

ON THE CONCEPTION OF SPACE AND OF TIME

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It is one of Goldstein's great merits to have thrown light on the difficult issue of disturbances of spatial orientation by viewing them in relation to the categories under which we organize our experience (1, 2). From this point of view I once analyzed the disturbance of a patient whose symptoms indicated both the presence of constructive apraxia and of an optic-agnostic disability (3). Using this case as an illustration, I should like to present here some further considerations regarding the nature of the conception of space and of time, as a tribute to the man who pioneered in this field.

In studying the disturbances of spatial sense—as well as those of time sense—we should distinguish between our conception of objective space, and that peculiar ability or quality of experience which underlies our realization of space in general. In the most general meaning of the term "space" we can think of various items that are distinct and separate in our consciousness, as being separated and ordered spatially within certain dimensions. In the case of those distinct experiences that occur simultaneously, the dimension within which they are separated and ordered must be conceived as being different from the dimension of passing time; in a graphic representation, the line representing this dimension must be drawn as a perpendicular to the line representing time dimension. Space then, in a more basic and general sense, is a psychological category which enables us to distinguish and order various perceptions even when they are similar in content and simultaneous in time. The experiences within this category are marked by the qualities of simultaneity, and by extension, duplication, and numerical ordering within a dimension different from that of temporal duration and sequence.

This general category of space enters as the spatial sense factor into the various specific conceptions or mental images of space which develop in the course of life, such as optic space, kinetic space, or the conception of space that is developed by a person born blind. Each of these various mental images of space depends on a specific set of sensory experiences in addition to the general spatial sense factor. The disturbances observable within one particular kind of space image could conceivably depend on a change in some factors specific to that particular organization. On the other hand, a defect in the spatial sense factor itself, a reduction of ability to use the category of space, may be expected to manifest itself in more than one area.

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At first glance the disturbance of the patient referred to above seems to center predominantly in the objective optic space. However, a more thorough examination suggests that its origin lies deeper, in the disturbance of the psychological space category as such.

Although the patient was not disoriented in the sense of not recognizing his surroundings, or of recognizing them falsely—while visiting various familiar rooms of the hospital he knew where he was—and although he was able to perform simple automatic everyday actions, he was unable to carry out performances that demanded a close observation of optical spatial relationships, such as copying two-dimensional and particularly tri-dimensional designs. He was unable to differentiate directions in the space around him, to discriminate simultaneous perceptions by ordering them in space. As a result of this loss of the directional element, both gnosis (cognition) and praxis (action) showed certain specific defects. The patient, e.g., was unable to read the time, because the various directions of the hands of the clock meant nothing to him; in trying to reproduce a square made of sticks he placed all the sticks in the same direction, in parallel rows. These defective performances indicate a disturbance of the general spatial sense, the factor which makes possible the discrimination and ordering of similar simultaneous contents.

For an accurate spatial differentiation in both the visual and the motor spheres, the various positions and directions must be organized in relation to a system of coordinates. In perception, the relationships "above-below," "right-left," "front-back" represent such outstanding, sharply defined directions into which other directions are embedded, and which serve to localize and order impressions. These coordinates probably originate in the spatial differentiation of the body sensations and the psychomotor activities related to them, and are only gradually transferred to objective external space. Whatever their development, our conceptions of these coordinates appear closely connected with the schema of our own body and its position in space; they are often tested and verified by reference to this model, e.g., right and left by reference to the right and left hand. The patient here discussed would have been unable to follow such a course, because his ability to differentiate directions on his own body was grossly disturbed; he was unable to tell what was above and below on his body, or left and right. If he received a command, such as pointing with his right hand to his left shoulder, or placing his right arm into a position identical to the one in which his left arm had been placed, he went through various contortions, but never succeeded in achieving the discrimination in

his own bodily space which was necessary for the correct performance. Assuming that the category of space is originally mediated through the body, these failures make the conclusion more compelling that the disturbance concerns the space category itself, affecting, as it does, not only the objective space, but also the vital space of one's own body.

In the light of the above, it might appear paradoxical that, to a certain extent, the patient was still able to work with spatial relationships in external space; he was able, e.g., in response to a request, to put a chair nearer to the wall, or to pile books on top of each other. Such performances, however, had been learned and practiced in the course of his life; having been automatized they required no new acts of spatial categorization and could therefore be preserved after the disturbance had set in, at least for a certain period of time. In performances of this type the patient would be superior to a 5- or 6-year-old child because of his longer experience and practice. But the child would be superior in carrying out simple but novel commands: the category of space would be brought into play and achieve new spatial organizations in its perceptions and actions. The difference is brought into a strong focus if we compare spontaneous motor behavior. In the child the localizing power is activated from within: it reaches for objects, is constantly active, undertakes journeys of discovery, and is not detained from them by difficulties of locomotion or by repeated falls. The child is aiming at new possibilities. The patient, on the other hand, if left alone, would remain indefinitely in the position he was in, however uncomfortable it might be. He seemed unable to conceive the possibility of any other position than the one he happened to be in.

Further evidence of the disturbance of the space category, rather than merely of the conception of the objective space, is provided by the patient's inability to organize simultaneously present and similar perceptions under the aspect of number. He was unable to see at a glance the difference between groups of 5 and 3 pencils. He could not tell how many candles there were on the table in front of him without first having to count them. In his actions also the aspect of number seemed never to become prominent. With four candles before him, when he was asked to light "the" candle, he might light one and express no puzzlement about the others; apparently the multiplication of the object was not clearly realized by him and thus created no dilemma.

All this gives a clinical picture which might be termed *loss of mental localization*, characterized by an atrophy of the ability of

spatial differentiation: Objects in space, including both one's own body and objective space, lose their directional element, and consequently can be neither clearly localized in relation to each other, nor compared as to their extension, nor perceived under the aspect of number.

The spatial sense, the disturbance of which results in this syndrome, might appear to be independent of the ability to discriminate time sequences. Yet a closer analysis shows that the two functions are dynamically interrelated. In the patient here described, even though his defect was centered predominantly in the spatial sphere, realization of time relationship was by no means intact. This was verified by repeated examinations.

As I have tried to demonstrate in a recent study (4), the time sense is intimately connected with the experienced continuity of sensations and perception (*duree tout pure*). If the sense of continuity of immediate experience has been lost, the power of time realization will suffer. This sense of continuity is also a precondition of the experience of simultaneity, the negative of sequence. Thus when the sense of continuity is lost, the realization of simultaneity becomes amorphous. Since the quality of simultaneity marks the experiences organized under the category of space, its diffuseness leads to a disturbance of spatial sense. Simultaneity, when diffuse, no longer appears in its typical form, that of *spatial* dimension differing from *temporal* sequence.

If this analysis is correct, the disturbance of the sense of continuity, in which both sequence and simultaneity have their determination, may be the root of disturbances of both the temporal and the spatial sense. Thus we should expect to find a loss of the time sense in every case of constructive apraxia, just as there is a loss of the directional element in every case of the Korsakow syndrome. The factors determining which of the two areas will become more strongly affected are yet imperfectly understood, but it is to be hoped that the continued fruitful interaction of general psychological hypotheses with clinical observation will clarify this issue and deepen our understanding of the complex ways of human functioning.

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