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Embodied Cognitive Science, Aesthetics, and the Study of Visual Language¹

Abstract

The paradigm of embodied cognition provides a perspective for rethinking the nature of experience, intersubjectivity, and the interaction of the human animal with its physical and sociocultural environments. Embodied cognitive science can be a productive framework for the study of aesthetic experience and visual communication, enabling us to transcend the cognitivist paradigm of the twentieth century, understood here as the view that cognition is the rule-based manipulation of symbolic representations in a disembodied and decontextualized mind. Summaries of key concepts of embodied cognition are provided, with suggestions for their use in the exploration of aesthetics and visual language.

Keywords

Cognition, Embodiment, Aesthetic Experience, Visual Language

The embodied perspective

Embodied cognition arises from the interaction of a living being with its environment. This view provides a fresh perspective for the study of the experiences of human and nonhuman agents. The defining work is a book, *The Embodied Mind*, by biologist Francisco Varela, philosopher Evan Thomp-

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son, and psychologist Eleanor Rosch, first published in 1991 (Varela *et al.* 1993). Another influential text is *Philosophy in the Flesh*, by linguist George Lakoff and philosopher Mark Johnson (1999). A large body of literature has been produced that discusses, refines, and at times confuses the field of embodied cognitive science. As in any emerging paradigm, there are internal contradictions that have yet to be worked out.² Today there is a loose consensus regarding core concepts.

Antecedents may be found in the work of psychologist William James (1910); in the writings of phenomenologists Edmund Husserl (2001) and Maurice Merleau-Ponty (1962), from the first half of the 20th century; in the publications of biologists Jakob von Uexküll (1957, 1982), from the same period, and Humberto Maturana (1980), a generation later. Varela, mentioned above, was a student of Maturana and co-authored publications with him (Maturana, Varela 1980, 1998). James Gibson's ecological psychology (1986), developed during the second half of the 20th century, may be seen as a precursor to the embodied perspective.³ In the field of aesthetic theory and visual communication, John Dewey (2005) and Rudolf Arnheim (1969) emphasized the importance of sensory experience and visual thinking in cognition; both concepts anticipate the embodied perspective (Johnson 2007, 228). A common thread in this body of work is a rejection of the cognitivist-computationalist paradigm, dominant in the second half of the twentieth century, with its model of the disembodied, rule-based manipulation of internal representations of an external world. Embodied cognitive science constitutes a paradigm shift, challenging established theories in a range of disciplines (Chemero 2011, 47–66; Johnson 2007, 112–118).

In the remainder of this section, key concepts of the embodied perspective are introduced, with suggestions as to how they may advance our understanding of aesthetics and visual language.

Cognition refers here to a bodily agent generating meaning through its interaction with the environment. Making sense of the environment through bodily experience is something living organisms do. It is our evolutionary heritage. Cognition, operating on conscious and nonconscious levels,

² See: Chemero 2011; Colombetti 2017; Di Paolo 2009; Gallagher 2015; Shapiro 2011; Sheets-Johnstone 2015.

³ Varela, Thompson, and Rosch (1993, 202–205) point out the differences between their view of embodied cognition and Gibson's ecological approach. Chemero (2011) reconciles Gibsonian ecological psychology with the concept of enactivism developed by Varela *et al.*

emerges from networks that evolved for perceptually-oriented action and action-oriented perception, providing solutions to challenges presented by the environment. Cognitive sense-making is embodied and embedded in the world. This view of mind provides a biological structure for understanding human experience, including the use of imaginative processes, in which meaning is linked to sensorimotor experience, as well as the conceptual tools we use in visual, verbal, musical, and mathematical perception, action, and thought.⁴

Perception is often thought of as the reception of stimuli by way of sight, hearing, touch, smell, and taste. There is more. A significant aspect of our experience is interoception, the nonconscious and conscious experience of the interior of the body, fundamental for the maintenance of homeostasis, a state of equilibrium with the environment (Craig 2003). Another aspect of our sense of being in the world is proprioception, the awareness of bodily position and movement through tactile sensation, the feel of gravity, and kinaesthesia, the sense of movement.⁵

For Lakoff and Johnson, mental images and tropes like metaphor and metonymy are central to the emergence of conceptual categories. These processes are grounded in the bodily experience of the world.⁶ While much of the published work in conceptual metaphor theory focuses on language, the conceptual structure they provide may be put to use in the study of visual language, ranging from the iconic expression of thought, through idea-based semasiography, to glottography linked to verbal language (Sampson 2015). Since these classes of visual communication may express thought in different ways, and most systems combine elements from two or three classes, a unified approach can avoid the fragmentation of a visual 'text' into 'iconography' and 'writing', providing solutions to current discussions among experts in ancient systems of visual language (Wright-Carr 2017).

The concept of *embodiment* rejects mind-body dualism, heir to ancient and medieval notions of 'soul' and 'body.'⁷ Living organisms, from cells to hu-

⁴ See: Johnson 2007, 113; Lakoff, Johnson 1999, 77–78; O'Regan 2011, 127–136; Varela *et al.* 1993, 99–100.

⁵ See: Damasio 2000, 52–53; Sheets-Johnstone 2004; M. Sheets-Johnstone 2011.

⁶ See: Johnson 1990; Lakoff 1990; Lakoff, Johnson 1981, 1999. In Johnson's later work (2007, 23–38), he focuses more on visual expressions of thought.

⁷ Ryle (1951, 23, 26–27, 62, 65, 159, 282, 287) relates the concept of 'soul' to that of 'mind', referring to the Cartesian separation of mind and body as "the dogma of the Ghost in the Machine" (Ryle 1951, 22, *passim*). For a critique of mind-body dualism and the separation of rationality from emotion, see: Damasio 2005. Lakoff and John-

mans, are seen as autopoietic systems, capable of sustaining and reproducing themselves, interacting with a larger and more complex environment (Maturana, Varela 1980). The nature of an organism's cognition is enabled and constrained by its bodily constitution, the result of its evolutionary heritage.⁸ In the case of humans, the environment includes a complex sociocultural dimension, the patterns of symbolic meaning that we collectively weave (Johnson 2007, 135–154; Varela *et al.* 1993, 178–179). Lakoff and Johnson (1999, 17) explain:

The evidence from cognitive science shows that classical faculty psychology is wrong. There is no fully autonomous faculty of reason separate from and independent of bodily capacities such as perception and movement. The evidence supports, instead, an evolutionary view, in which reason uses and grows out of such bodily capacities. The result is a radically different view of what reason is and therefore of what a human being is.

This way of thinking about the emergence of meaning differs from traditional semiotics, particularly the influential ideas of Charles Sanders Peirce which, as Maxine Sheets-Johnstone (2004, 106) has pointed out, emphasize categories of reference or representation “according to law-like, ordered semiotic relationships” in a system that “in large measure passes over an experiencing subject.” An embodied approach to visual communication in human and nonhuman animals offers a fresh perspective for comprehending the making of meaning.

To understand visual signs we must understand vision, not only the signs. Visual perception is an illusion (Noë 2002). Like other aspects of experience, it is determined and constrained by our biology. The visual system works together with the motor system. Like cognition, vision is embodied (O'Regan, Noë 2001). Enactivism postulates the unity of action and perception (Noë 2006). A deeper understanding of the implications of vision science for the study of aesthetics and visual language should be actively pursued.⁹

son (1999, 423, 563, 564) explain that “Christianity's split of the self into soul and body is carried directly over into the Kantian picture as a split between our rational and bodily natures,” stating that “Whether you call it mind or Soul, anything that both thinks and is free-floating is a myth. It cannot exist.”

⁸ See: Johnson 2007, 113–134; Maturana, Varela 1998, 75–80; Varela *et al.* 1993, 151–152.

⁹ See: Gallese 2005, 2015, 2016; Hodgson 2000, 2006.

Enaction is a key concept in embodiment theory. Varela, Thompson, and Rosch originally used this term to refer to “the capacity of a complex system to enact a world” through the interaction, or “structural coupling,” of an agent with its environment. Enactive cognition is an emergent phenomenon, a bringing forth of meaning through the combined experience of action and perception (Varela *et al.* 1993, 151; Noë 2006).

A biological view of cognition, perception, and action opens new horizons for the study of culture, including shared systems of signs. Tim Ingold (2011a; 2011b) explores the possibilities of a biology-based anthropology, reconciling the ecological and sociocultural contexts of human agents as living organisms and as members of society. He criticizes the dichotomy of drawing and writing, and the way in which the former is undervalued and the latter is overvalued. He disagrees with the view of drawing and writing as the projection of ideas onto a surface, seeing these actions as processes of making:

[...] in practice, making is less a matter of projection than one of gathering, more analogous, perhaps, to sewing or weaving than to shooting arrows at a target. As they make things, practitioners bind their own pathways or lines of becoming into the texture of the world. It is a question not of imposing form on matter [...], but of intervening in the fields of force and flows of material wherein the forms of things arise and are sustained. Thus the creativity of making lies in the practice itself, in an improvisatory movement that works things out as it goes along. Against the background of this latter view of making, the practices of drawing and writing take on a quite different significance (Ingold 2011a, 178).

The division of visual communication into categories, such as ‘art’ and ‘writing,’ reflects the dominance of the written text in the Modern era. The study of visual language in non-Western cultures often suffers from the conceptual limitations of this dichotomy. Visual signs that resemble our alphabetic script are classified as ‘writing,’ while signs that don’t fit easily into this culturally-defined category are labelled ‘art,’ ‘iconography,’ or ‘semasiography.’ These categories limit our comprehension of visual language by separating into distinct classes what was originally seen as—and continues to function as—a unified system of communication (Wright 2017).

Embedded cognition means that an agent’s mind is situated in its environment. Cognition depends on the environment and on the cognizing agent’s relationship to it, including perceived values or threats. An organism is at-

tuned to its world in terms of the practical affordances offered by the environment. The agent's activity determines the boundaries of its environment and its attentionally selected contents (Ward, Stapleton 2012).

The concept of affordances was developed by Gibson. These are opportunities that have the potential to aid an agent in the realization of its goals. Affordances are determined by the bodily constitution and the present state of an organism. Animals make sense of their environment in terms of the potential it offers for meaningful interaction, including feeding, finding refuge or comfort, and mating (Gibson 1986).

Neuroscientific research in monkeys and humans shows how visual perception is cognitively bound to motor simulation: objects that afford being grasped are mapped onto the corresponding region of the cortical motor system. Gallese (2015, 130) explains: "The functionality of the motor system literally carves out a pragmatic *Umwelt*, dynamically surrounding our body. The profile of peripersonal space is not arbitrary: it maps and delimits a perceptual space expressing—and being constituted by—the motor potentialities of the body parts it surrounds."¹⁰

The embedded nature of our cognitive processes, and the ways in which objects are experienced in relation to our bodies, highlights the expressive potential of format and scale in visual language. The representation of a deity can be sculpted from a large block of stone and placed in a monumental context, or it can be presented at an intimate scale, carved into a bit of stone that fits in one hand, or painted on the surface of a portable manuscript. An orthodox semiotic or iconographic interpretation of each of these objects would yield identical results, if their relation to the body is not considered. The creators of these objects had at least an intuitive sense of the significance of the potential interplay between their creations and the observers' bodies.

The notion of *Extended cognition* invites us to reconsider the boundaries between mind, brain, body, and environment. What is the locus of the mind? The brain? The brain plus the rest of the body? The brain, the rest of the body, and artificial extensions of the body? The brain, the rest of the body, its extensions, and the environmental context? Merleau-Ponty (1962, 143) offers an example of cognitive extension:

¹⁰ On the concept of *umwelt*, the bodily-constrained worldview of an organism, see: von Uexküll 1957.

The blind man's stick has ceased to be an object for him, and is no longer perceived for itself; its point has become an area of sensitivity, extending the scope and active radius of touch, and providing a parallel to sight. In the exploration of things, the length of the stick does not enter expressly as a middle term: the blind man is rather aware of it through the position of objects than of the position of objects through it. The position of things is immediately given through the extent of the reach which carries him to it, which comprises besides the arm's own reach the stick's range of action. If I want to get used to a stick, I try it by touching a few things with it, and eventually I have it 'well in hand', I can see what things are 'within reach' or out of reach of my stick.

The brain makes up the bulk of the nervous system, but it is part of that larger system, which occupies and interacts with the rest of the organism. The body is not a discreet entity. It ingests, contains and expels solids, liquids, and gasses, without which cognition—and life itself—would be unsustainable. The body is host to myriad life forms with nonhuman DNA, inextricably intertwined with other life forms (Di Paolo 2009). Human and nonhuman animals extend their capacities for coupling with their environments by using objects to expand their potential for action, perception, and communication.¹¹

We take cognitive extension to extremes through tools and technology. Visual language is a cognitive tool, often marked on material surfaces, enabling us to create meaning outside our bodies. The objects we create serve as extensions of our consciousness. Images permit their creators to transcend the limits of mental imagery, engaging in complex, multi-layered cognitive processes (Loughlin 2013). New interfaces connecting humans and machines are providing unprecedented ways of extending our cognitive horizons. Thinking about tools in terms of cognitive extension can provide novel approaches to research problems in aesthetics and visual communication.¹²

The affective dimension is essential to the embodied paradigm. Affect shapes cognition. It is regulated by neurotransmitters and hormones in response to the structural coupling of an organism with its environment (Gallagher 2015, 100–101). A valued object or agent attracts; a threatening object or agent repels (Gibson 1986, 18–19; Colombetti 2017).¹³ The cognizing

¹¹ See: Clark 2011; Colombetti 2017; Thompson, Stapleton 2009, 28; Ward, Stapleton 2012, 102–103.

¹² Nannicelli (2019) recognizes the utility of the extended mind thesis in aesthetic studies, while expressing caution about its limits.

¹³ For a history of ideas about emotions in the West, including Thomas Hobbes' "voluntary motions; commonly called the passions," see: Rosenwein (2016). The latter quote is from chapter 6 of the *Leviathan* (see: Rosenwein 2016, 289).

agent makes sense of its environment in terms of affordances. Our affective perspective is essential for successful interaction with the environment (Kiverstein, Miller 2015). Affect—including emotions, feelings and moods—motivates and demotivates perception and action.¹⁴ Fundamental processes of emotive cognition underlie the abstract cognition that is the hallmark our species (Thompson, Stapleton 2009, 26).

Aesthetic experience is inherently affective. Through it we feel aspects of our environment with an intensity that contrasts with ordinary experience. Aesthetic emotions and feelings emerge from our interaction with the environment, or from communication by means of any of several sensorimotor modalities, or through multimodal intersubjectivity. Traditionally, the aesthetic dimension of visual language has been left to philosophers and art historians. Efforts to integrate the affective and aesthetic dimensions into a broader understanding of human experience (Lindblom 2015), including the discipline called neuroaesthetics (Zeki 1999), have focused on the modern category of ‘art’, while this is only one way to conceptualize the making and experience of visual signs. Ingold (2011b, 12) explains: “we have to cease thinking of painting and carving as modalities of the production of art, and view art instead as a historically specific objectification of painting and carving.” The field of evolutionary aesthetics, or bioaesthetics, provides a platform for defining essential properties of aesthetic experience, moving beyond philosophical perspectives that are caught up in disembodied views of human experience.¹⁵

Mind-body dualism tends to sublimate supposedly ‘high-order,’ abstract mental processes, relegating emotions to an inferior, bodily-based role. Recent research shows that the affective dimension is an inseparable part of human cognition. It follows that we need to develop more effective methods for uncovering the affective and aesthetic aspects of visual communication, adapting them to specific modes of signification. Comprehending the transmission of emotions and feelings in visual language should have a place in our research agenda. The concept of empathy is fundamental.¹⁶

Socially situated cognition depends on the communication of ideas and emotions through visual, auditory, tactile, and other modes of interaction. The dynamic mind-body-environment system is distributed among the

¹⁴ See: Damasio 2000; LeDoux 1996; Colombetti 2017.

¹⁵ See: Deacon 2006; Hodgson 2000, 2006; Westphal-Fitch, Fitch 2018.

¹⁶ See: Brinck 2017; Gallese 2001; Gangopadhyay 2014.

members of a society, providing a matrix for the making of meaning (De Jaegher, Di Paolo 2007; Lindblom 2015). In a biologically grounded view of semiotics, signs do not encode meaning; they elicit context-dependent understandings (Kravchenko 2007). Concepts should not be considered as static abstract representations, rather as the consequence of interactions within a network of agents in an environment (Semin *et al.* 2012).

An embodied approach to the study of visual language implies a transdisciplinary view of the sociocultural context of the signs in a given system. Iconic, semasiographic, and glottographic signs do not possess implicit semantic values. Like cognition, they are emergent features of the complex interactions of a group of human agents in an environment, and these systems change through time and space.

The phrase ***embodied simulation*** was proposed by Gallese after the discovery of mirror neurons in monkeys. This concept explains how visual and auditory stimuli evoke the activation of motor areas in an agent's brain, resulting in the mental simulation of movement. Objects in space are experienced in relation to the body. Experience involves the affordances offered by the environment for the attainment of the agent's objectives. Perceptual experience triggers a plan for action. When monkeys and humans observe other agents like themselves, the actions of the other are experienced by the observer through a process of simulation, being mapped onto the motor system in the brain of the observer. We feel the actions of others as if they were our own. Embodied simulation is at the heart of intersubjective understanding, emotions, and empathy. Gallese shows that the automatic process of action simulation is different from the deliberate act of mental imagery, in which an agent imagines perceiving or doing something, and that this difference can be observed in studies using brain-imaging techniques.¹⁷

The concept of embodied simulation permits a deeper understanding of human communication, including verbal and visual languages and aesthetic intersubjectivity (Lindblom 2015). Gallese has shown that viewing handwritten alphabetic texts, Chinese writing, abstract paintings, and meaningless scribbles activates, in the brain of an observer, motor systems for the control of the hand (Gallese 2016, 243).¹⁸ We feel the visual stimuli in our bodies, heightening our aesthetic response.

¹⁷ See: Gallese 2001, 2005, 2015, 2016.

¹⁸ See also: Sbriscia-Fioretta *et al.* 2013.

Embodied Cognition as a Framework for Research in Aesthetic Theory and Practice

To test the possibilities of the embodied paradigm in understanding the aesthetic potency of non-Western visual language, I have used its concepts to inquire into the ubiquitous reptilian iconography in pre-Hispanic Mesoamerica. The results were presented in 2016, in the international conference *A Body of Knowledge—Embodied Cognition and the Arts* (Wright-Carr 2018b). In this study, I describe the foundations of enactive and evolutionary aesthetics, explaining that the fear of snakes in humans is the result of 60 million years of the coevolution of primates and serpents. The prevalence of reptilian imagery in ancient Mesoamerican sculpture and painting is testimony to the exploitation of ophidian forms to produce unusually intense emotional responses in viewers. The aesthetic potency of these images transcends the gulf separating ancient Mesoamericans from contemporary societies, as it can still be felt today. These findings indicate that the embodied perspective can provide a deeper understanding of the creation and reception of images.

Several years of academic practice, leading seminars and directing projects with graduate and undergraduate students in the arts, have shown that the embodied perspective can be productively employed in art education. Students acquire a deeper understanding of themselves and their relation to their environments, finding new avenues for the intersubjective expression of experience. Two examples will have to suffice here.¹⁹ In one project, inspired by research into reptilian iconography in Mesoamerica, Stephanie Constantino-Vega worked in a herpetarium, handling serpents, extracting essences in sketches, and using these experiences and visual notes to create drawings and paintings. In addition to the artworks, the preliminary results of this study have been accepted for publication in an academic journal (Constantino-Vega, Wright 2019). Another project using embodied aesthetic theory was undertaken by Daniela Ramírez-González, who worked with native artisans in Brazil and Mexico to learn techniques of weaving and binding plant fibres. She then selected plants from her immediate environment and manipulated them to create ephemeral urban installations based on feminine anatomy. These artworks generated a symbolic dialogue between the artist and the population of Guanajuato, a historic mining city in the mountains of central Mexico (Ramírez-González 2017; Ramírez-González, Wright-Carr 2019).

¹⁹ Additional projects and publications are mentioned in Wright 2018a, 82–83.

Final Reflections

The embodied perspective is naturalistic. It distances itself from much of the Western philosophical tradition, particularly that in which human experience is treated as essentially different from other forms of life. An enactive view of visual communication avoids the pitfalls of traditional dichotomies—human and animal, mind and body, reason and emotion, art and writing—so that we can evaluate visual language on its own terms.

The creation of visual language involves perception and action, as human agents bodily interact with their material and symbolic environments. This aspect of sign-making is often overlooked or undervalued. Its study can add a vital dimension to our understanding of sense-making with visual signs. When we consider the embeddedness of cognition, we look at the context of signs, their makers, and their observers. The concept of extended cognition invites us to reconsider the role of visual signs, not merely as reflections or projections of mental representations, but as extensions of the mind beyond the limits of the body. The interactions between mind, body, tools, and surfaces acquire a greater relevance.

The affective dimension of cognition, including the aesthetic responses that often accompany the experience of visual language, is part of the embodied perspective. Affect is an inseparable ingredient of conscious and non-conscious processes and is a vital ingredient in aesthetic experience. Omitting the study of the emotions expressed and experienced in visual language will limit our understanding of how these systems of signs are experienced in the embodied minds of the people that contemplate them.

Visual communication, like verbal language, aids in the distribution of cognition among the members of a society. The idea of a dynamic system, integrating the minds of its members in an environment, provides a conceptual structure for the study of visual language and its role in this system. Embodied simulation theory helps explain the neural processes involved in the visual communication of cognitive processes.

The embodied paradigm provides a framework for broadening our understanding of visual communication by considering its role in a complex system, in which agents use signs to make sense of themselves and their environments, and to communicate this sense to others. It compels us to look deeply into our nature: the evolutionary heritage genetically encoded in our bodies, vision and other modes of perception, the unity of perception and action, the use of visual signs in the sharing of ideas and experience, and the role of affect and aesthetics in human experience.

Bibliography

1. Arnheim Rudolf (1969), *Visual Thinking*, Berkeley, Los Angeles, & London: University of California Press.
2. Brinck Ingar (2017), "Empathy, Engagement, Entrainment: The Interaction Dynamics of Aesthetic Experience", *Cognitive Processing*, 19 (2), pp. 201–213.
3. Chemero Anthony (2011), *Radical Embodied Cognitive Science*, Cambridge & London: The MIT Press.
4. Clark Andy (2011), *Supersizing the Mind. Embodiment, Action, and Cognitive Extension*, Oxford & New York: Oxford University Press.
5. Colombetti Giovanna (2017), "Enactive Affectivity, Extended", *Topoi: An International Journal of Philosophy*, 36 (3), pp. 445–455.
6. Constantino-Vega Stephanie, & Wright-Carr David Charles (2019), "Reptiles Cós-micos y Experiencias Estéticas: Una Exploración Pictórica", *El Ornitorrinco Tachado*, 9 [in press].
7. Craig Arthur D. (2013), "Interoception: The Sense of the Physiological Condition of the Body", *Current Opinion in Neurobiology*, 13 (4), pp. 500–505.
8. Damasio Antonio R. (2000), *The Feeling of What Happens. Body and Emotion in the Making of Consciousness*, New York: Harcourt.
9. Damasio Antonio R. (2005), *Descartes' Error. Emotion, Reason, and the Human Brain*, London: Penguin Books.
10. De Jaegher Hanne, Di Paolo Ezequiel Alejandro (2007), "Participatory Sense-Making. An Enactive Approach to Social Cognition", *Phenomenology and the Cognitive Sciences*, 6 (4), pp. 485–507.
11. Deacon Terrence W. (2006), "The Aesthetic Faculty", [in:] Mark Turner (ed.), *The Artful Mind. Cognitive Science and the Riddle of Human Creativity*, Oxford & New York: Oxford University Press, pp. 21–53.
12. Dewey John (2005), *Art as Experience*, New York: Penguin Group.
13. Di Paolo Ezequiel Alejandro (2009), "Extended Life", *Topoi: An International Journal of Philosophy*, 28 (1), pp. 9–21.
14. Gallagher Shaun (2015), "Invasion of the Body Snatchers: How Embodied Cognition is Being Disembodied", *The Philosophers' Magazine*, 68, pp. 96–102.
15. Gallese Vittorio (2001), "The 'Shared Manifold' Hypothesis. From Mirror Neurons to Empathy", *Journal of Consciousness Studies*, 8 (5/7), pp. 33–50.
16. Gallese Vittorio (2005), "Embodied Simulation: From Neurons to Phenomenal Experience", *Phenomenology and the Cognitive Sciences*, 4 (4), pp. 23–48.
17. Gallese Vittorio (2015), "The Multimodal Nature of Visual Perception: Facts and Speculations, the Kanizsa Lecture 2015", *Gestalt Theory*, 38 (2/3), pp. 127–140.
18. Gallese Vittorio (2016), "Bodily Framing", [in:] Caroline A. Jones, David Mather, Rebecca Uchill (eds.), *Experience: Culture, Cognition and the Common Sense*, Cambridge & London: The MIT Press, pp. 236–247.
19. Gangopadhyay Nivedita (2014), "Introduction: Embodiment and Empathy, Current Debates in Social Cognition", *Topoi: An International Journal of Philosophy*, 33 (1), pp. 117–127.

20. Gibson James J. (1986), *The Ecological Approach to Visual Perception*, New York & Hove: Psychology Press.
21. Hodgson Derek (2000), "Art, Perception and Information Processing: An Evolutionary Perspective", *Rock Art Research*, 17 (1), pp. 3–34.
22. Hodgson Derek (2006), "Understanding the Origins of Paleart: The Neurovisual Resonance Theory and Brain Functioning", *PaleoAnthropology*, pp. 54–67.
23. Husserl Edmund (2001), *Phantasy, Image Consciousness, and Memory (1898–1925)*, trans. John B. Brough, Dordrecht: Springer.
24. Ingold Tim (2011a), *Being Alive. Essays on Movement, Knowledge and Description*, London & New York: Routledge.
25. Ingold Tim (2011b), *The Perception of the Environment. Essays on Livelihood, Dwelling, and Skill*, 2nd ed., London & New York: Routledge.
26. James William (1910), *The Principles of Psychology*, 2 vols., New York: Henry Holt & Company.
27. Johnson Mark (1990), *The Body in the Mind. The Bodily Basis of Meaning, Imagination, and Reason*, Chicago & London: The University of Chicago Press.
28. Johnson Mark (2007), *The Meaning of the Body. Aesthetics of Human Understanding*, Chicago & London: The University of Chicago Press.
29. Kiverstein Julian, Miller Mark (2015), "The Embodied Brain: Towards a Radical Embodied Cognitive Neuroscience", *Frontiers in Human Neuroscience*, 9, article 237, [online] <http://journal.frontiersin.org/article/10.3389/fnhum.2015.00237/full> [accessed: 8.08.2016].
30. Kravchenko Alexander V. (2007), "Essential Properties of Language, or Why Language Is Not a Code", *Language Sciences*, 29 (5), pp. 650–671.
31. Lakoff George (1990), *Women, Fire, and Dangerous Things. What Categories Reveal about the Mind*, Chicago: The University Of Chicago Press.
32. Lakoff George, Johnson Mark (1981), *Metaphors We Live By*, 2nd ed., Chicago: The University of Chicago Press.
33. Lakoff George, Johnson Mark (1999), *Philosophy in the Flesh. The Embodied Mind and Its Challenge to Western Thought*, New York: Basic Books.
34. LeDoux Josph (1996), *The Emotional Brain. The Mysterious Underpinnings of Emotional Life*, New York: Simon & Schuster.
35. Lindblom Jessica (2015), "Meaning-Making as a Socially Distributed and Embodied Practice", [in:] Alfonsina Scarinzi (ed.), *Aesthetics and the Embodied Mind: Beyond Art Theory and the Cartesian Mind-Body Dichotomy*, Dordrecht, Heidelberg, New York & London: Springer, pp. 2–19.
36. Loughlin Victor (2013), "Sketch This: Extended Mind and Consciousness Extension", *Phenomenology and the Cognitive Sciences*, 12 (1), pp. 41–50.
37. Maturana Humberto R. (1980), "Biology of Cognition (1970)", [in:] Humberto R. Maturana & Francisco J. Varela (eds.), *Autopoiesis and Cognition: The Realization of the Living*, Dordecht, Boston & London: D. Reidel Publishing Company, pp. 5–58.
38. Maturana Humberto R., Varela Francisco J. (1980), "Autopoiesis. The Organization of the Living. 1973", [in:] Humberto R. Maturana & Francisco J. Varela (eds.), *Autopoiesis and Cognition: The Realization of the Living*, Dordecht, Boston & London: D. Reidel Publishing Company, pp. 59–123.

39. Maturana Humberto R., Varela Francisco J. (1998), *The Tree of Knowledge. The Biological Roots of Understanding*, trans. Robert Paolucci, Boston & London: Shambhala.
40. Merleau-Ponty Maurice (1962), *Phenomenology of Perception*, trans. Colin Smith, London & Henley: Routledge & Kegan Paul.
41. Nannicelli Ted (2019), "Aesthetics and the Limits of the Extended Mind", *The British Journal of Aesthetics*, ayy048, [online] <https://doi.org/10.1093/aesthj/ayy048> [accessed: 26.01.2019].
42. Noë Alva (2002), "Is the Visual World a Grand Illusion?", *Journal of Consciousness Studies*, 9 (5/6), pp. 1–12.
43. Noë Alva (2006), *Action in Perception*, Cambridge & London: The MIT Press.
44. O'Regan J. Kevin (2011), *Why Red Doesn't Sound Like a Bell. Understanding the Feel of Consciousness*, Oxford & New York: Oxford University Press.
45. O'Regan J. Kevin, Noë Alva (2001), "A Sensorimotor Account of Vision and Visual Consciousness", *Behavioral and Brain Sciences*, 24 (5), pp. 939–1031.
46. Ramírez-González Daniela (2017), *Palhia, Fitoformas Infuorescentes. Trabajo de Titulación en la Modalidad de Ejecución de Obra para Obtener el Título de Licenciada en Artes Plásticas*, Guanajuato: University of Guanajuato.
47. Ramírez-González Daniela, Wright-Carr David Charles (2019), "Cuerpo y Ambiente. Una Exploración Estética Interactiva" [manuscript submitted for publication].
48. Rosenwein Barbara H. (2016), *Generations of Feeling. A History of Emotions, 600–1700*, Cambridge: Cambridge University Press.
49. Ryle Gilbert (1951), *The Concept of Mind*, reprint of the 1949 ed., London: Hutchinson's University Library.
50. Sampson Geoffrey (2015), *Writing Systems*, 2nd ed., Sheffield & Bristol: Equinox Publishing.
51. Sbriscia-Fioretti Beatrice, Berchio Cristina, Freedberg David, Gallese Vittorio, Umiltà Maria Alessandra (2013), "ERP Modulation during Observation of Abstract Paintings by Franz Kline", *Plos One*, 8 (10), [online] <http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0075241> [accessed: 30.01.2015].
52. Semin Gün R., Garrido Margarida V., Palma Tomás A. (2012), "Socially Situated Cognition: Recasting Social Cognition as an Emergent Phenomenon", [in:] Susan T. Fiske & C. Neil Macrae (eds.), *The Sage Handbook of Social Cognition*, London: Sage Publications, pp. 138–164.
53. Shapiro Lawrence (2011), *Embodied Cognition*, London & New York: Routledge.
54. Sheets-Johnstone Maxine (2004), "On Bacteria, Corporeal Representation, Neandertals, and Martha Graham: Steps toward an Evolutionary Semantics", [in:] Morana Alač & Patrizia Violi (eds.), *In the Beginning. Origins of Semiosis*, Bologna: Horizons Unlimited & Brepols Turnhout, pp. 105–136.
55. Sheets-Johnstone Maxine (2011), *The Primacy of Movement. Expanded Second Edition*, Amsterdam & Philadelphia: John Benjamins Publishing Company.
56. Sheets-Johnstone Maxine (2015), "Embodiment on Trial: A Phenomenological Investigation", *Continental Philosophy Review*, 48 (1), pp. 23–39.
57. Thompson Evan, Stapleton Mog (2009), "Making Sense of Sense-Making: Reflections on Enactive and Extended Mind Theories", *Topoi: An International Journal of Philosophy*, 28 (1), pp. 23–30.

-
58. Varela Francisco J., Thompson Evan, Rosch Eleanor (1993), *The Embodied Mind. Cognitive Science and Human Experience*, Cambridge & London: The MIT Press.
 59. von Uexküll Jakob (1957), "A Stroll Through the Worlds of Animals and Men. A Picture Book of Invisible Worlds [...] (1934)", [in:] idem, *Instinctive Behavior. The Development of a Modern Concept*, trans. & ed. Claire H. Schiller, New York: International Universities Press, pp. 5–80.
 60. von Uexküll Jakob (1982), "The Theory of Meaning", *Semiotica*, 42 (1), pp. 25–82.
 61. Ward Dave, Stapleton Mog (2012), "Es Are Good. Cognition as Enacted, Embodied, Embedded, Affective and Extended", [in:] Fabio Paglieri (ed.), *Consciousness in Interaction: The Role of Natural and Social Context in Shaping Consciousness*, Amsterdam & Philadelphia: John Benjamin Publishing Company, pp. 89–104.
 62. Westphal-Fitch Gesche, Fitch, W. Tecumseh (2018), "Bioaesthetics: The Evolution of Aesthetic Cognition in Humans and Other Animals", *Progress in Brain Research*, 237, pp. 3–24.
 63. Wright-Carr David Charles (2017), "Signs of Resistance: Iconography and Semasiography in Otomi Architectural Decoration and Manuscripts of the Early Colonial Period", *Visible Language*, 51 (1), pp. 58–87.
 64. Wright-Carr David Charles (2018a), "La Ciencia Cognitiva Corporeizada: Una Perspectiva para el Estudio de los Lenguajes Visuales", *Entreciencias. Diálogos en la Sociedad del Conocimiento*, 6 (16), pp. 73–88, [online] <http://dx.doi.org/10.22201/enesl.20078064e.2018.16.63364> [accessed: 23.09.2018].
 65. Wright-Carr David Charles (2018b), "Sacred Reptiles and Native Worldview: Enactive Aesthetics in Ancient Mesoamerica", *Proceedings of A Body of Knowledge—Embodied Cognition and the Arts Conference*, eScholarship, California Digital Library, Oakland: University of California, [online] <https://escholarship.org/uc/item/7548b88w> [accessed: 21.01.2019].
 66. Zeki Semir (1999), *Inner Vision. An Exploration of Art and the Brain*, Oxford & New York: Oxford University Press.

