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Perception and Action:
Unity and Disunity of our Perceptual Experience

1. Perceptual experience in phenomenology and brain sciences

"Experience" ("*Erfahrung*") plays an essential role in phenomenology. In particular, *perceptual* experience is considered, according to Husserl, to be the ultimate source of the "general thesis" of the world, in which we always live and have various experiences (Husserl 1982/1913, p. 82/p. 70).

Perceptual experience is regarded as a "primal experience" ("*Urerfahrung*"), in which all physical things are originally self-given and from which "all other experiences derive a major part of their grounding force" (Husserl 1982/1913, p. 82/p. 70).

In addition to this fundamental role in our experiences, perceptual experience is given an important methodological role in the phenomenological analysis. The constitutive analysis of perception and its objects, in which concepts such as adumbration, horizon, kinesthesis, and passive synthesis are developed and used, plays a model role for the constitutive analysis of other experiences and their objects.

Perceptual experience has, in this way, a privileged status in phenomenology. It is to be considered the home ground and the ultimate source from which every phenomenological philosophy starts, and in which various insights of phenomenological investigations are stored.

On the other hand, phenomenology is not the only philosophical discipline in which perceptual experience is regarded as an important theme, and focused upon. Perceptual experience is regarded to be one of the main themes in the field of the philosophy of mind, which is one of the major streams in current analytical philosophy. One of the characteris-

tics of the discussions in the field of the contemporary philosophy of mind is that they are strongly influenced by the insights provided by various sciences of perception such as psychology, cognitive science, and especially brain science.

The main reason for this is that some of the insights provided by these sciences seem to contradict the traditional view of perception and perceptual consciousness, which has long dominated common sense as well as the traditional philosophy.

According to the traditional understanding of perceptual experience, when a subject receives a sensory stimulus and makes a report about his or her experience, it is presupposed that the content of the report made by the subject corresponds to the content of the conscious experience of the subject. However, many cases of brain damage patients seem to show that this presupposition is false.

In the famous case of *blindsight* patients, for example, subjects can find the correct answer if they are asked to discriminate between stimuli forcefully although they maintain they cannot see the stimuli but can only guess them. That means, they seem to have a perceptual experience from a third person point of view, but they do not seem to have it from the first person point of view.

Not only in this *blindsight* case but also in other cases, we can find similar situations. In the case of prosopagnosia patients, who cannot recognize the faces of people, or in the case of unilateral spatial neglect patients, who neglect half of space in everyday actions, it can be shown that they can identify objects, if they are asked to do it forcefully.

Conversely, it is also well known that there are patients who are unaware of their impairments and thus fail to recognize their problems. Patients who are categorized as Anton's syndrome suffer a progressive visual field defect but do not seem to take any notice of their blindness.

These cases seem to indicate that first person reports about perceptual experiences are not as reliable as they seem to be. The transparency of consciousness which has long been presupposed as an essential character of conscious experiences is now put into question.

Many philosophers, especially many analytical philosophers, believe that these facts falsify the traditional phenomenological view of perceptual experience, as they think phenomenological description is based mostly on a first person report about a subject's experiences. Daniel Dennett, for example, proposes "heterophenomenology" in which physical science and third person point of view play an essential role for clarifying the characters of subjective experiences, against "autophenomenology" (Dennett 1993, p. 72ff). John Searle claims that phenomenological descriptions are nothing but the expressions of "phenomenological illusions" as long as they remain in the dimension of conscious experiences and are not trying to get at the underlying reality that lies beyond the reach of the consciousness (Searle 2005).

Now, how can phenomenologists respond to these criticisms?

Do we really regard various results brought about by sciences of perceptual experience as evidence that falsifies the phenomenological point of view? Do we have to displace the traditional phenomenology with "heterophenomenology," presupposing that phenomenological descriptions express nothing but a "phenomenological illusion"?

In this paper, I try to respond to these questions, taking up, as an example, a relatively new but now well known theory of visual experience, which is proposed by two brain scientists: David Milner and Melvyn Goodale.

These two brain scientists propose an interesting and challenging theory, in which a commonsense understanding of the relation between perception and action is denied, or at least is fundamentally revised.

In our everyday experience, perception and action seem to be inseparably connected. In order to grasp an object correctly, we must see it correctly. Only on the basis of a correct experience of an object can we take an appropriate action toward it. On the other hand, in order to see the detailed features of an object, we must be able to move to it, grasp it, and bring it near. Perception serves action, and action serves perception. If we presuppose this close connection between perception and action, it seems natural to think that a vision for perceptual cognition and a vision for controlling an action are realized by the same visual system.

However, Milner and Goodale showed that these two visual functions are realized by two different pathways in the brain and that there are cases of brain damage patients who can see an object but cannot act on it (optic ataxia), or who can act on an object but cannot see it (visual agnosia).

I think this theory is especially interesting and important for phe-

nomenology, as a close connection between perception and action constitutes the central core of every phenomenological theory of perceptual experience.

Husserl emphasized the role of kinesthesis, which plays an essential role for constituting a perceptual object. Heidegger proposed the concept of "circumspection (*Unsicht*)" to explicate the practical character of the perceptual experience of the handiness (*Zuhandenheit*) of objects we encounter in our everyday life. Merleau-Ponty focused on the role of bodily movement, which is inseparably connected with every kind of sensory experience we have.

If we continue to consider these phenomenological insights as important and valid, we cannot unconditionally accept the theory of Milner and Goodale. How should we then evaluate the theory of two visual systems from a phenomenological point of view? What lessons can we learn from it and what should we criticize in it?

These are the questions that I would like to address in this paper.

In the following, I first describe the dual visual system theory of Milner and Goodale insofar as is necessary, and try to clarify what lessons we can learn from this theory. Second, I try to formulate possible responses to this theory from a phenomenological point of view, which, I hope, leads to a clarification of the limits of their theory and some possible revisions. And lastly, on the basis of these discussions I point out some of the implications of discussions between phenomenology and brain sciences.

2. Vision for perception and vision for action

The idea that there are two different functional visual systems in the brain is not new. Various theories have been proposed since the 1960s. One of the most famous theories is that of Ungerleider and Mishkin. They argued that two streams of visual processing play different but complementary roles in the perception of incoming visual information. One stream is called the dorsal stream, which starts from V1 (primary visual cortex), and goes up and ends at the top of the cerebral hemispheres, the posterior parietal region. The other is called the ventral stream, which also starts from V1 but goes down to the lower part of the brain, the

inferior temporal region. According to Ungerleider and Mishkin, the former corresponds to the function of the localization of objects, which is thus called space vision or the vision of "where." The latter corresponds to the function of object identification or recognition, which is called object vision or the vision of "what" (Goodale and Milner 2004, p. 48f) (cf. figure 1).

On the basis of this view of dual visual systems, Milner and Goodale recently proposed a somewhat different interpretation of the two systems. Their interpretation of the ventral stream is fundamentally the same as that of Ungerleider and Mishkin. They also attribute to the ventral stream the role of object identification and recognition. However, the interpretation of the dorsal stream is different. They find the role of the dorsal stream mainly in the visual control and guidance of motor behavior rather than in the localization of objects.

Visual processing concerning spatial localization and spatial form is to be attributed not only to the dorsal but also to the ventral stream. That means space vision is realized differently depending on its function (Milner

[image omitted]

Figure 1.
"A schematic diagram of Ungerleider and Mishkin's original (1982) model of the two streams of visual processing in primate cerebral cortex. The brain illustrated is that of an Old World monkey. The ventral stream receives most of its visual input from the primary visual cortex (V1), which in turn receives its input from the lateral geniculate nucleus (LGNd) of the thalamus. The dorsal stream also receives input from V1, but in addition gets a substantial input from the superior colliculus (SC) via the pulvinar (Pulv), another nucleus in the thalamus. From Milner, A. D. & Goodale, M. A., *Visual Brain in Action*, Oxford University Press, 1995, Figure 3.1." (From Goodale and Milner 2004, p. 48f.)

and Goodale 1995, p. 118f). When it comes to the function of recognizing the form and the place of an object, it is realized through the ventral stream. But, when it comes to controlling and guiding motor movement, this function is realized through the dorsal stream. They call the former function "vision for perception" and the latter function "vision for action" and emphasize the independence of the two functions.

The main evidence for their interpretation comes from physiological experiments, i.e., experiments with single-cell recordings, or, lesion experiments, in which the dorsal and ventral streams of monkeys have been separately damaged. But the most interesting and impressive evidence comes from cases of human patients who suffered visual agnosia or optic ataxia because of a lesion in one of the two streams.

1) Doing without seeing

The case of a female patient (Dee F.), who suffered a brain damage because of a carbon monoxide poisoning, is remarkable and surprising.

In one sense, she seems to be almost blind, as she can enjoy only a very poor visual life. She cannot recognize her friends and relatives, and cannot differentiate between simple shapes such as squares and rectangles. Even a task of distinguishing between horizontal and vertical lines is impossible for her to solve.

On the other hand, when performing everyday actions, she shows very little difficulty. She can grasp a pencil held by another person without any clumsiness, whether it is held in the horizontal orientation or vertical orientation. In all experiments on motion guiding vision, she shows that she can perform every task as smoothly as normal-sighted persons. She can walk around without problems, and can even go on picnics and walk along a forest or a mountain trail.

> All the laboratory testing confirmed our informal observation: In one sense, Dee sees perfectly well. She uses visual information about the size, the orientation, and to some degree the shape, of objects to execute skilled movements. Yet in another sense, Dee sees nothing at all—and can certainly tell us nothing—about these attributes of the objects. (Goodale and Milner 2004, p. 28.)

We usually presuppose that in order to perform an action appropriately and smoothly toward an object we must see the object well and acquire extensive and useful information for motor control. The better we see, the better we can do. That seems to be our commonsense understanding of the relation between perceptual cognition and action. However, this commonsense understanding seems to be clearly challenged by Dee's case.

2) Seeing without doing

Dee's case suggests that there are two relatively independent visual systems in our brain. However, in order to make this view more steadfast, we need a converse case, in which vision for perceptual cognition is intact, while vision for action is severely damaged. Indeed we seem to have such cases.

Already at the beginning of the last century, the Hungarian neurologist Rudolph Bálint documented a patient who could recognize objects and people and even read, while he could not reach out and pick up objects. Unlike a blind man, he could see the objects perfectly well; he just could not guide his hand toward them (Goodale and Milner 2004, p. 32).

Similar symptoms can be found in many "optic ataxia" patients.

> The work we have summarized so far shows that optic ataxia patients not only have problems directing their actions to visual targets in space, but also have trouble with other visuomotor tasks in which object size and orientation are the critical factors. At the same time, when asked to *distinguish between* objects on the basis of their size, orientation or relative location, many of these patients do quite well. As we saw, this pattern of behavior is the converse of what we found with Dee. (Goodale and Milner 2004, p. 35.)

Perhaps you have some doubts about this symptom of optic ataxia, thinking that this symptom is simply caused by a disconnection between visual perception and action, in which perceptual information just cannot get through to the motor system. This would be a reasonable doubt, if we presuppose that there is only one kind of visual processing, through which not only visual recognition of objects but also visual control of motor actions are realized. However, under this presupposition, Dee's

case is impossible to understand, as it clearly shows that visual control of motor action toward objects is possible even if visual recognition of objects is impossible. Visual recognition and visual action are not connected in a linear way within a single visual system, but are realized in different systems in parallel. In this sense, this dual system hypothesis demands a revision of the traditional view of the relation between perception and action.

3) The disunity of vision in normal-sighted people

The above evidence of two visual systems comes from cases of patients with brain damage. What about in the case of normal-sighted people? Indeed, we can also find some evidence of two visual systems in some experiences of normal-sighted people.

Milner and Goodale cite various results of experiments concerning normal-sighted subjects, in which the behavior of the subjects acting on the basis of vision shows clearly different characters corresponding to differences in the tasks demanded.

In our usual visual experience an object appears always to be surrounded by various other things. It is a familiar phenomenon that an object surrounded by large objects appears to some extent to be smaller than when it is surrounded by smaller objects. On the basis of this size-contrast effect, psychologists think up various examples of visual illusions, in which objects of the same size appears quite different.

One famous illusion of this kind is the so-called Ebbinghaus illusion (cf. figure 2). In this illusion, two targets circles of the same size are pre-

[image omitted]

Figure 2.
"In the Ebbinghaus illusion, shown here, the two middle circles in the top two arrays appear to be different in size even though they are actually physically identical. The two middle circles in the bottom display appear to be identical but their real size is actually different. (To convince yourself of this, view each display through a piece of paper with two holes cut in it that reveal only the two central circles.)." (From Goodale and Milner 2004, p. 86f.)

[image omitted]

Figure 3.
"A three-dimensional version of the Ebbinghaus illusion. In this experiment, subjects were asked either to reach out and grasp one of the disks, or simply to show us what they thought the size was by opening their finger and thumb a matching amount. On some trials, the disks were physically identical whereas on other trials they were perceptually identical. From Haffenden, A. & Goodale, M. A., 'The effect of pictorial illusion on prehension and perception,' Journal of Cognitive Neuroscience, 10 (1), 1998, pp. 122-136, Figure 3." (From Goodale and Milner 2004, p. 88f.)

sented to subjects: one is surrounded by a ring of circles smaller than it, the other is surrounded by a ring of circles larger than it. In this constellation, the former looks larger than the latter. If you want to make the two target circles appear to be of the same size, you must make the sizes of the two circles physically different.

What is remarkable is that while the subjects see objects differently under the influence of this size-contrast illusion their finger motions continue to assume the same size from their behavior when they are asked to grasp the objects (cf. figure 3).

> This is exactly what happened. The students consistently judged a target block paired with a large companion as smaller than the same target when it was paired with a smaller companion. In contrast, when they reached out to *grasp* the target object, they opened their hand to an identical degree whichever companion it was paired with. In other words, the scaling of grip size to the size of the target block was not at all subject to the size contrast effect that was so compelling during perceptual judgments. (Goodale and Milner 2004, p. 84.)

According to Milner and Goodale, when we perceive objects without being demanded to execute some action in relation to them, we recog-

nize objects and their properties in a scene-based frame of reference. That means we recognize objects in relation to other objects in the scene. In contrast, when we begin to act toward objects, we see them in an egocentric-frame, and compute their sizes and other properties, using an "absolute metrics set" (Goodale and Milner 2004, p. 82f). The former function is characterized as representing the world, and is considered to belong to the dimension of conscious experience. The latter function of visual motor control is considered to be unconscious and inaccessible to the consciousness.

However, if the two visual systems function in such an independent way, as the case of the visual illusion shows, how do they cooperate in our normal visual lives?

According to Milner and Goodale, the typical form of cooperation is understood following the model of cooperation between the human operator (ventral system) that provides conscious monitoring of what is going on, and the robot (dorsal system) doing the work (Goodale and Milner 2004, p. 114).

> We have tried in this book to make a strong case for the idea that vision is not unitary, and that our visual phenomenology reflects only one aspect of what the visual brain is doing. Much of what vision does for us lies outside our visual experience. Indeed, most of our actions are controlled by essentially robotic systems that use visual computations that are completely inaccessible to conscious scrutiny. (Goodale and Milner 2004, p. 115.)

4) Lessons from the theory of two visual systems

I think one of the most important lessons we must learn from the story told by Milner and Goodale is that they clearly criticized the traditional view of the relation between perception and action, in which the relation is understood in a linear and unitary way. The model of the linear process, which begins from the stimulus input, goes through perceptual cognition of objects and ends with a behavioral output, is no longer valid, and we have now a new model of the parallel processes of visual information.

According to Milner and Goodale, in addition to the two visual systems there is a third pathway of visual information, which seems to

correspond to the function of blindsight. This process starts from the retina, but does not pass through V1, as in the case of the dorsal stream process, but through SC and Pulv, and goes to posterior parietal cortex, which is related to the task of guiding motor movement (cf. figure 1). The structure of our visual encounters with the world and responses to it cannot be considered to be one dimensional but multi-dimensional. In our normal visual lives, different processes cooperate to a considerable extent, but on some occasions such as in visual illusions the disunity of these processes becomes apparent. And, in cases of damages to these systems, the disunity becomes critical, as in the cases of visual agnosia, optic ataxia, or blind sight.

In this sense, there is definitely an important point we must learn from this story. However, this does not mean that everything it tells us is persuasive. Rather, it seems sometimes that the story has a strong bias, as the concepts and framework they use to develop their theory are deeply influenced by a traditional understanding of perception and action.

Especially when it comes to characterizing visual *perception* and visual *experience*, many questionable points come to the fore. About the job of perception they say the following: "The job of perception, after all, is to construct a useful internal model or representation of the real world outside. This representation can then serve as a visual foundation for our mental life, allowing us to make inferences about objects in the world and their causal relations, and to decide between different courses of action based on this knowledge" (Goodale and Milner 2004, p. 82).

They regard the function of perception as that of making an internal representation of the world; and, on the basis of this understanding, they claim that our perception and perceptual experience are realized only in the ventral stream.

In the above, they say: "our visual phenomenology reflects only one aspect of what the visual brain is doing." But, when they use this word "phenomenology," it means the phenomenology of internal representations and other aspects of mental life that are related to the operation of the representations. This "phenomenology" is understandable only within the framework of Cartesian dualism and is far removed from the phenomenology understood in contemporary philosophy. It is rather the phenomenology of Husserl, Heidegger, or Merleau-Ponty, which emphasizes the intentional character of perceptual experience, according to

which our perceptual experience is related to things themselves in the world rather than to internal representations.

Especially remarkable is the influence of Cartesian dualism in their operator-robot model, which they present in order to explain the cooperation between the two streams. Milner and Goodale themselves indicate that this model sounds like Cartesian dualism—the existence of a conscious mind separate from a reflexive machine (Goodale and Milner 2004, p. 115). Nevertheless, they maintain that there is "a complex but seamless interaction between the ventral perception stream and the dorsal action stream" (Goodale and Milner 2004, p. 115). However, if the functions of the two streams are so different as operator and robot or mind and machine, why and how is a seamless interaction possible? While the role of perception is considered that of making an internal representation of the world, the process of an action is entirely inaccessible to a perceptual consciousness. Taking these characterizations seriously, is it really possible to assume such a seamless interaction?

As an explanatory theory of the cases of brain damage patients, such as visual agnosia and optic ataxia, the theory of two visual systems is convincing and persuasive. But, when it comes to explaining the experience of normal-sighted people, I think it produces more problems than answers.

If this critical evaluation of the theory is correct, we now need another model and another phenomenology of the relation between perception and action.

What about "our" phenomenology? Does it help us to find a perspective, in which the relation between perception and action is more understandable than their theory?

3. Action in perception and perception in action

1) Heidegger

I think one of the typical responses to the theory of two visual systems from "our" phenomenological point of view is to indicate the similarity between this theory and Heidegger's philosophy of perception.

Most of the phenomenology minded philosophers, who hear the story of Milner and Goodale, will immediately be reminded of Heidegger's

views of "circumspection" and "handiness." Heidegger, as is well known, clearly differentiates the two modes of intentional relation to the world—the theoretical and the practical. According to Heidegger, both modes have their own "seeing." In the theoretical mode, objects reveal themselves in the mode of an "objective presence" ("*Vorhandenheit*"), and in this mode we see and recognize mainly objective properties. In the practical mode, which is dominant in our everyday lives, objects reveal themselves in the mode of "handiness" ("*Zuhandenheit*"), and in this mode we can see objects appropriately only through taking actions toward them or using them as instruments.

In one of the most famous passages in *Being and Time*, Heidegger describes this practical encounter with the world in the following way:

> The less we just stare at the thing called a hammer, the more actively we use it, the more original our relation to it becomes and the more undisguisedly it is encountered at what it is, as a useful thing. The act of hammering itself discovers the specific "handiness" of the hammer. (Heidegger 1996/1927, p. 65/p. 69.)

In this passage, Heidegger clearly distinguishes between two different ways of "seeing" objects in the world, i.e. "staring at the thing called a hammer" and "discovering the specific 'handiness' of the hammer." As he also emphasizes that these two types of visual function are realized independently and exclusively, we could interpret his view as a kind of theory of two visual systems.

In spite of these characteristics, I think we cannot neglect the fundamental difference between Heidegger's view and the theory of Milner and Goodale.

What Heidegger emphasizes in *Being and Time* is that there is a specific *revealing* of things we encounter in our everyday lives. This way of revealing corresponds to the "awareness" or the "consciousness" we have in our everyday lives. What Heidegger tries to clarify is, I think, not the fact that there is an unconscious mode of relations to things in our lives, which functions independently from the perceptual consciousness, but rather that there are at least two different forms of perceptual awareness or consciousness of things in our experiences. Skillful coping with useful things has a specific "seeing" involved in it, and cannot be considered

to be an unconscious robotic movement that proceeds automatically once started.

We often hear that experts need not be aware of each step and each factor of their behavior while the beginners cannot but direct their attention to every step and many factors of their behavior. However, this does not mean that experts' behavior comprises unconscious processes, and is similar to robotic movement. Rather, it means they can direct their attention appropriately and effectively to necessary directions and objects, and in this sense they need not perform as many (unnecessary) conscious activities as beginners.

Of course, this is only one possible interpretation of Heidegger's concept of "circumspection." However, if we can approve of this possibility, we can find in Heidegger's phenomenology an alternative view to the theory of Milner and Goodale, rather than a similar and corresponding view of them.

As far as normal-sighted people are concerned, i.e. as far as both ventral and dorsal streams function normally, there is no reason to assume that vision for motor control remains unconscious as in the case of visual agnosia. In addition, there are philosophers who maintain that even a visual agnosia patient such as Dee F. can be considered to have partial awareness, as awareness is to be considered a matter of degree (Noe and O'Regan 2002, p. 591). A vision for action needs not to be interpreted as an unconscious vision for motor control. It can be interpreted as a conscious vision in a specific mode, which is different from the mode of the vision for objective recognition. What we must confirm from Heidegger's view of circumspection is that perceptual consciousness or perceptual experience is not a unitary phenomenon but has at least two different modes, and it is in this sense multi-dimensional.

2) Husserl

Among the theories that emphasize the close connection between perception and action, Husserl's view is another representative one in phenomenology.

To formulate the intentional character of our perceptual experience, Husserl uses a concept of "adumbration" ("*Abschattung*").

Every object of our perceptual experience appears through a certain aspect that is inseparably connected with other hidden aspects. This structure of the presence and the absence of appearances, in which a physical object and its properties are perceived, is essential to our perceptual experiences and the perceived objects. The meaning of the transcendence of an object, or the meaning of its real being beyond the perceptual experience is "constituted" in this structure of adumbration. On the other hand, this adumbration structure of presence and absence of appearances shows the way in which a subject can handle an object and explicate hidden aspects by moving his or her body. The structure of adumbration has two aspects: one is related to the structure of the appearances of the objects of experiences, and the other is related to the structure of possible exploratory behavior, through which further perceptions become possible. The correlative relation between the system of appearances and the system of possible behavior is one of the central theses of Husserl's phenomenology of perception.

> Let us again give a privileged status to perception. Previously our gaze was directed at the multiplicity of side-exhibitings of one and the same thing and to the alteration of near and far perspectives. We soon note that these systems of "exhibiting of" are related back to correlative multiplicities of kinesthetic processes having the peculiar character of the "I do," "I move" (to which even the "I hold" must be added). The kinestheses are different from the movements of the living body which exhibits themselves merely as those of a physical body, yet they are somehow one with them, belonging to one's own living body with its two-sided character (internal kinestheses, external physical-real movement). (Husserl 1970, p. 161.)

From this Husserlian point of view it is remarkable that Milner and Goodale entirely neglect this behavioral element in the perceptual experience. A perceptual experience without an element of a possible behavioral relation to an object would be a perceptual experience without the structure of adumbration. But, a perception without the structure of adumbration cannot be a perception of a three dimensional real thing. A perception of a picture of an object would be regarded as such a perception, because in the perception of a picture we have no possibility to explicate the hidden aspects of the depicted object.

In this context, it is interesting that Milner and Goodale regard watch-

ing TV as a typical case of our perceptual experience.

> Understanding television is not, of course, what our visual system evolved to do. We do not have a special "TV-watching module" in our brain. And yet television tells us something important about perception… There is little doubt that the brain mechanisms that allow us to watch and understand TV are the very same mechanisms that allow us to perceive and understand the real world. In real life too, the brain uses stored knowledge of everyday objects, such as their size, to make inferences about the sizes of other objects and about their distance from us and from each other. (Goodale and Milner 2004, p. 75.)

Milner and Goodale emphasize the similarities between watching TV and perceiving the real world rather than differences. In this characterization of our perception we find again the peculiar character of "their" phenomenology of perception.

For example, when I see on a TV screen that something is coming toward me, I experience no urgent impulse to duck. I can understand the meaning of the movement of an object, but it has no reality, because the movement has its meaning only in the relation to other objects on the TV screen, and has nothing to do with things in the real world in which I live. Objects perceived without a possible behavioral relation fail to have a character of "givenness of 'in person'(*Leibhaftigkeit*)" (Husserl) or a " feeling of presence" (Matthen 2005, p. 305).

This decisive difference between the perception of an object in the real world and the perception of an object on a TV screen or in a picture is neglected in the phenomenology of Milner and Goodale. When they talk about a vision for perception, it means a vision that is not fundamentally different from a vision for the perception of pictures. But as the perceived objects in pictures cannot be objects of exploratory behavior, it is almost self-evident that such a vision for perception is dissociated from a vision for action. In this way, we can confirm again here the implicit (Cartesian) presupposition that deeply influences their understanding of basic concepts and their phenomenology.

If we leave the perception of pictures and go back to the perception of objects in the real world, and confirm the Husserlian thesis of the inseparable connection between perception and action, we can add one

necessary element to the view of the two different modes of perceptual experience, which we have found in Heidegger's phenomenology.

Take the example of a hammer again. Heidegger differentiates two modes of "seeing" a hammer. One is staring at it as on object, and the other is discovering its handiness by using it. Heidegger's point is that the latter practical relation to the hammer has its own specific type of perception. Now, Husserl's point is that the former theoretical relation has its own specific type of action, i.e. a type of an exploratory action. In contrast to this type of action, the other type can be called "performatory action," whose purpose is practical and not theoretical.

Adding this differentiation of actions, we can now devise an alternative view of two visual systems. The differentiating line is not drawn between perception and action, or a vision for perception and a vision for action, but it goes between two modes of connection of perception and action: perception/performatory action and perception/exploratory action.

If we think in this way, there is no longer a problem of how to connect perception and action. They are connected from the beginning. The differentiation or the dissociation occurs between two modes of connection. To explicate this structure of unity and disunity of our perceptual experience, I refer at the end of the paper to two views of perception: one is Michael Polanyi's theory of tacit knowledge and the other J. J. Gibson's ecological theory of perception.

3) The unity and disunity of perceptual experience

a. The unity of perception and action

According to Michael Polanyi, every intentional awareness has a two dimensional structure, i.e. the structure of "*from* a subsidiary (marginal or tacit) part *to* the focal (explicit) point" (Polanyi 1969, p. 138ff). This structure helps us to understand the relation between perceptual and behavioral elements of our experience.

Beginners, who have small stock of tacit knowledge, need to direct their attention to every factor of their behavior and bring them into a focal point. Experts, in contrast, can direct their attention smoothly and effectively to the necessary factors, bringing other factors into a tacit and subsidiary dimension of the awareness.

The point of this view is that the tacit and subsidiary dimension does

not function like a robot, which is monitored and commanded by a subject as its operator, but is embodied in the subject's own body, which is lived by the subject of the perception and constitutes the essential factor of perceptual experience. The hammers used by experts are no longer experienced as objects at a focal point, but are embodied in a tacit dimension and experienced as an extension of their bodies. Thus, the intentional and embodiment structures of the perceptual experience of beginners and experts are different.

According to this understanding, perceptual and behavioral elements constitute two sides of one intentional experience, whether the experience is realized as an exploratory or performatory action. In this sense, the perceptual and behavioral elements always function inseparably. However, this does not mean that perception and action, or exploratory and performatory action, always go hand in hand. They sometimes fall into a situation in which they contradict each other.

b. The disunity of perception and action

If we focus on the role of perception in behavioral control, we can say what to perceive and how to perceive constitute an essential part of how to behave and work. In order to behave and work well, we must learn to perceive appropriately. To see in a certain way does play the role of controlling a behavior. J. J. Gibson explicates and describes this relation in the following way:

> To say, in modern parlance, that it is a computer with a program, either inherited or acquired, that plans a voluntary action and then commands the muscles to move is only a little better than Descartes's theory, for to say this is still to remain confined within the doctrine of responses. Locomotion and manipulation are neither triggered nor commanded but *controlled*. They are constrained, guided, or steered, and only in this sense are they ruled or governed. And they are controlled not by the brain but by information, that is, by seeing oneself in the world. Control lies in the animal-environment system. (Gibson 1979, p. 225.)

The point here is that locomotive behavior and manipulative behavior are controlled by perceiving information that specifies the relation between an actor and an environment, and not by some operator,

whether it is understood as a human being, a brain or a ventral stream, which triggers and commands the process of behaviors.

As the process of behavior is not determined by prior intention but is controlled by the perception of a continuously changing relation between an actor and an environment, it is to be characterized as a *reciprocal* process of an interaction between an actor and an environment. In this sense, control lies not in the actor alone but in the actor-environment system. Thus, the process can be regarded as spontaneous and as relatively independent from the demand of an actor and his or her prior intention, which constitutes only one element of the system. This relative independence of the process from an actor does not make the process unintentional and mechanical.

As Gibson indicates, if we remain in the traditional framework of Cartesian theory, according to which "a computer with a program plans a voluntary action and then commands the muscles to move," it is impossible to characterize this reciprocal relation between perception and action appropriately. I think this Cartesian bias is again one of the main reasons that Milner and Goodale characterize the visual system of motor control as a kind of robotic movement independent from perceptual awareness, and place it in the unconscious dimension.

On the other hand, as the process of the perceptual control of behavior is dependent on each situation in which an actor finds himself or herself, and is not planned and commanded by prior intention, we cannot avoid the possibility that the process of behavior deviates from the originally planned course, and finds itself in a situation contrary to the original intention.

In our everyday lives we sometimes experience errors called *slips*. We find sometimes that someone pours salt into a cup of coffee. Someone, who goes into a kitchen and opens the door of a refrigerator, finds himself or herself wondering why one is there. It is not uncommon for us to be surprised to find ourselves in an unintended situation, in which we are doing things other than those originally intended.

This discrepancy between perception and action, or exploratory and performatory action, is not only an origin of errors, but is an origin of the creativity of our experience. Our experience does not always proceed in the way that it is intended, planned, and expected. It is always open to something unintended, unplanned, and unexpected. It is the discrep-

ancy between perception and action that makes our experience open to newness and creativity. In this sense, the discrepancy or the disunity is the other side of the inseparable connection or the unity between them. The discrepancy happens because a perception is closely related to an action and plays the role of behavioral control and not because a perception functions separately from actions.

4. Provisional conclusions

Now, after this discussion, what can we say about the relationship between phenomenology and brain sciences in general?

One thing is clear. We must be very careful when we learn lessons from various case studies and theories in the brain sciences, as brain scientists themselves are deeply influenced by certain "philosophical" presuppositions, which sometimes orient their discussions in a certain direction.

In spite of this, there are surely in the brain sciences many things that must be studied from phenomenological point of view.

People say, truth is stranger than fiction. Case studies about brain damage patients, for example, show us various examples of possible experiences, which can hardly be thought of in our imagination. In particular, it is important that these case studies give us a detailed description of the experiences of patients, which is difficult for us to imagine. The phenomenological investigation, which searches for an essential intuition of our experiences, needs these new results of scientific investigations in order to widen its perspective, revise its view, and make explicit its implicit presupposition inherited from its tradition. In this sense, brain scientists can be considered to be stimulating discussions partners for phenomenologists, rather than antagonists who declare that phenomenological descriptions are nothing but "phenomenological illusions." At least this would be a provisional conclusion of critical discussions about the theory of two visual systems in the contemporary brain science.