AN OLD PSEUDOPROBLEM

by Wolfgang Köhler

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Why are the objects of the phenomenal world perceived as before us, outside of ourselves, even though today everybody knows that they depend upon processes inside of us, in the central nervous system? A psychologist will as a rule, immediately be able to give a simple solution to this curious problem. But that it is generally known may not be assumed. It is not only a philosopher like SCHOPENHAUER who uncritically accepts the erroneous premises implicit in that question and must then make the wildest assumptions to answer it. Many of the greatest physiologists, among them even Helmholtz, have failed to achieve full clarity on this question. [From the principles of his theory of space, HELMHOLTZ proposes to derive *"an astonishing consequence"*: *"the objects present in space appear to us clothed in the qualities of our sensations. They appear to us red or green, cold or warm, they have smell or taste, etc., while these sensory qualities belong, after all, only to our nervous system and do not at all extend into outer space."* (H. v. HELMHOLTZ, *Die Thatsachen in der Wahrnehmung*. Berlin. August Hirschwald, 1879.)] MACH and AVENARIUS attempted to lead the scientific world away from the errors already implicit in the formulation of the paradox. But either their explanations remained little known, or they did not sufficiently elucidate the problem. [A much clearer attempt, correct in its essential points, to give a concrete, positive solution of the paradox was made by Ewald HERING as early as 1862, at least for visual perception. (E. HERING, *Beiträge zur Physiologie*. Leipzig: W. Engelmann, 1861-1864. Heft 2, 1862, 164-166.) By the way, HERING himself expressed great pessimism about the understanding of his arguments that could be expected among his contemporaries.] For only a few years ago a well-known physician raised the question anew: *"How is it that consciousness, which is bound to an organism, relates the changes in its sense organs to something located outside of itself?"* All attempts to explain this "compulsion to project" appeared useless to him, for he felt that here is one of the eternal enigmas, related to the mind-body problem. It seems clear that this contemporary physician is not alone; rather he represents the majority of natural scientists. Students, at any rate even those of the natural sciences, always have to go through a sort of revolution in their picture of the world as they try to transform what appears so strange into a simple, transparent matter. Under these circimstances, it may indeed be worthwhile once more to correct in somewhat more detail the error inherent in this question.

We have here a typical case of a difficulty which we create ourselves, in which we proceed on a correct line of reasoning for a while, but not consistently to the end. If new knowledge is gained in one area, while in a neighboring area an earlier stage of knowledge is inadvertently retained, contradictions must result. The path in the present case is directly determined by the development of physics from GALILEO and NEWTON on. Consequently, the way to discover and to eliminate the core of the difficulty that developed leads over this same road of natural science. Little would be gained if we tried to demonstrate by philosophical speculation that here must be an error, while science would find itself, just as before, led on its way to the same old paradox.

The physics of the late baroque period destroyed naive realism. The objects which exist independently of the observer and are to be the subject of scientific study could not possibly

possess all the variegated characteristics which the phenomenal environment certainly shows. Thus the physicist subtracts many socalled sensory qualities if he wants to extract what he considers the objective realities from the phenomenal manifold. I do not venture to judge whether the greatest minds of that time were immediately aware that much more is needed, namely a radical departure from the identity of phenomenal object and physical object. Sometimes it seems that for them the phenomenal object was simply the physical object itself, somewhat changed by all kinds of subjective trimmings, thus both basically still one and the same existence. Whatever the historical truth, after the elimination of the "secondary qualities," physics developed so rapidly that soon its way of thinking had to be applied to the relation between physical events and the organism. For example, whether a sound wave impinges on a violin string or on the human eardrum can, after all, make no difference in principle. From this moment on, there seems to be no escape from the paradox. Anatomy, physiology, and pathology teach us that about one point there can no longer be any possible doubt. The physical processes between object and sense organ are followed by further events which are propagated through nerves and nerve cells as far as certain regions of the brain. Somewhere in these regions processes take place which are tied to the occurrence of perception in general and, therefore, also to the existence of phenomenal objects. Thus a physical object which reflects light differently from its surroundings will be the source of a long series of successive processes of propagation and transformation through rather different media, until finally a complex of processes takes place which can be considered the physiological carrier of the corresponding phenomenal object. Now it would obviously be meaningless to identify with each other the starting point and such a late or distant phase of this sequence of events. Therefore this reasoning might well allow for similarities of some degree between the phenomenal object and its partner in the physical world; but in any case the two represent existences at least as different as the physical object and - in an entirely different spatial position - the brain process on which the existence of the phenomenal object directly depends. If I shoot at a target, nobody will claim that the hole in the target is the same thing as the revolver from which the bullet came. By the same reasoning, we may not identify the phenomenal object with the physical object from which the stimuli in question came. Under no circumstances has the phenomenal object anything to do with the place in physical space where the "corresponding" physical object is located. If it has to be localized at all at some point in physical space, then obviously it belongs most properly to that place in the brain where the directly corresponding physological process takes place. It is immediately apparent that SCHOPENHAUER, HELMHOLTZ, the above-mentioned physician, and everybody for whom this paradox exists would regard just such a localization of phenomenal objects and phenomenal qualities as the natural one. But instead, without any doubt, we have the phenomenal objects before us and outside of ourselves.

We might be tempted to say that parts of the phenomenal world should not be thought of as localized in *any* place in the physical world as a matter of principle, since phenomenal and physical localizations are incommensurable. Therefore localization of a phenomenal object within the brain is also ruled out. But we should not make the answer to our question *too* easy. Such a purely negative statement certainly does not solve the problem before us. For the problem lies in the fact that phenomenal objects are localized in a definite position *relative to our body*, only not *in* it, but *outside* of it. Thus the simplest experience seems to contradict the epistemological argument just considered. One finds, therefore, among biologists and even philosophers, the assumption that the phenomenal object is somehow again withdrawn from the body into physical space and, wherever possible, precisely to the place of its physical counterpart ("compulsion to project"). Fantastic as such an idea may be, it is unfortunately not uncommon to find all kinds of hypotheses in psychology so confused that nobody would tolerate them in the natural sciences proper. There

are surely also those who see in such an extraordinary achievement an expression of the superiority of mind over mere nature.

As to the epistemological argument of the incommensurability of physic and phenomenal localization there is, however, this to say. Let us assume that it is absolutely correct and that, therefore, the total phenomenal world of a person is simply not definitely localizable anywhere in the physical world, because it is not possible even to conceive of the relative localization of phenomenal and physical facts. Then it follows that we may arbitrarily think of the *totality* of a person s phenomenal world. wherever in the physical world it would help our thinking. Such a procedure, if followed systematically, can never lead to an inconsistency precisely because, in fact, we are always dealing with the relative localization either of physical data or of phenomenal data among themselves, but never with localization of the one relative to the other. [Similarly, I am completely free to think of the "pyramid of concepts" of classical logic or of the color pyramid in any arbitrary regions of space, precisely because their quasi-spatial nature neither excludes nor requires coincidence with a definite region of "real" space.] Now, according to our basic assumption, the totality of a person s perceptual world is strictly correlated with certain processes in his central nervous system. lt will then simplify our discussion and our terminology if, in what follows, we do not consider spatial relations of the phenomenal world as entirely separate from. thos in physical space, but think of the totality of the phenomenal world and its subdivisions as being mapped on those brain processes which certainly at least correspond to them. After what has been said. this procedure will prejudice nothing. Whoever believes that he can cautiously avoid this assumption and prefers to conceive of the totality of the phenomenal world as permanently set apart in an imommensurable space, must reach exactly the same result, the same solution to the paradox which we will reach. And besides, I want to show that this solution succeeds entirely even if one maintains, with HELMHOLTZ and so many biologists, that phenomenal data "belong only to our nervous system."

Phenomenal space everywhere offers examples of the relationship "outside one another." *Next to* my book, *outside of* it, is the pencil; still farther from both is the phenomenal object, the inkwell. This seems entirely natural to us. The only consideration required for the solution of our curious problem now consists in the fact that "my body," before which and outside of which the phenomenal objects are perceived, is itself such a phenomenal object along with others, in the same phenomenal space, and that under no circumstances may it be identified with the organism as the *physical* object which is investigated by the natural sciences, anatomy and physiology. Since at first, as long as this distinction is not yet obvious so that the pseudoproblem disappears, the situation is necessarily somewhat confusing, I shall explain it step by step. If I put my own hand next to the pencil and the inkwell, the hand reflects light and this stimulates my eye, exactly as the other two objects do. In that brain field which contains the physiological correlate of our perception - and, according to our assumption, also this perception itself - there thus occur not only two total processes corresponding to the external objects pencil and inkwell, but also a third process of generally exactly the same nature, connected with the appearance of the phenomenal object "hand." Nobody is surprised that the phenomenal object "pencil" is outside the phenomenal thing "inkwell." But it is no more astonishing that the hand as a third phenomenal object appears *next to* the other two and that they, in turn, appear *outside* of the hand. The processes in that brain field undoubtedly possess some properties on the basis of which perception in general is spatial; but also, more particularly, specific behavior of several brain processes corresponds to the phenomenal relations *next to* and *outside* of the respective phenomenal objects. If this particular behavior exists for the processes corresponding to pencil and inkwell, then in the case just discussed, it certainly does so in exactly the same way for both of these in their relation to the "hand process."

Now, as I sit at my desk, besides my hand there is also visible in the more peripheral field a good portion of both arms and the upper part of my body. Obviously arms and body are phenomenal objects just as the hand or the pencil and inkwell. They arise, physically and physiologically, in exactly the same way as the others, through retinal images and the ensuing processes in the nervous system; consequently they are subject to the same rules of relative localization as those objects. If there are understandable reasons why, under the conditions of our example, those other objects appear external to each other, then exactly the same reasons apply to their being external to my body as a phenomenal object.

To enable us to see the situation still more concretely, we shall introduce an assumption which is certainly not entirely correct in this form and will need later correction. We shall assume that if two objects, such as pencil and inkwell, exist phenomenally side by side at a particular phenomenal distance, the corresponding brain processes simply exist next to each other at a particular distance, in short that phenomenal space and the spatial distribution of the directly corresponding processes in the brain field are, to some extent, geometrically similar or even congruent. Then consideration of the example just discussed shows that the complex of processes for my body as a phenomenal object is localized at a particular place in the physical brain field, that the processes for other phenomenal objects take place all around it, and that, because of the relative geometrical relationships of these processes, phenomenal objects must be next to each other everywhere in phenomenal space, and at the same time they must all lie outside of one (for me) especially important phenomenal object which I call my body.

This is the first essential step to the solution of the paradox. If SCHOPENHAUER and many natural scientists after him were astonished by the "external localization" of phenomenal objects, the reason was only that they failed to apply to their own body an assumption which had become natural to them in considering other objects. For the body they retained the naive identification or confusion of physical and phenomenal object. But if we say some object is in front of "us," then what we mean by "us" is not the organism in the physical, physiological sense, but a phenomenal object among others which must show the same kind of localization relative to them as they have among themselves. And both, the other phenomenal objects as well as the "self" (in the everyday phenomenal sense) depend functionally on certain processes in one's own *physical* body; and likewise all relative phenomenal localizations depend on the distribution of these processes. Nobody has ever seen a phenomenal object localized relative to (outside of) his *physical* body. When we speak of the phenomenal self, the personality in a deeper sense remains entirely outside of our discussion. We speak here of the self which is intended when we say, "I lie down on the couch," "I sit down," "I go downstairs," etc.[When we speak of the phenomenal self, the personality in a deeper sense remains entirely outside of our discussion. We speak here of the self which is intended when we say, "I lie down on the couch," "I sit down," "I go downstairs," etc.]

At this point the reader might still be slightly uneasy because now, to be sure, phenomenal objects are understandably outside of the phenomenal self but still, according to our assumption, both of them exist *inside* our physical body. Later all doubts in this respect should disappear. But first an extension and a correction of what has been said so far are needed.

An extension is necessary because our phenomenal world contains very much more than just visual facts. So far the discussion has been confined to the visual content of phenomenal space because we know, and are accustomed to this knowledge, that visual processes occur in orderly fashion in one connected physiological field. Therefore the arrangement of the visual phenomenal

body next to other visual phenomenal objects is immediately convincing once we know that the phenomenal body may not be identified with the physical organism.

Sound is also localized in phenomenal space but, in general, less precisely so. Likewise I feel the hardness of the table under my hands (as phenomenal objects), thus again in phenomenal space. An old controversy is concerned with the relations to vision of such phenomenal spatial data in other modalities. But in any case one fact is phenomenologically certain: Whether sharply or diffusely localized, sound appears to us in places of the same phenomenal space in which we see phenomenal objects (in the same or in different places). It is only because of this that I can say, for instance, "Just now I heard a rustling sound in the bushes over there," and thus relate the place of a sound to the position of a visually given phenomenal object. In just the same way I feel the hardness of the table for instance, somewhat to the left of the place where the phenomenal object pencil lies, and thus I localize a felt place in relation to a seen one. Anyone who is in the habit of letting his judgement about the facts of perception be determined by his knowledge of the peripheral sense organs may not at once agree at this point, since the organs of sight, hearing, and touch represent separate receptor surfaces, and certainly the primary regions of entrance of the respective nerves into the cortex are also separate from each other. But as to the first point, the two eyes are also two separate peripheral sense organs, the stimulation of which nevertheless unquestionably results in *one* connected visual phenomenal space. Furthermore, there is no good evidence at all for the assumption that the primary regions of entrance of the several sensory nerves are also the last stations of the sensory process. The alternative hypothesis would correspond much better with direct experience - that all sensory processes finally enter a field common to them all, and that here they interact according to their respective relations; this would be the basis for their localization in a single phenomenal space. This is the physiological version of a view which at one time was considered almost obvious, and which more recently has been advanced again by William STERN. It would be a bad argument if someone wished to object that not infrequently discrepancies are observed between the localization of a sound and the position of the visual source of the sound, and that there are similar inconsistencies between the felt object and its seen form. The above assumption by no means implies that this could not happen; the observation of such a discrepancy indeed presupposes that acoustic location and visual location of the source of sound, that the tactual and the visual image, have in principle comparable characteristics since, in fact, I do *compare* the two. Normally, of course, not only does the localization of the phenomena of different sensory modalities take place in one and the same phenomenal space but also, at least by and large, whatever belongs together is perceived together; thus the locus of the sound and the locus of the source of the sound as a visual object coincide, etc. It is not essential for our question whether this approximate "fit" of the relative phenomenal localization of visual, auditory, and tactual objects is partly based on anatomy (as the unitary spatial order of seeing with the two eyes), or if an almost inconceivable amount of learning brings the locations of sounds, tactile objects, etc., into an approximately fitting relation to the unitary spatial order of the visual world, or if, finally, still other possible explanations might be considered. At any rate, this coordination of localization already exists very early in the life of the human being. And thus the other phenomenal data fit inte the one phenomenal context which was described first in its visual extension before the visually given body-self. Therefore we may also conceive of the sensory processes of nonvisual origin as taking place in the same regions of the cerebral field where the corresponding visual process complexes take place (but see below).

But a corresponding extension must also be made in regard to the phenomenal make-up of our bodily self. For it and its changing states, sensory data of nonvisual origin are undoubtedly even more important than its visual appearance which, for ourselves, always remains rather

incomplete. Just as our phenomenal world is enriched by the sense of touch, but at the same time preserves to a high degree the correct correlation of visual phenomenal objects and tactile data in *one* phenomenal space, so what we perceive of ourselves through the sense of touch incorporates itself in and attaches itself, on the whole correctly, to the visual object, "our body." Into the same region of phenomenal space, again in proper context, a great deal of data are included which exist essentially only for one's own phenomenal body and its members, and about whose physiological foundations in sense organs of the skin, muscles, joints, etc., we are actually very poorly informed. These are what we experience even without looking: the phenomenal positions of our limbs, the felt tension or relaxation of extremities and parts of the body. In the consideration of the immediate phenomenal data, we need continually to guard against slipping what is meant by these words into the physical-physiological states and changes in the corresponding regions of the physical organism. Obviously one of the most important groups of phenomenal data may not be forgotten, the one that concerns the change and motion of the phenomenal body and its limbs. It is well known that stimulation of the vestibular nerves gives rise, in a sense, to the purest perception of spatial dynamics. And all these states and events occur in and on the same phenomenal structure for which we have -phenomenologically quite properly - a single name, the self (in the everyday sense) without concerning ourselves with the enormous variety of different sensory inputs which, physiologically, contribute constantly to its make-up. This is again possible only because all these data, whatever their peripheral physiological source, may be ordered, in general, so entirely adequately in one structure of phenomenal space. The tension, which I just now feel in my right arm as I make a fist is localized in the structure which I experience visually as my right arm, etc. Again there is a conclusion to be drawn for brain physiology: the data from all these different sense organs contribute to the determination of one single segregated process complex, whose phenomenal correlate is called "self." Neither from considerations of brain physiology nor of phenomenology, therefore, does the "sensory heterogeneity" of the phenomenal self and of the phenomenal environment change anything of the fact that the one is *surrounded by* the parts of the other. There is then no reason whatever why the phenomenal environment should appear *within* the phenomenal self. This actually occurs only in special cases where it is a consequence precisely of the principle of normal appropriate organization of all sensory data in one phenomenal context: In taking food, I certainly perceive phenomenal objects, just now objects of the phenomenal *environment*, in the interior of the phenomenal body self - that is to say, in the mouth - for a few minutes. But, of course, this has nothing to do with the paradox from which we started. It only means that in a unitary perceptual field (and, correspondingly, in a brain field of unitary structure) it is quite possible to have continuous shifts of a phenomenal image (and likewise of the underlying brain processes) from a surrounding area to a surrounded one (the complex of self processes).

In addition to the above generalization of our considerations, from the visual facts only to perception in general, the solution of the paradox still requires the correction of a simplifying assumption which is not seriously tenable, but which has been made up to now. It is impossible that the spatial relationships in phenomenal space simply corrrespond to the geometrical relationships of their respective processes in the brain field. G. E. MÜLLER pointed out a long time ago that this is not conceivable because, for example, visual space acts like a fairly uniform continuum, while the corresponding processes of the brain field are anatomically-geometrically distributed over the two hemispheres; and therefore, from purely geometrical considerations, something, like a gap or at least a gross disturbance of continuity would have to be brought about by this inhomogeneity of the geometrical distribution of the processes. The same thing follows from the irregular arrangement of blood vessels in the nervous tissue (also emphasized by MÜLLER). Quite aside from such considerations, phenomenal space has a large number of

characteristics which would be alttogether incomprehensible on the assumption that its structure and its articulation in each concrete case were determined by nothing but purely geometrical relations of individual local processes. The new psychology of perception has demonstrated beyond any doubt that only the functional distribution of processes, as well as gradations and articulations in such a context, can be regarded as the physiological basis of the phenomenal spatial order. Accordingly, the physiological theory of phenomenal space must be dynamic, not geometrical. The symmetry of a perceived circle, for example, would not depend on the mere geometrical relationships between the loci of independent individual processes, but on the fact that, in an extended whole process which underlies the visual circle, a corresponding symmetry of the functional context exists. A more detailed discussion would lead us too far from our topic. [But cf. M. WERTHEIMER, Experimentelle Studien über das Sehen von Bewegung, *Zeitschrift für Psychologie*, 1912, 61, 161-265; and W. KÖHLER, Die physischen Gestalten in Ruhe und im stationären Zustand, Braunschweig: F. Vieweg & Sohn, 1920.] It will suffice if we show, by means of an analogy from elementary physics, how this changed assumption permits us also to solve those difficulties arising from the anatomical peculiarities.

Let a three-dimensional network or lattice be formed from filiform conductors, such that the conductors may be considered the edges of many equal small cubes. Consequently, at the corners of each such cube six filaments are in electrical contact, while they are otherwise encased in insulating sheaths. If such a network is connected to the poles of a battery in a certain manner, then the distribution of the stationary current may, of course, be represented purely geometrically. But this is a rather superfidal procedure, since purely spatial data mean very little for what takes place here, and since the distribution of the current must essentially be related to portions of the *conductor*. As far as geometry is concerned, the stationary distribution of current would be very different - it would be distorted - if the network were "bent," if some filaments were curved, etc. At the same time, however, in terms of length of conductor or amount of resistance, the distribution would be the same as before. Indeed, in these terms the distribution could still be considered the same even if some of the filaments (between two junctions) differed in length from the others but had the same resistance. Under these conditions there would certainly be considerable discrepancies between a description of the current in purely geometrical coordinates and one (the only adequate one) in functional coordinates. For instance, in the latter terms a certain distribution of current would have to be characterized as "homogeneous" while its density per square centimeter would vary considerably from place to place.

Since the distinction between functional and geometrical coordinates may be applied to other events, and thus must not be restricted to the case of stationary electrical currents, it may well be applied to the central nervous system and especially to that part of it whose processes underlie the spatial order of our perception. It is clear, then, that only functional coordinates may be used and that, therefore, the geometrical-anatomical position of the individual conducting structures and cells relative to each other becomes meaningless (a position partly determined by all kinds of secondary factors). With this step, the difficulties discussed by MÜLLER disappear. As a very rough approximation we can, of course, still assume a correspondence of geometrical-anatomical and functional coordinates of the system. For functionally neighboring parts of the tissue are usually also geometrical-anatomical neighbors, and functionally very distant parts are also separated anatomically from each other by a certain distance in space. But this correspondance will not hold in detail and will not apply strictly. It will be irrelevant for the understanding of the ordering of events in such a field since the functional distances are the only ones that really matter.

Without this principle it is impossible to understand even the relation between *visual* ordering of space and the corresponding brain events. It is all the more necessary if we want to make

comprehensible in physiological terms the fitting coordination of the phenomena of the various sensory modalities in one common space. (This needs to be considered in relation to the simplifying formulation above [2nd part].) But perhaps this point of view is most important for the understanding of the construction of the phenomenal self from such different sensory material. Again, it cannot seriously be maintained that in the brain region in question the corresponding process complex represents a kind of geometrical copy of the phenomenal body. For what matters are precisely the functional coordinates, and these may be "distorted" in a great many ways. This correction of the relevant coordinate system will not in the least change the relative localization of phenomenal self and phenomenal environment. "Being outside" and the changing distance of phenomenal objects relative to the phenomenal body are again to be thought of as *functionally* determined only, as a gradation in the extended context of processes which the purely geometrical distributions reflect only very roughly.

After this, nothing at all remains of the paradox of the localization of our phenomenal environment around us. Whatever relative phenomenal localization may take place is determined by functional proximities and distances in the underlying nervous process distributions. The fact that in their totality these are contained within the meninges and the skull in no way enters into these functional connections. Therefore they could not possibly appear in our perception, whose spatial character, indeed, depends only on those functional connections. Only if, during the analysisis, we shift from one kind of coordinate sytem to an entirely different kind, can we possibly still find difficulties here. If the phenomenal self depends on *one* process complex, the phenomenal environment on *other* such complexes, and if the relative phenomenal localization of the two corresponds to functional externality (just as two different phenomenal objects in the environment are outside of each other), then there is no problem left.

I do not wish to give the impression that this discussion leads to nothing more than to the disappearance of the old paradox. So far the emphasis has been on the fact that, in general, separate localization of phenomenal environment and self is natural and necessary for consistent thinking. From a slightly different point of view, however, these same considerations lead, rather, to a functional equivalence and kinship of the phenomenal self and phenomenal objects, which again cannot be understood as long as this self is not recognized as a separate part of the phenomenal world. Physiologically, the self and the objects of the environment represent complexes of processes in one and the same brain field. It is by no means necessary, and not even likely that these proccess complexes are functionally entirely indifferent to each other. The psychology of perception is full of instances of mutual influences between the objects nd occurrences of the phenomenal environment. For example, forms, sizes, and directions of seen objects may be strongly influenced by a suitably chosen surrounding visual environment. Because objectively and physically these are nothing but independent and mutually practically indifferent objects, forms, or contours, because there is thus no corresponding influence outside the organism, these distortions are usually called "illusions." But psychology is coming more and more to realize that, physiologically in any case, this is a matter of true influences on visual process complexes by their neighbors in the field. After what has been said, it is not astonishing that among the processes which underlie the phenomenal organization of space, more intimate functional connections exist than between the individual objects in physical space, whose forms, sizes, etc., are independent of each other under ordinary circumstances. Particularly striking influences are often observed in phenomenal space when there are movements in the field. Everybody has noticed, for example, that the moon clearly moves in the opposite direction when clouds pass in front of it. This is called "induced" movement of a phenomenal object, and recently DUNCKER has been able to offer a satisfactory explanation of its remarkable properties. [K.

DUNCKER, Über induzierte Bewegung, *Psychologische Forschung*, 1929, 12, 180-259] If, now, the phenomenal self belongs to the same interconnected field in which objects of the phenomenal environment can exert such an influence on one another, we may then expect that the same influence which is exerted, for instance, on the moon by the passing clouds may, under suitable conditions, also be exerted on the phenomenal self by vigorous movements of the phenomenal surroundings. Now, it is well known, and has even become a favorite amusement at country fairs, that obvious rotation of the visual environment leads regularly to rotation of the phenomenal self in the opposite direction, while the physical organism remains at rest. This phenomenon becomes, in principle, fully comprehensible if we consider the organization of the process complex which underlies the phenomenal self as part of the whole field of connected processes corresponding to everything phenomenal.

This simple example shows particularly impressively that phenomenal space and the underlying physiological field structure have qualities which do not exist in the same way in physical space. In particular, there are dynamic relations between the process complex of the self and the environment processes in the brain field which have no correlate in any analogous causal connections between the physical organism and its physical environment. But if we have gone this far, to be consistent, we must go very much farther. For, considerations of continuity demand that every kind of behavior in which we are directed toward a part of the environment will have to be understood as the expression of a vectorial state or event between the momentary process of the self and the environmental process in question. Depending on the actual characteristics of the two which, of course, always determine such a vectorial state, very different directions may occur. Such psychological facts as "attending to," "feeling attracted or repelled by," "hesitating before something," etc., occur in experienced space as directed from a phenomenal object to the self or vice versa. If one wants to be consistent, these will have to be incorporated in the schema outlined here of a correspondence between phenomenal order and functional connections in the brain field. But a more concrete development of this idea is hardly possible without also treating the phenomena of memory; it would therefore lead us too far from our problem.