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REVIEW

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Landscape and Perception: A systematic review

Abstract

Accurate knowledge of human perception can help designers to create desirable spaces. An increase in publications from 2000 to 2020 demonstrates that studies in human perception of the landscape are evolving. This systematic review aims to comprehensively review existing knowledge and published papers on human perception concerning landscape to promote these approaches in this field for future research. Therefore, a systematic literature search analysis of 255 articles was drawn from four databases: Scopus, ScienceDirect (Elsevier), SAGE, and Taylor & Francis. Results show that the previous concerns are categorized into four main categories: human, heritage, infrastructure, and landscape characteristics. The results of this paper suggest that in future studies researchers should study the heritage and infrastructures factors and evaluate the potential and effects of these issues in the process of human-environmental interactions.

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1 Introduction

Humans are known as the primary users of space. Therefore, considering the users' perceptions and the factors that influence human perceptions of these spaces is necessary to create desirable spaces. Green space design takes the view that human perception and preferences may increase residential satisfaction and intensify the positive psychological and physical effects of urban environment elements (Gerstenberg and Hofmann, 2016). The approach to the subject of perception can be classified into two general categories. The first category includes theorists who look at the world in terms of form and shape, and among its theorists are Alexander, Rapoport, Schultz, and Altman. They believe that perception is achieved through the human eye, observation of the world, and objectivity of phenomena (Alexander, 1979; Rapoport and Hawkes, 1970; Schutz, 1972). Theorists believe human perception can be based on visual impacts. As eyes are the advanced sense organ (Surat, 2017), and more than 80% of our information gathered from the world is acquired by our visual senses (Huang and Lin, 2020), visual perception is more permanent in memory (Surat, 2017). The quality of the visual experience is crucial for psychological and physical health (Özhanci and Yilmaz, 2017) and even affect location preferences (Kiper et al., 2017; Uzun and Muuml, 2011). In the second category, people like Pallasmaa believe in other concepts and use concepts such as "The eyes of skin" (Pallasmaa, 2012). It is thought that there is no need for objectivity to perceive the world, architecture, and landscape. Humans have many senses through which perception is created. In other words, in space, every experience is a multisensory experience; people measure the quality of matter, space, and scale alike with their ears, eyes, nose, tongue, skin, body, and muscles (Holl et al., 2006; Pallasmaa, 2012). Although each organ has its function, the perception process is subject to the cooperation of different organs. They believe that spaces can evoke and engage all human senses and perceptual complexities; in a complex, wordless experience, all speaking a person in the pure silence of perceptual phenomena (Holl et al., 2006). From another perspective, approaches before 2000 were classified into objectivist and subjectivist paradigms according to philosophers. Some researchers believe that only one approach should be considered. For example, Lothian concludes that only subjective models should be used in landscape quality research (Lothian, 1999). However, there is still a lack of comprehensive research that summarizes the categorization of components affecting the human perception of landscape.

Therefore, the purpose of this paper is to make more coherent and categorize the tangible and intangible factors affecting the human perception of landscape based on two main questions:

1. What components are influential in human perception of the landscape?
2. What categories can be considered for these factors?

To this end, the present research consisted of a review of 255 research papers, from 2000-2020, on human perception in interactions with the landscape to answer these questions. It should be noted that the underlying concept of this article is landscape as a space that is in daily contact with users (and not landscape as a scientific discipline). Based on this idea, extraction sources were analyzed and comprehensively classified.

2 Material and methods

This research was undertaken as a systematic review. A systematic review consists of planning, conducting, and reporting the review (Kitchenham, 2004) related to a research question, topic area, or phenomenon (Williams and Carver, 2010). As shown in Figure 1, the search string "Landscape" AND "Perception" was inserted into four databases, including Scopus search, Science direct search, SAGE search, and Taylor & Francis to find matches in article titles, keywords and abstracts during an automatic search in the electronic data sources. In order to make the process of extracting resources more targeted, the search in the field of Social science, Environmental science, and Arts & Humanities, as well as the type of data, was limited to original articles and review articles in the period 2000-2020. At this stage, 5781 articles were extracted from four databases. In the first phase of screening, based on the titles and key-

words of articles that were less relevant based on the authors' checklist (including items related to the purpose and questions of the present study), 1127 articles remained. In the second step, duplicates that were created due to the extraction of similar articles in different databases were removed. In the third stage, the authors studied the remaining 934 articles, and more precisely, the articles that were less relevant to the aims and questions of the present articles were excluded. At this stage, 406 articles were read in full text, and the articles were deleted again with less relevance. In other words, to be selected for the analysis process, research papers had to follow the inclusion criteria pertaining to the relationship between human perception and landscape. The remaining 255 articles, one by one, within the focus areas, research methods, and commonly studied aspects were analyzed, the required data were extracted, and finally, statistical analysis was performed.

The present classification was obtained in several steps. In the first part, reference was made to the literature and similar researches that tried to present the components affecting human perception from the landscape, and the authors studied those sources and how to classify the information and factors introduced. In the second stage, by studying 255 articles selected by the authors, the necessary information such as aim and objectives, problem statement, factors under consideration, research concerns, and results were extracted. In the third step, the extracted information was categorized.

Humans are in objective and subjective interaction with the environment. These interactions are received, organized, and interpreted by human perceptual tools so that human beings get to know their environment, create mental images and act accordingly. This phenomenon is affected by human physiological characteristics and is also influenced by human, contextual, and environmental factors that can be tangible or intangible. Each of the components is affected by several factors. In some interactions, they have two-way relationships with each other. In other words, a feature is an influence in one relationship, and in another, it is impacted. Figure 2 shows the influential factors in human-environment interaction that lead to the formation of perception, mental image, and the emergence of observed be-

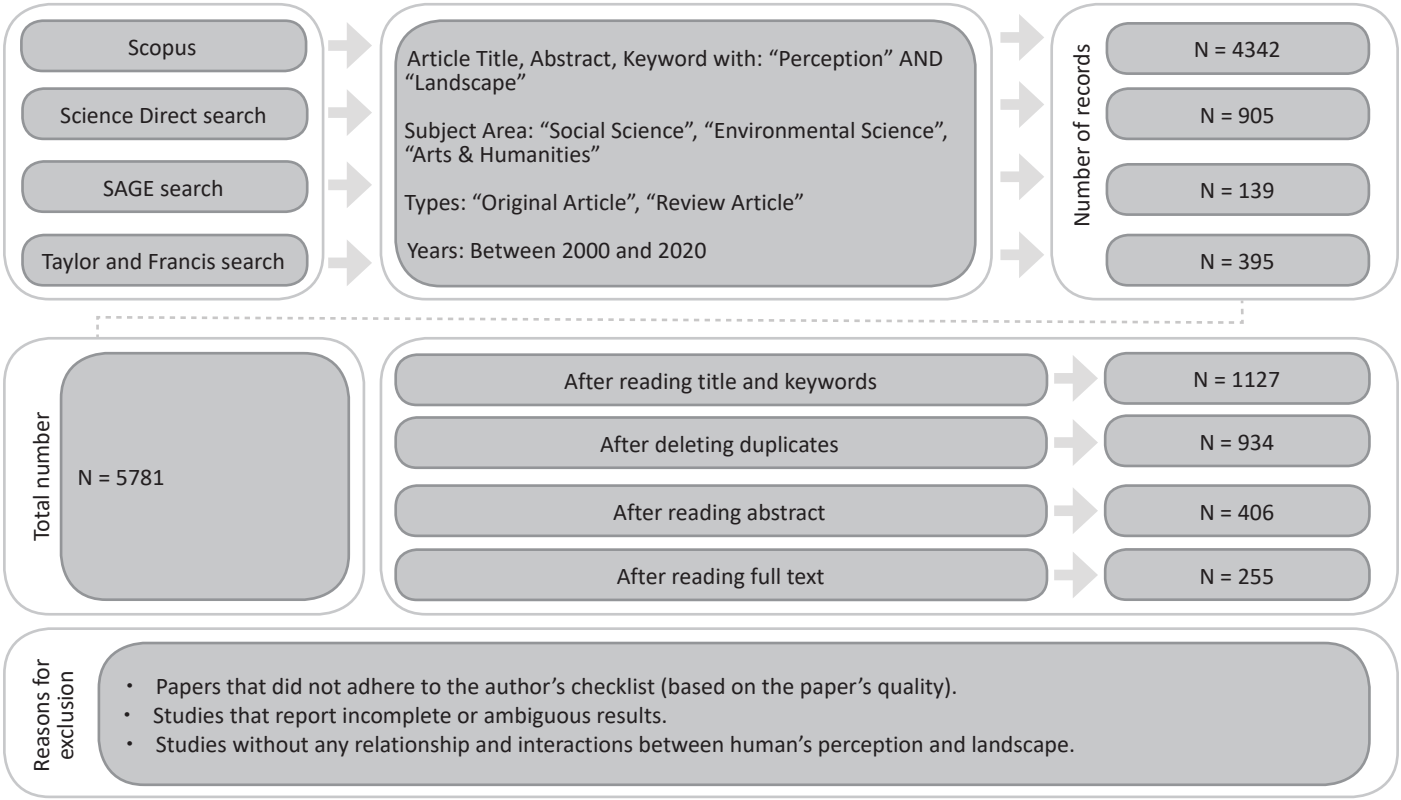

Figure 1. Search process and number of selected papers at each stage.

havior. The figure includes four main parts related to the environment and humans; each factor of these two parts can be tangible and intangible.

Some previous studies present classification for perception landscape; for instance, Zube et al. (1982) presented a landscape model based on three interactions between human, landscape, and outcomes. The human component includes experience, expectations, knowledge, and the socio-cultural context of individuals and groups, and also the landscape component encompasses both individual elements and landscapes as entities. The interaction affects the human and landscape features (Zube et al., 1982). Kamičaitytė et al. (2020) present a theoretical model of landscape perception included from interactions of three features: landscape characteristic (physical landscape), observer characteristic (psychological landscape), and interaction of subject and object (mental process) whereby observer characteristic and interaction of matter and object are

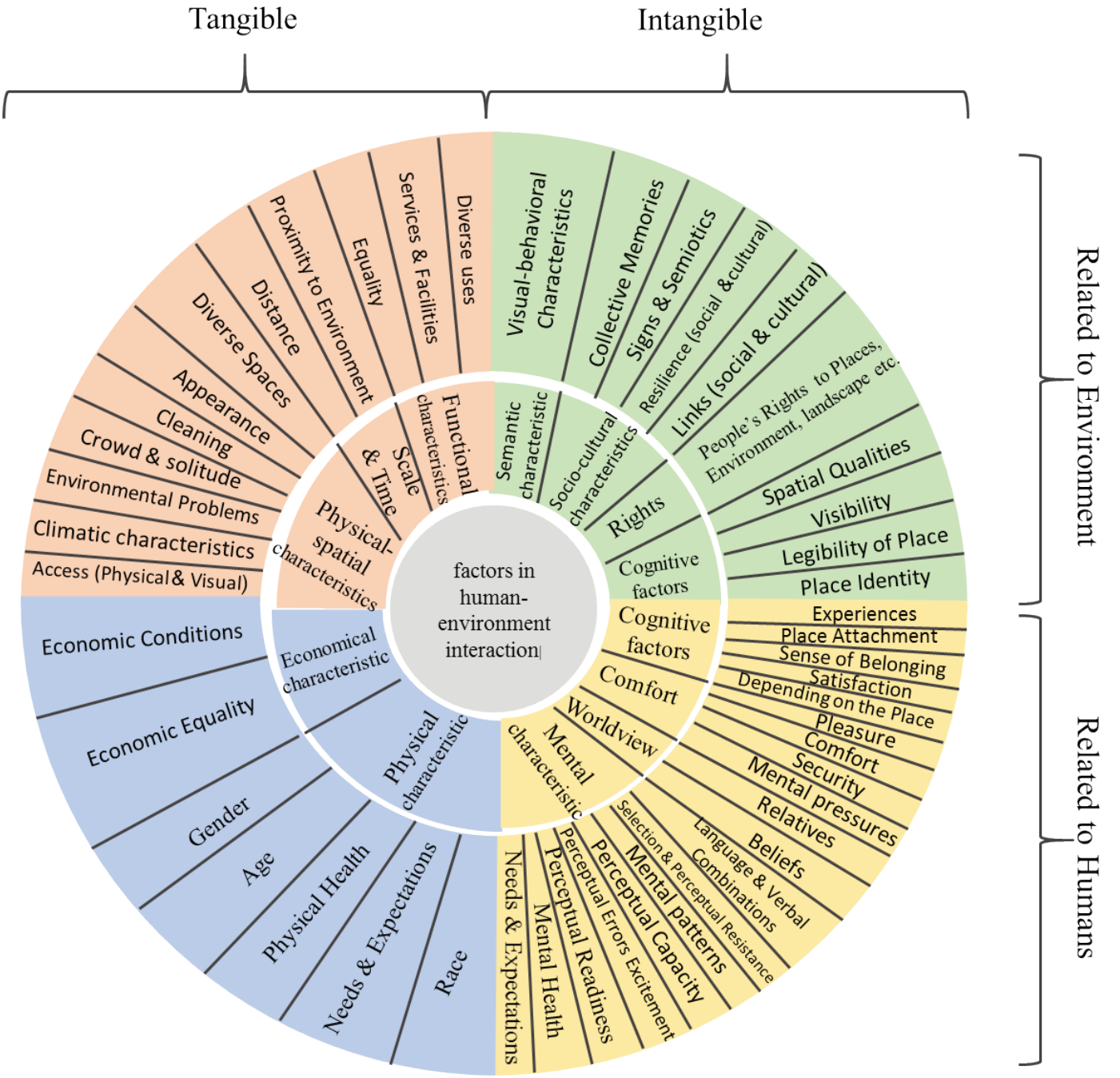

Figure 2. Factors influencing human-environment interactions.

the socio-cultural contexts (social and cultural features and functions) (Kamičaitytė et al., 2020). Based on previous studies' categories and authors' understanding of concepts presented in previous research, the authors categorized this aspect in four parts, which included (1) human factors, (2) heritage, (3) infrastructure, and (4) landscape factors. It should be noted that based on this systematic review there is no other category of literature related to human perception of landscape that is outside of this four main categories.

As mentioned, according to the literature, four main categories are effective in shaping human perception from a landscape. These four main categories, which inherently are correlated, can be placed in a hierarchical relationship (Figure 3). The landscape is a whole that is formed by different components. On the one hand, the landscape connects place and people (Spirn, 1998), and since the landscape can be considered an objective-subjective phenomenon (Mahan and Mansouri, 2017), Therefore, Human is a constructive component from the landscape and he cannot be eliminated. Moreover, environmental elements are part of the components of a landscape. These elements include natural components such as trees, mountains and seas, as well as artificial components known as hard infrastructure, such as power lines and green infrastructure. The other part of infrastructure is soft infrastructure such as culture. These main categories derive their existence from their meanings and context. In fact, the landscape has meaning (Spirn, 1998). The mentioned meanings are taken from the tangible and intangible heritage in each context. Therefore, the landscape can be considered as a whole that consists of all three main categories of human, infrastructure and heritage, and with its characteristics and categories, along with these cases as the main category, forms the human perception of the landscape.

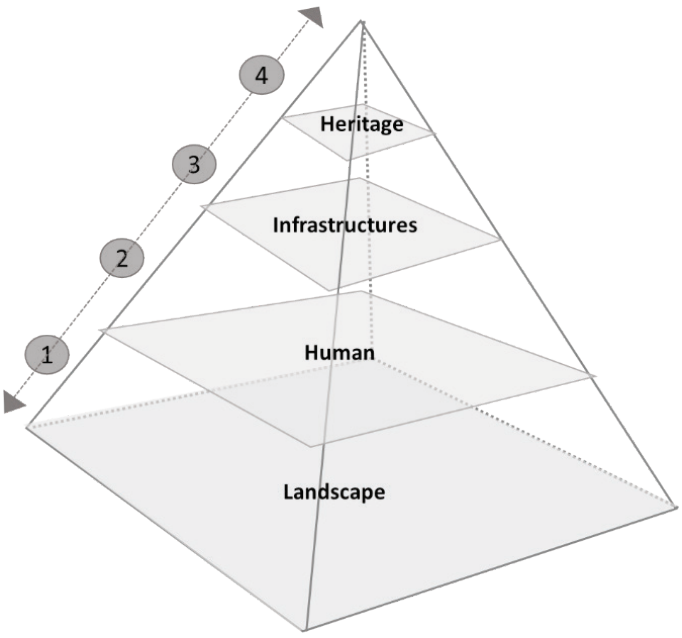

Figure 3. The conceptual framework of categories that influence human landscape perceptions

3 Results

Relevant papers have risen over the last 20 years, and 64% of articles have been published since 2014 (Figure 4). The increasing interest may be the increased attention in previous decades to human beings in landscape and recognizing the importance of environmental psychology for many researchers in this field.

The geographical distribution of research worldwide illustrated that the USA (36 papers, 13%) had the highest number of research (Figure 5), followed by Spain (25 articles, 9%) and China (22 articles, 8%). In some countries, including Norway, Malta, Mexico, Israel, Taiwan, Slovakia, Thailand, Latvia, and Finland, two papers were published. In many countries (Lebanon, Ukraine, Ireland, Iceland, Singapore, Indonesia, Estonia, Slovenia, Chile, Russia, Serbia, Syria, Bangladesh, Uganda, Scandinavia, Scotland, and Nepal), one paper was published.

As mentioned above, the authors gathered 255 papers covering the period between 2000 and 2020 among 84 journals (Table S1). Most papers were published in Landscape and Urban Planning (31 papers, 12%), Land Use Policy (14 papers, 5%), Landscape Research (12 papers, 5%), then Journal of Environmental Management (10 papers, 4%), Urban Forestry & Urban Greening (10papers, 4%), and Sustainability (10 papers, 4%). Next, Building & Environment (5papers, 2%), and Procedia-social & Behavioral science (5 papers, 2%) had published most articles. Also it need to be mentioned that the rest of journals had published less than 5 papers and they are too many for listing, but the analysis showed

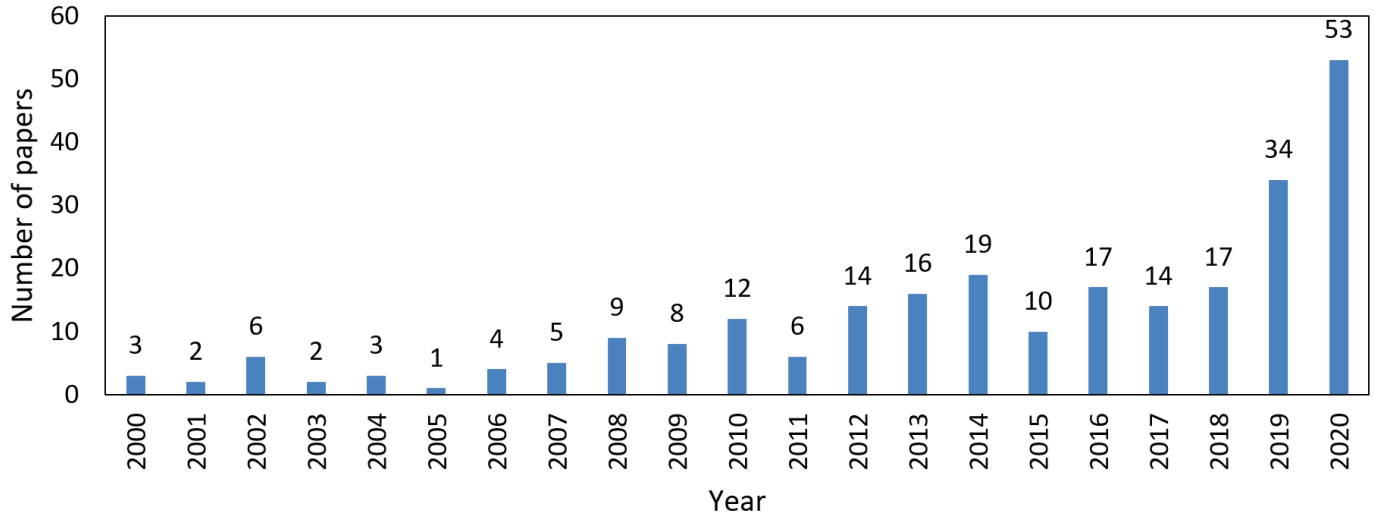

Figure 4. Publication history of paper on human landscape perceptions

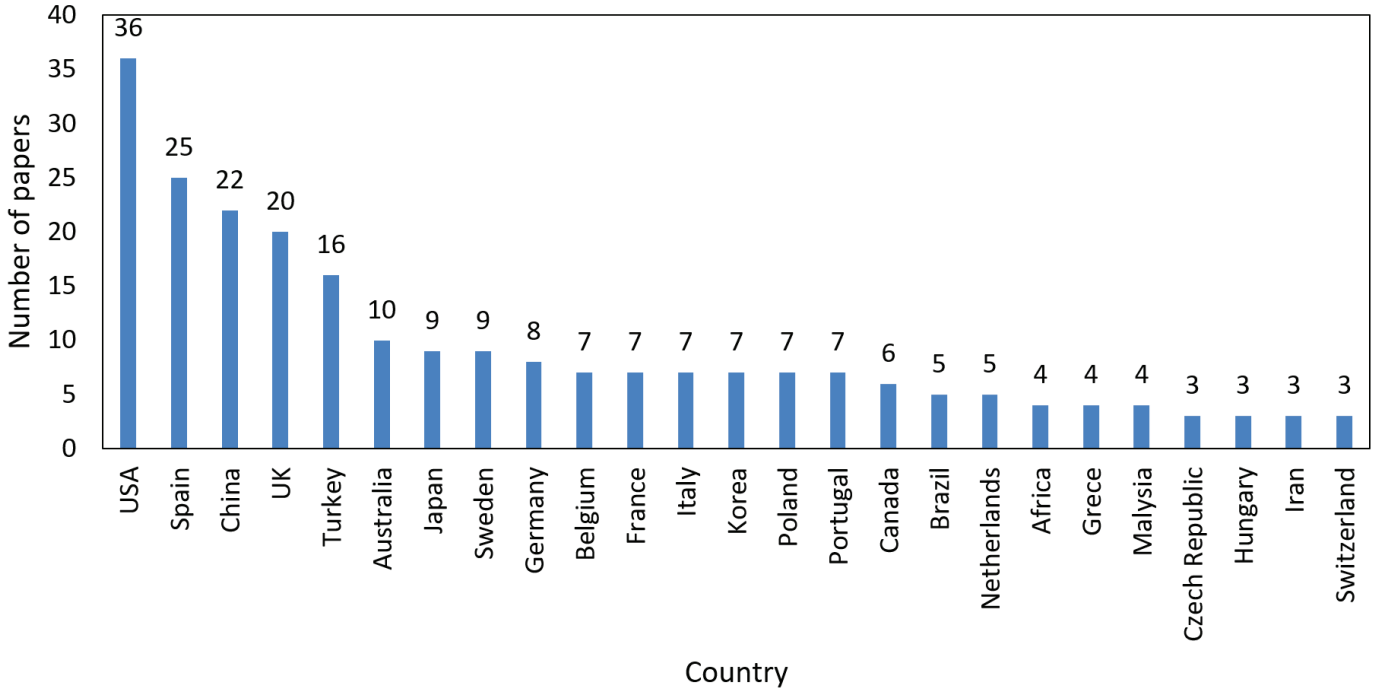

Figure 5. Number of papers on human landscape perceptions by country (The number of papers does not add to 255 as some papers included more than one country.)

that various types of journals have a broad interest, from psychology, society, leisure, to ecology and environment in different aspects of this topic.

On the other hand, different authors used various methods. The most common method were questionnaires (101 papers, 40%), followed by interviews (66 papers, 26%), photographs (39 papers, 15%), GIS (15 papers, 6%), photo questionnaires (13 papers, 5%), field studies (11 papers, 4%), literature reviews (11 papers, 4%), and then eye-tracking (8 papers, 3%), photo rating (7 papers, 3%), mapping techniques (6 papers, 2%), photo sorting (5 papers, 2%), focus group (5 papers, 2%), followed by Delphi techniques (3 papers, 1%), PPGIS (3 papers, 1%), Go-along (3 papers, 1%), participatory methodology (3 papers, 1%). Also, sketching (2 papers), the Photo-Projective method (PPM) (2 papers), painting/coloring (2 papers) were used by some researchers. On the other hand, EEG (1 paper), VR technique (1 paper), contingent valuation method (CVM) (1 paper), visitor employed photography (VEP) (1 paper), and expert-based methodology (1 paper) were still com-

paratively rare. As some papers used more than one method, the number of papers does not add 255. Also, it needs to be mentioned that most of the research studies combined two or three methods. Because the different data sources complement each other, making the assessment more comprehensive (Ode et al., 2010, p. 24).

Based on this systematic review, the concepts in previous studies are categorized into four main categories (Figure 6, Tables S2-5): (1) human characteristics, (2) heritage, (3) infrastructure, and (4) landscape characteristics. The following is a description of each of the main categories, categories and subcategories, and the reasons for this classification.

3.1 Human characteristics

Several researchers argued about the impact of **human** factors on different aspects of perception. The categories and subcategories that fall into this main category are derived from human characteristics (tangible and intangible / physical and non-physical). The authors divided the concepts discussed in previous research in human (observer) into five categories: **Physical characteristics** include qualities that are inherent and always associated with the person (with three subcategories: the physical senses, gender, and age). **Non-physical characteristics** are the characteristics that a person can gain or lose over a lifetime, or they are acquired, and can change depending on time conditions (with twelve subcategories: quality of life, having children, marriage, employment, income level, education level, information/knowledge level, living area, experience, type of sense, behavior/activity, and affiliation). **Mental characteristics** are taken from a person's mind, are not visible and tangible, but affect a person's thoughts and perceptions (with five subcategories: preferences, acceptance, responses, motivation, and mental values). **Involvement** refers to the factors that cause a person to be more or less involved with what is perceived (with two subcategories: connection and distance). **Purpose** which means the purpose of a person to interact with the landscape that can affect the process of perception of the landscape (with one subcategory: human field of view). In fact, the first main category, human and its characteristics, has tangible (such as the physical presence) and intangible factors (such as mental and perceptual characteristics). Also, landscape values are classified into three categories: ecology, community, and delight (Thompson, 2003). The category of the community directly; and the realm of pleasure through the visual senses (what is seen), as described in the "landscape language" book (Spirn, 1998), is related to the human category.

3.2 Heritage

The second main category is **heritage** which can be organized into three categories which include **identity**, (with two subcategories: collective identity, contextual identity) which can be derived from collective or contextual identity, both of which will be effective in shaping a person's identity and ultimately individual perception. **Archetype** refers to the patterns formed in each context according to their characteristics, which can be tangible or intangible (physical or non-physical). They affect the design patterns in that field and human perception (with three subcategories: design pattern, physical pattern, non-physical pattern), and **history**, which is unique in every context and is effective in shaping the identity of a land and its people (with one subcategory: context history). In a more general view, the heritage main category has two categories: the physical places left from the past, as Stonehenge in England (tangible), and the contextual factors, which have come from the past, such as traditional games that depend on the environment and context (intangible).

3.3 Infrastructure

The third main category is the **infrastructure**, which classifies into two categories (1) **soft infrastructure**, which is intangible and non-visual but directly affects human perception of landscape (with six subcategories: health, educational, political, cultural, social, economic), and (2) **hard infrastructure**, which, unlike the previous category, is tangible and is formed with the direct intervention of human beings (with seven subcategories: transport network, energy, communications, water, and sewage, greenery, waste management, land measurement, and monitoring network). In other view, the main category of infrastructure, on the one hand, has intangible factors such as culture, which has overlaps with

the values of the landscape, i.e., society, and on the other hand, with the ecological issues. This main category also has tangible components such as blue and green infrastructure.

3.4 Landscape characteristics

The fourth main category are **landscape characteristics**, which can be organized into three categories. **Physical characteristics**, which include components of the landscape that are visible and tangible (with two subcategories: landscape component and landscape feature). **Non-physical characteristics** are features of the landscape that are understandable but not observable and objective (with two subcategories: quality of landscape and landscape attribute). **Evaluation criteria** include items from the landscape that can also have a human origin and are effective on human evaluation from the landscape and its quality (with nine subcategories: landscape change, landscape potential, landscape benefit, landscape hazard, and landscape function, management, rehabilitation, conservation, and treatment). In fact, the landscape as the fourth main category is similar through visual elements (tangible components) and the field of delight (through the human senses). Also, factors such as memorable (intangible components) are defined in this category. Also, based on the category of triple values (Thompson, 2003), visual elements can be introduced in sensory (visual) aesthetics and concerning the aesthetic dimension. Human perception is formed in each context according to the characteristics of users (human), heritage, infrastructures, and landscape; therefore, each context should be measured separately so that the application results are desirable and effective in landscape design. Ultimately, different approaches to the landscape classify into three categories: objective, subjective, and subjective-objective (Mahan and Mansouri, 2017, pp. 19-21).

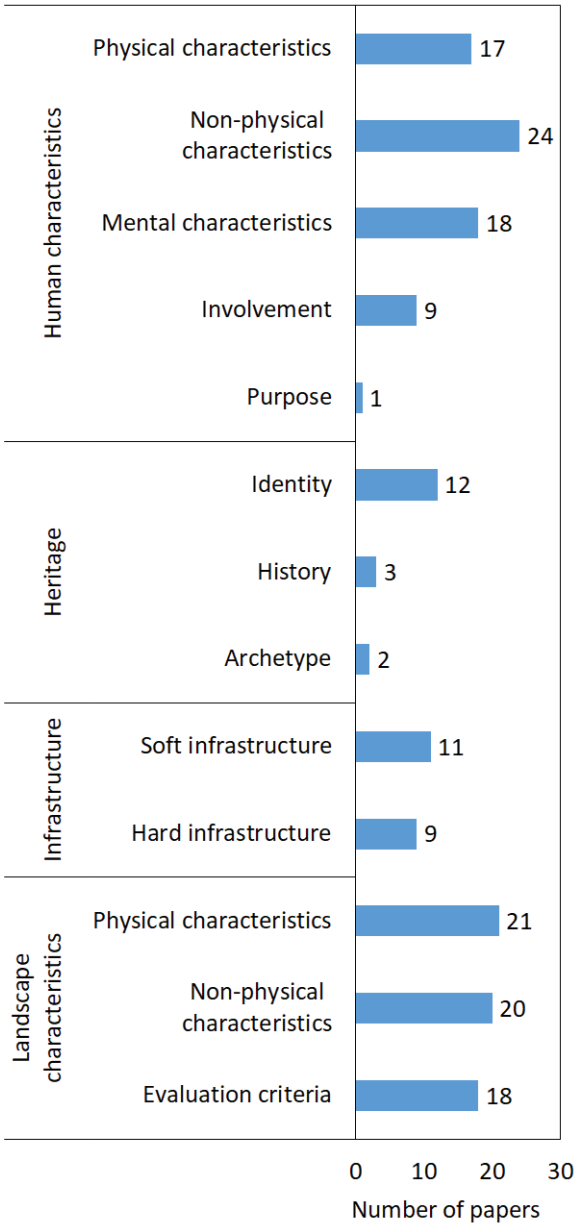

Figure 6. Publication history in each category, which influences human perception of landscape

4 Discussion

Based on the previous studies, the factors affecting the human perception of the landscape are classified into four main categories: human, heritage, infrastructures, and landscape characteristics.

4.1 Human characteristics

Human characteristics have an influential role in shaping human worldview, perception, and behavior. The present study showed that there is mainly agreement on the effect of age and gender on human perception of the landscape. Age and gender are some of the most recognized components related to human characteristics concerning the perception of greenspaces (Farahani and Maller, 2018). Many research finds slight evidence that women are more environmentally concerned than men (Jones

and Dunlap, 1992) or possess stronger environmental attitudes (Foster and McBeth, 1996). In addition, the human senses are the gateway to information from the environment and the means for perception. More than 80% of our knowledge gathered from the world is acquired by our visual senses (Huang and Lin, 2020). However, that mere dependence on vision is rejected for perceiving the world, and the emphasis is on using all sensory stimuli to connect humans and space (Pallasmaa, 2012), and addressing the non-visual senses is an influential factor in enriching the quality of the environment (Bentley, 1985). In fact, defects in any of these senses can alter human perception. However, a large part of the literature is related to human visual perception. At the same time, the environmental landscape is multi-sensory and can involve all human senses at the moment. Therefore, in future research, more attention should be paid to the various dimensions of receiving information from the environment by the human senses. Moreover, users' previous experiences can affect the emotional dimension, mental patterns, level of familiarity, and perception of the quality of benefits, services, and uses. The influence process of users' experiences on their perceptions and preferences in the future is one of the challenges that studies must address. Education can also influence human ideology concerning issues such as the environment. Sometimes these changes may cause a conflict between the individual's views, needs, and expectations and what the environment offers (based on the shared beliefs and values of that society in the field of culture, society, economy, etc.). However, there is no collective agreement on the impact of education on some indicators, such as landscape preferences (Müderrisoğlu and Gültekin, 2015, p. 2), and some consider it ineffective (Bjerke et al., 2006). But many studies have confirmed this relationship (Müderrisoğlu and Gültekin, 2015; Van den Berg et al., 1998; Yu, 1995). In addition, research shows higher levels of education as essential stimuli for environmental concerns and attitudes (Guagnano and Markee, 1995; Howell and Laska, 1992; Jones and Dunlap, 1992; Raudsepp, 2001; Scott and Willits, 1994). Even the field of study also plays a significant role in human perception of landscape (Svobodova et al., 2012). Many studies assessed the human preferences related to landscape in different aspects. Preferences are not always the same; especially when there are differences between landscape planners and residents, this can lead to differences between residents' demands and actual design (Hofmann et al., 2012, p. 1). Therefore, knowledge about people's landscape preferences is essential for effective and standard planning for the future (Filova et al., 2015, p. 2037). In addition, assessing the user's preferences can help prevent some problems due to the difference between landscape design and people's preferences. On the other hand, landscapes should be democratic and a platform for the use of all sections of society and their different preferences. The relationship between the preferences of individuals and the dimensions and characteristics of a landscape that becomes a civil and democratic landscape should be the subject of future research.

4.2 Heritage factors

One of these categories is Identity. The landscape identity is detected based on distinguishable visual attributes, although people's environment is a multisensory medium (Kljenak et al., 2013, p. 277). Based on the term ecological space (Gibson and Nobel, 1986), humans can perceive the mall part of the unlimited of their environment, which they can detect with their senses (Kljenak et al., 2013). However, identity is affected by many tangible and intangible factors that directly and indirectly affect human perception of the landscape. Identifying these factors and their effects can be effective in future research and identifying comprehensive dimensions of perception. Another one is Archetypes, as patterns, which influence design. The spatial pattern of man's settlement determines and is readjusted by daily human needs, cultural settings, and social norms (Nunta and Sahachaisaeree, 2010). It is not enough to be aware of being affected. Be aware that meeting the humans' basic needs alone would be inadequate without signifying their inherited identities and socio-cultural necessities (Nunta and Sahachaisaeree, 2012, p. 154). However, the literature showed that the effects of these patterns and factors on human perception had been less studied from a landscape. The last category is History. Undoubtedly, the historical course influences the formation and trend of landscape changes. Even as extensive internation-

al literature confirms, forest landscapes influence and reflect community cultural history (Rotherham, 2007, p. 100). Therefore, History's effects on human perspective and perceptions are significant and should be studied in more research.

4.3 Infrastructure

Soft infrastructure includes health, social, economic, cultural, political, and educational. In fact, besides physical attributes, some characteristics such as values, ideas, beliefs, or expectations of appropriate behavior confer meaning on the environment (Cheng et al., 2003; Scott and Canter, 1997). People, willingly or unwillingly, are influenced by these values, which can direct people's thoughts and actions in a specific direction. Some values, such as ecological values, are an active field in research that has created a strong foundation in ecological principles (Fry et al., 2009, p. 933). Some values, such as social values, must recognize at the landscape level to offer a more comprehensive understanding of the processes that lead to change in social-ecological systems (Brown et al., 2012; Folke et al., 2003; Liu et al., 2007). Although social values root in humans' perceptions of ecosystem goods and their services, they are rarely discussed (Chan et al., 2012; Kumar and Kumar, 2008; Raymond et al., 2009; Tyrväinen et al., 2007). These characteristics also affect the formation of the environment. Users believe in their context values and adhere to these items, and as long as that belief and value prevails, it will not be desirable if the design does not comply with them. Therefore, the values of their lives will always influence the ideology and ontology of people. But what is the process of influencing these values on the environment and perception? What are the relationships of these values with human and environmental components in each context? These questions are among the ones that are recommended to be considered in future studies. Hard infrastructure includes Transport network, energy, communications, water and sewage, greenery, waste management, land measurement, and monitoring network. One of the most controversial infrastructures in landscape perception is an energy infrastructure and renewable energy facilities. Many studies have addressed residents' perceptions of energy infrastructure in the field of aesthetics and how people perceive these elements as an element that is not part of the landscape and has been added to it, whether people perceive its benefits or perceive it as an additional element that affects the aesthetic of the landscape. Also, most research concerns resistance and acceptance and residents' engagement during the planning stages, and far fewer focus on what happens in solar power plants, communities once wind farms, and other energy infrastructures (Delicado et al., 2016). Another one is green infrastructure. The broad concept of green infrastructure has also varied according to the urban, political, and social context (Santo-Tomás Muro et al., 2020). The European Commission (2013) described green infrastructure as a "successfully tested tool for providing ecological, economic and social benefits through natural solutions" (Infrastructure, 2013). Significantly, green infrastructures in peri-urban areas can improve the quality of residents' lives by providing views, fostering healthy practices, and bringing nature closer to people's cities (Santo-Tomás Muro et al., 2020, p. 1). The present study demonstrated that green and blue infrastructures had been examined more in the landscape than other hard infrastructures. However, it is not the only component of the landscape of these two infrastructures, and to better understand the various dimensions of human perception from the landscape, there is a need for further study of all genies.

4.4 Landscape characteristic

Landscape types significantly influence the perception of landscape scenes (van den Berg and Koole, 2006). Nevertheless, the effect of landscape types on human perception has been less under concern in recent studies (Filova et al., 2015) ;still, there is a potential for further research. Physical properties of the landscape, including the green and blue elements and their qualities that affect human perception of the environment. Numerous studies have examined the physical factors of the landscape in different dimensions. For example, research has shown the impact of different ecological stresses on seed germination in protected areas (Saffariha et al., 2020), and different altitudes affect the essential oil content and plant composition (Saffariha et al., 2021). Moreover, for a comprehensive under-

standing of the human perception of landscape, one needs to assess how individual elements (not only the overall landscape) located in the landscape are perceived (Kaplan and Kaplan, 1989; Rogge et al., 2007). The presence of natural or artificial components can affect perception, which can be related to the context and other components of the landscape. As Lothian confirmed, wind turbines in a relatively high aesthetic value context have a negative effect. They positively impact landscapes with a relatively low aesthetic value (Lothian, 2008). Therefore, the authors recommend assessing individual elements of landscape and their role in human perception for a better comprehensive understanding of the human perception of the landscape. Another issue is the Evaluation criteria, including landscape changes, potential, benefits, hazard, function, management, rehabilitation, conservation, and treatment. These factors will affect the human evaluation of the landscape. These factors, directly and indirectly, affect human perception, environmental quality, sociability, and satisfaction. Some attempts have been made to create a more conceptual base to estimate the effects of changes on landscape preferences (Sevenant and Antrop, 2009, p. 2889). In addition, there is still very little research on human perception of such areas (Ruskule et al., 2013). However, many researchers believe that land abandonment has an opportunity for "re-wilding" the landscape (Bowen et al., 2007; Navarro and Pereira, 2015). Some studies pointed out that this has significant ecological consequences. The disappearance of a fine-grained mosaic landscape structure leads to the loss of many semi-natural habitats, homogenization, and a consequent decrease in biodiversity value (Henle et al., 2008; Nikodemus et al., 2005; Stoate et al., 2009; Uematsu et al., 2010). This field still has potential for further research in a different context for comprehensive understanding. Can the evaluation criteria affect other environmental attributes and characteristics such as identity or belonging? To what extent will contextual beliefs and values affect the perception of these hazards and how to deal with them? These are among the issues researchers can study separately in each specific historical, cultural, and geographical context.

5. Conclusions

Humans and landscapes are in daily interaction with each other. The connection point of this interaction is perception. The present review study showed that the factors affecting the human perception of the landscape could be classified into four main categories: human, heritage, infrastructure, and landscape factors, which inherently are correlated and can be placed in a hierarchical relationship. Each of them has its categories and subcategories, including tangible and intangible factors, which influence each other and human perception that still have the potential for future research to understand the hidden dimension of human perception better. Furthermore, the impact of schematic mental models on human characteristics, subjective and intangible approaches in heritage section, creating and assessing human rights through the landscape in the soft infrastructure main category; and comprehensive and holistic analysis of visual elements in the landscape section are less under-considered. Finally, based on statistical analysis in three sections showed that: **First**: the recognition of human and landscape factors had been measured on a large scale, respectively. While heritage and infrastructures dimensions are still less under-considered. Accordingly, the authors recommend that these subjects be researched in future studies. **Second**: in approach, the main focus has been on visual perception from the landscape in the last twenty years, while human beings are multidimensional beings. In interaction with the landscape, all aspects of human sensory data are activated and obtain information from the environment. Therefore, it is suggested that future research should pay more attention to other areas and multisensory approaches. **Third**: in the field of methodology, most researchers have dealt with traditional methods such as surveys, while on the one hand concerning different aspects of human beings, and on the other hand, advances in the field of cognitive sciences and creating tools for more accurate assessment for the human perceptual aspects. The authors suggest considering the updated method, Such as cognitive science tools such as eye-tracking, electroencephalography (EEG), virtual reality (VR), and augmented reality (AR), in future research. Ultimately, under-

standing the process of human perception from the landscape and factors affecting this process can help create more favorable spaces for humans.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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