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Spatio-artistic thresholds foster human-nature connections for sustainable transitions: cases of vernacular facades in Bhal, India

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Introduction: Despite growing awareness of the society-nature division as a root cause of current socio-ecological crises, sustainability transition approaches often overlook architectural design's role in fostering human-nature connections (HNCs). In fact, much of sustainable architecture practices also prioritise designing for technical efficiency and mitigation over designing for 'relationality' and nurturing HNCs. This gap highlights the need to redefine architecture as a system shaping and transforming human interactions with the world, and to develop relational design approaches for achieving sustainable urban transitions.

Aim: This paper introduces vernacular architecture as an exemplar of relational design. It aims to assess the vernacular Indian dwellings for "relationality," targeting their spatio-artistic entrance facades to identify HNCs fostered by these architectural thresholds.

Method: To achieve this, the visual ethnography method was utilised by triangulating photographs and sketches with observations for a case study of two wooden vernacular facades in Bhal, India, as representative examples of a typical half-timber Indian dwelling. Four areas of artefact analysis, supported by grounded theory techniques, were employed for the interpretive analysis of the facades to uncover embedded dimensions of HNCs.

Result: The findings indicate eight thematic levels of HNCs fostered by the intricate interplay of spatial-artistic features in facades, which together create a profound aesthetic experience of nature in the everyday life of inhabitants and also correlate to existing biophilic patterns. These elements serve functional purposes, along with expressing ecological consciousness and imparting cultural meanings to promote multiple internal-external connections with nature.

Discussion: Additionally, a potential analytical framework to evaluate architectural façade design is proposed along with the guidelines for relational design of these spaces. The results suggest that designing spatio-artistic façades and thresholds in architecture can act as a leverage point to facilitate relational ontological shifts towards nature in the human psyche for sustainability transitions. These insights are essential for socio-ecological urban planning and design to reorient societies with nature.

KEYWORDS

relationality, architecture, vernacular facades, human-nature connection, sustainability transition

1 Introduction

Overcoming dichotomies between society-nature and human-nonhuman embedded within current development trajectories of modern industrial societies is considered crucial for transformational change to sustainability (Ives et al., 2018; West et al., 2020). Socio-ecological transition scholars argue that sustainability must be rethought in relational and experiential terms and not just through systems modelling or carbon accounting (Cooke et al., 2016; Escobar et al., 2024). Relationality as a principle is defined as a fundamental shift from modern dualistic thinking towards an understanding of the radical interdependence of all things, human and nonhuman (Escobar et al., 2024). This has led to an increase in research aimed at identifying alternative relational approaches and engaging with paradigms and systems associated with human-nature connections (HNCs) as ‘deep’ leverage points to address the sustainability crisis. Architecture, as a fundamental medium of our being in the world, can shape and transform human interactions with the world (Pallasmaa, 2024), yet it remains underexplored as a design for sustainability transitions. Sustainable architecture, in fact, also adapts reductive approaches to efficiency and mitigation rather than relational approaches to integrate buildings as part of socio-ecological systems and a network of relationships, including those between humans and nature. Thus, there is a relational shift deemed necessary within the architectural discipline to address current sustainability crises.

Vernacular architecture, defined as a communal built environment shaped by HNCs (Rudofsky, 1964), can offer valuable insights for relational architectural design to achieve sustainable urban development. These structures represent what Alexander (1979) refers to as a timeless way of building, where each space is brought to life by specific patterns of relationships among the elements that are distinctive to its people, culture, and place. India, known for its diverse vernacular architectural styles, features thresholds (i.e., entrance verandas) as a common architectural characteristic of dwellings across its various regions, which is considered a unique socio-ecological design element (Jain, 2002; Tzortzi and Saxena, 2024). These thresholds are ‘patterns’ (Alexander et al., 1977) born from centuries of lived experience, creating a language of relationships—between inside and outside, public and private, human and nonhuman, family and community. The design of these spaces physically connects the natural exterior with the human-occupied interior and is also symbolically adorned with distinctive art forms depicting local flora, fauna, and mythical motifs as part of their façade (Tipnis and Lall, 2012). It presents a unique system of spatio-artistic patterns, interdependent at many levels, that makes these structures alive and provides them with biophilic qualities.

Escobar (2018) emphasises that the responses and behaviours elicited by designed objects can realign human interactions with each other and with nature. In fact, the life that occurs in a building is not only considered to be anchored in the space, but is shaped by the space and its patterns (Alexander, 1979). Despite this, the authors are unaware of any research that has attempted to investigate these vernacular entrance facades as a relational interface to understand their role in fostering HNCs. To address this gap, the research aims to assess the entrance facades of vernacular Indian dwellings for HNCs. The objective of this paper is to identify various types of HNCs fostered by the entrance façade in vernacular Indian dwellings, with a focus on determining features and patterns nurturing relationality in

everyday life. This objective will be addressed by answering the following research question (RQ):

RQ1: What types of HNCs are fostered by the spatial features of the entrance façade within vernacular dwellings?

RQ2: What types of HNCs are fostered by the artistic features of the entrance façade within vernacular dwellings?

It is hypothesised that the designs of vernacular entrance facades offer opportunities for both internal (philosophical or cognitive) and external (experiential or material) HNCs to emerge in everyday lives. In this study, HNCs are documented and analysed for wood-crafted entrance facades of two vernacular dwellings in the geological region of Bhal in Gujarat, India. Initially, the documentation of these facades is conducted using visual ethnography, followed by an analysis for HNCs utilising Müller’s (2021) four-stage artefact analysis method, which is supported by a grounded theory approach. The significance of this paper is primarily highlighted in two aspects. First, it suggests that vernacular architecture serves as a key example of designing “relationally”, which involves creating spaces that promote an awareness of the interconnectedness of humans with one another, the earth, and various nonhuman entities. Second, it puts vernacular architecture in context with sustainability transitions, biophilic design and HNCs and briefly proposes a potential analysis framework and guidelines for architectural thresholds as spaces for human-nature interaction.

Section 2 sets the background of the research via a literature review of relevant studies at the cross-section of sustainability transitions, HNCs and architecture. Section 3 elaborates on the methodology and cases under study, followed by Section 4, which provides a detailed analysis of the case. Section 5 articulates the resulting HNCs and provides a framework and guidelines for relational threshold design, followed by a conclusion that summarises the major takeaways from this research and its limitations.

2 Background

2.1 HNCs, architecture and sustainability transition

Nature, under modernity and industrialisation, is not something inherently “natural”; rather, it is seen as a resource for economic development and an object that can be commodified, dominated, and reconfigured to suit human needs (Escobar, 1999). Modern industrial society, devoid of reverence for the natural world, fostered a culture of exploitation—cultivating, manipulating, polluting ecosystems, and even eradicating natural resources (Duguid, 2010). As Gandhi famously stated, “*Nature can cater to man’s need but cannot cater to man’s greed*” This manipulation and domination of nature has resulted in unprecedented socio-ecological changes that are advancing “wicked problems” and threatening the planet’s stability and sustainability (Artmann, 2023; Muhar and Böck, 2018; Muradian and Gómez-Baggethun, 2021; Rockström et al., 2009). Current trajectories of human development necessitate radical transformations to ensure a sustainable future, as incremental adjustments are inadequate to tackle the scale and urgency of current global challenges (Markard and

Truffer, 2006). In response, the discursive concept of ‘sustainability transition’ emerged from the idea that social and environmental problems demand transformative change in existing systems to more sustainable modes of production and consumption (Köhler et al., 2019; Markard et al., 2012).

Researchers studying socio-ecological systems in sustainability transitions identify human-nature division and society’s disconnection from nature as one of the root causes of current social and environmental challenges (Dorninger et al., 2017; Folke et al., 2011; Ives et al., 2018). In fact, the sustainability crisis is argued to be a crisis of the modern system of thought that imposes a dichotomous worldview ontologically separating humans from nature and generating binaries between culture/nature and human/animal (Escobar, 2008). Thus, to make radical changes in current trajectories negatively impacting the planet, an ontological shift is proposed by recognising systematic interdependence between society and nature (Folke et al., 2021) and rethinking the relational qualities of HNCs (Artmann, 2023; Escobar, 2018; Ives et al., 2017). Relational ontology emphasises that human survival and thriving are interdependent, rather than individual, acknowledging the existence of multiple worlds (pluriverse), each relational. This has sparked a growing research interest in understanding HNCs and their essential qualities as well as identifying alternative relational approaches to challenge modern dualistic and hierarchical HNCs for sustainability transitions (Vindevoghel, 2024; Beery et al., 2023; Fitzgerald and Davies, 2022; Walsh et al., 2021; West et al., 2020; Ives et al., 2018). As a result, diverse relational discourses are emerging like *biophilia hypothesis* (Kellert and Wilson, 2013), *reconnecting to the biosphere* (Folke et al., 2011), *nature deficit disorder* (Louv, 2008), *connectedness to nature scale* (Mayer and Frantz, 2004), *nature relatedness* (Nisbet et al., 2009), *human-nature resonance* (Artmann, 2023) across disciplines, addressing visions of the system associated with HNCs as ‘deep’ leverage points for transformational change.

In this context, Escobar et al. (2024) argue for a relational ontological shift in the discipline of design, given its historical role as a practice linked to anthropocentrism. Considering the values and behaviours that design objects elicit in people, influencing one’s being in the world and vice versa, it also holds significance in the consolidation of relational ontology for sustainability transition (Escobar, 2018). Designing in a relational manner involves understanding that humans are in an inextricable relationship with each other, the planet, and various nonhuman beings (Escobar et al., 2024). Aligned with this and to address current crises, the architectural discipline is also undergoing a relational shift from sustainable to socio-ecological design approaches by reframing it as a material expression of human-nature relations (Graves et al., 2019; Sitcharon and Malaque, 2023). This shift is deemed necessary because sustainable architecture has mainly focused on reducing negative impacts by improving the efficiency of existing systems, without challenging the modern utilitarian view of nature and its resources (Graves et al., 2019). Currently, where sustainable design adapts reductive approaches, socio-ecological design adapts regenerative approaches, which entail understanding flows and relationships in a site to inform design responses for enhancing the regenerative potential of a place, its people, and nature (Hes and Bush, 2022). Diverse relational design approaches like *biophilic design* (Errante, 2022; Kellert et al., 2013), *regenerative design* (Cole et al., 2013; Zingoni de Baro, 2022), *multispecies design* (Grobman et al., 2023),

nature-based solutions (Butt, 2024; Cilliers et al., 2022), etc., are thus emerging in architecture. Of all these approaches, biophilic design is an innovative approach that has evolved and gained increased traction for restoring the inherent HNCs in the design of the built environment, further discussed in Section 2.2.

2.2 Biophilic design, patterns and vernacular architecture

Biophilic design is an approach that recognises the low environmental-impact objectives of sustainable architecture as insufficient and seeks the long-term sustainability of restoring and increasing people’s positive relationship to nature in the built world (Kellert et al., 2013). It is a set of design strategies that attempts to translate biophilia – the inherent human affinity to affiliate with natural systems and processes—into the design of the built environment. Existing research indicates that biophilic architecture and exposure to nature and natural habitats can improve humans’ overall well-being and health, their cognitive performance, while also cultivating environmental attitudes and pro-environmental behaviour (Liu and Chen, 2021; Latini et al., 2024; Zakaria et al., 2024). Although biophilic design is considered an innovation today, ironically, it was the way buildings were designed for much of human history (Kellert et al., 2013). Vernacular architecture is a biophilic built form. It has evolved through trial and error, in integration with the natural environment; using local materials, themes, and patterns of nature for building artefacts; in connection to culture and heritage; utilising indigenous construction techniques, while addressing both tangible and intangible needs of the community (Nasir and Arif Kamal, 2021; Srivastava and Das, 2023). In fact, one of Kellert et al.’s (2013) two key dimensions of biophilic design is place-based or vernacular, with its own set of elements and attributes that enable design to be rooted in local ecology, cultural traditions, and patterns of life. The search for a socio-ecological approach to planning and design has thus led to an increasing research interest in vernacular architectural spaces with regard to their design that leverages and complements local socio-ecological factors and patterns (Alkubaisi, 2021; Sitcharon and Malaque, 2023; Tipnis and Lall, 2012).

By being site-specific—adaptive to climate and environment, self-sufficient—in natural and knowledge resources, and cost-effective—in economic and social terms (Kazimee, 2008; Philokyprou, 2018), it adheres to a unique combination of natural flows/ patterns of relationships in a place. It is also influenced by various tangible and intangible factors such as religion, beliefs, customs, philosophies, habits, regulations, building processes and ornament/symbols (Hamka and Winarni, 2021). According to Alexander (1979), the buildings of the past offer one timeless way of building in which the space is infused with quality of life through varied patterns of relationship in space, which in turn supports the patterns of events that occur therein. Thus, the life that occurs in a structure is not simply rooted in the space, but is made up of the space and its patterns themselves. Vernacular architecture research over the years has focused on its materials, styles of buildings, environmental sustainability, building performance, thermal comfort, energy efficiency, traditional construction techniques and socio-cultural identity (Benkari et al., 2021; Dutta and Kumar, 2025; Jagatramka et al., 2020). However, although vernacular architecture is defined as a communal built

environment shaped by human-nature relations (Rudofsky, 1964), they have rarely been studied from a relational perspective, specifically for the HNCs it fosters through design. This research gap prevents the acquisition of traditional knowledge and insights that could inform the design of patterns of relationships in architecture within the socio-ecological context of sustainability transitions. This paper aims to address this gap.

Architecture is a manifestation of culture; it represents the psyche or collective mind of a society in a material form, expressing and communicating its ideas, values, and beliefs (Hendrix, 2012). Culture, in turn, is considered to shape worldviews and is in itself shaped by worldviews, which include values about life, reality, and nature (McLennan, 2004; Shiundu, 2024). From this perspective, the diverse vernacular architectural forms in India express the collective psyche of its cultures, reflecting and communicating the ‘cosmocentric’ worldview that is central to Indian societies. Cosmocentrism recognises the interconnectedness of humans, nature, and the divine, viewing human life as part of a broader cosmic framework and ensuring constant linkage, interaction and a repetitive association with nature and the natural elements around us. This traditional worldview perceives the microcosm (self) and macrocosm (universe) as comprised of the same fundamental elements (earth, water, fire, air, ether), reflecting the inherent unity of all existence (Bhatt, 2018; Misra et al., 2024). It articulates the mutuality and interdependence of all existence, with humans as an inseparable part of nature and nature as the very source of the universe (Vatsyayan and Saraswati, 1995). As a result, the concept of self is relational (Mascolo et al., 2004) in India, reflecting the metaphysical harmony and interconnectedness of humans with all entities in a universal cosmic network (Heimann, 2018). Thus, vernacular architecture in India as material culture holds the potential to communicate what Escobar (2018) calls traditional cosmologies and to represent the human psyche of ecological consciousness inherent to its traditional communities. Researching these spaces can provide alternative socio-ecological design perspectives for reorienting societies to nature. It can render useful guidelines to transform human existence—body, mind, and soul—towards a relational ontology for transition to sustainability, utilising design.

2.3 Facades, nature-culture interface and vernacular dwellings

India is home to diverse vernacular dwelling forms influenced by its cultural diversity, different microclimatic conditions, and the availability of building materials (Henna et al., 2021; Jain, 2019). Despite these differences, vernacular architecture across urban and rural regions of India shares many common characteristics, like courtyards, thick walls, narrow openings, sloping roofs, etc., that contribute to their socio-ecological design (Srivastava and Das, 2023). Threshold space, defined as complex multifunctional spatial structures that create transitions between different zones, often marking entrances to an area (Boettger, 2014), is one such common feature of its vernacular spaces. Semi-open porches and entrance verandas are essential elements of environmental responsiveness, socio-cultural integration, and material efficiency in vernacular dwellings across the country (Jain, 2002; Sadanand and Nagarajan, 2020; Tzortzi and Saxena, 2024). Architecture, as a fundamental medium of our being

in the world, can shape and transform our human experience of reality by framing, structuring, articulating, linking, separating, uniting, enabling, and restricting our interactions with the world (Pallasmaa, 2024). This viewpoint emphasises the significance of entrance verandas as a relational design element that acts as a threshold, connecting the outside world with the interior and linking nature with culture in vernacular dwellings. The spatial characteristics of these verandas thus can influence the types of HNCs that develop as people inhabit these spaces. Despite this potential, there is hardly any research that has attempted to investigate these entrance thresholds and their role in mediating external (experiential and material) HNCs from the perspective of sustainability transition.

Along with architecture, art has always been an evolving medium of cultural expression for traditional communities, serving as a source of inspiration and creation throughout history. It is also an integral part of vernacular dwellings in India, where each region's local arts and crafts—such as painting, mosaic work, tile work, etc.—contribute to its diversity in vernacular structures (Tipnis and Lall, 2012). These art forms are typically found as embellishments on the walls and facades of entrance verandas/courtyards in dwellings and are used to decorate homes, symbolise nature, represent everyday life, and serve ritualistic purposes. Common themes in these art forms include local flora and fauna, mythological figures, deities, epic scenes, and depictions of nature. *Bhil* and *Gond* wall paintings in Madhya Pradesh, *Chittara* paintings of the *Deewaru* tribe in Karnataka (Basu, 2020), frescoes and mural walls of Shekhawati havelis in Rajasthan (Singh, 2023; Yadav et al., 2023), and stonework in temples, forts, and palaces (Sharma, 2023) are a few examples of art on façades of traditional dwellings. These art forms, both in their concepts and practices, are also firmly anchored in the traditional holistic, integral vision of HNCs. Indian Art, in fact, is considered rooted within a “cosmocentric” cultural worldview, with creativity in both sacred and secular art growing out of the re-enactment of its traditional relational perspectives (Choudhuri, 1999; Singh, 1995; Vatsyayan and Bäumer, 1995). As a result, traditional artists perceived the self as an extension of nature and held the belief that artistic creation, much like natural growth, relies on the foundational five elements (Singh, 1995). This relationship influenced their creative processes, promoting wise resource utilisation and symbolic interpretations of nature as reflected in their artistic creation.

In this context, entrance facades, in addition to their function as transitional zones physically connecting the inside and outside, also assume a significant symbolic role as artistic thresholds influencing the types of relationalities between inhabitants and nature. The façade embellishments—often featuring richly ornamented walls, columns, beams, brackets, etc.—carry symbolic meanings, reflecting the community's identity and relationship with their environment (Tzortzi and Saxena, 2024). In the western villages of Gujarat, India, organically evolved wooden vernacular dwellings showcase the artistic talents of their inhabitants, reflecting their agricultural lifestyle and cultural worldviews within design. The art of wood carving facades originated here as a unique cultural entity, encompassing symbolically in itself history, culture, mythology, religion, social values, inherited traditions, and human interpretations and expressions of nature (Thakkar, 2004). Though created by individual artists and shaped by the tangible and intangible cultural forces of the region, it is an artistic projection of society and its ‘cosmocentric’ worldview. As Winston Churchill once said, “First we shape our buildings, and then our buildings shape us.”

This wood-crafted vernacular facade carries symbolism that can significantly influence inhabitants' lives, their values, and the kinds of relationships they develop with nature through daily experiences of its intricate craftsmanship. Art, in fact, possesses significant potential to forge internal (emotional or philosophical) HNCs with its capacity to evoke visceral experiences and expand consciousness. Despite this potential, in vernacular architecture studies, we often tend to overlook these small-scale architectural features and patterns, neglecting to investigate the role of these subtle art forms in socio-ecological design. *Therefore, in this research, we document and analyse spatial and artistic features in the entrance facades of two vernacular dwellings constructed using half-timbering techniques in the region of Bhal, Gujarat, India.*

3 Materials and methods

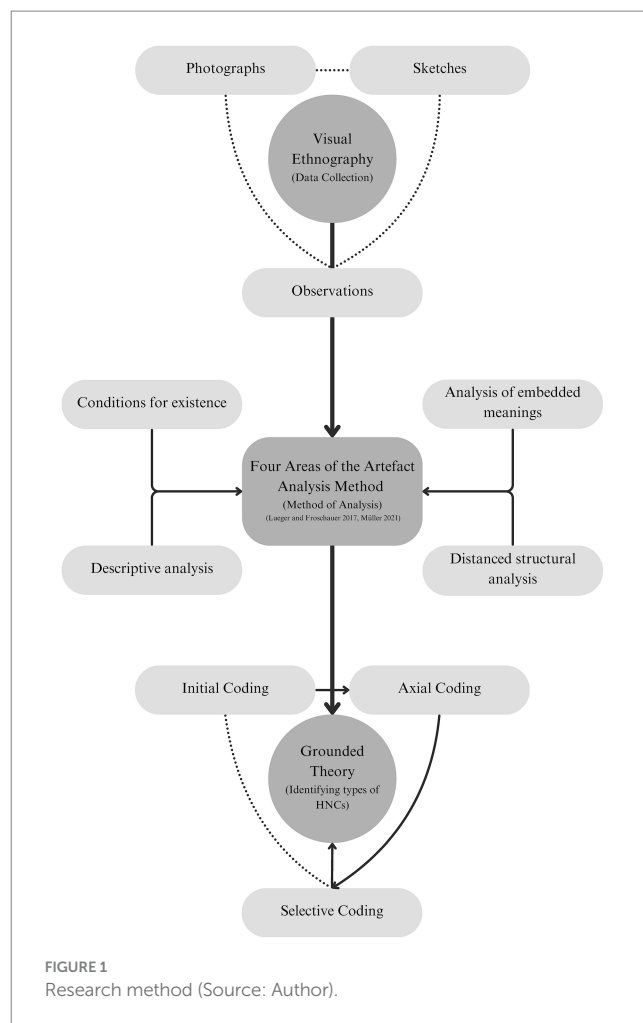
3.1 Research design

The genesis phase of this research employed a narrative review method to explore the interconnections between sustainability transitions, socio-ecological systems, and vernacular architecture. This method allows for the consolidation of various information pieces into a readable narrative format, enabling the presentation and interlinking of diverse topics and investigations (Bourhis, 2017; Green et al., 2006). It facilitated the summarisation of existing knowledge on these topics, identified gaps, and provided a conceptual background (discussed in Section 2) justifying the need for this study. This process allowed for articulation of the goal of this research to identify different types of HNCs mediated by the entrance facades in vernacular dwellings and to investigate the role of spatio-artistic features and patterns in vernacular facades nurturing these HNCs in everyday life for sustainability transition.

To achieve this goal, the study utilises the visual ethnography method. This method encompasses a wide range of approaches, which include photo elicitation, photography, family photos, GIS, art making, etc. (Van Den Scott, 2018). In this research, we triangulate photographs and sketches with observations as a method (Figure 1). Traditional ethnography involves systematic recording, analysis, and written descriptions of socio-cultural aspects to understand people and their activities within their natural contexts. Visual ethnography captures how artefacts are used, displayed, and interacted with in everyday life. It goes beyond textual descriptions by allowing for the documentation of artefacts *in situ*, thus providing empirical grounding for visual analysis.

For analysis, the methodology follows Müller's (2021) and Lueger and Froschauer's (2017) *four areas of artefact analysis* outlined for material culture studies, taking an interpretivist paradigm, with authors as the primary research instrument. Several categorical variables, as shown in Table 1, are examined in the artefact under study to uncover patterns of spatial, symbolic, and relational dimensions. These categories served as descriptive anchors for understanding the design characteristics in the vernacular facades. This interpretive analysis of thresholds is further supported by grounded theory techniques, as suggested by Lueger (2000) (stated in Müller, 2021), for the identification of HNCs.

This study follows a case study approach, employing the discussed research methods for gathering and analysing data to understand the HNC phenomenon within the entrance façade of vernacular



dwellings. Case study has a well-established history in architectural research, as it allows for effective analyses of phenomena within its real-life context using multiple sources of information such as documentation, observations, archival records and artefacts (Adewumi et al., 2020; Yin, 2014). Thus, two vernacular dwellings in the geological region of Bhal, Gujarat, India, were selected as cases purposively. To ensure relevance and rigour, four primary criteria were applied in identifying these vernacular dwellings: (a) the case should exemplify the typical characteristics of the half-timber vernacular architectural tradition of the country; (b) the typology of dwelling should be among those rapidly disappearing due to the homogenising effects of globalisation and contemporary development; (c) the case should have largely retained its original architectural configuration, or at minimum, provide sufficient visual evidence of its original form; (d) the case should belong to the region of the country which is less known and less studied for its vernacular architecture.

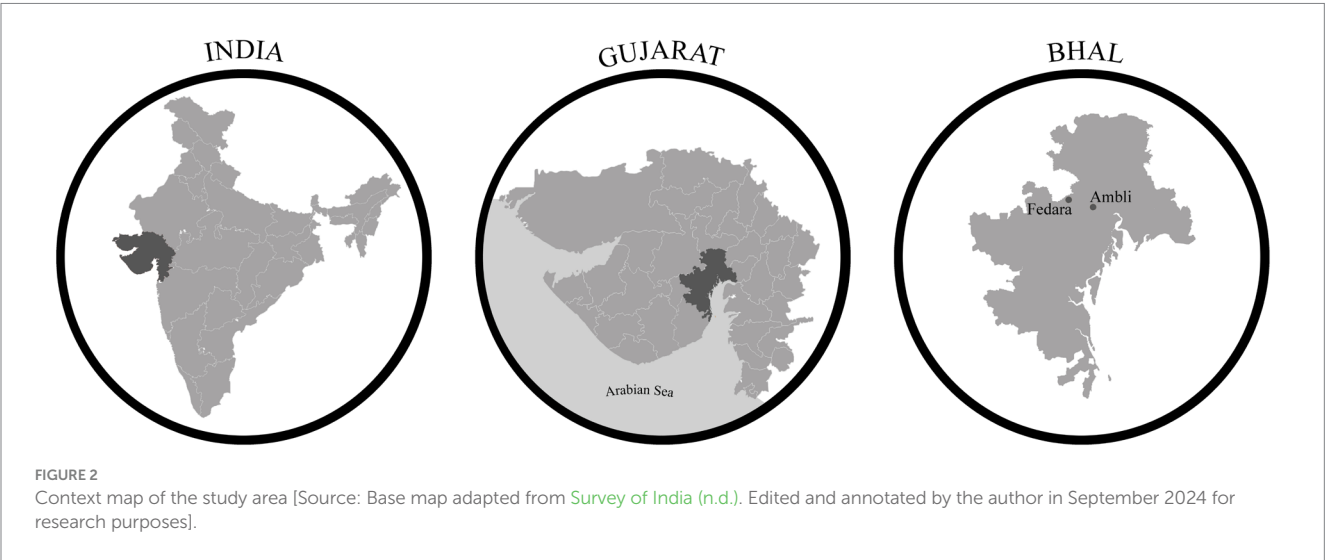
3.2 Site and case descriptions

Bhal is an ecologically complex semi-arid coastal region that spans approximately 100 km in length and 25 km in breadth on the left border of the Gulf of Khambhat (Cambay) (Vyas and Joshi, 2014) (shown in Figure 2). It is believed to have emerged due to the shifting

TABLE 1 Four areas of artefact analysis.

Artefact analysis areas		Categorical variables to analyse
Conditions for existence	In which context is the artefact encountered and what is the history behind it? Examining why this artifact exists in the current context, as well as the cultural, ecological and social contexts that surround it.	Historical context Climatic/Ecological rationale Socio-cultural factors Socioeconomic influences
Descriptive analysis	What is the artefact made of? What different elements does it contain? The systematic description of the individual elements which constitute the artefacts.	Materiality Architectural elements Visual composition Construction techniques
Analysis of embedded meanings	What are the concepts and meanings to which the artefact is associated? Is it related with emotional or sensory qualities? Placing the material elements in an everyday context and considering the artefact in its entirety.	Symbolic meanings Physical orientation Linked rituals/everyday practices Narratives/interpretations
Distanced structural analysis	In what context was the artefact produced? How is it produced? How and in what context is it used and changed? The structures of meaning which ultimately form the basis for appearance of the artefact in its form.	Systems of production Knowledge transmission Evolution of use or form Continuity or disappearance

Source: Adapted from Müller (2021, p. 84).



of the sea, resulting in a geographical landscape equally flat to the level of the sea, characterised by saline soil and water conditions, receiving an average annual rainfall of about 650 to 700 mm (Shah and Patel, 1968; Vyas and Joshi, 2015). In the local dialect of Gujarati, Bhal means ‘forehead’. This metaphor stems from the fact that, just as no hairs grow on the forehead, nothing grows in this region, and one village appears to be floating in the mirage of another. Thus, timber is not naturally available in the region. Despite this, it has been widely used as a material for the construction of traditional temples to vernacular dwellings in this region. A typical dwelling, in fact, in most traditional Indian towns and villages was timber-framed, with brick infill and lime stucco on both sides (also known as half-timber structures) (Tipnis and Lall, 2012). The emergence of traditional wooden architecture can be traced back to historical accounts of the communities living in Bhal. These accounts suggest that maritime trade and voyages once thrived in the area, with shipping routes extending from the Gulf of Khambhat to Daman and even reaching as far as Burma (Shah and Patel, 1968).

As a result, the evolution of half-timber structures in Bhal was made possible because the wood was imported in large quantities through sea trade, making it a locally available material in the region.

The region’s unique geological and geographical features, along with limited resource availability, led to the development of an agro-pastoral society characterised by a distinct protective philosophy, socio-cultural practices, and ecological awareness. These factors shaped a peculiar approach to dwelling construction in Bhal, where each dwelling was designed as a self-contained unit featuring an individual open front yard enclosed by a wall on all sides and accessed through a single doorway known locally as ‘Delo.’ The main multi-storied building in this larger unit was constructed using a wooden framing system, with small bricks infilled within the frame. These bricks were set in place using mud mortar and finished with lime or mud plaster. The enclosed unit also included a separate cob-built cattle shed and often featured a *Tulasi* (Basil) plant, which may be found in a flower bed or in the open compound. The standout feature of this

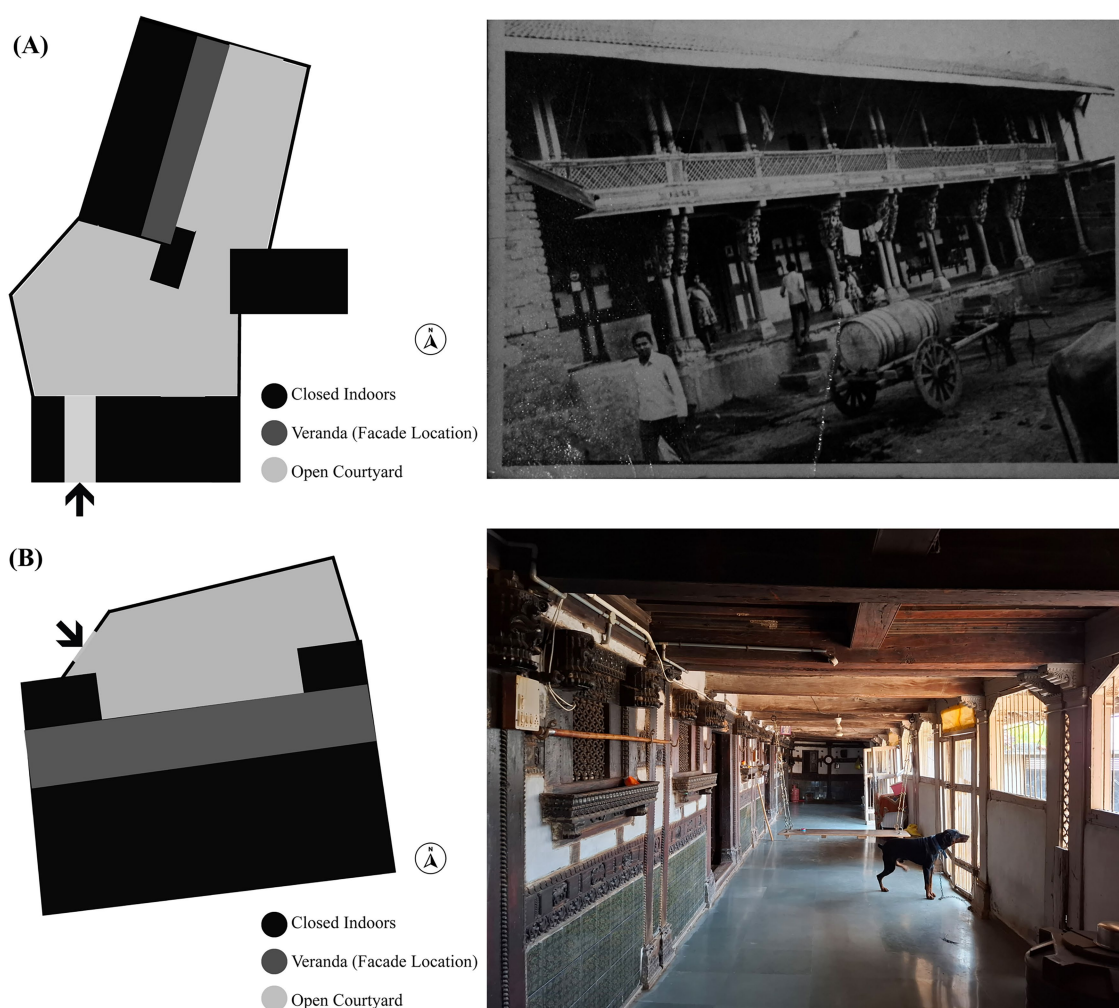


FIGURE 3

(A) Left: Master plan of dwelling complex showing the location of facade 1 (Source: Author). Right: Image of the dwelling and façade covering veranda space (Source: Photograph from the dwelling owner's family album, photographer unknown, likely to have been taken in 1970). (B) Left: Master plan of dwelling complex showing the location of facade 2 (Source: Author). Right: Image of the veranda space (Source: Photograph by author, October 2024).

abode was the wood-crafted entrance façade of the main building, where exposed timber frames, structural elements, door frames, doors, and windows are decorated with motifs and patterns inspired by the nature and culture of the region (shown in Figure 3). As a result, the wood-crafted entrance façades of the main building from two different 'Delo' units belonging to the Rajput families from Fedara and Ambli (as shown in Figure 2) villages in the Bhal region in the Ahmedabad district are documented and analysed as case studies in this research. The oral evidence establishes the minimum average age of these wooden buildings as 150 years.

The reason for choosing these cases stems from the fact that the Bhal region is rapidly urbanising as a result of the Dholera SIR (Special Investment Region), a government project aimed at developing a smart industrial city in the vicinity. This development, although aiming for economic and social balance, indicates a change in rural land use and livelihoods, reshaping traditional practices of the region to meet industrial and urban demands. The emergence of such new urban forms has significant implications for HNCs and the sustainable future of the region. Thus, to effectively address the changing

rural–urban dynamics in Bhal and to incorporate socio-ecological, context-sensitive design approaches into these future developments, it is essential to analyse and learn from the vernacular architecture of the region. The decision to study only two entrance façades of vernacular dwellings is to enable in-depth analysis and is based on their repetitive spatial and formal characteristics that make the selected cases representative examples of the broader regional socio-ecological design sustaining HNCs. It also stems from the fact that there are very few examples left in the region that still adhere to this traditional vernacular style, as most have transitioned to an international style, imitating the European domestic structure known as the 'Bungalow,' which is regarded as a symbol of modernity.

3.3 Data collection

Fieldwork was conducted in May 2023 (Summer) and October 2024 (Winter), using the village of Fedara as a base. Both dwellings were visited during these periods, and data were collected through site

immersion by triangulating photographs and sketches with observations. Around 3 days, on average, were spent by the principal investigator (PI) at each site during both field visits documenting the entrance veranda, gathering primarily visual data with some textual observational notes. The visits at two different seasons facilitated detailed observations over time, allowing for a deeper understanding of the setting, building trust with inhabitants, and consistently repeating the data collection process central to the case study to prevent any misinformation. Triangulation enhanced the validity, reliability, and legitimacy of the collected data, allowing for a more comprehensive documentation of the vernacular façade by capturing and interpreting its spatial and artistic characteristics. The visual documentation methods also facilitated the recording of data and information, which allowed for the creation of proportionate base drawings of the entrance facades after returning from the field. These drawings aided in the visual analysis of facades to examine the role of these artefacts and their artistic features in connecting the inhabitants with nature, both physically and symbolically.

3.4 Method of analysis

Four areas of the artefact analysis method were employed to address the questions: what types of HNCs are mediated by the spatial features, and what types are nurtured by the artistic features of the entrance façade? Each of the two cases was visually analysed, and its features and patterns were interpreted for each of the four areas articulated by Müller (2021). These interpretations were also supported by referring to a group of patterns (specifically patterns 95–253) which shape individual buildings as described in “*A Pattern Language*” by Christopher Alexander et al. (1977) (discussed in Sections 4.1–4.3). Further, the grounded theory technique of coding was employed following visual analysis to interpret HNCs as a phenomenon and to inductively identify patterns and types of HNCs mediated by the art and design of entrance facades in vernacular dwellings. Based on the results of grounded theory, the authors used thematic analysis to further synthesise the types of HNCs and develop a relational analysis framework from the study.

4 Case study analysis

In accordance with the research method, this section will visually analyse the two selected cases from a relational design perspective, following the structure of the four areas of artefact analysis. As per the focus of this research, the analysis will explore the spatial and artistic features and patterns of the entrance facades to demonstrate their role in HNCs. For ease of reference, the dwelling in Fedara will be referred to as Facade 1, while the dwelling in Ambli will be referred to as Facade 2.

4.1 Conditions for existence

4.1.1 Spatial

The observation of the cases suggests that the entrance veranda, featuring artistic wood-crafted facades, is typically encountered as a spatial element within the main building unit. This artefact serves as

a transitional space that connects the main building (pattern 99) (Alexander et al., 1977, p. 485) with the contained open yard in the ‘Delo’ complex (pattern 95) (Alexander et al., 1977, p. 468), as illustrated in the master plans in Figure 3. It highlights the main building as the soul of the group that houses the most essential function in the complex and helps in creating the positive outdoor space (pattern 106) (Alexander et al., 1977, p. 517) by opening to the central courtyard. The existence of these artefacts in a spatial context, viewed through the lens of HNCs, unveils that they are a semi-open interface designed in response to the socio-cultural rhythms of the family’s agrarian lifestyle. The sheltered yet open design of these spaces traditionally fosters a deep connection between the occupant’s daily activities and the rhythms of nature. For example, during a visit to façade 2, the drying of chillies was observed, which was planned according to the availability of sunlight in the space. Additionally, the space was also observed supporting informal gatherings and interactions with neighbours or between family members, especially during the cooler evening temperatures, thus acting as a common area at the heart (pattern 129) (Alexander et al., 1977, p. 618). Its openness of structure is inviting for non-human others—birds, insects, etc., which were seen as dwelling in these spaces. Thus, it acts as a bridge between nature and culture, creating a space of pause that can stimulate the senses of individuals to reflect on their connection to and reliance on the natural world. In addition, these façades also play a pivotal role as climate-conscious artefacts in the hot and dry climate of Bhal. It connects enclosed spaces with the natural environment, acting as a liminal space that regulates the dwelling’s microclimate by providing shade and ventilation, while also shielding the interiors from direct sunlight and rain. Thus, it promotes sensorial and physiological comfort as well as supports the conscious experience of entering a building for inhabitants from the uncontrolled natural world into the controlled human environment. It acts as an entrance transition (pattern 112) (Alexander et al., 1977, p. 548) supporting a graceful and mindful transition of one’s relative position within the larger world.

4.1.2 Artistic

The estimated age (approximately 150 years) of these dwellings suggests that these facades were crafted by local artisans of the region in the late nineteenth and early twentieth centuries and have been passed down over five to six generations in the family. The existence of artefacts in an artistic context, particularly from the perspective of HNCs, suggests that they act as a symbolic interface of interdependence. These artefacts with woodcarving primarily applied to the structural elements of facades are designed to project and transmit the values and beliefs of nature shared by both the artist and the community, across generations. The diverse repertoire of ornamental (pattern 249) (Alexander et al., 1977, p. 1146) forms depicting flora, fauna, and divine/mythological figures found in both cases serves as proof of this point. This diversity is a result of unique interpretations of the natural world by the artists in artwork reflecting their emotional responses, psyche and personal connection to nature. For instance, when comparing the lion motifs in façades 1 and 2, as shown in Figure 4, we see two distinct creative forms of a lion’s anatomy. Instead of aiming for an exact replication, these interpretations highlight the individuality of each artist’s style and perspective on this majestic creature. Such creative interpretations, along with authentically captured emotional expressions of nature by



FIGURE 4

Left: Lion motif in façade 1; Right: Lion motif in façade 2 (Source: Photographs by Author, October 2024).

artists in facades, evoke visceral experiences that foster curiosity and a similar sensory connection to being in nature, significantly influencing the viewer's perception of it. This argument can be reinforced by the personal experience of the PI during the field visit to the dwellings in Bhal. The continued interactions with the entrance façade and its artistic elements representing nature during documentation influenced PI's emotions and senses, which evoked for him a subjective feeling of being in nature when occupying this space despite being physically distanced from it. This experience illustrates how the artefacts being studied can inspire curiosity and exploration about nature in viewers through art, encouraging them to engage with the natural world in meaningful and personal ways. These artefacts also serve as a representation of the family's social and economic status, which can be noted by the difference in the intricacy of details and artistry in the carvings of the facades between the two cases.

4.2 Descriptive analysis

4.2.1 Spatial

The entrance veranda consists of two distinct layers, as illustrated in Figure 5. The front layer showcases a combination of intricately crafted columns, brackets, beams, balustrades, and jaalis where the structure seems to follow social space (pattern 205) (Alexander et al., 1977, p. 940). In contrast, the back layer features a thick wall (pattern 197) (Alexander et al., 1977, p. 908) adorned with carved wooden structural bands, doors, windows, lintels, sills, and niches. A comprehensive analysis of the materials and elements composing each layer of the façades is presented in Table 2. The teak wood is the primary material used to create these artistic thresholds, in addition to sandstones, iron, brass, and brick masonry plastered with lime. These natural materials have unique textures and visual patterns that promote both tactile and visual interaction, creating a direct sensory connection with the natural world. Additionally, these materials contribute to microclimatic regulation, acting as insulators and temperature buffers within the dwelling, which enhances the sensorial and physiological comfort in the interiors. Thus, they are good materials (pattern 207) (Alexander et al., 1977, p. 955) that are also observed to be ageing gracefully as they expand, contract, and weather over time and with changing seasons. For example, the sandstone bases of the columns in both cases are weathered due to rain exposure, while the wood has developed shallow surface cracks in various parts of the façade as a result of prolonged sunlight exposure. This process

gives the façades a dynamic, almost living and breathing quality. Such time-based transformation of these façades offers visual cues that hold the possibility to subconsciously connect inhabitants to the familiar cycles and rhythms of nature as well as to the idea of impermanence. As Alexander (1979) states, a building that is whole must always reflect the character of nature. Since nature itself is inherently transitory, this character cannot emerge without the awareness and acceptance of death. This subconscious connection is further reinforced by the standardised, repetitive placements of the elements on the façade (shown in Figure 5), creating a column space (pattern 226) (Alexander et al., 1977, p. 1064) cohesive visual harmony echoing the natural order within the dwelling.

4.2.2 Artistic

The artistic elements forming the entrance facades in both cases can be categorised and described into three types based on the process of carving—relief carving, chip carving and sculptural carvings. The intricacy of details in the façade leaves room for interpreting that these processes of carving could have been slow and meditative, serving as a ritual for the craftsman to search for their own identity and place in the world. It reflects a conscious dialogue between the artisan, the material, and the natural world, whether through the reinterpretation of natural forms in relief carving or by the echoing of mathematical principles and geometric patterns found in nature in chip carving or in the sculpting of anatomy, posture, and expressions of human, animal, or hybrid forms within the wooden facades. These processes allow the artist to connect deeply with nature at material, sensory, and intellectual levels, fostering a profound appreciation for the beauty and complexity of the natural world. Furthermore, when describing the types of ornamentation on the façade, the two categories of motifs and patterns proposed by Thakkar (2004) remain applicable to the cases under study. Motifs are found as isolated units in various sizes and forms on these facades, typically depicting animals, birds, gods, flowers, and more. They are commonly visible on wooden bands, columns, and brackets. In contrast, patterns are infinite in nature and take the form of continuous bands that extend from one edge to another within the elements of facades. They are commonly encountered as part of lintel bands, window sills, and door and window frames that act as thickened edges (pattern 225) (Alexander et al., 1977, p. 1059). These forms of embellishment hold the potential to tap into our deep-seated imaginations and memories of connection with the natural world. When viewers encounter ornamented (pattern 249) (Alexander et al., 1977, p. 1146) motifs that represent animals or

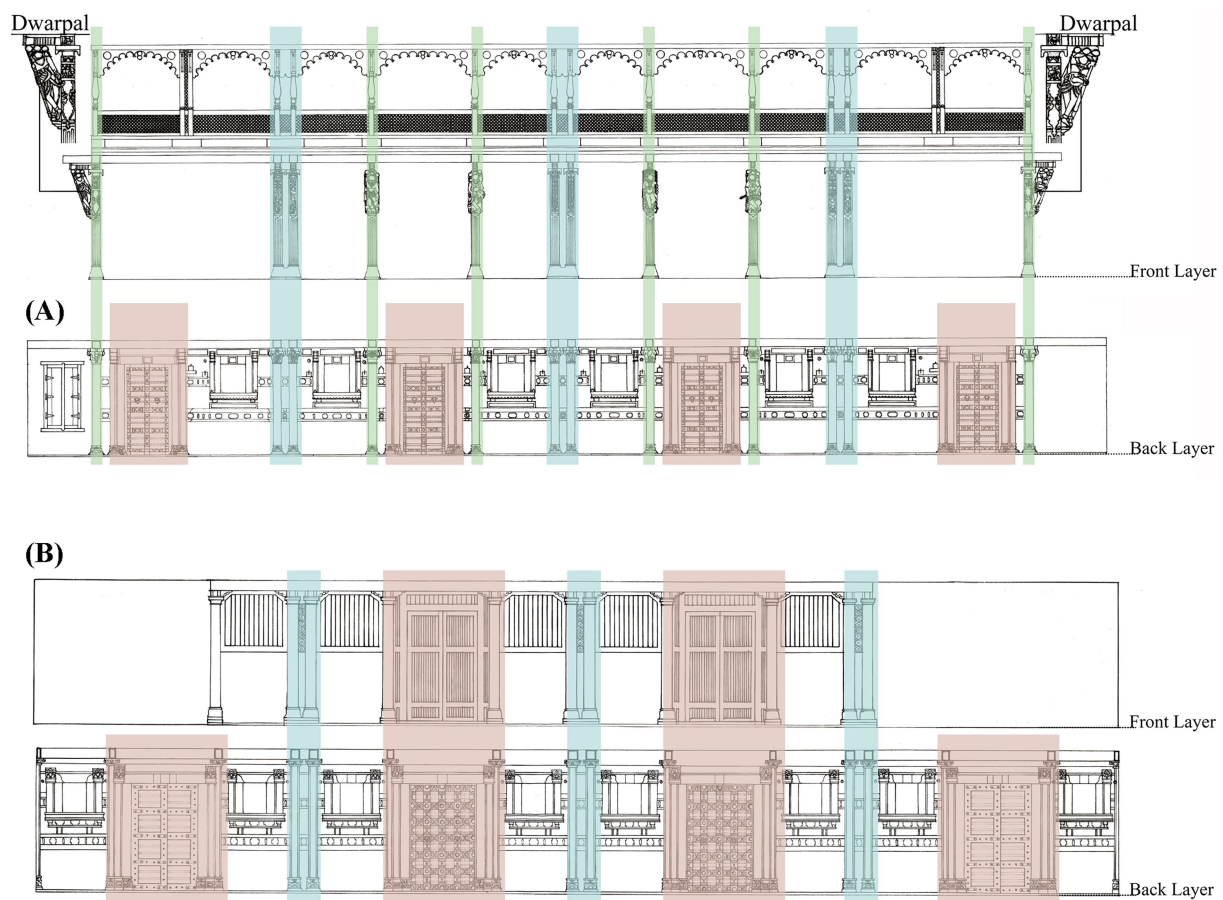


FIGURE 5

(A) Illustration depicting the layers and rhythm of elements in facade 1. The repetitions of these elements forming the rhythms are depicted with repetition of similar colours. (B) Illustration depicting the layers and rhythm of elements in facade 2. The repetitions of these elements forming the rhythms are depicted with the repetition of similar colours (Source: Author).

patterns that resemble leaves, it evokes a *visual familiarity* that creates a bridge between the artwork and the viewer's personal experiences in/with nature. For example, during the documentation of facade 2, when the PI encountered the motif of a snake (shown in [Supplementary Annexure 1](#)), it triggered a memory of a personal experience from his childhood when he accidentally tried to pick up a snake, mistaking it for a rope.

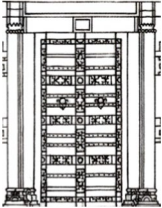
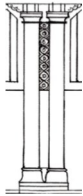
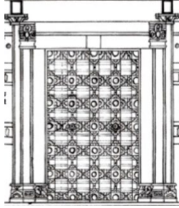
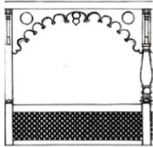
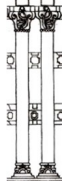
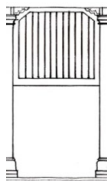
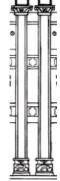
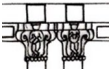
4.3 Analysis of embedded meanings

4.3.1 Spatial

According to the cosmocentric worldview prevalent in India, the entrance facades are prescribed a symbolic meaning of a spatial passage between the sacred and secular. Crossing the threshold when entering or exiting a dwelling is thus compared with navigating the spiritual and physical realms of existence ([Strawn, 2016](#)). As a result, the entrance transition (pattern 112) ([Alexander et al., 1977, p. 548](#)) facades are believed to absorb negative energies, sanctify the space and provide protection to those who enter/exit the space and inhabit dwellings, through their spatial characteristics, intricate embellishments, and orientation with respect to cardinal directions.

This is evident in the cases being studied. Façade 1 is oriented towards the east, the direction of the rising sun, which is believed to bring prosperity, good health, and positive energy into the dwelling. In contrast, Façade 2 is oriented to the north, traditionally believed to promote mental peace, tranquillity, and positive energy within the home. These orientations are also a climate-sensitive approach, making the east and north walls more open to light and air, considering that the south and west are heat-gaining directions ([Padmavathi, 2005](#)). This creates a comfortable outdoor room (pattern 163) ([Alexander et al., 1977, p. 764](#)) for spending extended periods in these spaces, promoting sensory comfort and a sustained connection with surrounding nature. In addition to this, the arrangement of various ornamented (pattern 249) ([Alexander et al., 1977, p. 1146](#)) motifs in the veranda, the daily ritualistic practices performed by the inhabitants in this space, and its semi-open design that provides a broader view of the surroundings all contribute to its embedded meaning of protective structure within the dwelling. As seen in the case of facade 1, the *dvarapalas* (door guardians) are positioned as brackets flanking both ends of the entrance veranda (shown in [Figure 5](#)). These figures are represented as formidable warriors armed with weapons, symbolically serving the role of shielding the space from negative energies, malevolent entities, and intruders, whether

TABLE 2 Materials and elements evoking HNCs in façades.

Material name	Elements: Façade 1		Elements: Façade 2		Properties/characteristics that sustains HNCs
	Front layer	Back layer	Front layer	Back layer	
Wood	Columns 	Door 	Columns 	Door 	Natural veins and textures capture the essence of the living natural world; the artists have crafted it quite intricately; teak has developed shallow surface cracks in a few parts as a result of prolonged sunlight exposure.
	Brackets (Sculptural) 	Window 	Bracket (Sculptural Carving) 	Window 	
	Parapet and Arch 	Columns 	Frames 	Columns 	
	Beams 	Structural Bands (Relief Carving) 	Beams 	Structural Bands (Relief Carving) 	
		Beams 		Beams 	

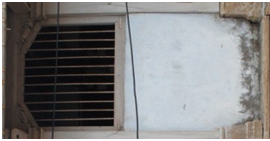
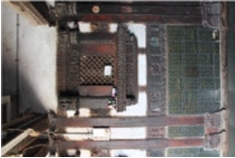
(Continued)

TABLE 2 (Continued)

Material name	Elements: Façade 1		Elements: Façade 2		Properties/characteristics that sustains HNCs
	Front layer	Back layer	Front layer	Back layer	
Sandstone	Column Base 	NA	Column Base 	NA	It was originally carved like other wooden elements, but it has weathered over time, symbolizing the natural world's order and impermanence and its constant state of flux.
Iron	NA	Window Screen 	Jalis 	Window Screen 	Security and privacy; patterns of the window screens almost create the illusion of sunlight passing through the leaves of trees within the interior architectural spaces.
Brass	NA	Door Knobs and Hooks  	NA	Door Knobs and Hooks  	Elegance, attractive weight, and a warm feeling when touched create a sense of comfort and mimics the feeling of holding a smooth stone.

(Continued)

TABLE 2 (Continued)

Material name	Elements: Façade 1		Elements: Façade 2		Properties/characteristics that sustains HNCs
	Front layer	Back layer	Front layer	Back layer	
Brick Masonry with Lime Plaster	NA	 Wall	 Wall	 Wall (tile is a later addition in response to the	Regulates indoor temperatures, providing in a cooler interior setting during hot summers. The lime colour perfectly complements the wooden frames, producing a visual symphony.

physical or spiritual. In the case of façade 2, residents were observed participating in morning rituals that involved worshipping a motif of Lord Ganesha crafted over doors and drawing a Swastik symbol on the base of doors, which is widely considered a way to sanctify the entrance and invite positive energies. These practices performed by the inhabitants at the entrance façade, their associated meanings and their reliance on the artefact offer a moment of reflection, fostering their personal connection with both the artefact and the natural world.

4.3.2 Artistic

The intricate carvings under study, which often feature natural motifs, divine figures, and patterns, are designed to celebrate the life-giving energy of nature, improve the well-being of the inhabitants and create a sense of protection and tranquillity within the dwelling (shown in Figure 6). These motifs and patterns on the entrance façade traditionally held deep cultural and social significance, imbued with unique spiritual and symbolic meanings, serving as a constant backdrop in the daily lives of the inhabitants. While the local narratives associated with these artefacts are lost to generational amnesia, the traditional symbolic meanings of each artistic element can be deciphered from relevant secondary sources and texts, as presented in Supplementary Annexure 1 and summarised in Table 3. These meanings highlight the efforts of traditional humans, of both the artists and the clientele, to aestheticise and culturally interpret the natural world and its forms within the entrance façade. It acts as a symbolic communicator and serves as a gateway to the past, expressing ancestral wisdom, cosmological beliefs, and human kinship with nature while prompting inhabitants to rethink and comprehend their position in the natural world. Exploring these artistic expressions and their associated symbolic meanings in the entrance façade on an everyday basis can provoke aesthetic receptivity towards nature. It can also shape an individual's perception of nature by promoting an understanding of its elements from a cosmological or spiritual perspective through art. In addition to their traditional symbolic meanings, the artefact also offers opportunities for a variety of interpretations. It enables individuals to engage with its motifs and patterns in a personal and imaginative way, fostering a deeper connection with the natural world. For example, when the motif of the monkey from façade 1 (shown in Figure 7) was interpreted independently by the authors, it led to three different associations. The first author made an anthropomorphic association through the memory of monkeys stealing vegetables from his home. In contrast, the second author associated monkeys with the emotion of joviality and regarded them as symbols of guardianship, seeing them as saviours of the place. Meanwhile, the third author connected monkeys with the concepts of interdependence and kinship, viewing them as part family and part guardians who share the bounty of the landscape of Bhal. Such spontaneous and reactionary interpretations of the nuances of artistic façades can be seen as stemming from an individual's imagination or perceptions, which are shaped by their socio-cultural background, prior interactions with nature, or philosophical beliefs.

4.4 Distanced structural analysis

4.4.1 Spatial

The artefacts in question are a spatial element of vernacular architectural spaces. Thus, it can be inferred that they have emerged as a result of a collaborative construction process involving clientele,

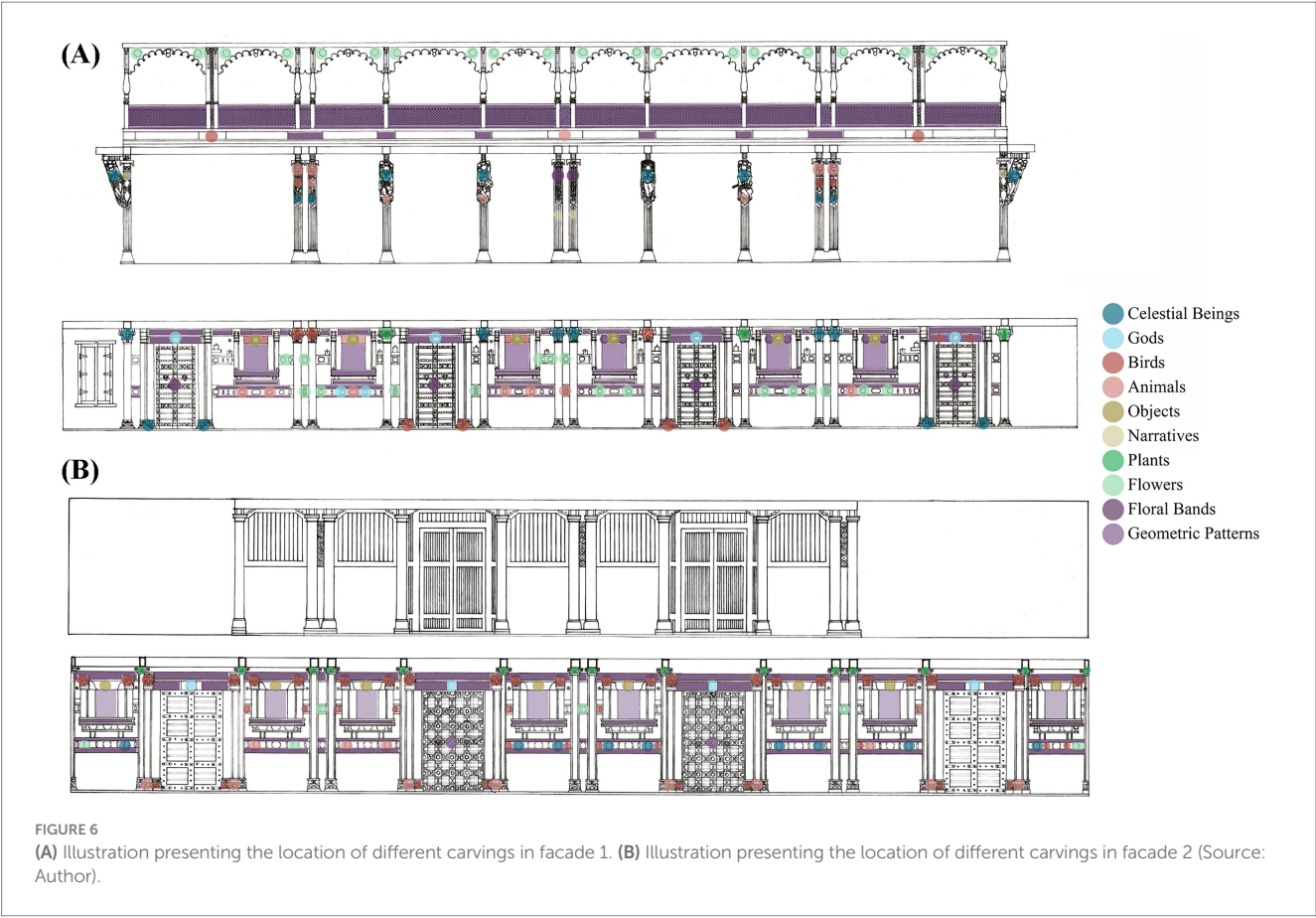


TABLE 3 Summarised meanings of nature that evoke HNCs in the façades.

Category	Type	Façade 1	Façade 2	Meanings and HNCs
Figural Motifs	Celestial Beings	<i>Gandharvas</i> (Semi-Divine Beings); <i>Vidhyadharas</i> (Knowledge Holders); <i>Dvarapalas</i> (Gate Guardians); <i>Pratiharas</i> (Warriors); <i>Apsaras</i> (Celestial Nymphs)	<i>Gandharvas</i> (Semi-Divine Beings); <i>Dvarapalas</i> (Gate Guardians); <i>Pratiharas</i> (Warriors)	Each motif has a distinct meaning and serves as an element of storytelling, aesthetic enhancement, and tool for spiritual elevation, and a symbol of spiritual, cultural, and natural harmony. They are crafted to invoke divine protection, safeguard spaces, convey moral values, ethical norms, inspire reverence, or reflect cosmic principles.
	Gods	<i>Ganesha</i> (Elephant-headed man), Sun and Moon	<i>Ganesha</i> (Elephant-headed man)	
	Birds	Peacock &Parrots	Peacock and Parrots	
	Animals	Lion, Monkey, Cow, Elephants, Mystical Beast- <i>Gajasimha</i> (Part Lion-Part Elephant) <i>Simhamukha</i> (Part Lion-Part Man)	Lion, Bull, Elephants, Snake, Horse	
	Objects	<i>Kalasha</i> (Pot of Nectar)	<i>Kalasha</i> (Pot of Nectar)	
	Narratives	Hunting Scenes and Festivals.	NA	
Natural Motifs and Patterns	Plants	Weeping Willow	Weeping Willow	It symbolizes growth, harmony, and the connection between humanity and nature representing concepts like purity, fertility, enlightenment and rebirth. They evoke a sense of tranquillity and uplift the human spirit.
	Flowers	Lotus, Nargis	Lotus	
	Floral Bands	Tanka (Scroll Band), Sinusoid Band, Charu Manjarika, Flower Band, Palmette Band	Tanka (Scroll Band). Sinusoid Band, Charu Manjarika, Flower Band, Palmette Band	
Geometrical Motifs and Patterns	NA	Polygon Santeens	NA	It adds visual appeal and intricacy to the spaces while also symbolizing cosmic order, harmony, and the interconnected nature of the universe. Additionally, they serve practical purposes like ventilation and light control in enclosed spaces.

Source: Categories adapted from Thakkar (2004); Meanings derived from Stutley (2019) and Achari (2015); Table developed by the authors. Refer to Supplementary Annexure 1 for detailed meanings associated with each carving.



FIGURE 7
Monkey symbols in façade 1 carrying vegetables (Source: Photograph by Author, May 2023).



FIGURE 8
Image showing hybridisation of the façade 1 (Source: Photograph by Author, May 2023).

carpenters, and masons in the Bhal region. Consequently, the process would facilitate the exchange of values, beliefs, and ecological knowledge, leading to a material culture that reflects the psyche or collective mind of a community toward nature. As the inhabitants take an active role in designing and building these artefacts, they gain a deeper understanding of the natural materials used and develop a deeper aesthetic receptiveness to the artistic forms representing nature. The design and building processes of these artefacts are typically rooted in generations of accumulated knowledge about the local climate, landscape, and available resources. These artefacts are also passed down through generations, serving as a symbol of collective identity. Thus, in subsequent stages of consumption, communicative value endures through these artistic facades as they become a carrier of messages from the past. As a result, it has the potential to deepen the inhabitants' understanding of and respect for the natural forces shaping their lives and dwellings. Having said that, since the British regime, the sea trade system in the region has declined, leading to a reduced availability of wood and a decrease in the practice of wooden architecture. This transition is further

accelerated by a modernisation-driven mindset, homogenization of architectural forms and the availability of newer materials like concrete, steel, etc., for construction in the villages of Bhal. It has led to the creation of a more consistent sensory environment, which is more uniform in terms of materials, lighting, colour palette, etc., reducing the impact of these transitional moments and resulting in a loss of a sense of threshold. Though spatially, the entrance veranda is visible as an element in the newly built forms within these villages, the materiality, the artistic forms and the aestheticised nature that provided the living quality to these artefacts have disappeared in the newer forms. Additionally, changing family structures are also affecting the existing vernacular facades with extensions and partitions carried out within the dwelling, not following the traditional style to accommodate family needs. This has resulted in the vernacular hybrid forms, specifically visible in the case of façade 1, shown in [Figure 8](#). These transitions suggest that while the thresholds retain their functional significance, they have lost their symbolic value, which once subtly reinforced personal and spiritual human connections with the natural world.

4.4.2 Artistic

Since the artefacts under study were originally crafted six generations ago, specific evidence about the local artisan community that created them remains elusive. Given the expertise and knowledge required for wooden construction and carving, it can be inferred that local carpenters (known as suthars) primarily would have undertaken the work of executing these artefacts. The secondary sources also suggest that the *Mevadas*, a community of carpenters renowned for their proficiency in wood carving, may have been the ones behind these creations (Thakkar, 2004). While created by individuals, as already discussed before, these artefacts are also shaped by the intangible forces of culture, the collective beliefs and values towards the nature of the community. Traditionally, artistic creation is likened to cosmic creation. In this analogy, cosmic elements serve as the foundational building blocks for producing art, and the process involves ordering chaotic materials to give them form, with the ultimate goal of achieving spiritual fulfilment through the process (Vatsyayan and Bäumer, 1995). According to this perspective, artists can be seen as divine creators who bring their imagination to life through spontaneous conception and personal inspiration from nature. They use the grammar of form, lines, and geometric shapes to imitate the forms of nature, creatively rather than passively, in their artistic articulation. Thus, when viewed from a distance, the main line of the facade intrigues the spectator's eye and mind, and as one moves closer, the composition of elements and materials that comprise the artefact becomes more apparent, and further closer observation reveals its elemental and eternal details and meanings of carved surfaces. The making process allows the artisans to connect with nature through their imaginations and processes of artistic articulation, which, in turn, through the process of observation, can also influence the inhabitants in a similar manner. For example, again taking the motif of monkeys on façade 1, as shown in Figure 7, they are depicted carrying vegetables, which can be an imaginative personification of the spring season, representing a good harvest or a symbol of prosperity. Unfortunately, this intricate art of wood carving in dwellings is on the decline due to the changing economic as well as architectural landscape of the region. Wood carving skills were traditionally passed down through generations, but with increasing alternative economic opportunities, younger generations of these artisans opt for more profitable professional careers, resulting in a significant loss of knowledge of craftsmanship in the region. This is further yielded by the changes in construction materiality, which have fostered the decay in the practice of making traditional motifs and patterns that were once integral to the façades of dwellings.

This analysis presented various connections with nature mediated by spatial and artistic features. Although the artistic and spatial components of facades are analysed separately here, their interconnection became evident during the analysis. It is important to study these elements in tandem to fully understand the phenomenon of HNC in vernacular facades. Following this, the Section 5 will focus on synthesising the analysis to present the results and discuss the thematic levels of HNCs fostered by the facades.

5 Results and discussion

The two selected entrance facades serve as examples to illustrate how spatial and artistic features can promote HNCs within dwellings,

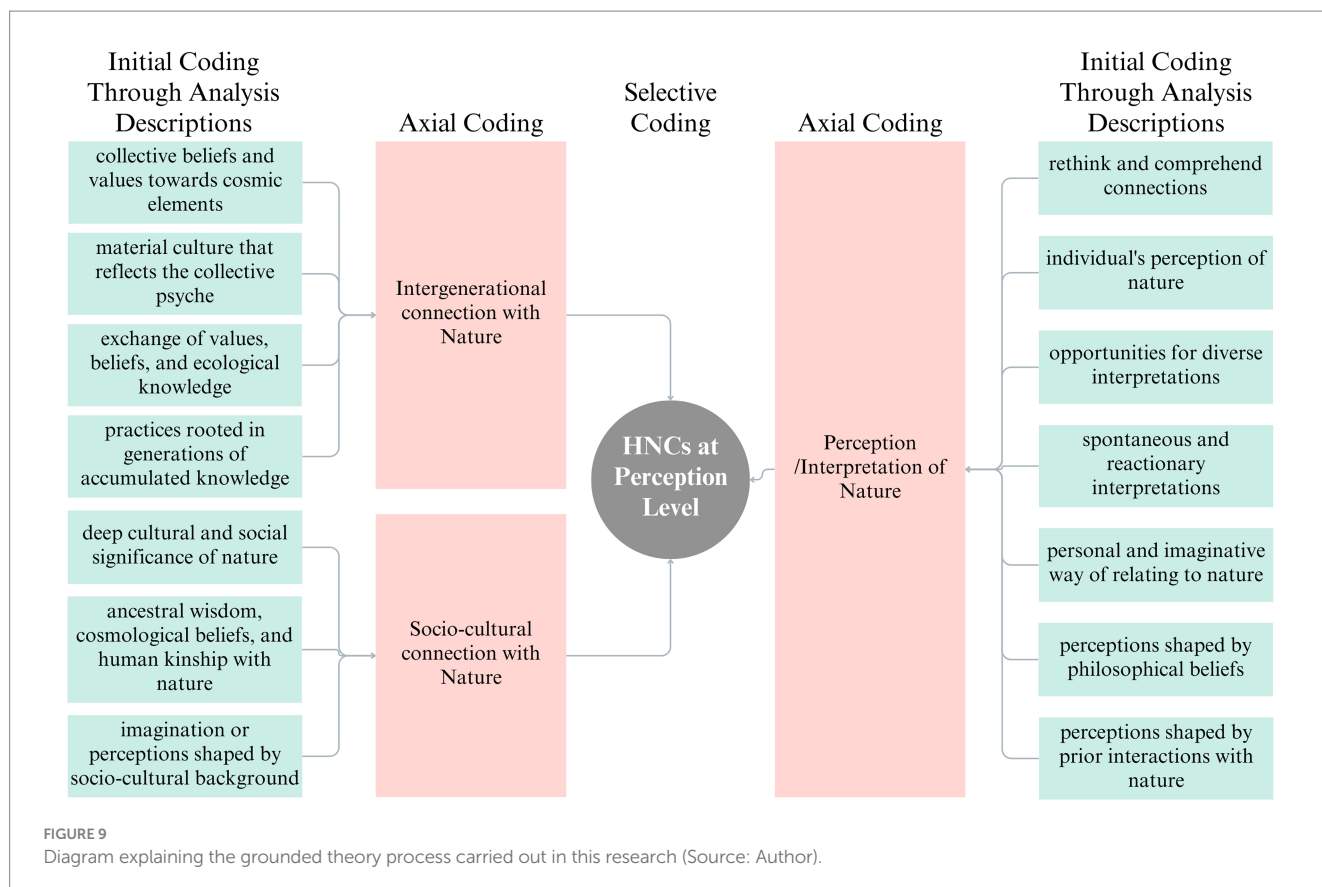
TABLE 4 Coding and identifying HNCs.

Axial codes of HNCs	Selective codes of HNCs
Bioclimatic connection Material utilization connection Empathetic connections	HNCs at material level
Direct nature connection Sensory engagement connection Connection by transition/mediation with nature Connection by spatial relationship with nature	HNCs at sensorial level
Psychological connection to nature Nature in imaginative representations Vicarious connections	HNCs at imaginative level
Creative reflection of nature in design Symbolic, emotional, or intellectual connection through articulation Knowledge based connection with nature	HNCs at artistic articulation level
Symbolic, emotional, or intellectual connection through interpretation Spiritual connection with nature Aesthetic understanding/appreciation of nature	HNCs at aesthetic receptivity level
Temporal connection with nature Familiarity with natural order	HNCs at familiarity level
Personal connection with nature Experiential connection with nature	HNCs at personal level
Socio-cultural connection with nature Perception/interpretation of nature Intergenerational connection with nature	HNCs at perception level

contributing to sustainability transitions. First, the results will be discussed, emphasising the various levels of HNCs influenced by design and embellishments in the cases (Section 5.1). Subsequently, the discussion will focus on proposing a relational analysis framework and guideline by thematically synthesising the results of the analysis (Section 5.2).

5.1 Types of HNCs

The various connections fostered by spatial and artistic characteristics outlined in the case studies (Section 4) were initially coded to identify concepts related to HNCs in the façade. This process revealed several key concepts, including: “connecting daily activities with the rhythms of nature,” “personal connection to nature,” “creating a direct sensory connection,” “linking to familiar cycles of nature,” “connection to natural materials,” and “imaginings and memories of nature,” among others. The initial concepts were further organised through axial coding that established 23 larger categories, as discussed in Table 4. Eventually, through selective coding, eight thematic levels of HNCs were identified, which are influenced by the spatial and artistic features of the façade. The grounded theory process followed for emerging these themes is shown in an example of perception level HNCs in Figure 9. Each of these categories is discussed in this section.



Four of these categories also directly correspond with the existing 4 of the 14 patterns of HNCs proposed in Biophilic Design by [Browning et al. \(2014\)](#); these connections are also discussed here.

- i. *HNCs at Material Level*: This category refers to the physical connections with nature that are mediated by the material characteristics and their conscious utilisation in an artefact. As discussed in the cases studied, this includes visual and tactile connections fostered by textures and organic patterns of materials, microclimatic regulation through materials and material empathy in the process of artefact creation. It reflects the 'material connection with nature' pattern of biophilic design, emphasising the use of natural materials in the built environment to represent local geology or ecology, thereby creating a distinct sense of place ([Browning et al., 2014](#), p. 40).
- ii. *HNCs at Sensorial Level*: This category pertains to physical connections with nature facilitated by the design characteristics that stimulate human senses in an artefact. It includes sensorial connections fostered by the spatial quality of the artefact, visceral experiences of art forms, pauses and movement within the artefact and processes of embodied creation of artefacts. It corresponds to the 'non-visual connection with nature' pattern of biophilic design, which is defined as auditory, haptic, olfactory, or gustatory stimuli in the built environment that engender a positive reference to nature or its systems and processes ([Browning et al., 2014](#), p. 26).
- iii. *HNCs at Imaginative Level*: This category refers to an artefact's ability to transcend sensory, spatial, and temporal limits, stimulating imagination and provoking memories to connect

with nature. In the cases examined, this includes vicarious connections developed by processes of imagination in the creation of artefacts and interpretation and reminiscence of natural motifs and patterns in the artefact.

- iv. *HNCs at Artistic Articulation Level*: This category pertains to the symbolic, emotional, or intellectual connections with nature facilitated during the creative articulation of artefacts. As discussed in the studied cases, it includes expressive connections emerging during the creative articulation of emotional responses to nature, the capturing of emotional expressions of nature, or the embedding of the symbolic values of nature by the artists within the artefact.
- v. *HNCs at Aesthetic Receptivity Level*: This category refers to the symbolic, emotional, or intellectual connections with nature fostered by the aesthetic receptivity of artefacts. This includes explorative connections fostered by active collaboration of inhabitants and artisans in the design of artefacts, attentive exploration of artistic forms and deciphering the traditional meanings associated with art and artefacts, as demonstrated in the analysis of cases. It reflects the category of 'biomorphic forms and patterns' in biophilic design, emphasising symbolic references in built spaces to the contoured, patterned, and textured arrangements that are prevalent in nature ([Browning et al., 2014](#), p. 38).
- vi. *HNCs at Familiarity Level*: This category relates to the subconscious connections with the cycles and rhythms of nature, influenced by the compositional and transformative qualities of artefacts. In the context of the cases, this includes familiar connections evoked by the ageing and weathering of

materials over time in artefacts, the standardised, repetitive arrangement of structural elements, and the visually recognisable composition of natural motifs and patterns. It corresponds to the ‘*connection with natural systems*’ category of biophilic design, which emphasises awareness of natural processes, particularly seasonal and temporal changes in ecosystems within the built environment (Browning et al., 2014, p. 36).

- vii. *HNCs at Personal Level*: This category pertains to the personal connections with nature developed through spontaneous or reactive creation and interpretation of the characteristics of artefacts. In the cases examined, this includes personal connections established through spontaneous conception and interpretations of nature in the creation of these artefacts, curiosity-driven interpretations of various expressions of nature in artefacts and the practices performed by individuals concerning nature within the context of the artefact.
- viii. *HNCs at Perception Level*: This category relates to the perceptual connections with nature that are shaped by the socio-cultural or philosophical creation and interpretation of the characteristics of the artefacts. As discussed in the examined cases, it includes the phenomenal connections that arise during the designing of the artefact responding to the socio-cultural rhythms of the family, cosmological or spiritual interpretations of various artistic expressions of nature found in the artefacts, and personal interpretations of artistic façades influenced by socio-cultural or philosophical beliefs of an individual.

5.2 Relationality: guidelines and analysis framework

The results indicate that the vernacular facades foster multiple levels of HNCs (as discussed in 5.1), highlighting the importance of spatial and artistic features in shaping these relationships. Based on the analysis of the vernacular cases, five fundamental guidelines for the relational design of architectural thresholds, specifically facades, can be provided as a means of effectively enhancing human-nature connections. The guidelines are as follows:

1. The representational expressions of nature in facades should be diverse, recurrent, themed, abundant and place-based (inspired by local flora and fauna) to immerse inhabitants in echoes of the natural world. The greater the variety of living patterns in a space, the more it feels alive as a whole, creating a self-sustaining energy that integrates the building with nature (Alexander, 1979).
2. The artistic forms and spatial characteristics should be interwoven as “*patterns of relationships*.” Each unique configuration of artistic patterns should rely on spatial patterns to thrive, creating a profound aesthetic experience of nature in the daily lives of the inhabitants.
3. The ornamental forms of nature in facades should also have a clear and definite function within a building. As observed in the case studies, the artistic forms can be typically integrated as part of the structural elements of the building, door frames, windows, balconies, balustrades, etc.
4. As Alexander (1979) states, a building that achieves wholeness must embody the character of nature, which inherently includes processes of decay and death. Accordingly, the materials used for thresholds should be carefully selected so that they weather and age gracefully, thereby evoking the sense of impermanence within inhabitants that lies at the heart of the natural world.
5. In creating patterns and motifs inspired by nature, architects and designers should step back and trust the artist’s spontaneous conception and personal interpretation of natural forms to guide the design. This approach ensures variation and uniqueness in how patterns manifest while being repeated, following the generative logic of nature itself.

In these cases, it was observed that the art of wood carving evokes feelings of awe, wonder, and reverence, often triggering memories that connect one emotionally to the natural world. At the same time, its spatial qualities create a multisensory experience, encouraging one to engage with nature in a present and embodied way. These entrance facades thus play a crucial role in connecting people with nature both internally and externally in everyday life and thus hold the potential for sustainability transitions. Therefore, it’s important to emphasise that architectural design—whether in urban or rural areas—should prioritise careful design of façades and thresholds, as they play a vital role in maintaining HNCs. These elements enhance the aesthetic appeal of buildings and contribute to the overall harmony between architecture, inhabitants and the natural surroundings. However, current architectural research lacks a framework for examining how transitional architectural spaces, such as verandas and entrance facades, facilitate embodied and emotional connections between humans and the natural environment. This poses a risk of these traditional architectural elements disappearing without a comprehensive understanding of their relational and symbolic significance, due to increasing standardisation and the loss of vernacular practices. Recognising this loss, we developed an initial framework by thematically synthesising the analysis and results of this research, as shown in Table 5.

Derived from the methodological approach of this research, this framework is intended to be utilised by architects and researchers for further studies of architectural facades and their role in HNCs. This framework will potentially also assist sustainability researchers, transition researchers and artists in understanding the integration of art and architecture for reconnecting humans with nature.

From this research, it can be stated that these relationally designed elements in architecture can contribute to inner transformations (Ives et al., 2023; Ives et al., 2020) which focus on bringing fundamental shifts in the interior dimensions of sustainability, such as values, beliefs, worldviews and inner capacities. Furthermore, the results also provide a significant contribution to studies at the intersection of connectedness with nature, living in crisis (Sachdeva et al., 2022), and holistic well-being (Chakraborty, 2024) and biophilic design (Kellert et al., 2013). Urbanisation is considered to have resulted in a loss of direct contact with nature, leading to an “extinction of experience” and human-nature disconnection (Soga and Gaston, 2016; Cumming et al., 2014). The guidelines derived by analysing thresholds in vernacular dwellings that maintain HNCs can be integrated into a current sustainable development model for housing and urban planning to “revive the experience” of nature in the towns and cities.

TABLE 5 Relational analysis framework for HNCs.

Components	Level of HNCs	Characteristics of artefacts to be analysed
Physical	Material level Sensorial level	Analysing material, spatial and artistic characteristics of artefacts that stimulates human senses to foster a physical connections with nature.
Creative	Imaginary level Artistic articulation level	Analysing process of creative articulation of artefacts that stimulates imagination and provokes memories to foster symbolic, emotional, or intellectual connections with nature.
Communicative	Familiarity level Aesthetic receptivity level	Analysing the communicative strength of an artifact in nurturing aesthetic receptivity and familiarity with the natural rhythms to foster subconscious connections with nature.
Interpretive	Personal level Perception level	Analysing spontaneous or socio-cultural interpretations of nature in artefacts that fosters personal and perceptual connections with nature.

Source: Authors.

6 Conclusion

There is a lack of research investigating vernacular architecture and its entrance thresholds from a relational perspective, despite their critical role in connecting humans and nature within the built environment. Investigating these spaces can provide socio-ecological design perspectives and valuable guidelines for transforming societies toward a relational ontology and facilitate the transition to sustainability through architectural design. The present research aimed to explore the HNCs mediated by the entrance facades in vernacular dwellings in everyday life, studying two wooden vernacular facades in the Bhal region of Gujarat, India. It explored the key question of what types of HNCs are fostered by the spatial and artistic features of the entrance façade, acting as a relational design element within vernacular dwellings.

Based on this qualitative study, the authors found that entrance facades operate as physical and symbolic relational space, fostering eight levels of HNCs—material, sensorial, imaginative, artistic articulation, aesthetic receptivity, familiarity, personal, and perceptual, which enhance the ecological consciousness of the inhabitants. Through a complex interplay of orientation, materials, and spatial form, combined with artistic features that represent the natural world, these elements serve as visual and tactile reminders of one's place within a larger ecological system. Together, the entrance façade's spatial and artistic elements create an intertwined design system, which, on one hand, develops a porous boundary that facilitates sensory and experiential engagement with the surroundings and, on the other hand, encodes collective mindsets, cultural narratives, traditional ecological knowledge, and cosmological beliefs, fostering philosophical and emotional connections with nature. Thus, analysis proves the hypothesis that designs of vernacular entrance facades offer multiple opportunities for both internal (philosophical or cognitive) and external (experiential or material) HNCs and can thus act as a leverage point for sustainability transitions. This multiplicity highlights the role of these elements as active contributors to relational ontology, yielding essential insights for socio-ecological design that is grounded in the cultural and ecological context of a place.

Further, the guidelines and analysis framework proposed within the study synthesise the research findings, laying out tools for relational design application as well as effective analysis of architectural thresholds as spaces for HNCs. However, it goes beyond the scope of this paper to provide a comprehensive set of guidelines and an analysis framework for HNCs. Instead, it encourages researchers to challenge convention by bringing together the disciplines of architecture and sustainability transitions for HNCs. It reimagines and represents

vernacular architecture as a key exemplar of designing 'relationally.' Thus, future studies can refine the proposed guidelines and framework by applying them as part of the architectural design process or examining other vernacular spaces. Also, this research engages with scholarship on biophilic design and pattern language; however, the mathematical analysis of vernacular patterns to understand their role in strengthening the bond between individuals, their surroundings, and nature lies beyond its scope. Future studies could extend in this direction to deepen the understanding of these patterns through mathematical approaches.

While the sample of two dwellings is contextually representative, the localised focus of this research limits the capacity to make broader generalisations and the potential transferability of its results to other cultural and geographical contexts. Therefore, future research should include additional case studies of diverse vernacular practices across India, explore similar artistic thresholds in urban vernacular settings, or conduct a comparative analysis of threshold designs across different cultures and countries. This would help in the development of universal design guidelines for architecture to foster HNCs and relationality in the context of sustainability transitions. Additionally, access to well-preserved vernacular dwellings with their original entrance facade elements in an unaltered state is limited, as many of these spaces (seen in façade 1) have been adapted and modernised. Studying these transitions within vernacular spaces from a relational perspective is also essential to further understanding changes in human perception of and relationships with nature. By integrating these lessons, newer architectural forms in both rural and urban regions can be designed to be more relational, thereby enhancing the HNCs and promoting a shift to more sustainable modes of living and being in/with nature.

Data availability statement

The original contributions presented in the study are included in the article/[Supplementary material](#), further inquiries can be directed to the corresponding author.

Author contributions

DR: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Visualization, Writing – original draft, Writing – review & editing. KC: Conceptualization, Methodology, Supervision, Writing – review & editing, Resources. SK:

Conceptualization, Methodology, Supervision, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Correction note

This article has been corrected with minor changes. These changes do not impact the scientific content of the article.

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Supplementary material

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