Notes & Commentary

Body & Society

2017, Vol. 23(1) 96–111

DOI: 10.1177/1357034X16681443
journals.sagepub.com/home/bod
SAGE

Embodied and Existential Wisdom in Architecture: The Thinking Hand

Juhani Pallasmaa
Helsinki

Abstract
In our culture, intelligence, emotions and embodied intuitions continue to be seen as separate categories. The body is regarded as a medium of identity as well as social and sexual appeal, but neglected as the ground of embodied existence and silent knowledge, or the full understanding of the human condition. Prevailing educational and pedagogic practices also still separate the mental and intellectual capacities from emotions and the senses, and the multifarious dimensions of human embodiment.

Keywords
embodied consciousness, empathy, existential wisdom, lived reality, sensory thinking, thinking hand

> A hand is not simply part of the body, but the expression and continuation of a thought which must be captured and conveyed. (Honoré Balzac, *Le Chef d'oeuvre inconnu*, in Merleau-Ponty, 1964: 18)
>
> The hand is the window on to the mind. (Immanuel Kant, in Sennett, 2008: 149)

The knowledge and skills of traditional societies reside in the sensory and muscular memory, directly embedded and encoded in the situations of life.[1] Learning a skill is not primarily founded on verbal teaching but on the transference of the skill from the body and muscles of the teacher to the bodily systems of the apprentice through

Corresponding author: Juhani Pallasmaa. Email: jpallasmaa@gmail.com
Extra material: http://theoryculturesociety.org

perception and bodily mimesis. Also architectural ideas arise 'biologically' from unconceptualized and lived existential intuitions rather than intellectual analyses and theories. All our sensory systems 'think' in the sense of structuring our relationships with the world. Even in the case of learning skills, the complex sequence of movements and spatio-temporal relationships is unconsciously internalized and embodied rather than intellectually understood and remembered.

All art forms are specific modes of non-verbal thinking, and profound artists are engaged in the philosophical issues of the human condition. Creative work calls for a double perspective; one needs to focus simultaneously on the world and oneself, and education has to cultivate and support the human abilities of imagination and empathy.

The Dilemma of Embodied Existence

Western consumer culture continues to project a dualistic attitude towards the human body. On the one hand, we have an obsessively aestheticized and eroticized cult of the body, but, on the other, intelligence and creative capacity are equally celebrated, but as totally separate qualities. In either case, the body and the mind are understood as unrelated or even conflicting and exclusive entities that do not constitute an integrated unity. This separation is reflected in the strict division of human activities and work into physical and intellectual categories.The body is regarded as the medium of identity and self-presentation, as well as an instrument of social and sexual appeal, but its significance is seen merely in its physical and physiological essence, while totally undervalued and neglected as the very ground of embodied existence and knowledge, and the full understanding of the human condition.

Psychologist Howard Gardner has promoted the idea of multiple intelligences, and he suggests that there are seven categories of human intelligence: *linguistic*, *logical-mathematical*, *musical*, *bodily-kinesthetic*, *spatial*, *interpersonal* and *intrapersonal intelligence.* Later he has considered three further categories: *naturalistic*, *spiritual* and *existential intelligence*, and he even discusses the possibility of the category of *moral intelligence* (Gardner, 1999: 41–3, 47, 66). Besides, other writers have strongly supported the existence of an

emotional intelligence. In my writings, I have suggested the categories of *aesthetic* and *atmospheric* intelligence; both are capable of immediately grasping the meaning of complex and multi-sensory environmental entities. So, intelligence itself is not as simple and uniform a concept as we tend to think.

The categoric separation of body and mind, of course, has its solid foundation in the history of western philosophy. Prevailing educational pedagogies and practices regrettably continue to separate mental, intellectual and emotional capacities from the senses and the multifarious dimensions of human embodiment. Educational practices usually provide some degree of physical training for the body, but they do not acknowledge our fundamentally embodied and holistic essence. The body is addressed in sports and dance, for instance, and the senses are directly acknowledged in connection with art and music education, but our embodied existence is rarely identified as the very basis of our interaction and integration with the world, or of our consciousness and self-understanding. Training of the hand is provided in courses that teach elementary skills in the handicrafts and arts, but the integral role of the hand in the evolution and different manifestations of human intelligence and processes of thought, is not acknowledged.

The Lesson of Causalities

There is plenty of evidence to argue that today's prevailing educational principles fail to grasp the indeterminate, dynamic and sensually integrated essence of human existence, thought and action. It is, in fact, reasonable to assume that prior to our current industrial, mechanized, digitalized and materialist consumer and information culture, situations in daily life, as well as processes of maturation and education, provided a more comprehensive experiential ground for human growth and learning, due to the direct interaction with the natural world and its complex causalities. In earlier modes of life, the intimate contact with work, production, materials, climate and the ever varying phenomena of nature provided ample sensory interaction with the world of physical causalities and developed an unspoken existential understanding of how we occupy the 'flesh of the world' to use Maurice Merleau-Ponty's thought-provoking notion (Merleau-Ponty, 1992). I would also suggest that closer family and

social ties, as well as the presence of domestic animals, provided more experiences for the development of a sense of empathy and compassion than today's technological, individualized and molecular life world.

I believe that even one's sense of beauty and ethical judgement are firmly grounded in the early experiences of the integrated nature of the human life world. Beauty is not a detached aesthetic quality as it is currently understood; the experience of beauty arises from grasping the unquestionable causalities and interdependences of the life world. On the other hand, aesthetic judgement has a fundamental value in human life; 'On the whole, every new aesthetic reality makes man's ethical reality more precise. Aesthetics is the Mother of ethics', Joseph Brodsky (1997: 49), the poet argues.

Manipulated Identities

In our age of massive industrial production, surreal consumption, euphoric communication and fictitious digital environments, we continue to live in our bodies in the same way that we inhabit our houses, because we have sadly forgotten that we do not live in our bodies but we *are* ourselves fundamentally embodied constitutions. Embodiment is not a secondary experience; the human existence is basically an embodied condition. Today, our senses and bodies are objects of ceaseless commercial manipulation and exploitation. Physical beauty, strength, youth and virility are particularly adored in the realms of social values, advertising and entertainment. In case we fail to possess ideal physical qualities, our bodies are turned against us as causes of deep disappointment and guilt. With ever accelerating frequency, all our senses are exploited by consumer manipulation, yet at the same time these very same senses continue to be undervalued as prerequisites of our existential condition or as educational objectives. Intellectually and philosophically, we may well have rejected the Cartesian duality of body and mind, but the separation continues to rule in cultural, educational and social practices.

It is tragic, indeed, that at the time in which our technologies offer a multi-dimensional and simultaneous perception of the world and ourselves, we should throw our consciousness and capacities back to the Euclidian world. I do not wish to dwell on nostalgic images of an

Arcadian past, or to represent a conservative view of cultural development. I just want to remind myself, as well as my readers, of the very evident blind spots in our established understanding of our own historicity as biological and cultural beings. We have never fully understood our biological and historical essence and origins. The pioneer in biophilic science and ethics, Edward O. Wilson, biologist, makes the somewhat shocking statement: 'All man's problems may arise ... from the fact, that we do not know what we are, and we are unable to agree on what we want to become' (Wilson, 1984: 20).

Embodied Consciousness

Human consciousness is an embodied consciousness; our world is structured around a sensory and corporeal centre. 'I am my body', Gabriel Marcel (in Dreyfus and Dreyfus, 1964: xii) claims; 'I am what is around me', Wallace Stevens (1990: 86) argues; 'I am the space, where I am', Noel Arnaud (in Bachelard, 1964: 157) establishes; and finally, 'I am my world', Ludwig Wittgenstein (1972: 68, prop. 5.63) concludes.

We are connected with the world through our senses. However, the senses are not merely passive receptors of stimuli, and the body is not only a point of viewing the world from a central perspective. Neither is the head the sole locus of cognitive thinking, as our senses and entire bodily being directly structure, produce and store silent existential knowledge. Recent discoveries of the immense bacterial microcosm in the human body, and its crucial role in our metabolic functions, as well as mental and emotive states is revolutionizing our self-understanding to the degree that some researchers call our inner bacterial biosystem our 'second brain', though in terms of evolutionary history, it could even be called our first brain (*Toiset aivot*, 2015). The human body is a knowing entity. Our entire being in the world is a sensuous and embodied mode of being, and this very sense of being is the ground of existential knowledge. '[U]nderstanding is not a quality coming to human reality from the outside; it is its characteristic way of existing', as Jean-Paul Sartre (1993: 9) claims.

Existentially essential knowledge is not primarily a knowledge moulded into words, concepts and theories. In normal human interaction alone, 80 percent of communication is estimated to take place outside the verbal and conceptual channel. Communication takes

place even on chemical level; the endocrine glands have been thought of as a closed system sealed in the body and only indirectly linked to the outside world. However, the experiments of A.S. Parker and H.M. Bruce show that chemical regulators, such as odoriferous substances, work directly on the body chemistry of other organisms conditioning behaviour.[2] Social insects, such as termites, are assumed to possess communication capacities, based primarily on chemical processes, that are a million times more precise and efficient than our own natural capacities (Marais, 1939).

The knowledge and skills of traditional societies reside directly in the senses and muscles, in the knowing and intelligent hands, and directly embedded and encoded in the settings and situations of life. The curious historical fact that the representation of the human figure was perfected in Greek sculpture roughly a thousand years earlier than painters could perfectly depict the human body is explained by the surprising theory that early sculpture was not primarily a visual art form. Sculpture was communication from the muscles of the model through the muscles of the sculptor directly to the muscular sense of the viewer (Hall, 1966: 84).

In accordance with Sartre's argument, which I quoted previously, we are born into the world which, in itself, is the most important source of knowledge for us. Our normal understanding is that children are born completely ignorant of the world. However, according to today's cognitive psychology, this is a gross misunderstanding.

> We know now that babies know more about the world than we would ever have thought possible. They have ideas about other human beings, about objects and the world – right from the day they are born. And these are fairly complex ideas, not just reflexes or responses to sensation . . . . Newborn babies have an initial theory about the world and the inferential learning capacities to revise, change and rework those initial theories on the evidence they experience from the very beginning of their lives.

So argues Alison Gopnik (2003: 42–5), Professor of Cognitive Psychology at the University of California at Berkeley.

Philosophy in the Flesh

In their thought-provoking book *Philosophy in the Flesh*, George Lakoff and Mark Johnson point out that even ordinary daily acts and

choices call for a philosophical understanding; we must be able to make sense of our own lives in all the countless situations that we constantly face in life. The philosophers argue:

> Living a human life is a philosophical endeavour. Every thought we have, every decision we make, and every act we perform is based upon philosophical assumptions so numerous we couldn't possibly list them all . . . . Though we are only occasionally aware of it, we are all metaphysicians – not in some ivory-tower sense but as part of our everyday capacity to make sense of our experience. It is through our conceptual systems that we are able to make sense of everyday life, and our everyday metaphysics is embodied in those conceptual systems. (Lakoff and Johnson, 1999: 9–10)

Learning a skill is not primarily founded on verbal teaching but rather on the transference of the skill from the body and muscles of the teacher directly to the body and muscles of the apprentice through the act of sensory perception and bodily mimesis. Here I wish to recall the origins of Greek sculpture, mentioned earlier. This capacity of mimetic learning is currently attributed to human mirror neurons (Slacky, 2007: 12). These neurons make us mimic what we sense around us; this is why yawning is socially contagious, for instance. The same principle of embodied knowledge and skill continues to be the core of artistic learning. In my view, the foremost skill of the architect is, likewise, to turn the multi-dimensional essence of the design task into embodied and lived sensations and images; eventually the entire personality and body of the designer becomes the site of the design task, and the task is lived rather than understood. An essential, but barely understood skill of the designer is the capacity of empathy (see Pallasmaa, 2014: 80–5). Alvar Aalto acknowledges the essential connection of architecture and biology: 'I would like to add my personal, emotional views that architecture and its details are in some way all part of biology' (Aalto, 1997 [1948]: 108). The Austrian-American architect Richard Neutra articulated the biological ground of architecture further and made the surprising suggestion: 'Today design may exert a far-reaching influence on the nervous make-up of generations' (Neutra, 1954: 7).

Architectural ideas arise 'biologically' from unconceptualized and lived existential knowledge and intuition, rather than from mere analyses, theories and intellect. If my assumptions, which have

gradually arisen through almost half a century of personal design practice and four decades of teaching around the world, are true, it is obvious that today's intellectualized emphasis of architectural education is misguided.

Architecture and Lived Reality

Architectural problems are, indeed, far too complex and deeply existential to be dealt with in a solely conceptualized and rational manner. Profound ideas or responses in architecture are not individual inventions *ex nihilo* either; they are embedded in the lived reality of the task itself and the age-old traditions of the craft. Milan Kundera writes about 'the wisdom of the novel' and argues that all gifted writers collaborate with this historically accumulated wisdom (Kundera, 1986: 165). There is certainly a similar 'wisdom of architecture' that we need to acknowledge, maintain and collaborate with. The significance of tradition is thought-provokingly pointed out by the Catalan philosopher Eugenio d'Ors in his paradoxical statement: 'Everything that is outside of tradition, is plagiarism.'[3] The role of this fundamental, unconscious, situational and tacit understanding of the body in the making of architecture is grossly undervalued in today's culture of quasi-rationality and arrogant self-consciousness.

Even masterful architects do not invent architectural realities, they rather reveal and articulate what exists and what are the natural potentials of the given conditions, or what the given situation calls for. Álvaro Siza, one of the finest architects in our time in combining a deeply rooted sense of tradition with a unique personal expression, puts it sharply: 'Architects don't invent anything, they transform reality' (in Frampton, 2002: 18).

Jean Renoir, the film director, expresses the same idea of artistic humility in film-making somewhat differently: 'The director is not a creator, but a midwife. His task is to help the actor give birth to a child, that she has not realized having carried inside her', he confesses in his touchingly humane memoirs (Renoir, 1974: 134). Profound artists or thinkers and makers of any kind rarely speak of freedom – another fashionable word in today's architectural studios – in their work; they emphasize limits, restrictions and difficulties. Already Leonardo taught us 'Strength arises from limits and it dies in freedom' (in Stravinsky, 1968: 75).

The Thinking Hand

Architecture is also a product of the knowing and feeling hand. The hand grasps the physicality and materiality of thought and turns it into a concrete image. In the arduous processes of designing, the hand often takes the lead in probing for a vision, or a vague inkling, which it eventually turns into a sketch, materializing thus the idea. The pencil in the architect's hand is a bridge between the imagining mind and the image that appears on the sheet of paper. In the ecstasy of work, the draughtsman forgets both his hand and the pencil, and the image emerges as if it were an automatic projection of the imagining mind. Or, perhaps, it is the hand that really imagines as it exists and operates directly in the flesh of the world, the reality of space, matter and time, the very physical condition of the imagined object, or space.

Martin Heidegger connects the hand directly with the human thinking capacity:

> [T]he hand's essence can never be determined, or explained, by its being an organ which can grasp .... Every motion of the hand in every one of its works carries itself through the element of thinking, every bearing of the hand bears itself in that element. (Heidegger, 1977: 357)

Gaston Bachelard writes about the imagination of the hand: 'Even the hand has its dreams and assumptions. It helps us understand the innermost essence of matter. That is why it also helps us imagine [forms of] matter' (Bachelard, 1982: 107). The capacity to imagine, to liberate oneself of the limits of matter, place and time, must be regarded as the most human and essential of all our qualities. Creative capacity, as well as ethical judgement, calls for imagination. It is evident, however, that the capacity of imagination does not hide in our brains alone as our entire bodily constitution has its fantasies, desires and dreams. Some philosophers, such as Alva Noë, have recently questioned the self-evidently assumed location of human consciousness in the brain. For these thinkers consciousness is a co-product of our brain or neural systems, our embodied being and the world (Noë, 2009).

Sensory Thinking

All our sensory systems 'think' in the sense of structuring our relation with the world, although we are not usually conscious of this perpetual

self-regulated activity. Many of our existentially most crucial skills are internalized as automatic reactions beyond conscious awareness and intentionality. We are hardly aware of the fantastically complex and automated metabolic chemical, bacterial and neurological processes, for instance, without which we could not survive a split second. Even in the case of learning skills, the complex sequence of movements and spatial and temporal relationships in the execution of the task is unconsciously internalized and embodied rather than understood and remembered intellectually. As we learn to ride a bicycle, we forget the theory. In fact, if I begin to think of the theoretical principles that keep my bicycle upright, I'll surely fall.

Knowledge is normally supposed to reside in verbalized concepts, but any grasp of a life situation and a meaningful reaction to it can, and indeed should, be regarded as knowledge. In my view, the sensory and embodied mode of thinking is particularly essential in all artistic phenomena and creative work. The well-known description of Albert Einstein of the role of visual and muscular images in his thinking processes in the fields of mathematics and physics provides an authoritative example of embodied thinking.

> The words or the language, as they are written or spoken, do not seem to play any role in my mechanism of thought. The psychical entities which seem to serve as elements in thought are certain signs and more or less clear images which can be 'voluntarily' reproduced and combined. . . . The above mentioned elements are, in my case, of visual and some of muscular type. Conventional words or other signs have to be sought for laboriously only in a secondary stage, when the mentioned associative play is sufficiently established and can be reproduced at will.

This is what Einstein confesses in his famous letter to Jacques Hadamard, the French mathematician.[4]

It is also evident that an emotional and aesthetic factor, as well as an embodied personal identification, is equally central in scientific creativity as in the making and experiencing of art. Henry Moore, one of the greatest sculptors of the modern era, emphasizes the bodily identification and simultaneous grasp of several points of view in the sculptor's work:

> [The sculptor] must strive continually to think of, and use form in its full spatial completeness. He gets the solid shape, as it were, inside his

> head – he thinks of it, whatever its size, as if he were holding it completely enclosed in the hollow of his hand. He mentally visualizes a complex form from all round itself; he knows while he looks at one side what the other side is like; he identifies himself with its centre of gravity, its mass, its weight; he realizes its volume, and the space that the shape displaces in the air. (Moore, 1966: 62–4)

Thinking through Art

All art forms, such as sculpture, painting, music, cinema and architecture, are specific modes of non-verbal thinking. All profound artistic works are engaged in the philosophical issues of the human condition. They articulate the very boundary line, the skin, between us and the world. They represent ways of sensory and embodied thought characteristic to the particular artistic medium. These modes of thinking are images of the hand and the body, and they exemplify essential existential knowledge. Instead of being mere visual aestheticization, architecture, for instance, is a mode of existential and metaphysical philosophizing about the condition of existence through the means of space, structure, matter, gravity and light. Profound architecture does not merely beautify the settings of our dwelling, it articulates the experiences of our very existence. Meaningful works of art from Frank Lloyd Wright's Fallingwater House to Giorgio Morandi's minute still-lifes are microcosms, miniaturized re-presentations of the world.

Salman Rushdie points out that a distinct softening of the boundary between the world and the self takes place in an artistic experience: 'Literature is made at the boundary between self and the world, and during the creative act this borderline softens, turns penetrable and allows the world to flow into the artist and the artist to flow into the world' (Rushdie, 1996: 8). This softening of the existential boundary, the fusion of the world and the self, object and subject, takes place in every meaningful artistic work and experience.

Creative work calls for a double perspective: one needs to focus simultaneously on the world and on oneself, the external space and one's inner mental space. All artworks articulate the boundary between the self and the world, both in the experience of the artist and that of the viewer/listener/occupant. In this sense, the art form of architecture not only provides a shelter for the body, it also redefines the contour of our consciousness and is a true externalization of the

mind. Architecture, as well as the entire world constructed by man, with its cities, houses, tools and objects, has its mental ground and counterpart. As we construct our self-made world, we construct projections and metaphors of our own mindscapes. We dwell in the landscape and the landscape dwells in us. A landscape wounded by acts of man, the fragmentation of the cityscape, as well as insensible buildings, are all external and materialized evidence of an alienation and shattering of the human inner space, *Weltinnenraum*, to use a beautiful notion of Rainer Maria Rilke (Enwald, 1997: 8).

Existential Knowledge

Even in the technological culture of today, the most important existential knowledge in our everyday life does not reside in detached theories and explanations, but is a silent knowledge, beyond the threshold of consciousness, fused with daily environments and behavioural situations. The poet, too, speaks of encounters at the 'threshold of being', as Gaston Bachelard points out (1982: xii). Art guides us to this 'threshold', and surveys and restructures the biological and unconscious realms of the body and mind. In so doing, it maintains vital connections with our biological and cultural past, the soil of genetic and mythical knowledge. Consequently, the essential time dimension of art points to the past rather than the future; significant art and architecture maintain roots and traditions instead of uprooting and inventing. However, today's obsession with uniqueness and novelty has misguided our judgement of artistic phenomena. Radical works of art and building surely appear as ruptures or discontinuities of convention but, at the same time on a deeper level, all profound artworks reinforce the perception and understanding of human biocultural historicity and continuity. Artistic revolutions always imply a reconnection with the invisible undercurrents of the universe of our mind. All great works of art are ancient and novel, at the same time.

The Task of Education

The duty of education is to cultivate and support the human abilities of imagination and empathy, but the prevailing values of culture today tend to discourage fantasy, suppress the senses, and petrify the boundary between the world and the self. Consequently, education in any creative field in our time has to begin with the questioning of the absoluteness of

the lived world and with the re-sensitization of the boundaries of self. The main objective of artistic education may not directly reside in the principles of artistic making, but rather in the emancipation and opening-up of the personality of the student and his/her self-awareness and self-image in relation to the immensely rich traditions of art, and the lived world at large.

The prevailing educational philosophies regrettably continue to emphasize and value conceptual, intellectual and verbal knowledge over the tacit and non-conceptual wisdom of our embodied processes. I am here thinking of the general educational philosophy rather than architectural education. This attitude continues regardless of the overwhelming evidence of this catastrophic bias provided by philosophical argumentation as well as recent developments and discoveries in neurology and cognitive science. The objective of writing my two books *The Thinking Hand* (2009) and *The Embodied Image* (2011) was to shake the foundations of this hegemonic but erroneous and harmful paradigm in the realm of architecture.

It is evident that an educational change concerning the significance of the sensory and mental realm is urgently needed in order to enable us to re-discover ourselves as complete physical and mental beings, to fully utilize our capacities, and to make us less vulnerable to hidden manipulations and exploitations in our consumer culture. In the words of the philosopher Michel Serres, 'If a revolt is to come, it will have to come from the five senses' (1995: 71). The intelligence, thinking and skills of the hand also need to be rediscovered before we become 'handless' against our biological definition as primates. Even more importantly, the unbiased and full understanding of human embodied existence is the prerequisite for a dignified life.

> If the body had been easier to understand, nobody would have thought that we had a mind. (Rorty, 1979: 239)

Notes

1. This essay is loosely based on the themes of the introductory chapter in Juhani Pallasmaa, *The Thinking Hand: Embodied and Existential Wisdom in Architecture* (2009).
2. For the biochemistry of crowding see Hall (1966: 32–40).

3. Igor Stravinsky quotes the d'Ors statement in *Musiikin poetiikka* (1968: 59) without crediting the Catalan philosopher. Also Luis Buñuel quotes the sentence in *Viimeinen henkäykseni* (1983: 86–7), providing, however, the appropriate source.
4. Einstein's letter is published as Appendix II in Jacques Hadamard (1949: 142–3).

References

Aalto A (1997 [1948]) The trout and the stream. In: Schildt G (ed.) *Alvar Aalto in His Own Words*. Helsinki: Otava.

Bachelard G (1964) *The Poetics of Space*. Boston, MA: Beacon Press.

Bachelard G (1982) *Water and Dreams: An Essay on the Imagination of Matter*. Dallas, TX: The Pegasus Foundation.

Brodsky J (1997) Uncommon visage. In: *On Grief and Reason*. New York: Farrar, Straus and Giroux.

Buñuel L (1983) *Viimeinen henkäykseni* [*Mon dernier soupir*]. Helsinki: Otava.

Dreyfus HL and Dreyfus PA (1964) Translator's introduction. In: Merleau-Ponty M, *Sense and Non-sense*. Evanston, IL: Northwestern University Press.

Enwald L (1997) Lukijalle [To the reader]. In: Enwald L (ed.) *Rainer Maria Rilke, Hiljainen taiteen sisin: kirjeitä vuosilta 1900–1926* [*Rainer Maria Rilke, The Silent Innermost Core of Art: Letters 1900–1926*]. Helsinki: TAI-teos.

Frampton K (2002) Introduction. In: Frampton K, *Labour, Work and Architecture: Collected Essays on Architecture and Design*. London: Phaidon.

Gardner H (1999) *Intelligence Reframed: Multiple Intelligences for the Twenty-first Century*. New York: Basic Books.

Gopnik A (2003) The scientist in the crib interviewed: What every baby knows. *New Scientist* 178(2395, 17 May): 42–5.

Hadamard J (1949) *The Psychology of Invention in the Mathematical Field*. Princeton, NJ: Princeton University Press.

Hall ET (1966) *The Hidden Dimension*. New York: Anchor Books Doubleday.

Heidegger M (1977) What calls for thinking? In: *Basic Writings*. New York: Harper and Row.

Kundera M (1986) *Romaanin taide* [*The Art of the Novel*]. Helsinki: Werner Söderström Oy.
Lakoff G and Johnson M (1999) *Philosophy in the Flesh: The Embodied Mind and Its Challenge to Western Thought*. New York: Basic Books.
Marais E (1939) *The Soul of the White Ant*. London: Methuen.
Merleau-Ponty M (1964) Cézanne's doubt. In: *Sense and Non-sense*. Evanston, IL: Northwestern University Press.
Merleau-Ponty M (1992) The intertwining: The chiasm. In: Lefort C (ed.) *The Visible and the Invisible*. Evanston, IL: Northwestern University Press.
Moore M (1966) The sculptor speaks. In: James P (ed.) *Henry Moore on Sculpture*. London: MacDonald.
Neutra R (1954) *Survival through Design*. Oxford: Oxford University Press.
Noë A (2009) *Out of Our Heads: Why You Are Not Your Brain and Other Lessons from the Biology of Consciousness*. New York: Hill and Wang.
Pallasmaa J (2009) *The Thinking Hand: Embodied and Existential Wisdom in Architecture*. London: John Wiley and Sons.
Pallasmaa J (2011) *The Embodied Image: Imagination and Imagery in Architecture*. London: John Wiley and Sons.
Pallasmaa J (2014) Empathic imagination: Formal and experiential projection. *AD Architectural Design Journal* 84(5): 80–85.
Renoir J (1974) *Elämäni ja elokuvani* [*My Life and My Films*]. Helsinki: Love-Kirjat.
Rorty R (1979) *Philosophy and the Mirror of Nature*. Princeton, NJ: Princeton University Press.
Rushdie S (1996) Eikö mikään ole pyhää? [Isn't anything sacred?]. *Parnasso* 1.
Sartre J-P (1993) *The Emotions: An Outline of a Theory*. New York: Carol Publishing.
Sennett R (2008) *The Craftsman*. New Haven, CT: Yale University Press.
Serres M (1995) *Angels: A Modern Myth*. New York: Flammarion.
Slacky G (2007) Source of human empathy found in brain. *New Scientist* 196(2692, 10 November).
Stevens W (1990) Theory. In: *The Collected Poems*. New York: Vintage Books.

Stravinsky I (1968) *Musiikin poetiikka* [*Poétique musicale*]. Helsinki: Otava.

Toiset aivot [*The Second Brain*] (2015) Arte France, Finnish Television, June.

Wilson EO (1984) *Biophilia: The Human Bond with Other Species*. Cambridge, MA: Harvard University Press.

Wittgenstein L (1972) *Tractatus Logico Philosophicus eli Loogis-filosofinen tutkielma*, trans. Nyman H. Helsinki: Werner Söderström, Porvoo.

Juhani Pallasmaa, architect, professor emeritus, Helsinki. Practised design first in collaboration with other architects, and since 1983 through his office in Helsinki. He has held positions such as Rector of the Institute of Industrial Design Helsinki, Director of the Museum of Finnish Architecture, and Professor and Dean of the School of Architecture, Helsinki University of Technology, and several visiting professorships in the USA, and taught and lectured extensively in numerous universities in Europe, North and South America, Africa, Asia and Australia. Member of the Pritzker Architecture Prize Jury 2008–14.