

# The Extended Domicile—Culture, Embodied Existence and the Senses



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**Abstract** We extend our physical selfs, perceptual and cognitive realities as well as memories and imagination through countless technical inventions and conceptual systems. In his book *The Extended Phenotype*, the biologist Richard Dawkins, suggests that in the biological world such extensions are so important that, for instance, the dams and water regulation systems of the beaver should be included in the biological definition of the species of the beaver. Similarly, our countless constructions, structures, technical systems as well as intellectual discoveries, ought to be included in the definition of *Homo Sapiens*, but we still continue to see ourselves limited by our skin. Altogether, we tend to think of our environments in terms of isolated, definable objects and entities, rather than dynamic and constantly interactive and expanding systems. Architecture is likewise seen as material aestheticized structures that are external to us, rather than as part of our biological and mental constitution. However, our environments from intimate objects to rooms, buildings, cities, regions and all the way to the entire world and the universe, can also be regarded as part of our material, perceptual, and conceptual reality. Instead of being seen as material objects and buildings, architecture should be regarded as an active entity which very concretely mediates our relationships with the world through space and time. Human history, culture, and collective consciousness widen our world of thought and action beyond material boundaries. Through our structures, we, humans, turn limitless, shapeless and meaningless space into lived space with human meanings. We also regard architecture as an aesthetic expression of its architect, but Maurice Merleau-Ponty argues thought provokingly: “We come to see not the work of art, but the world according to the work”. Architecture has a crucial role in the constitution of the human world, both material and mental.

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The human sensory and neural system, as well as the brain, is the result of evolutionary adaptation to the prevailing environments and conditions of life during the continuum of human evolutionary history. The nature of our senses and neural functions, as well as instinctive environmental preferences, needs to be viewed in a bio-cultural and bio-historical perspective, instead of regarding them as ahistorical, unchanging or simply given properties of the *Homo Sapiens*. We are undeniably historical beings, but the time perspectives in our biological constitution, behaviour and mental lives are most often neglected in today's objectified and aestheticized design thinking, as design tends to be interested only in the dimensions of now-ness and novelty. We dwell in the continua of space and time, but we are not usually conscious of the fact that we continue to be subject to evolutionary forces and changes in the future as well. Although human adaptation to the conditions of life has primarily taken place through technological inventions, we undoubtedly also keep evolving biologically. With artificial intelligence and stem cell manipulation, we are already in dangerously confusing territory in regard to the categories of what is biological and what is man-made.

## 1 Adaptation Through Technology

Even our own inventions, structures and acquired habits eventually cause biological changes. The taming of fire, for instance, estimated to have taken place roughly 50,000 years ago, caused changes in human tooth structure and intestinal functions as a consequence of eating cooked food. "Control over fire changed human anatomy and physiology and became encoded in our evolving genome", Stephen Pyne argues [1]. The first architectural writer in history, Marcus Vitruvius Pollio (80–70 BC-15 BC), even connects the origins of architecture with the domestication of fire [2]. Like Vitruvius, some linguistic scholars of our time have suggested that gathering around a fire for extended periods also accelerated the development of language. Fire has been so central during the course of human cultural evolution that even in our technologized and globalized culture, it continues to convey deep feelings of domesticity and pleasure, and flames are still a strong stimulus for dreaming and imagination. Gaston Bachelard, the philosopher of poetic imagery, wrote two books on the poetic impact of fire on the human imagination [3].

We tend to think that our technical inventions are all beneficial and "innocent", but the man-made and technologized world can cause major changes in our behaviour and habits, as well as in our mental lives. Walter J. Ong argues convincingly that writing, and especially mechanical printing, initiated the shift from aural space to visual space, and that this shift to the hegemony of vision was not entirely positive. "Print replaced the lingering hearing-dominance in the world of thought and expressions with the sight-dominance, which had its beginning in writing", Ong argues [4]. In his view, "[T]his is an insistent world of cold, non-human facts" [5]. The fundamental change in the perception and understanding of the world seems irreversible to the writer: "Though words are grounded in oral speech, writing tyrannically locks them

into a visual field forever [...] a literate person cannot fully recover a sense of what the word is to purely oral people” [6].

No doubt, similar sensory and mental changes initiated by ever-evolving technologies continue today. Current studies in Finland have shown that children are becoming incapable of identifying the facial gestures and emotions of others due to their extensive communication through mobile phones. The current shift in architectural design from manual sketching, drawing and model to the insistent use of computers and 3D modelling must be having similar negative consequences on our embodied and spatial modes of thinking and imagining. Thinking has always had its bodily and emotive components. We are engaged in creative work as complete embodied and sensory beings, not just through vision and intellect. In fact, an unconscious, non-logical, associative, emotive, and intuitive synthetic mode of thinking is the very essence of our creative capacity.

## 2 Biology and Aesthetics

In his book *Inner Vision: An Exploration of Art and the Brain*, neurobiologist Semir Zeki outlines “a theory of aesthetics that is biologically based” [7]. “My primary aim is to convince the reader that we are at the threshold of a great enterprise, of learning something about the neurobiological basis of one of the most noble and profound of human endeavours [arts]”, he adds [8]. Zeki’s assumption and goal seem entirely plausible to me. In fact, it would be questionable to assume that our aesthetic sensibilities and preferences would have developed independently of our biological evolution, or that our aesthetic preferences would conflict with the evolutionary principles of survival. Isn’t the deep resonance between our natural settings and aesthetic sensibilities the reason why we experience nature and its evolving phenomena as pleasurable and beautiful? My assumption suggests that we experience beauty primarily unconsciously as nature’s expression of its inner causalities. This is what Josef Brodsky, the nobel Laureate poet, seems to suggest in his credo, “The purpose of evolution, believe it or not, is beauty” [9]. This poetic formulation will probably not be approved by today’s theorists of evolution, but can well be valorized by evolutionary and biological argumentation in the future. In today’s world of forceful aesthetic conditioning, personality and politics, as well as architecture, have turned into deliberate aesthetic manipulations, and as a result of our current aesthetic culture, aesthetic choices seem distant from their original biological motives, losing their spontaneity. It is surely a mistake to think of human evolution only in cultural terms, distanced and separated from the underlying processes of biological meaning. It is equally misguided to neglect the biological ground of human behaviour and instinctual choices; this is the lesson of ecological psychology. Based on the ecological psychology of Jay Appleton, and especially his prospect-refuge theory [10], Grant Hildebrand has analyzed the psychological effects of Frank Lloyd Wright’s houses, and concludes that the architect grasped intuitively the fundamental psychological meaning of this basic polarity, which still applies in today’s spatial design [11]. In another book of

his, entitled *Origins of Architectural Pleasure*, Hildebrand has a suggestive chapter title, “The Aesthetics of Survival”, which boldly connects the cultural and biological dimensions of environmental qualities [12]. Aesthetic sensibilities seem ultimately to serve purposes of survival and evolution, but they may just as well be distorted by arbitrary cultural values, such as the fashion of forcefully bound legs of ladies in China between the 10th and 19th centuries, or today’s fashionable but esthetically arbitrary architecture.

The biologist Edward O. Wilson is the spokesman for *biophilia*, “the new ethics and science of life”, whose passionate defense of life and lifelike processes is seminal today, when humankind is running out of time to establish the future conditions for human life through absolutely necessary cultural adjustments. “All of man’s troubles may well arise [...] from the fact that we do not know who we are, and do not agree on what we want to become”, he writes [13].

Now that biological precedents and models are increasingly being used in advanced technologies, our own biological essence and historicity must surely also be acknowledged, including in relation to architecture and planning. Our biological historicity is evidenced by relics such as the *plica semilunaris*, the pink triangles in our eye corners to which our horizontally moving extra eye lids were fixed during our lizard phase in the Saurian age. Human culture has developed towards increasing artificiality, but we need to recognize the biological reality and its refined processes of adaptation, change and becoming.

### 3 Interacting with the World

Like all forms of life, we are related to our living world through the senses and neural systems. Life is an evolving system of interaction with its contexts and environments. With the advance of scientific research, it is becoming clear that our interactions with the world are far more complex than we have so far assumed. We do not just dwell in the world, as we are also part of it in a complex manner. We are part of the “flesh of the world”, to use the suggestive notion of Maurice Merleau-Ponty [14]. As Semir Zeki remarks, quoting Henri Matisse: “We see in order to be able to acquire knowledge about the world [...] Other senses do the exact same thing” [15].

Since Aristotle, we have believed that we have five senses, but Steinerian philosophy names twelve human senses [16], and a recent study suggests that we are connected with the world through no less than thirty-three systems of monitoring and interaction [17]. The fixation with the five senses has evidently been supported by the simple fact that we have a specific, identifiable and visible organ for each one of these five modes of sensing, whereas the sensing of environmental atmospheres and of our own existence, for instance, are multi-sensory, unfocused and shapeless, and they lack “thingness”. Tonino Griffero calls such complex and diffuse phenomena “quasi-things” [18]. As architecture, especially that of modernity, has primarily been interested in form, such “formless” phenomena as atmospheres, feelings, empathy and emotions have been largely neglected. Also, the existential sense is central

to our relationship with the environment and architecture, but due to its complex and synthetic nature, it cannot be associated with or located in any specific sensory organ. The sense of self, or the existential sense, is our coordinating and synthesizing sense, not vision, as we usually think. The thirty-year-old discovery of “the mirror neurons” by a research group at the University of Parma is another significant biologically-determined capacity of “learning” and “understanding” through unconscious imitation and simulation, which has already proved of seminal importance for the understanding of how we internalize external phenomena and stimuli, such as works of art.

Current research on the significance and complex functions of the bacterial world in our intestines dramatically complicates our interaction with the environment. The recent understanding of the role and complexity of our intestinal bacterial universe, “our second brain” [19], serves as an example of the fundamental expansions that are currently taking place in the understanding of our interactions with the world. We have only recently learned that each one of us carries more than one and half kilos of bacteria in our intestines, and we actually have more bacterial DNA in our bodies than human DNA.

## 4 The Extended Man

Our sensory systems, not to mention the imaginative projections of the mind, such as concepts and metaphors, enable us to “sense” the entire universe.”Through vision, we touch the sun and the stars”, Maurice Merleau-Ponty exclaims poetically [20]. Besides, we extend our physical, perceptual and cognitive capacities, as well as memory and imagination, through an ever-increasing number of technical inventions and conceptualizing systems, such as the dramatic expansion of human memory through the Google and the computerized “cloud”.

In his book *The Extended Phenotype* [21], the controversial biologist Richard Dawkins suggests that the acquired extensions of the body functions are so important in the biological world that, for instance, the dams and water regulation systems of the beaver should be included in the biological definition of the beaver species. Altogether, the refinements of the ways by which even lower animals adjust their relationships with their surroundings are often almost beyond imagination, but these amazing capabilities have hardly been studied seriously [22]. Again, the deep evolutionary time helps in understanding the development of the superb skills of animals. For instance, spiders have been practicing their methods of web construction for over 300 million years, in comparison with the roughly 50,000 years of human construction.

Similarly, our own countless constructions, structures, and technical systems, as well as intellectual discoveries, should be included in the concept and definition of *Homo Sapiens*, but we still continue to see ourselves limited by the surface of our skin. In their series of pioneering research publications of 1963–67 entitled *The World Resources Inventory*, Richard Buckminster Fuller and John McHale introduced the

idea of both the human individual and the collective humankind, as seen through their huge external material, technical and conceptual extensions [23].

Even biologically, the sphere of the human body is not limited by the skin. We sense our personal space as an extension of our body and feel it being violated as if it were part of our physical body. In the 1960s, the American anthropologist Edward T. Hall introduced the discipline of *proxemics*, the study of the human unconscious and culture-specific use of personal and collective space as behavioural extensions of the body [24]. The designer of spaces needs to understand these unconscious extensions and invisible behavioural mechanisms, not just the anatomy and physical dimensions of the human body.

But even our actual metabolic functions exceed the body's limits. Hall mentions the research of A. S. Parkes and H. M. Bruce from the 1960s into the functions of our ductless endocrine glands, which showed that although these glands—in accordance with their very name—have been assumed to function strictly within the body, they also function and interact externally through chemical communications [25]. The researchers even suggested renaming their research area as “exocrinology” to express the unexpected external communicative functions of the internal glands.

More recently, research has established that with today's instruments of measurement, the electrical impulses of our heart can be monitored at a five-meter distance. These examples should make it clear that our range of metabolic interactions extend into space beyond our skin. So, where are the boundaries of our functional and experiential selves? How do we frame and define the human being for whom we design?

## 5 The Unity of Space and Self

We think of ourselves as creatures limited by our skin and of our environments as a set of isolated, definable objects and entities outside of ourselves, rather than as integrated, dynamic, constantly interactive and interweaving systems. Besides, we still continue to make a categorical separation between outer and inner, material and mental realities, although science has revealed the multiplicity of interactions between these assumed oppositions, and phenomenological thinking in philosophy has questioned and abandoned such exclusive categorical distinctions. It is a fundamental phenomenological assumption that the inner and outer spaces, as well as the material and the mental, constitute a continuum. The American literary scholar Robert Pogue Harrison gives this mirroring a poetical expression: “In the fusion of place and soul, the soul is as much a container of the place as place is container of soul, and both are susceptible to the same forces of destruction” [26]. Merleau-Ponty gives this reciprocity and simultaneity an even more cryptic formulation: “The world is wholly inside and I am wholly outside myself” [27].

Yet another surprising interaction between the world and the human mind has recently been suggested by the Californian philosopher Alva Noë. In his provocative book *Out of Our Heads: Why You Are Not Your Brains, and Other Lessons from the*

*Biology of Consciousness* [28], he argues that the reason why research has failed to locate human consciousness in the brain is that the location of consciousness has been sought in the wrong place. In the philosopher's view, consciousness is a relation between the mind and the world, and as a relational phenomenon, it cannot be placed, because a relation has no distinct physical location. At the same time, this view also suggests a complete continuum between the inner and the outer, the mental and the material. We have come to believe that our consciousness is the most human of our capacities, but it may well be "out there" instead of being inside our brains. Atmospheres, which are proving to be significant aspects of architectural and environmental quality, are similarly in-between and relational phenomena. It is the relational essence of atmospheres that has made them difficult to identify and grasp theoretically or intellectually, although we spontaneously feel them and they unavoidably impact our feelings and behavior [29].

## 6 Architecture—Object or Experience?

Architecture is also normally seen as aestheticized material structures that are external to us, rather than as part of our biological and mental constitution. It is regarded as physical and material spaces, structures and objects, instead of experiences or mental and emotional encounters. However, environments from the most intimate objects to rooms, buildings, cities, regions, and all the way up to the entire world can be regarded as part of our perceptual, mental and conceptual reality, and instead of being seen merely as material contents and entities, architecture can be regarded as active verbs, which concretely mediate and alter our relationships with the world, space and time. In addition to organizing and channeling life and actions, architecture determines our relationships with the world and gives our experiences of it specific meanings. John Dewey argued provocatively that "mind is a verb" [30], and the essence of architecture can also be seen as a verb. The verb connotation of architecture becomes concrete when we realize that it is always a kind of pre-scripted choreography for human movement, action, attention and emotion. Architecture organizes our material world, but it also provides horizons and frames for perception and understanding. The world is experienced through and in relation to human structures, material and conceptual, current and historical. The built structures of our experiential world pre-organize and pre-interpret the world for our perception and understanding. It is entirely feasible to think that a house pre-senses and pre-experiences the landscape around it, natural or man-made, on behalf of the future resident. Besides, architecture is also always an invitation to distinct acts and activities and a promise of predictability, order and safety.

When all of the extensions of our mobility, climatic adaptation, sensory reach and memory, as well as cognition and imagination, are seen as essential characteristics of our bio-cultural selves, architecture also turns into a dense field of interactions in space, time and meaning. Human history, culture, and collective consciousness further widen the world of thoughts and actions beyond material boundaries. Through

our human structures, both physical and mental, we turn limitless, shapeless and meaningless “natural” space into lived cultural space with specific human purposes and meanings. Instead of living in a natural world, we live in a man-made world structured by our countless constructions, devices and inventions, as well as conceptualizations and ideas.

We have also primarily regarded architecture as an aesthetic expression of its individual architect, but Maurice Merleau-Ponty argues, thought-provokingly: “We come to see not the work of art, but the world according to the work” [31]. The philosopher’s statement on the real contents of art certainly applies in architecture. Instead of being merely individual and artistic expressions, buildings are essentially about the world and being human in that world. Architecture acquires its content and meaning through its resonance with universally human qualities, not from explicitly individual expressions. It has a crucial role in the constitution of the human world, both material and mental, as well as in the establishment of our very humanity.

## 7 Embodied Experience

Since its invention in Renaissance times, the perspectival understanding of space has emphasized and strengthened the retinal and focused architecture of vision. Through its geometric construction, focused perspectival space turns us into outsiders and observers, as it pushes us outside of the realm of the object of focused perception, whereas simultaneous, haptically and peripherally perceived spaces enclose and enfold us in their embrace, making us insiders and participants. In the retinal understanding of space, we observe it, whereas acoustic, haptic and olfactory spaces, as well as percepts of peripheral and unfocused vision, constitute our lived and shared existential condition. We are embraced by space, rather than looking at it. This mode of sensing is also the grounding for atmospheric experience and attunement, both being notions that have been neglected in modern architectural theory. Contrastingly, theoretical studies on architectural spaces have frequently described them as negative or absent volumes and forms. Yet, the world and the perceiver are not separated and polarized, as they are both ingredients in the shared existential flesh, “the flesh of the world”, to use Merleau-Ponty’s notion.

The quest to liberate the eye from its perspectival fixation has gradually brought about conceptions of a multi-perspectival, simultaneous and haptic space. The dynamic life and depth in our perception arise from the fact that they are essentially an ever-changing dynamic collage of separate multi-perspectival glances that constitute a haptic continuum, our true embodied experience of space. This is the perceptual and psychological essence of Impressionist, Cubist and Abstract Expressionist painterly spaces, which pull us into the painting and cause us to experience it as insiders in a fully embodied plastic sensation. Visual space thus turns into an embodied plastic and existential space, which is essentially a dialogue and exchange between the space of the world and the internal space of the perceiver’s mental world. The experience of interiority and belonging is a merging of the outside and inside



worlds, the evocation of Rainer Maria Rilke's beautiful notion of *Weltinnenraum* [32]. This is a unique and personal existential space that we occupy in our continuous lived experience. In the recognition of place, particularly that of one's domicile and home, the external world and space become internalized, and they are sensed as intra-personal conditions, rather than external material objects, scenes or percepts. Our domicile is the *Omega* point of Pierre Teilhard de Chardin "from which the world can be seen as a whole and correctly" [33]. Our domicile grants us the experience of complete interiority, which implies the fusion of the world and the self.

The heightened presence and reality of profound artworks derive from the way they engage our perceptual and psychological mechanisms and articulate the boundary between the viewer's experience of self and the world. Such an experience also reveals and re-activates our deep biological and forgotten existential memories. The experience of domicile gives both space and place their historical and temporal dimensions. Works of art have two simultaneous existences: their existence as material objects or performance (in music, theatre and dance) on the one hand, and as imaginative worlds of imagery, emotion and ideal on the other. The experiential reality of art is always an imaginative reality, a fusion of perception, memory and imagination, and it is essentially a recreation by the viewer/listener/reader/occupant. This is the message of John Dewey's seminal book *Art as Experience* of 1934: "In common conception, the work of art is often identified with the building, book, painting, or statue in its existence apart from human experience. Since the actual work of art is what the product does with and in experience, the result is not favorable to understanding [...] When artistic objects are separated from both conditions of origin and operation in experience, a wall is built around them that renders almost opaque their general significance, with which esthetic theory deals" [34].

Lived reality always fuses observation, memory and fantasy, as well as the cerebral and the embodied, into fused existential experiences. As the consequence of this categorical "impurity" of experience, it is beyond precise objective and scientific description, and approachable only through its live encounter and the resulting poetic evocation. This is the innate structural vagueness of human consciousness. Gaston Bachelard was an authoritative philosopher of science until his mid-career, when he came to the dramatic conclusion that only a poetic approach, not scientific inquiry and methodology, can touch upon the essence of lived human reality. Science deals with conceptualizations and fragmentations of reality, whereas the artist touches upon and conveys the lived reality that reflects true human meanings and values.

Instead of confining us in an alienating, constructed or fabricated artificiality, moving works of architecture connect us with the complexities and mysteries of perception and the real world. In meaningful architectural works, the imaginary world is rooted in the tectonic reality, materiality and processes of construction. Authoritative architecture also articulates and expresses its processes of construction and use at the same time that it expresses how it feels to be human in this world. In Merleau-Ponty's view, "Cézanne's paintings make us feel how the world touches us" [35]. Profound architecture similarly makes us feel the way in which the world touches us or how we are contained in it or are part of its flesh. True architecture articulates the functional, behavioural and technical realities of building and its use, but it also

maintains its autonomy as an artistic and confessional statement. In today's utilitarian and quasi-rational world, this autonomy of architecture is severely threatened. The narrative and logic of construction, as well as its utility, distinguishes architecture from other art forms, such as sculpture and installation art, which also utilize space, as all art forms, including music, do. Without the tension between its simultaneous material reality and its imaginary mental suggestion, its utility and autonomy, reason and emotionality, a piece of architecture remains a crude piece of practical construction and utility. Instead of being the product of a scientific process of thinking, real architecture is always a confession. And a meaningful embodiment of architecture fuses our biological and cultural essences.

What is most human is not rationalism, but the uncontrolled and uncontrollable continuous surge of creative radical imagination in and through the flux of representation, affects and desires.

Cornelius Castoriadis [36]

## References

1. Stephen, J. (2012). *Pyne, fire* (p. 47). London: Reaktion Books.
2. Vitruvius (1960) Capter I: The origin of the dwelling house. In *The ten books on architecture* (M. H. Morgan, Trans.) (p. 38). New York: Dover Publications.
3. Bachelard, G. (1988). *The psychoanalysis of fire* (Boston: Beacon Press, 1964), and; *the flame of a candle*. Dallas, Texas: The Dallas Institute Publications.
4. Ong, W. J. (1991). *Orality & literacy—The technologizing of the word* (p. 121). London and New York: Routledge.
5. Ibid., 122.
6. Ibid., 12.
7. Zeki, S., & Vision, Inner. (1999). *An exploration of art and the brain* (p. 1). New York: Oxford University Press.
8. Ibid., 2.
9. Brodsky, J. (1997). An immodest proposal. In *On grief and reason* (p. 208). New York: Farrar, Straus and Giroux.
10. Appleton, J. (1975). *The experience of landscape*. London: John Wiley.
11. Hildebrand, G. (1991). *The wright space: Pattern & meaning in frank lloyd wright's houses*. Seattle: University of Washington Press.
12. Hildebrand, G. (1999). *Origins of architectural pleasure* (p. 5). Berkeley, Los Angeles, London: University of California Press.
13. Wilson, E. O. (1984). *Biophilia: The human bond with other species* (p. 20). Cambridge, MA: Harvard University Press.
14. Merleau-Ponty, M. (1969). The intertwining—The chiasm. In C. Lefort (Ed.), *The visible and the invisible*. Evanston, IL: Northwestern University Press. "My body is made of the same flesh as the world [...], and moreover [...] this flesh of my body is shared by the world" (248), and: "The flesh [of the world or my own] is [...] a texture that returns to itself and conforms to itself" (146).
15. Semir Zeki, quoting Henri, M., op.cit., 4.
16. Soesmann, A. (1998). *Our twelve senses: Wellsprings of the soul*. Stroud, Gloucestershire, Worcester, UK: Hawthorn Press.
17. Howes, D. (ed.). (2011). *The sixth sense reader* (pp. 23–24). New York: Berg.

18. Griffero, T. (2017). *Quasi-things: The paradigm of atmospheres*. Albany: State University of New York.
19. “Our Second Brain” is the title of a French television document on the human intestinal bacterial universe and its biological functions. The film was shown in Finnish television in the summer of 2017.
20. Merleau-Ponty, M. (1993). The introduction, In D. M. Levin (Ed.) *Modernity and the hegemony of vision* (p. 14). Berkeley, Los Angeles, London: University of California Press.
21. Dawkins, R. (1982). *The extended phenotype*. New York: Oxford University Press.
22. For the marvels of animal architecture, see Juhani Pallasmaa, *Animal Architecture* (Helsinki, Museum of Finnish Architecture, 1995). A few years ago I was invited to lecture in a conference in Venice of biologists, mathematicians and computer scientists on “What Can We Learn from Swarming Insects” organized by the Institute of Living Technology. Such an event suggests a growing interest in animal building behaviour and the human application of these frequently nearly unbelievable skills brought about by millions of years of evolution.
23. Buckminster Fuller, R., McHale, J. (1963). *The world resources inventory*. The series of publications published by Southern Illinois University, Carbondale, were initiated by Fuller in 1963 at the Conference of the International Union of Architects in London.
24. Hall, E. T. (1966, 1982). *The hidden dimension*. New York, London, Toronto, Sydney, Auckland: Anchor Books.
25. Op.cit., 33.
26. Robert Pogue Harrison. (2008). *Gardens: An essay on the human condition* (p. 130). Chicago: The University of Chicago Press.
27. Merleau-Ponty, M. (1962). *The phenomenology of perception* (p. 409). London: Routledge and Kegan Paul.
28. Noë, A. (2009). *Out of our heads: Why you are not your brains, and other lessons from the biology of consciousness*. Hill and Wang: New York, London, Toronto.
29. Juhani, P. (2012). On atmospheres: Peripheral perception and existential experiences. In *Encounters 2: Juhani Pallasmaa—Architectural Essays* (pp. 238–251). Helsinki: Rakennusteollisuus Publishing.
30. As quoted in Sarah Robinson, Dewey, J. (2015). The dialogue between architecture and neuroscience (p. 3). In *ARQ architectural research quarterly*. Cambridge: University Press.
31. Maurice Merleau-Ponty as quoted in McGilchrist, I. (2010). *The master and his emissary: The divided brain and the making of the western world* (p. 409). New Haven and London: Yale University Press.
32. Rainer Maria Rilke as quoted in Lukijalle [to the reader], *Rainer Maria Rilke, Hiljainen Taiteen Sisin: Kirjeitä vuosilta 1900–1926* [the silent innermost core of art: letters 1900–1926], Liisa Ehnwald, ed. (Helsinki: TAI-teos, 1997), 8.
33. Pierre Teilhard de Chardin. (2008). *The phenomenon of man*. London: Harper & Row.
34. Dewey, J. (1934). *Art as experience* (p. 4). New York: Putnam’s.
35. Merleau-Ponty, M. (1964). Cézanne’s doubt. In *Sense and non-sense* (p. 19). Evanston, Ill.: Northwestern University Press.
36. Cornelius Castoriadis as in Modell, A. H. (2006). *Imagination and the meaningful brain*. Cambridge, MA and London, England: The MIT Press.