

Embodied Cognition and its applications: A brief review

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Abstract

Embodied cognition is a research program comprising an array of methods from diverse theoretical fields (e.g., philosophy, neuroscience, psychology, etc.) held together by the key assumption that the body functions as a *constituent* of the mind rather than a passive perceiver and actor *servicing* the mind. With a longstanding tradition in continental and pragmatic philosophy and a recent explosion in theoretical and empirical research in psychology and cognitive science, the embodied cognition research program is now ready to be formally translated into an applied approach for clinical, sport, education, social, media and health settings. This brief review sets the scene for this special edition by outlining philosophies and theory underpinning the embodied cognition research program and briefly reviewing accounts of embodied cognition that form themes running through the articles included in this special edition. Finally, we provide some examples of existing interventions, therapies and practices that utilise body–mind principles common to embodied cognition, though under other descriptive methodological titles. We suggest that embracing and integrating these interventions, therapies and practices under “applied embodied cognition” will encourage interdisciplinary discussion, thereby helping to move the field forward.

Keywords: *embodied cognition; applied psychology; body–mind philosophy; experimental psychology; embodiment; naturalism; phenomenology; ecological theory*

What we know today as “embodied cognition” is a research program comprising an array of methods from diverse theoretical fields—including philosophy, neuroscience, psychology and more. This varied body of scholarship is held together by the key assumption that the body functions as a *constituent* of the mind rather than a passive perceiver and actor *servicing* the mind. As a dynamic domain of research, embodied cognition investigates, in multiple ways and with multiple aims, the claim that the body is *directly involved* in cognition (Shapiro, 2007), rather than secondary to cognition. As a research field, embodied cognition is informed by long and rich philosophical traditions. Concepts from continental philosophy (e.g.,

in the work of Kant, Heidegger, Merleau-Ponty etc.) are evident in embodied methodologies, and while most accounts of embodied cognition reference the seminal work of James and Eleanor Gibson's "ecological psychology" in relation to embodied ontogeny, the enterprise owes just as much to approaches from the North American pragmatist tradition (e.g., the work of James, Dewey). These divergent philosophical traditions are now becoming integrated in more recent psychological theories of embodiment (e.g., Barsalou, 1999). While its roots in Western scholarship go back centuries, there has been a boom over the last three decades in theoretical and empirical research underpinned by embodied cognition paradigm (for reviews see Barsalou, 2008; Clark & Chalmers, 1998; de Bruin & Kästner, 2012; Shapiro, 2011; Smith, 2005).

Collectively, the embodied cognition research program has now established a firm foundation allowing the extension of research from an initial “theoretical and empirical phase” to an “application phase” in which empirically tractable knowledge is being applied in clinical, sport, education, social and health settings. The translation of soundly supported evidence-based theory into practice provides exciting opportunities for both research and practice. Many therapists, clinicians, community workers, sports scientists, teachers and other professionals have now been introduced to the embodied approach as an explicit conceptual paradigm, and conversely practitioners have become involved in translational research. While the unspecified application of those principles named by embodied cognition has been occurring throughout human history in cultures the world over, it is only in recent decades that Western person-centred practices are overtly employing “embodied” principles. Thus, as a domain of inquiry, embodied cognition may function as a cohesive, empirically supported framework for existing embodied practices as well as a strong foundation for the construction of novel embodied practices.

This brief review provides a context for the papers included in this special edition by outlining the predominant philosophies and theory underpinning embodied cognition, then detailing three accounts of

embodied cognition that are identifiable throughout the articles constituting this special edition. Finally, we address some existing and potential applications of embodied cognition in clinical, sport, education, social, media and health settings. We do not propose to construct here an exhaustive record of this extremely diverse and complex area, but rather to briefly establish a historical and methodological milieu for the specific nodes of research collected in this special edition.

Philosophies and theory underpinning embodied cognition

The embodied cognition paradigm is arguably founded on two distinct philosophical traditions derived from a blending of continental and pragmatist foundations: naturalism and phenomenology (Johnson, 2006, 2007). Philosophical naturalism asserts that all things in the world, including body and mind, are naturally emergent, as opposed to non-material (Aikin, 2006; Horst, 2002). Subsequently, all explanation should be causal and reducible to the natural (materially manifest) (Aikin, 2006; Johnson, 2006). Phenomenology, on the other hand, focuses on experiential meaning, and thus derives explanatory propositions from the *subjective experience* (Gallagher & Zahavi, 2007). While naturalism and phenomenology utilise quite different methodological paradigms, they are not mutually exclusive and are integrated in James Gibson's "ecological theory", which forms an important cornerstone in the theorisation of embodied cognition.

Naturalism posits cognition as emerging and evolving from the organism-environment relationship (Johnson, 2007). In their development of the naturalistic tenets of embodied cognition, philosophers Johnson and Rohrer (Johnson, 2006; Johnson & Rohrer, 2007) bring together the work of US philosopher, psychologist and physician William James (1892) and US philosopher, psychologist and education activist John Dewey (from works between 1925-1953; in 1981, 1991), both of whom emphasised the dependence of cognition upon bodily adaptations to environment. James (1892) criticised what he termed "rational psychology" for explaining higher cognitive activities – such as memory and reasoning – without reference to the world to, and of, which these activities speak. Rather, he postulated that higher cognitive functions are adaptations generated by interactions with the world and thus primarily involve the body and world. Dewey (from works between 1925-1953; in 1981, 1991) took this idea further, suggesting that higher cognitions emerge from organic activity – such as feeling, perception, object manipulation and bodily movement – and involve a higher degree of complexity but not a new or separate type of ontological processes. Thus, James and Dewey each elevate body and world as crucial constituents of cognition from an evolutionary perspective, both their work contributing to the

foundations of the formalised embodied cognition paradigm (Johnson, 2006; Johnson & Rohrer, 2007).

The most prominent phenomenological account underpinning embodied cognition is the "lived-body" as conceived by French philosopher and psychologist Maurice Merleau-Ponty (1945; 1942 translated in 1962; 1965, respectively). Like James and Dewey, Merleau-Ponty argued that cognitions cannot be understood without reference to the body that engages with the world (Marshall, 2008; Merleau-Ponty, 1962, 1965). However, as a phenomenologist, Merleau-Ponty was interested in developing a detailed description of the body and its *active role* in cognition, rather than in organising its ontogenetic and phylogenetic relationship to mind and world. Consequently, for Merleau-Ponty, the body is "lived-through" and is "subjective" in cognitive experience, rather than a "passive" and "objective" vehicle via which the mind operates. Merleau-Ponty thereby emphasises body and world as crucial constituent components of cognition from a phenomenological perspective.

Phenomenological and naturalistic explanations are often seen as incompatible (Aikin, 2006). Phenomenology is often viewed as being "anti-naturalistic" because it does not analyse the biological constitution of a human being and instead addresses subjective experience, which, in the instance of a phenomenology of cognition, means a person's own experience of their cognition. However, this does not mean that phenomenology cannot be an important aid in the analysis of the biological constitution of a human being (Aikin, 2006; Gallagher & Zahavi, 2007). Phenomenologists argue that in order to build an informative naturalistic account of a cognitive phenomenon, it is beneficial to first understand the subjective experience as an informative basis for naturalistic inquiries (Gallagher & Zahavi, 2007). Phenomenologists thus provide to naturalists a detailed subjective model of the phenomenon in question, in this case cognition, resulting in a more complete model of cognition for naturalists to start with than if they were to start only with an "objective" scientific theory of cognition (Gallagher & Zahavi, 2007). These differing approaches are thereby compatible and can produce a more holistic analysis of a phenomenon such as cognition (Borrett, Kelly, & Kwan, 2000).

One important psychological theory that integrates phenomenological and naturalistic perspectives is James Gibson's "ecological theory" (Gibson, 1979). Ecological theory posited that perception is direct and that the environment is meaningful. Direct perception was Gibson's idea that perception occurs through the direct sensorial contact between an organism and the environment (Gibson, 1979). Consequently, Gibson argued that if there was no mediating "mind" between perception and action, but perception could still guide action, then the environment must contain enough information to allow for this (Gibson, 1979). Gibson

called this meaningful environmental information ‘affordances’, which are opportunities for action given directly by the environment (Garbarini & Adenzato, 2004; Gibson, 1979). Thus, ecological theory aligns with both Dewey’s naturalism and Merleau-Ponty’s phenomenology in that it implies cognition naturally emerges due to an organism’s place in its environment, and that the body experiences the environment directly rather than as a passive biological machine, subsidiary to the mind.

The crux of ecological theory then, is the rejection of the dichotomy between action and perception and thus also the dichotomy between physical and mental capacities (Garbarini & Adenzato, 2004). This idea forms the framework for embodied cognition, which, as a research program, acknowledges and investigates the inextricable intertwining of mind and body, perception and action, doing and thinking.

In integrating these ostensibly divergent understandings of natural emergence, subjective experience and meaningful environmental information from naturalism, phenomenology and ecology, respectively, embodied cognition, broadly speaking, can be said to posit a notion of mind as uniquely emergent from the subjective experience of the body in the world.

Accounts of embodied cognition

Since embodied cognition is a *research program* embracing varied *accounts*, it is difficult to define apart from its central assumption that the body functions as a *constituent* of the mind rather than a perceiver and actor *servicing* the mind, and is thus *directly* involved in, and productive of, cognition (Shapiro, 2007). Shapiro (2011) recently distinguished three accounts of embodied cognition; replacement, conceptualisation, and constitution. In order to best describe embodied cognition, this section will briefly address these by highlighting exemplars of each account, which commonly underpin different contemporary applications of embodied cognition.

Replacement and Dynamical Systems

The replacement account of embodied cognition argues that the traditional concepts and methods of cognitive science should be replaced with alternatives. Central assumptions of the replacement account are that (1) cognition does not best fit with traditional cognitive science’s computational model, wherein cognition consists of symbol manipulation and a linear input-processing–output system, and that (2) representation is not required for cognition (Shapiro, 2011). Dynamic systems theory is an approach that provides an exemplary description of the replacement account of embodied cognition.

Dynamical systems theory is a branch of mathematics used to describe and model evolution of complex

systems consisting of several interacting components. This theory has been adapted for use within embodied cognition, where dynamical (or dynamic) systems theorists contend that cognition is not a process localised to the mind, but can involve mind, body, and world working as a system that changes over time and which can be described mathematically (Smith, 2005; Van Gelder et al., 1998). Two key features of dynamic system are *emergence* (or self-organisation) and *coupling*.

Emergence is the idea that there are no predefined rules governing the behaviour of parts in forming new outcomes, but rather parts coordinate, or self-organise, in forming new outcomes according to constraints and opportunities provided by the environment; e.g. oil molecules on a frying pan forming convection rolls due to heat. Coupling is the idea that, when described mathematically, parts within a system must include a term that describes the other parts within the system; i.e. the system is always relational and each component is always “in relation” rather than discrete, even as parts and whole modify over time. Cognition is a self-organising system that changes over time, and is thus suitable for investigation using a dynamic systems account (Smith, 2005; Van Gelder et al., 1998).

One prominent example of a dynamic systems account of cognition is Thelen, Schoner, Scheier and Smith’s (2001) reinterpretation of Swiss psychologist and philosopher Jean Piaget’s (1954) illustrious A-not-B error experiment. In the original experiment, a toy is hidden, in view, under a lid at location A and the infant reaches for the toy. This A-location trial is repeated several times. Then comes the crucial switch trial; the toy is hidden, in view, at a new location, B. If there is a short delay between hiding and reaching, 8 to 10 month-old infants reach back to location A, where they found the object previously, not to where they saw the object disappear. This is referred to as the A-not-B error. However, after 12 months infants no longer make this error, leading Piaget to assume, famously, that this is when infants learn that objects exist apart from their own actions (termed “object permanence”; Smith & Thelen, 2003; Thelen et al., 2001).

A dynamic systems re-interpretation of the A-not-B error experiment posits that the infant’s behaviour is guided by a collection of (embodied) processes rather than an (abstract) object representation in the mind, and that it is the *course of interaction* between these processes that causes the error (Thelen et al., 2001). Thelen et al. (2001) argued that the most salient interaction of processes is between the infant’s past reaching behaviour and his or her current reaching behaviour. Thus, the authors argued that the development of what Piaget conceived of as “object permanence” is actually the process of the infant learning to break their habit of reaching to location A (Shapiro, 2011). When the A-not-B error experiment was re-conducted and re-interpreted using a dynamical

field model,¹ it was found that environmental changes to the task,² as well as modifications to temporal conditions, lead to elimination of the error (Smith & Thelen, 2003; Thelen et al., 2001). On the basis of these findings, it was argued that the A-not-B error could be better understood in terms of the coupled processes between the infant and the toy, rather than an object representation. Furthermore, this interpretation suggests that, for infants, knowing, or cognition, *is* moving and perceiving (Thelen et al., 2001).

Conceptualisation and Grounded Cognition

The conceptualisation account of embodied cognition investigates the way in which humans form constructs from their experience of the world. The core assumption of the conceptualisation account is that the experiences of an organism, and thereby the range and character of concepts an organism possesses, are in some sense determined by the nature of the organism's body (Shapiro, 2011). This idea is utilized in theories stemming from grounded cognition..

Grounded cognition encompasses a variety of theories drawn together by two major assumptions: (1) that cognition involves bodily interactions with the world, and (2) that these interactions are represented in the brain (e.g., Barsalou, 2008; Lakoff & Johnson, 1999). Different grounded cognition theories vary as to how these bodily interactions are represented in the brain, with some theories positing abstracted "image schemas" corresponding to bodily interactions in the world, which are activated during the processing of abstract conceptual knowledge (see Lakoff & Johnson, 1999). For example, a spatial image schema of the notion "up" is activated when processing abstract concepts such as "power" or "God" (Meier & Dionne, 2009; Meier, Hauser, Robinson, Friesen, & Schjeldahl, 2007). However, most grounded cognition theories propose that representations are stored in the putative "experiential system" of the brain, which includes sensorimotor, proprioceptive, introspective and emotion systems. Bodily experiences represented in these systems are then supposedly reconstructed, or "simulated" during cognition (Barsalou, 1999; Gallese & Lakoff, 2005; Glenberg, 1997).

There has been an abundance of empirical support for the grounded cognition account over the past two decades (Barsalou, 2008). The most common type of empirical support comes from "demonstration studies" that select a concept, or set of concepts, proposed to be grounded/embodied in a particular experiential state, and examine whether cognitive processing related to the

concept(s) in question is facilitated when the experiential state is primed. For example, judgments related to importance are influenced by the manipulation of weight, with heavier items perceived to be more important than lighter ones (Jostmann, Lakens, & Schubert, 2009). If specific conceptual processes are enhanced when the grounded experiential state is primed, it is often interpreted as evidence that the concept(s) are grounded/embodied in the experiential state. The implication is that concepts in some part arise from corporeally located subjective experience, and are enabled by activation of corresponding experiential representations, rather than the other way around as conventional logic might suggest – that we "know" gravitas because our bodies understand gravity. Such studies have suggested that both concrete (e.g., Estes, Verges, & Barsalou, 2008; Tucker & Ellis, 1998 etc.) and abstract concepts (e.g., Boroditsky, 2001; Chandler & Schwarz, 2009; Jostmann et al., 2009; Schubert & Koole, 2009 etc.) may be grounded in experiential states.

Constitution and Extended Mind

Unlike replacement and conceptualisation accounts, which are about "how" cognition occurs, the constitution account addresses "what" should be regarded as cognition. The constitution account of embodied cognition argues that cognitive processing does not occur solely in the brain. That is, it argues that mind comprises not only brain but also includes both body and world (Shapiro, 2011). The extended mind thesis provides a good articulation of this proposition that cognition extends beyond the brain and into the body and world.

The extended mind thesis came to prominence in the latter part of the 20th century with the work of analytic philosophers Andy Clark and David Chalmers (1998) and challenges traditional psychological definitions of both mind and body. This thesis posits that the mind – and cognition with it – extend not only beyond the brain into the body, but beyond the skin and into the surrounding world (Clark & Chalmers, 1998). The extended mind thesis argues that the *world* is in fact a *constituent* of cognition (Clark & Chalmers, 1998). The implication is that whenever the world serves a function, which if performed in the "mind" would be considered cognition, that part of the world should also be considered a constituent of cognition (Clark & Chalmers, 1998).

This is exemplified by Clark and Chalmers (1998) in their thought experiment involving Inga, a normally functioning individual with full memory capacity, and Otto, who has Alzheimer's disease, resulting in a memory deficit. Both hear about an exhibition in the museum of modern art, a place both have previously visited. Upon hearing about the exhibition, Inga must pause for a second and consult her memory to recall that the museum is on 53rd St. It is important to note

¹ Mathematically simulates the decisions of infants to reach to location A or B by integrating, over time, the various influences on that decision.

² Such as drawing the infant's attention to location B or using novel bodily, motor movements to obtain the toy from location B.

that Inga had a belief that the museum was on 53rd St before consulting her memory; these beliefs are called “non-occurrent” beliefs, in that they are present, but only consciously present when attended to (via memory in this case). Otto on the other hand, due to his memory deficit, must consult his notebook, in which all his information is stored. Thus, Otto’s notebook acts in place of his biological memory and store of non-occurrent beliefs. Clark and Chalmers argue that the notebook is a constituent of cognition for Otto, just as Inga’s neural memory is a constituent of cognition for her.

Existing applications of embodied cognition

Within the broader field of contemporary psychology – including clinical, sport, education, social, media and health psychology – numerous interventions, therapies and practices utilise body-mind principles that are common to embodied cognition, but which are known under other descriptive methodological titles. Most contemporary clinical interventions and therapies address body and world to some degree when treating mental illness: however, interventions and therapies overtly acknowledging the unity of mind, body and world and consequently the ability of the body to influence cognitions are few and far between.

In notable exception to this, body/world oriented interventions and therapies for children’s disorders such as autism are quite popular and well established (Ollendick & King, 2004; Srinivasan & Bhat, 2013; Vismara & Rogers, 2010). This is arguably due to the influence of prominent developmental theories, which typically propose that children’s cognitions are directly and inextricably linked with their embodied behavioural/emotion experiences. As children develop toward adulthood however, cognition is proposed to become more abstract, disembodied and separated from behaviour/emotion (Mandler, 1988; Piaget & Inhelder, 1969).

Nevertheless, there do exist some well-developed, though less prominent interventions and therapies for adults that treat mental illness via the interface of body/world. One example of a treatment facility utilising such therapies is La Borde: a residential psychiatric clinic in France that supports patients with severe mental illness to re-engage with self, others and world via involvement in theatrical plays, group therapy and negotiated work rotations in the clinic’s kitchen and laundry (staff also historically took part in these rotations) (Genosko, 2003; Guattari, 2009). Such “embodied” therapies were developed at La Borde and in private practice by psychotherapist Félix Guattari, who, in his work with patients with severe mental illness, focused on dynamic non-representational relations between bodies, minds and worlds (Guattari, 1984, 2009, 2013). More recently, the field of body

psychotherapy (BP; or body-oriented (psycho] therapy or somatic psychology)”, which is most prominent in Europe and encompasses “embodied” interventions such as dance and movement therapy, has begun to receive more empirical support (see Röhricht, 2009 for review). More common to the Western psychosocial sphere is the corporeally-integrated treatment of mental illness via exercise and mindfulness methods (Michalak, Burg, & Heidenreich, 2012; Stathopoulou, Powers, Berry, Smits, & Otto, 2006).

Another field in which embodied principles are applied is in health psychology. Research outlines how breast cancer, pro-breastfeeding and anti-circumcision activists employ embodied techniques to persuade people toward their cause (Newman & Carpenter, 2013). Activists employ testimonies of people who have had embodied experiences with the issue (e.g., intact male opponents of male circumcision), emphasising the subjective experience of habitation in a body that could be intimately harmed and the visceral reactions of health professionals assisting with circumcision (Brown et al., 2004; Newman & Carpenter, 2013).

Education is one field which embodied cognition has always had a strong grasp; primarily because education relates to children, and, as discussed above, children’s cognitions are theorised to be directly and inextricably linked with their embodied, behavioural/emotion experiences. Most Western educational programs for children are based on prominent developmental learning models that emphasise experiential learning (Mandler, 1988; Piaget, 1952; Piaget & Inhelder, 1969; Webb, 1980). Akin to therapies for children, teaching methods for young children utilise the body and senses to engage cognitive processes (Berruta-Clement, Schweinhart, Barnett, Epstein, & Weikart, 1984). However, it has also been shown in more recent research that gesture, which aligns with principles of embodied cognition, improves learning capacities for adults (Macedonia & Knösche, 2011).

Beilock and colleagues have identified numerous ways in which embodied cognition can be applied to sport and sport psychology (Beilock, 2008; Beilock & Hohmann, 2010). Studies suggest that embodied cognition plays an important role in sport-related action perception, understanding, prediction, judgement (see Calvo-Merino, Glaser, Grèzes, Passingham, & Haggard, 2005; Casile & Giese, 2006; Pizzera & Raab, 2012), training (Moreau, Clerc, Mansy-Dannay, & Guerrien, 2012) and language comprehension (Beilock & Holt, 2007; Holt & Beilock, 2006; Milton, Solodkin, Hluštík, & Small, 2007). For example, Pizzera and Raab (2012) found that sport officials performed better (i.e., they were better able to make refereeing-related cognitive judgements) if they had motor and/or visual experience in the sport they were officiating. These studies suggest that embodied cognition has been incorporated into sport and sport psychology. However,

only a small portion of these studies are explicitly framed as “embodied cognition” research (e.g., Beilock, 2008; Beilock & Hohmann, 2010).

Theories of embodiment are also widely applied in social and corporate settings including leadership and marketing. Driven by an abundance of empirical research regarding the embodiment of leadership (e.g., Schubert, 2005), embodiment is now considered a key component of leadership training, with entire courses and seminars dedicated to it (e.g., www.embodimentfoundation.org). All aspects of marketing, from visual and spatial elements of product advertisements to physical product placement that appeal to consumer motor preference, have been empirically examined and utilised in the consumer setting (Eelen, Dewitte, & Warlop, 2013; Van Rompay, De Vries, Bontekoe, & Tanja-Dijkstra, 2012).

In philosophy and cultural theory there is a growing body of work investigating the dynamic corporeality inherent in audio-visual cultures, where human and screen bodies and thought processes are inextricable; for example in the notions of the ‘cinematic body’ and ‘post-cinematic affect’ (Shaviro, 1993) and the non-representational, corporeally gendered coding evident within screen cultures (Braidotti, 2002). The field of game studies investigates the dynamics between body and technology in computer games, especially of the first-person shooter kind. McCrea (2007) discusses how these games are overtly developed with special attention to the inevitable end in violent death of bodies, such that they explode, fly through the air and fall etc. with more apparent weight and gravitas. Gamers in turn commonly investigate dead bodies in game worlds, poking or pillaging from them such that the routine exploitation of corpses in intricate and viscerally affective ways that transgress normal human body-world relations becomes central to the game experience (McCrea, 2007). In another analysis of screen affect and politically modified aesthetic and material dynamics between self, body and world, Colman (2009) discusses the use of gaming technology e.g. via remote engagement technologies, and the production and publication to YouTube of trophy videos by US and allied soldiers in Iraq (Colman, 2009).

Conclusion

This brief review thus provides an overview of the major philosophies and theory underpinning embodied cognition and of some prominent accounts of embodied cognition, which adhere to the assumption that the body functions as a *constituent* of the mind rather than a perceiver and actor *servicing* the mind (Shapiro, 2007). We also demonstrate that understandings of mind-body-world as existing in a non-hierarchical relationship have informed applied research and practice for centuries, even when not self-declared under the umbrella of

embodied cognition. Finally, we draw attention to some of the recent ways in which principles of embodied cognition have begun to be overtly applied in various fields of contemporary psychology.

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Research profile

My primary research interest is the application of embodied cognition in clinical psychology. I completed a Ph.D. examining embodiment of the “heal” concept. Since then I have authored a paper considering the implications of applying embodied cognition for clinical psychology. I have also been involved in numerous projects involving psychosocial interventions for severe mental illness, including bipolar disorder and psychotic disorders. I am currently considering the application of embodied interventions for severe mental illness.