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Chapter 15

The notion of embodied knowledge

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SUMMARY

This paper discusses the notion of embodied knowledge, which is derived from the phenomenology of Maurice Merleau-Ponty. Embodied knowledge is a type of knowledge where the body knows how to act (e.g., how to touch type, how to ride a bicycle, etc.). One of the important features of this knowledge is that the body, not the mind, is the knowing subject. Procedures for performance are embodied such that the body knows how to act in a given situation. Embodied knowledge is not confined only to motor skills, but is concerned with the variety of human experiences, all of which share the property of 'doing without representing'. There is no need for representation because there exists a pre-reflective correspondence between body and world. Through examining Merleau-Ponty's notion of body schema, I try to clarify that embodied knowledge is beyond the Cartesian mind-body dualism and requires an embodied view of mind.

INTRODUCTION

Embodied knowledge is a type of knowledge where the *body* knows how to act. A simple and general example is riding a bicycle. Most of us know how to ride a bicycle, and we are able to do it without any deliberation. There is no need to verbalize or represent in the mind all the procedures required. The knowledge seems to be imprinted in one's body. The knowing-subject here is the body itself, not the mind. Or more precisely, it is the mind-body.

The notion of embodied knowledge is derived from the phenomenology of the French philosopher, Maurice Merleau-Ponty (1908–1961). In his main work, *Phenomenology of Perception* (1945/1962), he explains it as follows, using the example of knowing how to touch type:

> [T]o know how to touch type is not, then, to know the place of each letter among the keys, nor even to have acquired a conditioned reflex for each one, which is set in motion by the letter as it comes before our eye. … It is *knowledge in the hands*, which is forthcoming only when bodily effort is made, and cannot be formulated in detachment from that effort (Merleau-Ponty, 1962, p. 144; emphasis added).

What Merleau-Ponty described as "knowledge in the hands" is the particular type of knowledge which is not distinctly explicit, conscious, mentally representative, or articulated. It is, however, well known by the body or through the body, when it is practiced. Phenomenologically, the knowledge of how to touch type is just lived by the hands or by the body. Merleau-Ponty also refers to it as 'knowledge bred of familiarity' (*savoir de familiarité*). This is the original source of embodied knowledge.

Embodied knowledge is similar in concept to the procedural knowledge of cognitive science as contrasted with declarative knowledge (Stillings et al., 1995). It can be better presented by performance than by verbal explanation. However, in contrast to the ideas of Merleau-Ponty, Cartesian mind-body dualism (and the reduction of mind to brain which historically derived from it) is still dominant in mainstream cognitive science (Gibbs, 2006). The embodied nature of knowledge seems to be overlooked, as we see below.

Descartes, with his methodological skepticism, separated mind and body, and at the same time rejected any knowledge that could be doubted. Thus, in the Cartesian worldview, the knowing-subject, which certain knowledge belongs to, is the mind. The body is a mere known-object (Descartes, 1637, 1642). There is no place for any 'embodied' knowledge.

Embodied knowledge is not constituted upon such dualism. For the mind, it is not apparent as knowledge since it is not clearly represented; nevertheless, we experience it with certainty through our own body. It is not confined only to motor skills, but is concerned with the variety of human experiences which occur within the lifeworld (Husserl's *Lebenswelt*). By giving several examples, I wish to show that embodied knowledge encompasses a broad range of psychological experiences.

EXAMPLES OF EMBODIED KNOWLEDGE

Example 1: Phantom Limb

A phantom limb is the feeling that an amputated limb is still present. The individual may feel that the missing limb is still attached to the body and moves with other body parts. It is thought that the body image in the brain remains intact and becomes active spontaneously without somesthetic stimulation (Berlucchi & Aglioti, 1997; Melzack, 1990). However, it is important to recognize the phenomenon itself before seeking its cause in brain processes.

Consider the following example. Ramachandran and Blakeslee (1998) recount the story of a patient, named Tom, who had lost his left arm in a car accident:

> [H]e could wiggle each 'finger', 'reach out' and 'grab' objects that were within arm's reach. Indeed, *his phantom arm seemed to be able to do anything that the real arm would have done automatically*, such as warding off blows, breaking falls or patting his little brother on the back. Since Tom had been left-handed, his phantom would reach for the receiver whenever the telephone rang (pp. 21−22; emphasis added).

Apparently the patient's body still reacted to certain stimuli in a habitual manner. Whenever the telephone rang, his whole body was led to answer it as he used to, and this action involved movement of the left hand. The sensation of the missing limb seems to occur as a part of a habitual action that had been established between the body and a certain situation. The patient need not represent in his mind the missing part of the body but may feel it immediately, as an embodied action.

According to Merleau-Ponty (1945/1962), the body comprises two layers: one is the 'habit-body' (*le corps habituel*) and the other is the 'body-at-this-moment' (*le corps actuel*). The habit-body, comprising a complex of various patterns of habit, responds

skillfully to a given situation. What appears as a phantom limb is the unchanged pattern of action, which is deeply embodied in the habit-body and performed without conscious intent. In a sense, the body knows how to cope with a situation skillfully even when lacking the necessary part.

Example 2: Affordances

Gibsonian affordances are another example (Gibson, 1979). This is where a physical property of the environment affords (or offers) an individual the opportunity for a particular action. For example, firm and level ground affords an individual the chance to stand on it, to walk around on it, or to lie down on it. Gibson named these action possibilities which are latent in the environment as affordances.

Gibson's idea is interesting not only as a theory of perception, but also of behavior, because the notion of affordance enables us to focus on the pre-reflective dimension of human behavior, which is different from reflex. There is a likelihood of human actions where certain conditions are present in an environment.

For example, when we walk through an opening, the ratio between the aperture and our shoulder-width determines our action. If the ratio is less than 1.3, we rotate our body to walk through sideways instead of frontal walking (Warren & Whang, 1987). When we go up stairs, the ratio between the step height and leg-length determines our action. If the ratio is more than 0.88, we judge it as not climbable (Warren, 1984).

These examples imply that our actions are bodily scaled; to perceive the environment is to 'know' the possible action to take in the environment. As opposed to the information processing view of mind, perception as 'input' does not occur apart from action as 'output'. There is a direct connection between perception and action. Especially, in cases of spatial behaviors, such as the examples above, human actions are not the product of computation processes in the mind. What guides our behavior is not the goal represented in the mind but the affordances picked up by the body. This is to say, the body knows how to act, and to act adaptively, in a given environment before the mind tries to control the body movements toward a goal. As Merleau-Ponty (1962) puts it: "to move one's body is to aim at things through it; it is *to allow oneself to respond to their call*, which is made upon it *independently of any representation*" (p. 139; emphasis added).

Example 3: Personal Space

The spatial experience known as personal space (Hall, 1966; Sommer, 1969) is also an example of embodied knowledge. Personal space (also called peripersonal space in neuroscience) is the spatial zone surrounding an individual's body which is unconsciously presumed as personal territory. If someone unfamiliar enters this zone, it makes the individual feel uncomfortable. This feeling is often experienced in crowded places, such as elevators, buses, or concert halls.

The invasion of personal space evokes various visible reactions as well as inner feelings of discomfort. Sommer (1969) reports aggressive facial expressions (frowning), defensive gestures (facing away, closing eyes, folding arms), signs of tension (rocking, tapping), and moving away. This implies that the basic sense of self is continued and embodied into the space outside of and beyond the skin. Personal space is an extended boundary of the self, and the body shows various forms of defense when it is invaded.

In terms of distance, personal space is used as a kind of buffer zone between people. In his classic research, Hall (1966) categorized these zones into four types: intimate distance, personal distance, social distance, and public distance. This classification is based on the types of possible interactions at each distance. In general, the closer the distance, the more intimate the interaction; the further the distance, the more formal the interaction becomes.

It is well known that psychological or social distance between people is correlated with physical distance (Little, 1965). We tend to adjust the spatial divide when our communication partners change. There is a proper distance for interaction between family members, between colleagues, among acquaintances, and so forth. We have a subtle sense of distance, and the body knows how to regulate it for cordial communication with others.

These examples are reinterpretations of known psychological experiences from our perspective involving embodied knowledge. Embodied knowledge, first of all, is concerned with motor skills and habitual actions, as we have seen in the case of the phantom limb. In addition, it is also concerned with perception of the environment, spatial behavior, sense of self and nonverbal behavior, as was shown in the cases of affordances and personal space.

All the examples, however, share the property of 'doing without representing'. There is no need for representation because the body knows how to act. Thus, in a sense, embodied knowledge is what we do without trying to do, or what we know before trying to know. It is possible to find this property in other psychological experiences, such as imitation, mirroring, and certain types of gestures or postures. Embodied knowledge is concerned with a broad range of our actions performed in everyday life.

'I THINK' AND 'I CAN'

For Merleau-Ponty, we are bodily beings, or embodied beings, as opposed to Descartes for whom the essence of humanity was the mind. Descartes found the mind in 'I think' (*cogito*), but Merleau-Ponty sees the origin of consciousness as 'I can' (*je peux*), following Husserl's work (Husserl, 1952/1989). Merleau-Ponty writes, "Consciousness is in the first place not a matter of 'I think that' but of 'I can'" (1962, p. 137). 'I can' is a pre-reflective, and therefore the just-lived consciousness which accompanies each bodily movement. It is also called 'motor intentionality'.

Embodied knowledge is the 'I can' type of knowledge. As embodied beings, we are situated in this world ('being-in-the-world') and are always engaged in a concrete activity: walking, eating food, putting on clothes, driving a car, touch typing, talking with others, and so on. All of these behaviors have their own know-how to be embodied, and we practice them without deliberating on the procedures, or sometimes even without thematizing the behavior itself. Obviously, this is not the 'I think' type of knowledge.

For most ordinary behaviors of everyday life, we do not think to move our bodies, nor do we control them consciously. We just move the body as the situation demands, although remaining aware of behavioral goals in the background. The body is always embedded in some particular situation, and the surrounding objects induce the body to move appropriately; for example, a chair affords us to sit down on it. There is a pre-reflective correspondence between body and situation, and the body moves almost

spontaneously, just following the affordances provided by the situation. In short, we do not move the body but the body moves by itself.

It is important to note, however, that this correspondence is not a matter of reflex. The body often moves outside of awareness, but it does in conformity with the intention of behavior. When I reach for the knob to open the door, the whole movement is in accordance with my intention of opening it, while my hand and arm move in close to an automatic way. This is the way in which motor intentionality functions.

In the cognitivist paradigm of cognitive science, an agent's cognition and behavior is explained by the information processing model, which has a 'Sense-Think-Act' cycle (Pfeifer & Scheier, 1999). In this model, the mind is supposed to represent the situation based on perception ('Sense'), and then to compute the most adaptive behavior ('Think'), and finally to move the body toward the represented goal ('Act').

That is to say, the mind is something separated from the world and merely operates on representations of it. Ontologically, the mind is 'being-out-of-the-world'. In this sense the cognitivist paradigm is still based on the Cartesian worldview of subject-object dualism, no matter whether the mind is reduced to the brain or not. There can only be the 'I think' type of knowledge in this paradigm. Knowledge is an object for 'I think' and it must be represented in the form of a proposition. This is the cognitivist view of knowledge.

In contrast, as has been pointed out (Dreyfus, 2005; Varela, Thompson, & Rosch, 1991), we find a non-cognitivist and non-representationalist view of knowledge in the writings of Merleau-Ponty (1962), who states:

> [O]ur bodily experience of movement is not a particular case of knowledge; it provides us with a way of access to the world and the object, with a 'praktognosia', which has to be recognized as original and perhaps as primary. (p. 140)

According to Merleau-Ponty, the 'I can' type of knowledge is original and primary. When 'I can' touch type, for instance, I do not need to represent each letter on the keys, nor compute the movement of each finger. Probably the keyboard itself is the 'representation' which guides the finger movements. As Dreyfus (2005) writes, "the best 'representation' of our practical understanding of the world turns out to be the world itself" (p. 132).

THE MERLEAU-PONTIAN NOTION OF BODY SCHEMA

Embodied knowledge is found in the pre-reflective correspondence between body and world. 'I can' implies that the body knows how to respond to 'calls' from the environment. The motor intentionality of 'I can' is different from the intentionality of 'I think', which reflectively objectifies the world and ignores the correspondence.

Explaining this correspondence, Merleau-Ponty introduces the notion of the body schema (*le schéma corporel*). In general, in psychology or neurology, the body schema is often explained as the representation of the body in the brain, the visual image of the body, or the mind's awareness of the body. It is through the body schema that one recognizes the present posture and movement, and also knows the spatial positions of each part of the body (Head & Holmes, 1911; Schilder, 1935).

Merleau-Ponty further developed the notion of body schema, from the philosophical viewpoint of 'being-in-the-world', which he inherited from Heidegger (1927/1962). He acknowledged that the body schema is a subjective awareness of the body; it is, however, an indirect awareness which is felt through an ongoing task. When we sit on a chair, for example, we are aware of the waist, the hip, and the legs, and their spatial relationships with each other. But these parts of the body come into the internal senses only insofar as is necessary to do the task (to sit down). The body schema enables body awareness, relative to the context of movement toward a task, but the major part of it is tacit and unfocused (Gallagher, 2005).

Thus, the body schema is the way one knows one's own body through living in concrete action. This is the key to 'doing without representing'. The body schema coordinates the body parts into action and organizes the necessary behavior for any given situation. We know our own body through living in action, and therefore we do not need to represent it, or to be aware of its internal processes. The more skilled, or the more habitualized the action is, the less aware we become of it. We are able to perform skilled actions without representing the body. Thus, the body schema is, firstly, a corporeal system which enables habitual or skillful actions.

Secondly, this implies that the body schema is the converting system of perception and action. Skillfully coping with a situation is made possible when a direct association is established between perception of an environment and appropriate action toward it. The perceptual appearance of a situation immediately solicits a particular action, and then the situational change brought by the action will create a new perceptual appearance which solicits a subsequent action. 'I can' is based on the conversion of perception into action without being mediated by 'I think'. However, this is a pre-reflective correspondence which is different from reflex in terms of intention (Merleau-Ponty used the term of 'intentional arc' instead of 'reflex arc').

Thirdly, the body schema provides a body with the possible emergence of new actions. When facing a new or unfamiliar situation, new actions emerge through interaction with the environment. Although we are asked to deliberate in a detached way, we find how to act purposively through contingency. In this sense, the body schema is a self-organizing system of actions which is open to situational change. The acquisition of new skills or habits is made possible by this aspect of the body schema. It is a re-arrangement and renewal of the body schema, as Merleau-Ponty (1962) pointed out.

The last point is that the body schema is not equivalent to the physical body (Tanaka, 2009). As was shown in the case of phantom limbs, one is able to have the sense of proprioception in an empty space. Or, as we have seen in the case of personal space, one has a similar sense of proprioception in the surrounding space. The body schema extends our bodily feelings and body awareness beyond the skin. It is through tools that we often experience this kind of extension. For example, when we drive a car, we have extended feelings from fender to fender, as if the car were a natural part of our body. Tools are incorporated into the body schema and we extend our bodily feelings to the environment through them (Maravita & Iriki, 2004).

LEARNING EXPERIMENT ON BALL JUGGLING

Based on above ideas about body schema, we conducted a learning experiment involving ball juggling in order to clarify how the body becomes the knowing subject (Tanaka & Ogawara, 2010). Volunteer participants (N = 8; 5 men and 3 women) with no

prior juggling experience learned the three-ball cascade technique over a period of four weeks. We examined how the participants acquired the juggling skill, from a subjective, first-person perspective, as well as from an objective, third-person perspective.

Only three participants attained the learning goal of catching the balls consecutively more than 100 times. However, comparing the recorded video data of the first day in the experiment with those of the last day, we observed notable changes in the ball trajectories, upper limb movements, and postures that were common for all the participants.

On the first day of learning, none of the participants were able to throw the balls stably. Each throw went to various heights and the balls traveled away from or toward their body trunk. The trajectories and dropping points of the balls varied widely. Thus the catching hands moved around right and left or back and forth, and this instability finally made it impossible to keep on juggling in a fixed position. The mean number of consecutive catches for all the participants was merely 2.9.

On the last day, in contrast, every participant was able to throw and catch the balls in close to an automatic way. Each throw went to the appropriate height and the ball trajectories became stable. Since their eyes were almost fixed on the peak, most participants caught the balls without confirming visually the dropping point. Catching hands drew smooth circles and the whole body kept a stable posture during the movements. The mean number of consecutive catches increased to 67.4.

These changes imply that the participants' body schema has been rearranged through repeated practice. At first they had to 'think' the order of throwing and catching since there was no pre-reflective correspondence between their hands and the balls. Nobody was able to catch the balls without tracing them visually. However, the participants successfully extended their bodily feelings into the ball trajectories. At the end of the experiment, their hands 'knew' the precise dropping points without visual feedback, as if they knew exactly the itchy spot when scratching.

Since the experimenter did not give any instruction except showing an example movie repeatedly, the participants were required to learn by themselves. They had to find how to coordinate the body parts and partial movements to realize the cascade juggling as an integrated action. Interestingly enough, all the participants emphasized the importance of refraining from thinking during the trials. Juggling is so fast moving that there is not enough time to deliberate about the next step and adjust the movement.

Accordingly, the moments when the participants improve their juggling skill are subjectively experienced as an emergence of new action. During the trials there happened to be an occasional correspondence between intention and action, and it was felt as "the motor grasping of a motor significance" (Merleau-Ponty, 1962, p. 143). A discontinuous change, where the body parts start to coordinate differently from before, occurs through the process of learning.

In these moments of emergence, the mind is no longer the 'control tower' which functions as 'I think' and the body is no longer the 'instrument' to be controlled. Through the learning process, the duality of mind and body is dissolved and thus the body becomes the knowing subject. This is the way in which the body comes to know how to juggle.

CONCLUDING REMARKS

Embodied knowledge cannot be placed properly in the Cartesian worldview of 'I think'. When the body knows how to act, the 'I can' type of knowledge is at work. As Merleau-Ponty pointed out, 'I can' means that there is a pre-reflective correspondence between body and world. Merleau-Ponty introduced the notion of body schema to clarify this correspondence.

Body schema is a self-organizing system that realizes an action without bodily awareness. It converts the perceptions of environment into the appropriate action toward environment, and facilitates skillfully coping with situations. It also produces new actions through interactions with unfamiliar situations. It is closely related to, but is not equivalent to the physical body. In short, body schema plays a key role in 'doing without representing'.

As is shown in the case of the learning experiment on ball juggling, research on body schema can be developed from the third-person, as well as from the first person perspectives. Since the body schema realizes our pre-reflective actions in the world, it is not only experienced subjectively, but is also observable from an objective perspective. Body schema is the point of contact of the objective body with the lived body. Merleau-Ponty wrote the following about the notion of body schema:

> [t]he notion of *body schema* is ambiguous, as are all notions which make their appearance at turning points in scientific advance. They can be fully developed only through a *reform of methods*. (1962, p. 98; emphasis added. The term *body schema* was originally translated as *body image* by C. Smith)

What is discussed above is concerned with this 'reform of methods'. It is difficult to promote research about embodied knowledge when the research methodology is based on Cartesian epistemology and the concepts of mind and body which derive from it. Such a dualistic view reduces the phenomenon of embodied knowledge to a mere complex of conditioned reflexes or neural processes in the brain. It never succeeds to describe the phenomenon as such.

Based on the notion of body schema, we are able to open up the dialogue between the scientific explanations of the objective body and the phenomenological descriptions of the lived body. This dialogue will lead us to the foundation of a new methodology in psychology and will bring a truly embodied view of mind.

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