

ORIGINAL ARTICLE

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# “Reading”, “listening” and sound, light environment

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## Abstract

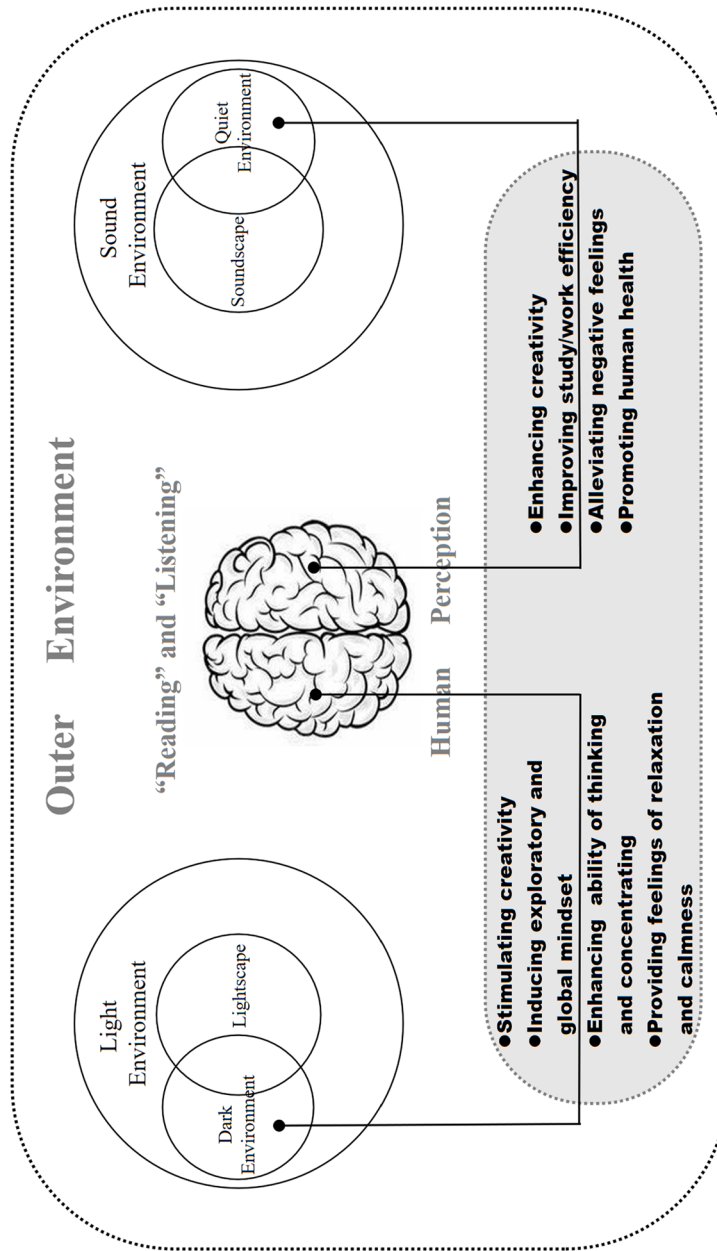
Sound is always an important medium for passing on knowledge and skills as well as for communicating information. Reading accompanies the use of the brain in the silent reading of words, an act that transforms textual information into verbal information. People can “listen” and “read” in a dark or low light environment. Learning and thinking in a quiet, dark environment is not only conducive to the formation of innovative thinking, but also the inheritance of ancient ideas of health and wisdom. Modern disciplines follow the human perception mechanism and advocate concepts of “Quiet Area” (in soundscape discipline) and “Dark Night Sky” (in lightscape discipline). It is in accordance with the ancients preference of thinking and learning in a “quiet, dark environment”, which is consistent with the law of the matter and the origin of things. This also reflects the integration of human life wisdom and modern science.

**Keywords:** Reading and listening, Sound, Soundscape, Light, Lightscape, Human environment

## Introduction

The five senses of human, namely eyes, ears, nose, tongue and body(skin), are respectively responsible for visual, auditory, olfactory, gustatory, tactile and sensory functions (including heat and humidity), and they communicate with the external environment with multiple information. Human beings are closely connected with the environment in various ways. People’s perception and appreciation of the surroundings is the overall impression and judgment process formed by the synthesis of multiple senses. Contemporary landscape theory tends to concentrate on the visual physical landscape too much, while neglecting the auditory, olfactory and tactile senses and other feelings of the landscape as well as the lightscape, which is a special type of visual landscape, leading to an incompleteness of the overall perception and aesthetic experience of that particular landscape.

Human being’s mindset, emotions and creative thinking are influenced by the physical characteristics and spatial patterns of outer environment (Lee and Lee 2023). This paper attempts to analyze how some special “sound” and “light” environment influence on “listening” and “reading”—two main behaviors for human communication and cultural transmission, and then on human perception (Fig. 1). Based on the intrinsic correlation



**Fig. 1** Sound and light environment influence human perception

between the outer environment and the perception of the human mind, the concept from ancient human about emphasizing “quiet” and “dark” environments in life, especially when reading or studying, is extremely scientific and healthy. “Soundscape” and quiet environment have the same logical rationale, also “lightscape” and dark/low light environment. All these echoes highlight that the simple human wisdom in life is consistent with the theories of modern environmental science essentially and in root.

## **Sound environment and soundscape**

### **Sound’s role of cultural transmission and its spatial/temporal dimensions**

In the long historical period before invention of writing, human beings have always relied on oral and aural communication, even the spread of culture and technology, so education has always been conducted by listening to lectures (Fig. 2). Even today, education still relies heavily on teachers teaching and stu-

dents listening. This is why Confucius emphasized the importance of “obedience to the ear” [“耳顺”], and Xunzi also said that “the voice enters into the heart” [“声入心通”]. Historically, literature from all over the world has also been created and transmitted via verbal communication. The Homeric epics, for example, were not the product of writing, but rather the work of the procession singers who passed them on by word of mouth. Ancient Chinese literature also relied on storytellers to create and disseminate. This is evidenced by the fact that all ancient chapter books end with the phrase “please listen to the next chapter” [“请听下回分解”].

In order to improve the acoustic environment of human habitation, we must focus on the two dimensions of space and time, and adhere to the three scales of macro, meso and micro to divide the bustling area, bustling time, buffer zone and buffer time, quiet area and quiet time. Noisy everywhere, all the time is highly undesirable. Especially for places for reading, listening and thinking, such as classrooms, reading rooms, libraries, study rooms, etc., it is important to provide good interior acoustic design to create a quiet time and space.

### **Soundscape and the concept of “Quiet Area”**

Soundscape refers to the acoustic environment as perceived by an individual, group or community within a given scene (ISO 2014). The beginning of the soundscape discipline was marked by the “World Soundscape Program” initiated by Canadian composer R. Murray Schafer in the 1960s, and the 2002 EU “Environmental Noise Assessment and Management Directive” (2002/49 / EC) initiated a series of policies and major issues in Europe that were milestones in the development of soundscape.

Soundscape focuses on human perception and its interaction with the environment, forming a cross-complementary relationship with environmental acoustics. Nowadays, soundscape practice has played a unique role in enhancing environmental quality, health healing and artistic creation (Figs. 3 and 4) (Jianzhen et al. 2022).

The EU Directive 2002/49 / EC defines the importance of Quiet Areas and divides them into two types: open countryside areas which are not disturbed by noise from traffic, industrial and recreational activities, and agglomerations where the daytime and night-time sound pressure levels or other applicable noise indicators are lower than the prescribed values (Directive 2002). The Department for Environment, Food and Rural



**Fig. 2** Painted scroll of Confucius' lecture (Confucius Museum collected)

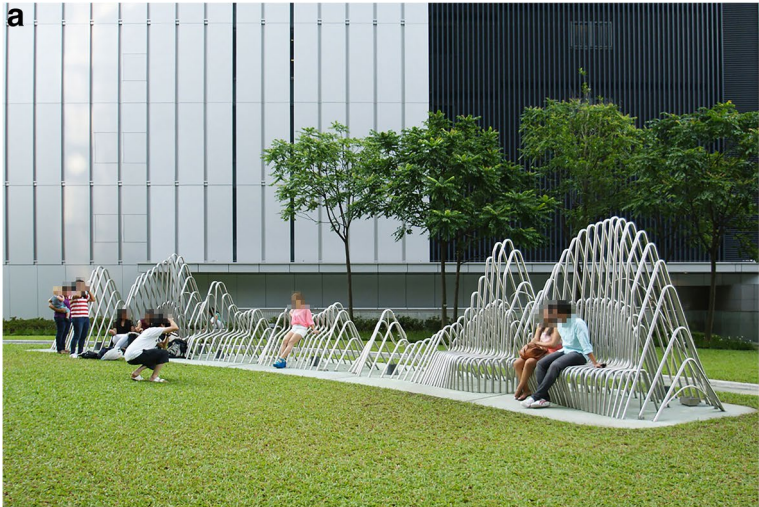
Affairs (Defra), in its 2006 policy document, proposed a process for identifying short- and long-term quiet zones (Defra 2006), as well as more stringent acoustic protection measures on specific types of sites (e.g., churches, courtyards, cemeteries, etc.), in order to provide environments for "quiet contemplation" ODPM (Office of the Deputy Prime Minister), 2002). The Swedish government has proposed the creation of a "Quiet Side" to reduce the level of acoustic annoyance in residential areas, and to include the creation of quiet areas in urban planning strategies (Bodin et al. 2015).

#### **"Quiet Area" and healthy environments**

Soundscape revolutionized the research perspective on sound environment from decibel-based noise control to a focus on potential positive qualities and introducing a new



**Fig. 3** 'Cutting Edge' Soundscape Sculpture, Sheffield, UK (Ed O'Keeffe 2011)



**Fig. 4** 'Soundscape', Tamar Park, HK (Gold Award, Design For Asia Award 2014) (Edmond Wong Studio 2015)

qualitative perspective on the management of sound environment (Vogiatzis and Remy 2014). “Quiet Area” is a particularly important concept in soundscape for improving human well-being.

The delineation of “Quiet Area” considers comprehensively objective acoustic indicators such as urban quietness index, tranquility ratings, in addition to the measurement of ambient sound levels (Aletta et al. 2016; Pheasant et al. 2008; Tsaligopoulos et al. 2021). Some research have pointed out that reference can be made to multidimensionality of the perception of the individual or the community, such as the visual impression, accessibility, and non-acoustic factors of environmental and cultural qualities (Brambilla & Maffei 2006; Cerwén & Mossberg 2019). The Quiet Areas Definition and Management Action Plans (QU.A.D.M.A.P), co-funded by the EU LIFE + 2010 Financial Program, has developed and tested a standardized procedure to be applied by urban planners in their practice of selecting, evaluating and managing quiet areas in order to identify, delineate and prioritize Quiet Urban Areas (QUAs) (Licitra et al. 2011).

Health and well-being experience are prioritized in the implementation and management of “Quiet Areas”. In Paris, the government defines quiet areas not only based on analyzing noise maps and geographical information, but also taking the comments of local residents and on-site perception assessments into account (Duguet et al. 2012); Candidate Quiet Areas (CQAs) in Scotland take into account other data such as the size of public gardens, open spaces and open land, in addition to sound pressure levels; public gardens, urban parks and urban squares in urban areas are considered to be the preferred Candidate Quiet Areas in England as they are more likely to bring significant health, well-being and a high quality of life to the surrounding community (Payne & Bruce 2019).

There is a growing number of research showing the positive effects of quiet environments in enhancing creativity and the breadth of attention, increasing work performance, improving human health and alleviating negative feelings. Quiet environments can enhance individual creativity and expand attention breadth (Kasof 1997). Expand attention range; Quiet working environment can increase cognitive resources allocated to target task (Becker et al. 1995), enhance individual’s working memory (Jones 1993), and improve human study and work efficiency (Szalma & Hancock 2011, Samani 2012). Staying in a quiet environment can effectively alleviate people’s negative feelings such as stress (Hillier et al. 2006) and worries (Coensel et al. 2009); and, quiet areas itself have positive health benefits as well as healing effects (Zhongming et al. 2016; Van den Berg 2005).

Furthermore, improved soundscapes and reduced urban sound levels have similar positive effects on health (Nilsson and Berglund 2006). Acoustic measures in quiet areas include both preventing noise disturbance and providing access to natural sounds such as water, wind and birdsong to create healthy acoustic environments and enhance stress restoration potential (Ratcliffe et al. 2016; Watts & Pheasant 2013), while some sounds of human activity and vehicular machinery that diminish the sense of tranquility may cause negative health impacts (Jeon et al. 2010; Jo & Jeon 2020; Liu et al. 2019; You et al. 2010).

As can be seen from above, the quiet environment advocated by the ancients not only directly provides an efficient learning and working environment, but also helps people

to maintain a healthy emotion and improve their quality of life. Its internal rationale is completely compatible with the scientific concept of soundscape.

### **Dark environment and human perceptual mechanisms**

Perception is a process by which the brain organizes and interprets human behaviors of “listening” and “reading” to form perceptions and understandings (Gregory 2015). The mechanism of human perception is an interwoven presentation of a comprehensive experience to the surrounding environment (Barsalou 2008). On one hand, perception influences cognitive, interpretive, and evaluative responses by transmitting environmental information through bodily pathways; on the other hand, perceptual responses such as attention, memory, reasoning, judgment, imagination and reflection, semantic interpretation and symbolic decoding, in turn stimulate people’s emotions, influence behavioral tendencies and behavioral outcomes (Casciani 2020).

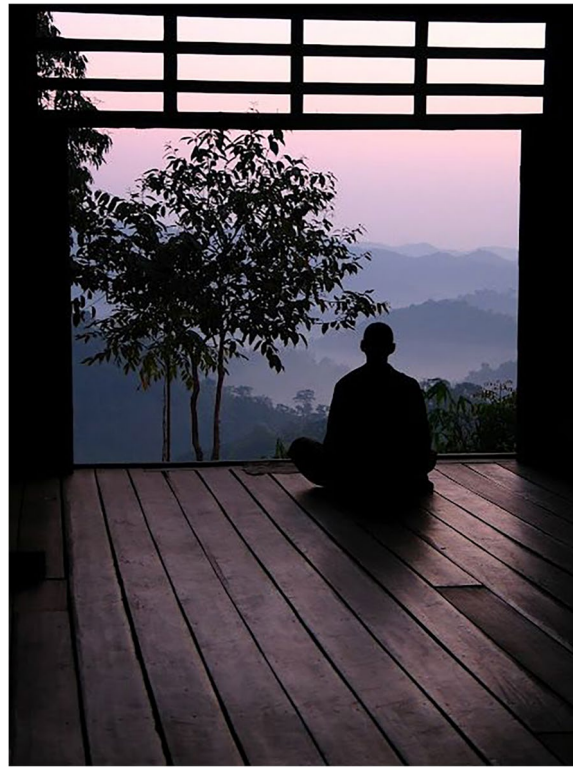
The Chinese habit of saying “读书 *dushu*” (reading books) rather than “看书 *kanshu*” (watching books) and calling intellectuals “读书人 *dushuren*” (the one who read books), really speak to the essence of reading. When people read, although they are looking at words or notations with their eyes, this is actually accompanied by the act of reading the words silently (maybe sometimes reading out) with their brain. In other words, reading is a process of transforming textual information into verbal information.

Thinking, although there is pictorial or figurative thinking, relies more on language, a process of thinking in a “silent stream of speech”, i.e., the process of “listening to your inner voice”. Writing, on the contrary, is the inverse of the process of transforming verbal information into textual information. If information and knowledge are received via “listening”, then the process of converting text into speech is eliminated, and they will enter directly into conscious mind and stored as a “language stream”.

The process of “listening” can go on in a dark environment. Especially nowadays, thanks to the revolution in information technology, it is not difficult to instantly convert text and language, video and audio, and it is perfectly fine to learn in a dark environment through audiobooks or by listening to lectures. Thinking, as mentioned earlier, relies primarily on language. Thus, with the exception of those lines of thought that require the use of images or visual symbols to accomplish them, thinking, as a rule, can also go on in a quiet, darkened environment by means of meditation (Fig. 5).

The majority of studies confirm dark or low light environment can provide people the feelings of relaxation and calmness (Manav 2007; Custers et al. 2010). Dark environment is good at enabling a global and explorative processing style at perceptual and conceptual levels (Steidle et al. 2011), increase risky and disinhibited behavior which deviance from norms (Miwa & Hanyu 2006). The relatively dark environment had a significant positive effect on students’ concentration, thinking ability and memory performance (Jago & Tanner 1999), Castilla et al. 2023), thereby improving study and work performance (Samani 2012). Meanwhile, dark environments significantly stimulate individual creativity and creative thinking (Steidle and Werth 2013; Lee & Lee 2023; Amabile & Gruskiewicz 1989).

Therefore, listening and meditation in dark or low light environment are not only conducive to the learning and dissemination of knowledge and creative thinking, but also helpful for the for energy consumption of lighting and realize the goal of low carbon.



**Fig. 5** Meditation (Grandet 2014)

The modern term "dark environment experience" refers to the special visual experience that occurs under the natural night sky or under artificially dark environmental conditions. The perceptual mechanisms of body-mind interaction are the basis of the dark environment experience. Compared to visual perception in bright environments, darker environments tend to actively blur perceptual boundaries and thinking styles (Steidle et al. 2011), and their mental experience may also be accompanied by a sense of hiding or liberation from moral constraints (Zhong et al. 2010). Darker-based environments tend to stimulate the experienter to feel the mournful emotions of important and heavy historical stories (Lv et al. 2022). Dark tourism bases on the perception law mentioned above, set up in a specific light environment with reflection, remembrance from the educational significance of the experience in the place. New York World Trade Center, Nanjing Massacre Victims Memorial Museum, etc. or the use of black materials, or in the process of touring the design of weak light in the dark atmosphere to create a unique tourism experience (Jiaojiao 2018). Moreover, the use of dark environments to create specific atmospheres in artistic creations is also well known, as in the case of the Sonic Cradle, a meditation experience designed by Simon Fraser University in Canada, where an interactive pressure management system balances the user's control in a dark environment to foster an immersive meditation experience (Vidyarthi et al. 2012).

### **Lightscape and dark environment experience**

#### **Lightscape**

The academic concept of "lightscape" is defined by the first author of this paper (ShuoXian 2019, 2017; Jianzhen & ShuoXian 2017). "Lightscape" is a special facet of landscape.



It refers to a landscape that is mainly composed of various light sources, light and shadow, and their changes. It can also refer to a landscape that causes strong visual impressions from various light sources, light and shadow, and their changes. Among them, the lightscape formed by natural light source is called natural lightscape, the lightscape formed by artificial light source is called artificial lightscape, and there are also composite lightscapes with both. "Lightscape" has been advocated as a new discipline alongside soundscape and smellscape, and it also points out a new path for the integration of the three landscapes into a multifaceted landscape creation (ShuoXian 2022). It also points out a new path for the "integration of soundscape, lightscape and smellscape" in the creation of diversified landscapes (ShuoXian 2022). Lightscape studies the light environment of human settlements and its landscape from the perspective of multi-disciplinary intersection and integration, forming a cross-complementary relationship with architectural optics traditionally based on "photometry", just like the relationship between soundscape and architectural acoustics.

Lightscape advocates to understand the light source and its environment from human subjective perception and experience to form the overall landscape characteristics, and also attaches importance to the interpretation of "human-light-environment" from both the spatial and temporal dimensions of the overall field. Lightscape focuses on the relationship between light and science, technology, society, culture, aesthetics, humanities and geography, and emphasizes how the social and cultural connotations of lightscape can be felt, appreciated and understood by individuals or social groups.

Limited by the development of lighting technology for a long time, the habit of "start working at sunrise and rest at sunset" and the formation of the corresponding circadian rhythm were formed during the human evolution process. Following this routine is not only good for health, but also good for energy saving.

The reasons why the first author of this paper puts forward the concept of "lightscape" are as followed: firstly, it inherits the cultural wisdom about "light" in human development (e.g. the most celebrated meaning of "enlightenment" is "illumination, awareness"); secondly, the prevalence of current lighting projects has already turned nights into days, which results in tremendous energy waste and light pollution, even at the cost of human health and well-being. Lightscape's appreciation includes that to the of natural lightscape, such as stars and fireflies. This mainly focuses on the formation of the artistic mood of the landscape, but not on the numerical value or standard of brightness and illumination. Thus, this correct concept is really beneficial to health and energy saving.

The mechanisms and patterns of human perception to lightscape involve sociology, cultural geography and psychology. Researches have demonstrated that human perception in lightscape is not completely consistent with the normative indicators of modern environment or architecture lighting (Henckel 2019, 2021; Jianzhen et al. 2020), certain lightscapes (including fireflies, moon, stars, aurora borealis lightscape, etc.) require an appropriately darkened environment for proper appreciation (Yating & jianzhen 2023; Jianzhen & Ranpeng 2021). The formation and perception of lightscape involves multi-disciplinary complexity and contradiction, by which is exactly its diversity and uniqueness are manifested.

### The lightscape significance of “Dark-Night-Sky”

With the rapid development of artificial lighting, light pollution has become the second largest source of pollution after noise (Payne et al. 2009). Overuse of artificial light has caused sky glow, weakening visual contrast and resulting in diminished visibility of stars (Ying et al. 2014). Artificial light pollution at night has significantly disrupted the circadian rhythms of humans and animals, destroyed the biodiversity and ecological processes of our living environment (Navara & Nelson 2007).

In recently years, a new proposition in urban lighting planning has emerged that centered on the idea called “less lighting is more”. Zielinska-Dabkowska proposes the concept and methodology of “dark infrastructure” (Zielinska-Dabkowska 2019). The International Dark-Sky Association (IDA), which has gained worldwide attention, aims to raise public awareness of night sky protection (Jili et al. 2020).

“Dark-Sky” refers to a night sky of outstanding quality with recreational, aesthetic and tourist functions, and is not affected by light pollution (Silver & Hickey 2020; Le et al. 2019). “Dark-Sky” plays an important role because of its aesthetic value as a landscape. Moreover, it provides places for appreciating and studying activities of stargazers and astronomy enthusiasts. By delineating special areas for night sky protection and research, the Dark Sky Society steps forward to protect the natural authenticity and against light pollution (Barentine 2016). The International Dark Sky Places (IDSP) program was established in 2001, and as of January 2023, there are 201 certified International Dark Sky Places, including 115 Parks, 38 Communities, 20 Sanctuaries, 16 Reserves, 6 Urban Night Sky Places, and 6 Dark Sky Development Reserves (IDA 2023a).

Tibet, Taiwan and Shenzhen of China have already joined IDSP program. In Tibet, the Ali Dark Sky Reserve and the Naqu Night Sky Park are pilot sites for “Chinese Dark Sky Preserve”, visitors can enjoy the stunning scenery of “stars hanging over the wilderness” (星垂平野阔 *xing chui ping ye kuo*) and “star shadows swaying” (星影摇摇欲坠 *xing ying yao yao yu zhui*) in this excellent dark sky environment. He-huan Mountain International Dark Sky Park, located in the Taroko National Park and Huangshan Mountain Forest Park, Taiwan, has been built as a destination for year-round stargazing (Fig. 6). Shenzhen is the first city in China to designate a “dark sky protection area” as part of special urban lighting planning. Now, the construction of the Dapeng Star Park and the Shenzhen Dark Sky Protection Demonstration Area, along with other projects are in progress. Shenzhen Xichong will become the first International Dark Sky Community in China, presenting a beautiful night sky by reducing overall background brightness and limiting artificial lighting, attracting fireflies to return with its superior ecological environment (Fig. 7), thereby creating a rich lightscape experience for this young city.

### Suggestions

This paper advocates the restoration of the ancestral circadian rhythm of human living and the corresponding sound and light environment where possible. “Reading” and “listening” may strengthen the absorption and understanding of knowledge by listening to the world and also our inner voice in a quiet and dark environment. When we learn and contemplate in a quiet and dark environment in a meditative way, it is



**Fig. 6** He-huan Mountain Dark Sky Park, Nantou County, Taiwan (IDA 2019)



**Fig. 7** Fireflies under star trail around the Shenzhen observatory (IDA 2023b)

beneficial to harvesting the results of innovative thinking. The “dark sky project” is conducive to the presentation of a fantastic natural lightscape, which is the practical embodiment of lightscape concept, e.g., “scientific, ecological and environmental protection” landscape is the best. Darkness is also beneficial to a healthier and better sound and light environment, and it also contributes to energy saving and sustainability goals in human settlements environment.

#### **Acknowledgements**

This research was funded by State Key Laboratory of Subtropical Building and Urban Science (2022KB06) and Chinese Academy of Sciences (2018-ZW01-A-031)

#### **Authors' contributions**

Shuoxian Wu proposes a general framework and had the idea about ancient wisdom for the article; Jianzhen Qiu performed the literature search, expanded the article on soundscape and lightscape in connection with ancient wisdom, and drafted the work.

### Availability of data and materials

Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

### Declarations

#### Competing interests

The authors declare there are no personal or financial dependencies to disclose.

Received: 19 July 2023 Accepted: 17 October 2023

Published online: 17 January 2024

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