploration. Relying solely on physical indicators to measure visual preference is not sufficiently comprehensive or accurate. The literature suggests adopting a perceptual framework for assessing the visual preference of pedestrian wayfinding signage and its application to existing environments. This approach defines the visual preference of pedestrian wayfinding signage as a measurable, regulatable, and predictable visual characteristic.

Perceptualist paradigm preference modelling, an evaluation technique that integrates previous visual assessment methods, can lead to the development of new standards, protocols or techniques to enhance visual preference. Visual preference, being a somewhat subjective concept, is influenced by national, cultural, and environmental values (Spehar et al., 2015; Wang et al., 2016). Establishing a unified framework for assessing the visual preference of pedestrian wayfinding signage is, therefore, a pressing need, particularly for improving assessment methods across different types of signage within the pedestrian wayfinding signage domain.

Most existing management systems overlook the distinction between pedestrian wayfinding signage and traffic wayfinding signage and may not fully address the protection and enhancement of pedestrian wayfinding signage. Therefore, there is a demand for a comprehensive system that caters to public needs and preferences.

This study establishes a unified review framework, emphasising the definition of the visual preference of pedestrian wayfinding signage as the outcome of the interaction between signage's physical characteristics and human aesthetic perception, as presented in the previous part of this paper. The framework is employed to evaluate the visual preference of pedestrian wayfinding signage by considering both the psychological perception of individuals and the physical characteristics of signage (Figure 3).
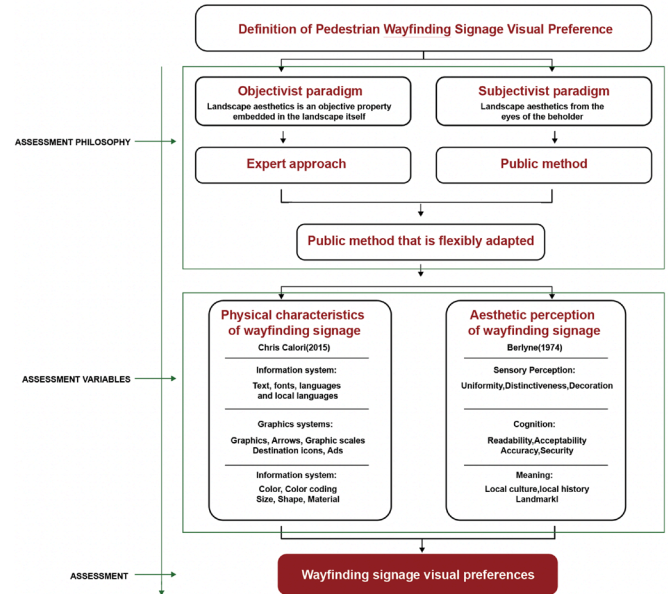

Figure 3: *A framework for Visual Reference Evaluation of Pedestrian wayfinding signage*
Created by the author

4. DISCUSSION AND CONCLUSION

This paper explores a pedestrian wayfinding signage design method that adapts to different urban environments based on the evaluation framework of visual preference for wayfinding signage. This section discusses the results of our comprehensive analysis of the relevant literature and presents our research perspective and contribution.

(1) Recent Studies and Knowledge Gap

First, this study identified a scarcity of recent studies on the visual preference assessment of pedestrian wayfinding signage, particularly from 2010 to 2023. This scarcity may be attributed to the absence of a clear and unified evaluation framework, as well as the various difficulties and challenges inherent in the evaluation process. Recent studies, such as evaluation of wayfinding signs in tourist areas (Zhang et al., 2020) and hospital signage adaptive signage systems (Rodrigues et al., 2020), highlight a growing interest in signage evaluation methods. However, a systematic review of these trends remains absent. Consequently, our study fills a significant knowledge gap by providing a comprehensive and systematic literature review and a conceptual framework that synthesizes these fragmented efforts.

(2) Visual Preference and Urban Impacts

Second, this study introduced the concept of "Pedestrian Wayfinding Signage Visual Preference" and highlighted its multidimensional

impacts on urban residents and visitors. Pedestrian wayfinding signage visual preference relates to an individual's positive emotions and cognitive mapping abilities concerning signage as wayfinding elements. This, in turn, enhances their comfort and convenience in navigating urban environments. Our findings align with Muekthong et al. (2021), who emphasized the dual role of signage in improving functional navigation and fostering cultural identity. Similarly, Supasumond et al. (2021) highlighted how culturally embedded signage can elevate pedestrians' emotional attachment to urban spaces. We assert that pedestrian wayfinding signage visual preference should be a crucial consideration in planning and management methods to foster walkability, tourism, and sustainable urban development.

(3) Evaluation Paradigms and Proposed Framework

Third, this study delved into the aesthetic and philosophical issues involved in evaluating pedestrian wayfinding signage visual preference and compared various evaluation methods. We identified two evaluation paradigms in philosophy: the objective paradigm, which posits that visual effects are determined by signage's physical characteristics, and the subjective paradigm, which suggests that visual effects are determined by the perceptions of onlookers. Previous research has largely focused on either paradigm in isolation (e.g., expert-focused assessments by Zhang et al., 2021, vs. user-centric approaches by Xu & Shen et al., 2023), often neglecting the complementary insights these methods provide. We advocate for a comprehensive approach that combines both methods, suggesting an evaluation framework that encompasses both objective and subjective paradigms, signage's physical characteristics, and aesthetic perception.

(4) Application to Diverse Urban Contexts

Finally, this study discussed the application of our evaluation framework to diverse urban environments. The diversity of urban pedestrian settings poses a challenge in establishing a universal evaluation framework. For instance, culturally vibrant areas may prioritize symbolic signage, whereas industrial zones may emphasize functionality and clarity. Therefore, we propose the customization of the evaluation framework according to the unique characteristics of the local urban pedestrian environment and public opinions. The evaluation results can then be used to guide and enhance signage design, protection, and management, ultimately contributing to the development of an aesthetically pleasing and effective pedestrian wayfinding signage system. This customized approach ensures that the city's image and quality are aligned with its cultural, functional, and sustainable goals.

5. LIMITATIONS AND FUTURE STUDIES

This study aims to explore and develop a Pedestrian wayfinding signage design method that can adapt to various urban environments based on the evaluation framework of signage visual preference. This section will discuss the limitations of our study and the implications for interpreting and applying its findings.

First, this study exclusively utilised the Scientific Citation Index Expanded (Scopus) database to retrieve relevant literature. While this database is among the most comprehensive and authoritative,

it may still have limitations or biases, potentially resulting in omissions. Consequently, the knowledge base of this study may not be entirely exhaustive. To address this limitation, we recommend considering the inclusion of additional databases and search engines, such as EBSCO (Elton B. Stephens Company) and ScienceDirect, to access a broader range of literature related to the study's topic, thus enhancing the completeness and comprehensiveness of the knowledge base.

Second, this study employed a combination of multiple keywords and synonyms in the literature search to encompass various expressions and perspectives. Nevertheless, due to the inherent limitations of keyword selection and search scope, there is a possibility of missing relevant literature that did not use these specific keywords or employed alternative terms. This potential omission could result in overlooking essential characteristics and factors related to pedestrian wayfinding signage visual preference. As a result, the analysis outcomes of this study may not be as precise and comprehensive as desired. In future research, we suggest a more extensive exploration of the literature to identify new keywords and expand the diversity of search terms, ultimately enhancing the breadth and depth of the literature review.

Finally, this study has proposed future research directions that are determined based on the current literature review and the researchers' cognitive judgment on pedestrian wayfinding signage visual characteristics and evaluation indicators. These directions are suggested in light of the limitations of this study. It is important to note that researchers from different fields or backgrounds may propose alternative and more creative directions based on their experiences and knowledge. The future research directions presented in this study are not the sole or definitive choices but possibilities and sources of inspiration.

Nonetheless, future research has the potential to transcend the limitations of this study by conducting repeated or extended investigations in various scenarios to validate and enrich our findings. In particular, future research can employ methods such as experiments or surveys to gather feedback from pedestrians regarding signage's physical characteristics and aesthetic perception. These findings can then be compared and analysed alongside the objective principles outlined in the literature review. This approach can enhance the validity and reliability of assessing pedestrian wayfinding signage visual preference and provide a more robust foundation and guidance for designing pedestrian wayfinding signage.

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