

The Exploring of the Embodied Cognition and the 4E Cognition Concepts: The Conceptualization and Overview

*Pattarapol Pengwat*¹

(Received: February 17, 2024; Revised: March 27, 2024; Accepted: April 1, 2024)

Abstract

This academic article aims to explore the Embodied Cognition and 4E Cognition concepts. The content will begin with the traditional cognitive theory which has been the former theory is an essential tool for describing the cognitive system. Then, the article will mention a new movement that did not agree with traditional cognitive theory. That movement presented the critiques and offered a new thought for the cognitive system, it is Embodied cognition. After that, the content will be presented regarding the fundamental essence of embodied cognition idea and Barsalou's Perceptual Symbol System in the overview, the supporting principle for embodied cognition, and the view of establishing cognition through the perceptual system. Moreover, the pillars of conceptualization of embodied cognition are also ascribed to show the motivation of embodied cognition. In the last part, I presented the basic meaning of the 4E cognition ideas that substitute Embodied, Embedded, Extended, and Enactive and offer two arguments for 4E cognition that are 4E cognition is consistent with postmodern methodology, and 4E cognition is the process of radical intense philosophizing.

Keywords: Embodied Cognition, 4E Cognition, Embedded Cognition, Extended Cognition, Enactive Cognition

¹ A Ph.D. student under the Department of Philosophy, Faculty of Arts, University of Delhi, The Republic of India.

Corresponding Author, E-mail: pattarapol.pengwat@gmail.com

สำรวจแนวคิดการรู้คิดสมานกายและการรู้คิดแบบ 4E: การประกอบสร้างมโนทัศน์และภาพรวมเบื้องต้น

ภัทรพล เป็งวัฒน์²

(วันที่รับ: 17 ก.พ. 2567; วันที่แก้ไขเสร็จ: 27 มี.ค. 2567; วันที่ตอบรับ: 1 เม.ย. 2567)

บทคัดย่อ

บทความวิชาการชิ้นนี้มีจุดมุ่งหมายเพื่อสำรวจแนวคิดการรู้คิดสมานกายและการรู้คิดแบบ 4E เนื้อหาจะเริ่มต้นด้วยทฤษฎีประสาทศาสตร์แบบดั้งเดิมซึ่งเป็นทฤษฎีเดิมที่เป็นเครื่องมือสำคัญสำหรับการอธิบายระบบประสาทศาสตร์ จากนั้นบทความจะกล่าวถึงขบวนการเคลื่อนไหวใหม่ที่ไม่เห็นด้วยกับทฤษฎีประสาทศาสตร์แบบดั้งเดิม ขบวนการเคลื่อนไหวดังกล่าวนำเสนอข้อวิพากษ์วิจารณ์และเสนอแนวคิดใหม่แก่ระบบประสาทศาสตร์ ขบวนการที่ว่านี้คือการรู้คิดสมานกาย³ เนื้อหาในส่วนต่อมาจะนำเสนอเกี่ยวกับหลักใหญ่ใจความสำคัญพื้นฐานโดยสังเขปของแนวคิดการรู้คิดสมานกายและระบบสัญญาเชิงผัสสะของบาร์ชาลูนเป็นหลักการที่สนับสนุนการรู้คิดสมานกาย และ เป็นมุมมองที่นำเสนอการประกอบสร้างการรู้คิดผ่านระบบเชิงผัสสะ นอกจากนี้ เสาหลักของการประกอบสร้างมโนทัศน์การรู้คิดสมานกายจะถูกกล่าวถึงเช่นกันเพื่อแสดงให้เห็นถึงแรงจูงใจขับเคลื่อนให้เกิดการรู้คิดสมานกาย ในส่วนสุดท้าย ข้าพเจ้าผู้เขียนบทความได้นำเสนอ

² นักศึกษาระดับปริญญาเอก สาขาวิชาปรัชญา ภาควิชาปรัชญา คณะศิลปศาสตร์ มหาวิทยาลัยเดลี สาธารณรัฐอินเดีย
ผู้เขียนหลัก, E-mail: pattarapol.pengwat@gmail.com

³ ในบทความชิ้นนี้ผู้เขียนแปลคำว่า Embodied, Embedded, Extended, and Enactive Cognition ว่าเป็นการรู้คิดสมานกาย ผังตัวตน ยืดขยาย และ บัญญัติร่วม ตามลำดับ โดยผู้เขียนใช้คำว่า Embodied แปลว่า สมานกาย และ Extended แปลว่า ยืดขยาย อ้างอิงตามบทความวิชาการ ชื่อ *สำรวจข้อถกเถียงทางปรัชญาเกี่ยวกับอารมณ์และทฤษฎีอารมณ์สมานกาย* ดูเพิ่มเติมที่ Prathomwong, P. (2016a) และ *แนวคิดอารมณ์ความรู้สึกยืดขยายของจิโรวานน่า โคลอมเบตตี* ดูเพิ่มเติมที่ Prathomwong, P. (2016b). เนื่องจากผู้เขียนเห็นว่าการใช้คำว่า สมานกาย และ ยืดขยาย สามารถให้ความหมายชัดเจนและใกล้เคียงกับความหมายในภาษาอังกฤษได้เหมาะสมมากที่สุด สำหรับคำว่า Embedded และ Enactive ผู้เขียนแปลใช้คำว่า ผังตัวตน และ บัญญัติร่วม ตามลำดับ

ความหมายพื้นฐานของแนวคิดการรู้คิดแบบ 4E ซึ่งเป็นตัวแทนให้กับ สมานกาย ฝังตัวตน ยืดขยาย และ บัญญัติร่วม และได้เสนอข้อวิจารณ์สองประการต่อการรู้คิดแบบ 4E คือ การรู้คิดแบบ 4E สอดคล้องกับ วิธีวิทยาแบบโพสต์โมเดิร์น และ การรู้คิดแบบ 4E เป็นกระบวนการทำปรัชญาที่เข้มข้นสุดโต่ง

คำสำคัญ: การรู้คิดสมานกาย, การรู้คิดแบบ 4E, การรู้คิดฝังตัวตน, การรู้คิดยืดขยาย, การรู้คิดบัญญัติร่วม

Introduction

The 4E cognition concept arose from the conceptual revolution in the philosophy of cognitive science. This interdisciplinary research program refers to and connects with academic fields that debate the investigation of human cognition, such as philosophy, neuroscience, psychology, linguistics, etc. The 4E cognition was invented from the ‘Embodied Cognition’ movement which was used to rebel against the former traditional cognitive theory. Fundamentally, the 4E represents Embodied, Embedded, Extended, and Enactive. These ideas trust that the brain, body, and environment constitute cognition. In other words, the embodied cognitivists insisted that cognition is nothing but a collaborative construction of the brain-body-environment in an ecological system (Shapiro & Spaulding, 2021). To explore the 4E Cognition concept, I will begin the article with the historical ground of the embodied cognition movement.

The Embodied Cognition: The movement against the traditional cognitive theory

Around the middle of the Twentieth Century, the Computational Theory of Mind (henceforth CTM) was popular in the sciences and technology circles and was used as a tool for explaining human cognition. CTM principle articulated that human cognition equally functions as the computational processes, or it can be counted that the human mind is the computer working model (Shapiro & Spaulding, 2021). The classic cognitivists employed CTM to elucidate that the human mind has input and output procedures, and the human mind has a solving system for dealing with the obstacles in the environment by using a symbolic system. According to CTM, human cognition is composed of representational symbols and codes as the representation of the world. Those representations operate as symbols similar to the number formula in a computer. Importantly, those processes limited in the brain are comprised of representation and computation. Humans obtain input information from sensory perception, convert sensory input into symbols, collect those symbolic items in the brain, and recall stored items again through their action output. Therefore, from CTM’s standpoint, everything in the brain such as memories, languages, and concepts, are as symbolic or ‘language of thought’. Our cognition solely happens in the head. The sensation and the body are only considered the channels for input and output (Newen, et al., 2018, pp. 3-8). It can be seen that the cognition by CTM’s consideration strictly emphasized

the brain as an essential internal operation and omitted other vital cognitive constituters like body and environment. The ignorance of classic cognitivists who relied on the CTM principle engendered the turning point of the Embodied turn. The embodied cognition movement occurred as a new trajectory that pointed out the role of the body and the environment as part of the association in cognitive processes.

The traditional cognitive theory has been critiqued by later cognitivists who raised the new trajectory. It was the embodied cognition ideology (henceforth EC). The embodied cognitivists began the criticism by invitation to turn to reconsideration of the environment as the one significant coordinator of cognitive processes and turn to scrutinize the body attributes of the organism, especially, the quality of embodied. The body attributes are essential determinants in establishing and shaping an organism's cognition, moreover, the configuration and functions of the organism's body are also the major characteristics that impose the possibilities of interaction with the organism's environment. The embodied cognitivists also pointed out that cognition emerged and evolved when and where the interaction of body and environment happens. Cognition emerges when the organism encounters and diligently learns to thrive through dynamic interplaying in the ecosystem, and the cognitive process evolves and develops in such a way that real-time patterns during goal achievement (Coward, n.d.). Furthermore, the EC theorists presented that the cognitive system should be consisted of the integrating operation of extracranial bodily patterns, and the coordination among the brain, body, and environment. Cognitive system investigation should not be limited to only the skull. It should be not only the brain is the main player in the contribution of the cognitive process but also the intimate association of the body and environment is the important player in the cognitive system (Newen, et al., 2018, pp. 3-8). The new offers from the EC principle have challenged the former CTM view. The result of this challenge has been the paradigm shifts from intensely intracranial attention to the collaboratively extracranial investigation of cognition.

The Embodied Cognition Ideology

The EC principle stresses the kinds of an organism's body, both configuration and shape. They were contributors to what constructs an organism's cognition. The physical features of an organism were the major actors in constructing learning in the cognitive system.

According to EC, cognition emerges when the organism struggles in its surroundings. The organism creates affordances through the possibly optional function of its body to coexist in its situations. The recognition in organisms' consciousness is consistently created when the organism attempts to accomplish a difficult task in a special situation for the first time. The organism would learn to solve or cope with those problems in the real-time pattern as far as its body option provides its potentiality. As time passes, if the organism witnesses similar events for the second and future times. The organism will retrieve its past imprinted activities to combine with a new real-time activity that simultaneously happens in that new situation, to create and improve how to deal with the problem it is facing. The EC cognitivists believe that the organism always repeats these processes and collects the ways of how to survive in the world by this trajectory. In any case, the different situations and the different organisms would realize and respond to their environment in numerous patterns. Their affordances would depend on the different configurations and shapes of organisms that they possess (Shapiro & Spaulding, 2021; Cowart, n.d.).

In addition, the EC theorists emphasize the importance of the physiology and body schemes of the organism. EC theorists envision that an organism's body is the core variant that permits the organism to interact with the environment in possibilities of various routes as much as its body provides (Cowart, n.d.). For instance, the two species of organism, a bird and a human. Both would like to drink the water in a half-water-filled glass. In human terms, a person can normally use their hands to grasp a glass and drink. However, in the bird's terms, if it wants to drink water, it needs to search for pebbles to fill the glass. Once the water level reaches the rim of the glass, the bird can drink the water. It can be beheld that the anatomy and physiology of both permit them to differently interact with the natural world. It also includes the perceptual system, all the parts of the body, like the visual system, auditory system, olfactory system, and gustatory system. The EC theorists raised the issue of sensorimotor experiences and argued that sensorimotor plays a major role in learning and memorizing sensibility activities in the world. The sensorimotor units in the muscle system and the neural system are the memorial centers and detectors of signals of the organism's interaction with the world in many situations. The sensorimotor units always record realization in each situation and collect the sensorimotor experiences that they are understood by the organism. The organism would understand and respond to the external world by recollection the past sensorimotor experiences and by integrating the real-time option.

Besides, from the point of view of the EC principle, the environment is considered one of the major causes of cognition. The environment provides selective choices to the organism and the organism can deal with its contexts by selecting the best implement for reaching its goal in situations. The environment influentially arranges the choices for the organism in all dimensions. The organism would adjust its interconnection with the world by considering its space, the weather, the position, the location, etc. Therefore, the organism's interaction is partly the result of the given limits from the environment (Shapiro & Spaulding, 2021; Cowart, n.d.).

Overall, we can realize that the embodied cognition movement is founded on elucidating the intricate interplay between the brain, body, and environment. Within this conceptual framework, cognitive processes are constructed from the dynamic interrelation among the brain's neural mechanisms, the body's physiological responses, and the contextual possibilities given by the environment.

Although this EC idea is contested by CTM theorists, some thinkers support it as well. In the next section, I will present Barsalou's Perceptual Symbol System which was a supporting theory of the EC principle. Its theory suggests the coworking between a modal system and an amodal system.

Barsalou's Perceptual Symbol System: The Striking Idea against The Computational Theory of Mind

One of the most outstanding thoughts that has been brought to support the embodied cognition movement is Barsalou's Perceptual Symbol System (1999). Lawrence W. Barsalou proposed that the recognition of everything that the agent obtained is the outcome of the interaction between the physical bodily activities of the agent and the world. In other words, the agent's recognition comes from the sensorimotor system's act/response to the world and during the organism lives its life or does activities in the world. The organisms' concept originated by the embodiment or, what we can call, the 'modal system'. The concepts do not occur via the computational cognitive science model or 'amodal system'. He exhibited that it is incompatible if the concepts perform as same as the symbols in the computer because the symbol is not specific and capricious. As stated in the amodal system, there is a conceptual medium that they are composed of 'symbols' a medium that repre-

sents the things in the real world, and ‘references’ which are the things in the real world that are referred to. However, the ‘symbols’ and the ‘references’ could be arbitrarily modified. For example, the word ‘horse’ in the English language represents the concept of the horse and the word ‘ม้า’ in the Thai language represents the concept of the horse as well. In Barsalou’s view, the function of these representations did not correlate to perceptual experiences and over-prioritize the representation symbols. For this reason, he argued that perceptual states, memories, languages, and thoughts have not been transduced to computational symbols or mathematical equations and collected in the human brain.

In contrast, he pointed out that humans comprehend the external world by dependence on sensory-motor experiences. The construction of concepts and representation processes in cognition inevitably relies on the perceptual system. Per the perceptual symbol system, neurons in the sensory-motor system enable the representation of the qualities and functional information of the situations that humans perceive in real-time during they want to implement their tasks and this flexible perceptual symbol system can function in many different situations. Its function has the properties of feasible adaptation for supporting human dwelling in variable environments and the capability for broadly searching possible trajectories for human interconnect to the world. The process of the perceptual symbol is established through the sensory modalities, especially, the processes of proprioception and introspection.⁴ Moreover, Barsalou illustrated that a sensory-motor system is the main creator of conceptual formation. Conceptual understanding of some things in the world is shaped by human bodily configuration, attention, and decisions in different situations and by the moment that humans confront something in the real environment and straightly actually perceive it (Barsalou, 1999, pp. 577–660). For instance, the concept of ‘Nubra Valley’ in Leh Ladakh is constituted while the human journeys to Nubra Valley in real life, when a human touches the genuine mountain landscape, he explores the atmosphere and the weather of

⁴ The proprioception is the realization of self-movement and body postures of the human. It is operated by neuron units in the brain, the muscle system, and the skeleton frame (Tuthill & Azim, 2018, pp. R194 – R203). In terms of introspection, are the internal-awareness system, the realization of mental scale, mental states, and emotional states in the levels of conscious thought (Schwitzgebel, 2010).

that valley, he hears the sound of animals and the wind in that valley's environment and he contacts and moves his motions and gestures. He obtained the Nubra Valley impression that is implanted in the sensorimotor units in his brain through sensory-motor units. He obtained the conceptual model of the valley in the brain which is the specific sensational information, exceptionally obtained via his sensory-motor system and his body. Therefore, the understanding and thought of Nubra Valley or other concepts depended upon sensory-motor perceptual states that humans specifically perceived in divergent personal situations.

Barsalou's perceptual symbol system is an important cannon-bullet idea for encouraging the EC principle. However, it still has other supporting ideas for EC such as the coupled system, parity principle, and wide computationalism (Shapiro & Spaulding, 2021). These theories are grounded from an EC standpoint and have remained controversial. There are both compatible opinions and contrary opinions, and this intellectual war debate has continued in the present.

In the next section, I provided the fundamental ideologies that are essential inspirations for the formalization of the EC principle, to show the dynamics of the philosophical concepts involved in this EC concept.

Three Pillars of Motivation to Embodied Cognition Ideology

The conceptualization of embodied cognition ideology occurred from three trends. They are Ecological Psychology, Connectionism, and Phenomenology. All trends have a shared posture disputing the traditional cognitive theory.

The first trend is Ecological Psychology (henceforth EP). From the computationalism perspective, it offers the inference that human cognition is based on the knowledge background at the sub-conscious level. Computationalists were influenced by Noam Chomsky's hypothesis. Chomsky presented that infants spontaneously have an innate structure named Language Acquisition Device (LAD). LAD habitually organizes the learning of humans and matches the language that humans receive from hearing to fit with different grammatical formulas in the brain (Shatz, 2007, pp. 1-15). The organization in the human brain carries the special detectors by birth to understand language. According to LAD theory, it allows CTM

theorists to consider perceptual data as merely the interpretation of representation matching with the detectors in the brain and the role of the world is clues that humans could not directly conceive the world but they merely interpret some particular clues that were consistent with functional detectors in the brain and the function of human learning solely occurs through the sensory system and organs such as the eyes, the images on the retina area, and the brain operation.

In contrast, EP theorists have not considered that cognition is limited according to LAD theory, but cognition is constituted by all parts of an organism's body and the moment while the organism is dwelling in its environment. Based on EP, an organism creates its movements that are always changed and unstable. The changing movement counter-reflects the organism's perceptual realization. The characters of a perceived object would be varied according to the distance between the organism and the object, and the organism's body. In other words, the locomotion, movement, and physical structure of an organism determine the perception of shape, size, texture, and sensory information of the perceived object. This EP idea is grounded by the father of ecological psychology, James J. Gibson. He pioneered the concept of affordance which means the possible interaction of organisms with the environment. The interaction would be permitted by an environment, so to speak, open opportunities by an environment for organisms' actions that are meaningful to organisms. The environment would create the choices for affordances and organisms would realize which actions they could interact with in their surroundings (Lobo, et al., 2018, pp. 7-8). Gibson's concept of affordance was a key precursor to the EC principle and was widely used in philosophy, neuroscience, and AI studies later.

The second pillar is the connectionism (henceforth CN). The CN's counterattack denied the representational symbols were the foundation of cognition. The CN principle replies that the basement of cognition is the network of nodes. The network frame has functions of activation and obstruction to manipulate an organism's behavior in the cognitive processes. The key major of cognitive processes originated from the transference of electric current between each node at a neural level. The linkage and communication of nodes caused the organism's behavior. Moreover, the CN theorists have relied on the scientific evidence which has been discovered that the functions of the electric current at a neural level were different from the symbolic system in the computer. The fundamental of cognition is the interconnection of neuron units. The neuron units activate the muscle memories and

the sensorimotor of the body and brain. This CN's counterattack has scientifically proved that cognition is no longer grounded on the CM principle (Hans Dooremalen, 2020; Edison Barrios, 2021; Shapiro & Spaulding, 2021).

The last is phenomenology. Phenomenology has been the root-fundamental ground of the EC movement, neuroscience, and cognitive science because numerous ideas researched in phenomenological inquiry are employed in these fields. Two heart concepts from phenomenology directly connected to the EC view were the concepts of the sense of ownership (SO) and the sense of agency (SA). The SO is the concept of the recognition of subjective experiences of the human as the subjectivity in the phenomenon and The SO is inclusively the first-person experience that the one possesses. It is the sense that the subjective human perceives what he is doing through his body and what is happening with his body, he is the owner of the subjective experience of something via perceptual experiences. The SA concept is a pre-reflective experience and the sense that the human would perceive the possession of the body and himself as the creator of his actions. For example, in the first case, the man raises his hand over the head. He knows that he is raising his hand and he is raising his hands by himself. In this case, he perceives the SO (the raising of his hand) and he possesses the SA, the cause of action (he intends to raise his hand). In the second case. When someone pushes the man from the backside. The man is being forced. He obtains the SO (he knows that someone or something is damaging him.) and he is not the man who pushed himself. He does not have the SA. These phenomenological principles have been correspondently developed in cognitive science and neuroscience (Gallagher, 2014, pp. 9-19). Moreover, Phenomenologists such as Martin Heidegger and Maurice Merleau-Ponty proposed that our understandings are shaped by bodies, the capability of the human body relates to the function of consciousness, and human bodies and the environment are the constituters of experience of consciousness (Shapiro & Spaulding, 2021).

From the three trends above, EC suggests that we should step back to reconsider our environment as the main role of contextual factors that create the affordance to organisms. CN informs us that brain activity is not only the process of symbolic representations but it is the coordination of nerve impulses at the cellular level. Phenomenology emphasizes the roles of the body and perception that are essential parts of constructing human consciousness. Later, after the formation of Embodied cognition ideology occurred. There was the branching of sub-ideas under the EC umbrella that can be categorized into Embodied,

Embedded, Extended, and Enactive cognitions.

4E Cognition: Embodied, Embedded, Extended, and Enactive

The core concepts of the EC principle are the reliance on the organism's bodily particularities for cognitive capacities, the rejection of symbolic representation as the primary language of thought, and the recognition of cognition as arising from the dynamic interplay between the brain, body, and environment (Shapiro, 2011, pp. 1-6). However, interpretations of the meaning of embodiment within the EC community have sparked controversy, giving rise to alternative perspectives such as Embedded, Extended, and Enactive cognition. These divergent viewpoints collectively form the framework known as 4E cognition, a term first coined during a conference on 4E cognition held in 2007 at the University of Central Florida (Newen, et al., 2018, p. 4; Rowlands, 2010, p. 3). Each of the 'E' might be slightly different in how they explain cognition and there may be a special focus on some constituent for the cognitive process. However, these connected ideas are still on the same standpoint as embodied cognition which insists that cognition is the process that is constituted by the participation of the brain, body, and the world. The cognitive process is not intracranially constrained in the skull and cannot operate without connection with the external world and the cooperation of extracranial bodily processes (Shapiro & Spaulding, 2021).

In the Oxford Handbook of 4E Cognition (2018), cognitive theorists categorized the standard for distinguishing the kinds of E using two criteria. The first criterion is a delineation of the involvement of the extracranial process. The 4E theorists divided the intensity of the extracranial-process involvement into the strong and the weak types. The strong type is the constitution of cognition is vigorously manipulated by the process outside the skull, or it can be said that the cognition construction cannot be organized without the extracranial process. Regarding the weak type, cognition is not directly constituted by the process outside the skull rather cognition is causally affected by the outside, or the world was the slight factor in cognitive formation.

The second criterion entails identifying the constituents that form cognitive processes. These constituents are categorized into two types: bodily and extrabodily. Bodily constituents refer to cognitive processes formed by the brain and body, while extrabodily constituents encompass cognitive processes formed by the intricate interplay between

the brain, body, and environment.

Considering both criteria, 4E theorists have proposed four categories of cognition synthesis: strong-bodily, strong-extrabodily, weak-bodily, and weak-extrabodily. However, only two of these categories are deemed consistent with the principles of embodied cognition ideology. These are the strong-extrabodily and weak-extrabodily frameworks (Newen, et al., 2018, pp. 3-8).

The strong-extrabodily type, known as extended cognition offers that cognition is systematically integrated with extrabodily elements and processes with extracranial processes playing a fundamental role in this interaction (Newen et al., 2018, pp. 3-8). According to Extended theorists, “Extended” means cognition is not confined solely within the confines of the skull and skin. Rather, cognitive processes can extensively occur beyond these boundaries that encompass external artifacts such as tools and devices in daily life. Extended theorists assert that external cognition should be considered an integral component of the cognitive system (Kiverstein, 2018. pp. 19-25; Shapiro & Spaulding, 2021).

The weak-extrabodily type is termed embedded cognition. It emphasizes the role of extrabodily participation in shaping cognitive processes. In this framework, extrabodily processes serve as causal collaborators that influence the organism’s bodily response functions by forming the foundation of understanding (Newen, et al., 2018, pp. 3-8). Embedded theorists argue that the surroundings play a crucial role in shaping cognitive processes and cognitive processes would happen while an organism is deeply immersed in its environment. According to embedded cognition theory, individuals can enhance their cognitive abilities by engaging with appropriate physical and social environments (Shapiro & Spaulding, 2021). For example, a tea barista would develop his ability to calculate ingredient volumes after he has long experience in brewing tea. This case demonstrates how immersion in a particular context can shape cognitive processes.

Another trajectory for understanding cognition is enactive cognition. It proposes that cognition emerges through the cooperative engagement of extracranial processes. Enactive cognition theory asserts that cognition is developed and evolved through the active interaction of a subjective entity with its environment and emphasizes that cognition is not merely an activity that happens within the brain but cognition is enacted through ongoing interaction and engagement with the surroundings, in other words, cognition emerges from the recipro-

cal interaction between an organism and its environmental context where the organism actively engages and adapts to the world. According to this concept, it is also believed that objects and the external environment create the affordances to the organism's actions, and sensorimotor in the organism's body plays a pivotal role as a key mechanism in interaction (Coward, n.d.; Ward, n.d.).

The new movement of 4E cognition breaks down the CTM principle and creates a new perspective for elucidating the nature of cognition. We can conceive that cognition is not the computation and internal processes in the brain. Conversely to CTM, the essence of cognition is the interaction of the brain, body, and environment. Such proposals lead humans to move beyond the traditional method of CTM and find new approaches to defining the new meaning of cognition. The debate on the meaning of cognition ignited by 4E cognition is just the beginning of a new explanation in the philosophy of cognitive science. The implications of 4E cognition will be discussed in the next section.

Criticism of 4E Cognition

I have two arguments about this idea that are 4E cognition is consistent with postmodern methodology, and 4E cognition is the process of radical intense philosophizing.

In the first issue, the postmodern methodology is 'Discourse Analysis'. Discourse analysis indicates that the knowledge system and epistemological investigation are indeterminacy and interpretative because discourse analysis is faithful to the critical study and multidisciplinary perspective and its approach defeats the traditional boundaries among disciplines of different sciences and supports the interconnection that gets across between various sciences. These such characters of discourse analysis create the conversation between different knowledge and extend the realm of epistemology for investigation and explanation of the meanings and social phenomena that exist in the present world. Moreover, discourse analysis is the methodology that endeavors to understand the multiplicities rather than to value one series of knowledge as superior to another series of knowledge. Apart from these, discourse analysis does not reject specialized knowledge series, but creates a bridging between knowledge series (Susen, 2015, pp. 64-82). Therefore, it can be said that 4E cognition has the characteristics of a critical study consistent with the postmodern methodology because 4E cognition is an approach that interpretatively opens to considering and studying possible

meanings of cognition and deconstructing CTM as well. That is, although 4E cognition holds on to the notion that the interaction of brain-body-environment factors constitutes cognition, 4E cognition expresses its status that does not ignore probably theoretical arguments from both the computational and anti-computational theorists. This means 4E cognition does not block the conceptual possibility for other kinds of investigation of the meaning of cognition. For example, If one day in the future. Cognitive theorists must turn back to relying on CTM for solving cognitive problems and might find that CTM can support to discovery of possible correct answers to the meaning of cognition. 4E cognition readily accepts CTM. Or if any other kinds of new cognitive theory can improve accurate knowledge for comprehension of functions of the cognitive system properly. 4E cognition would accept those theories as well. As Newen, Bruin, and Gallagher write

“... 4E approach as such does not presuppose a specific view on representation and computation” (Newen, et al., 2018, p. 8).

Such status of 4E cognition indicates the ontologically theoretical distribution which does not exalt any one theory to transcend over any other theories. By contrast, 4E cognition aims to integrate and comprehensively understand different knowledge from many fields to investigate the meaning of cognition. Consequently, 4E cognition is consistent with postmodern methodology in this respect.

The second issue, 4E cognition is the process of radical intense philosophizing because 4E cognition theorists have considered the meaning of cognition by combining the different knowledge series and bringing those knowledge series to create dialectic conversation to develop the advance of the philosophy of cognitive science. In other words, 4E cognition theorists comprehensively and interpretatively consider interconnected knowledge series because 4E cognition is correlated with different sciences, including philosophy, neuroscience, psychology, linguistics, etc. and its theory integrates and dynamically develops the knowledge of the entire society together.

For more clarity, we shall consider my second argument from the question ‘Why is 4E cognition the process of radical intense philosophizing’. In my perspective, we must turn back to consider the formalization of 4E cognition. From the above information, we can find that 4E cognition emerged from three pillars, Ecological psychology, Connectionism, and

Phenomenology. The integration of each pillar enabled 4E cognition to become an interdisciplinary movement. In other words, it can be said that a crossing-over process between different boundaries of science creates 4E cognition. And if we consider it elaborately. In one aspect, we can find that the interdisciplinary movement of 4E cognition is a theoretical openness to integrate various arguments to discover an absolute meaning of cognition. In another aspect, 4E cognition shows the process of the doing philosophy at the theoretical level which permits for disputation, argumentation, and encounter among heterogeneous sciences. This process entails the analytic and synthesized movement of 4E cognition that is growing at present. Therefore, it makes sense that 4E cognition is the process of radical intense philosophizing.

In addition, 4Ecognition also contributes to the consideration of cognition in diverse fields (It depends on what kind of theoretical stance that cognitivists are interested in and what he or she is interested in studying.). For example, there is the development of the robotic bottom-up system that relies on the detection of real-time reactions of a robot to the environment. Robotic cognitivists have found that bottom-up robots can function in the physical world better than top-down robots that depend on disembodied syntax computation which is based on the CTM concept. By contrast, a bottom-up system was designed to release the robot to interact with its real physical environment and to create informational representations correlated with its environment (Gallagher & Zahavi, 2008, pp. 133-134). Another example is the Conceptual Metaphor Theory of George Lakoff and Mark Johnson. They propose that abstract concepts of humans occur from perceiving daily physical activities and constructing concepts by metaphorical processes, such as bodily motion or movement. Their theory uses the EC principle as knowledge background, as they write:

“... metaphor is pervasive in everyday life, not just in language but in thought and action. Our ordinary conceptual system, in terms of which we both think and act, is fundamentally metaphorical in nature.” (Lakoff & Johnson, 1980, p.3)

In this way, language and concepts emerge from metaphorical processes.

Therefore, from the two examples shown, it can be expressed that 4E cognition is bringing different sciences bridge each other through the doing philosophy processes, and 4E cognition builds itself the process of radical intense philosophizing.

Conclusion

The concept of 4E cognition emerged from the embodied cognition framework with four dimensions, they consist of Embodied, Embedded, Extended, and Enactive cognition. These dimensions challenge the computational theory of cognition which relies on symbolic representation for explaining the nature of cognition. The sub-concepts within the 4E framework vary in their interpretations. For instance, enactive cognition offers a radical perspective by proposing that cognition arises from ongoing interactions between an organism and its environment, and extended cognition contends that cognitive processes are not confined to the brain alone but can also encompass external devices or tools in the environment.

However, all dimensions under the 4E cognition umbrella adhere to the fundamental premise that cognition emerges from the dynamic interaction between the brain, body, and environment. 4E cognition theorists confirm that cognitive processes extend beyond the confines of the brain and include interactions with external processes in the world. Cognition occurs when a subjective entity engages with its ecological context and actively pursues tasks driven by attentional focus and goals.

From my point of view, I argue two issues about 4E cognition. First, 4E cognition aligns with the discourse analysis of postmodern methodology that emphasizes interpretative approaches and interdisciplinary connections for understanding cognition. Second, 4E cognition involves intense philosophical inquiry by integrating knowledge from diverse fields to advance cognitive science, emphasizing interpretation and interconnectedness across disciplines. Overall, 4E cognition should be seen as a critical philosophical investigation and interdisciplinary dialogue of the exploration of the meaning of cognition.

References

- Barsalou, L. W. (1999). Perceptual symbol systems. *BEHAVIORAL AND BRAIN SCIENCES*, 22(4), 577-660.
doi.org/10.1017/s0140525x99002149
- Cowart, M. (n.d.). *Embodied Cognition*. The Internet Encyclopedia of Philosophy. Retrieved from
<https://iep.utm.edu/home/about/>
- Edison Barrios. (2021, May 26) *Connectionism 2: Overview of Networks [Video]*. YouTube. Retrieved from
https://www.youtube.com/watch?v=n_R6dxoqqNg
- Gallagher, S. & Zahavi, D. (2008). *The Phenomenological Mind: An Introduction to Philosophy of Mind and Cognitive Science*. Routledge.
- Gallagher, S. (2014). Phenomenology and Embodied Cognition. In L. Shapiro (Editor), *The Routledge Handbook of Embodied Cognition* (pp. 9-18). Routledge.
- Hans Dooremalen. (2020, February 11). *Connectionism [Video]*. YouTube. Retrieved from
<https://www.youtube.com/watch?v=ITwpDxx0UBE>
- Kiverstein, J. (2018). Extended Cognition. In A. Newen, L. D. Bruin, & S. Gallagher (Eds.). *The Oxford Handbook of 4E Cognition* (pp. 19-40). Oxford University Press.
- Lakoff, G. & Johnson, M. (1980). *Metaphors We Live By*. The University of Chicago Press.
- Lobo, L., Heras-Escribano, M., & Travieso, D. (2018). The History and Philosophy of Ecological Psychology. *Frontiers in Psychology*, 9, 2228.
doi.org/10.3389/fpsyg. 2018.02228
- Newen, A., Bruin, L. D., & Gallagher, S. (2018). 4E Cognition: Historical Roots, Key Concepts, and Central Issues. In A. Newen, L. D. Bruin, & S. Gallagher (Eds.), *The Oxford Handbook of 4E Cognition* (pp. 3-15). Oxford University Press.
- Prathomwong, P. (2016a). Exploring a Philosophical Debate about Emotion and Theory of Embodied Emotion. *Walailak Journal of Social Science*, 9(9), 75-109. Retrieved from
<https://so06.tci-thaijo.org/index.php/asi/article/download/94268/73701/234268>
- Prathomwong, P. (2016b, December 23-25). Giovanna Colombetti's Idea of the Extended Affectivity [Paper presentation]. *20th Annual Meeting of the Philosophy and Religion Society of Thailand (PARST) at the Faculty of Humanities, Burapha University*,

Chonburi, Thailand, 106 – 125.

Rowlands, M. (2010). *The New Science of the Mind: From Extended Mind to Embodied.*

The MIT Press.

Schwitzgebel, E. (2010, February 02). *Introspection*. Stanford Encyclopedia of Philosophy.

Retrieved from

<https://plato.stanford.edu/entries/introspection/#GeneFeatIntr>

Shapiro, L. (2011). *Embodied Cognition*. Routledge.

Shapiro, L., & Spaulding, S. (2021, June 25). *Embodied Cognition*. Stanford Encyclopedia of Philosophy. Retrieved from

<https://plato.stanford.edu/entries/embodied-cognition/>

Shatz, M. (2007). On the development of the field of language development. In E. Hoff & M. Shatz (Eds.), *Blackwell Handbook of Language Development* (pp. 1-15). Blackwell Publishing.

Susen, S. (2015). *The 'Postmodern Turn' in the Social Sciences*. Palgrave Macmillan.

Tuthill, J. & Azim, E. (2018). Proprioception. *Current Biology*, 28, R194 – R203.

doi.org/10.1016/j.cub.2018.01.064

Ward, D. (n.d.). Enactivism. *The History of Distributed Cognition*. Retrieved from

<http://www.hdc.ed.ac.uk/seminars/enactivism>