Cultural Factors in Spatial Orientation*

- A. Irving Hallowell

Spatially, like temporally, coordinated patterns of behavior are basic to the personal adjustment of all human beings. They involve fundamental dimensions of experience and are a necessary condition of psychological maturity and social living. Without the capacity for space perception, spatial orientation and the manipulation of spatial concepts, the human being would be incapable of effective locomotion, to say nothing of being unable to coordinate other aspects of his behavior with that of his fellows in a common social life.[1] In addition to the psycho-physical and psycho-physiological conditions of human space perception, we know that variations occur, between one culture and another with respect to the selective emphasis given to the spatial relations and attributes of things, and degree of refinement that occurs in the concepts employed, and the reference points that are selected for spatial orientation. The human individual is always provided with some culturally constituted means that are among the conditions which enable him to participate with his fellows in a world whose spatial attributes are, in part, conceptualized and expressed in common terms. Ontogenetically, self-orientation, object-orientation, and spatio-temporal orientation are concomitantly developed during the process of socialization.

Long ago, Poincaré pointed out that the notion of space must be understood as a function of objects and all their relations. There is no such thing as space independent of objects. Relations among objects and the movements of objects are a necessary condition of space perception. More recently, Gibson (1950: 228) approaching the problem from the standpoint of psycho-physics, has developed the hypothesis "that space is constituted of the same variables as things . . . that surfaces and margins are what we see, not air. Space must be filled to be visible; empty space is an abstraction." This author distinguishes problems concerned with (a) "the perception of the substantial or spatial world," "the world of colors, textures, surfaces, edges, slopes, shapes and interspaces," what he calls *literal* perception, from (b) "the perception of the world of useful and significant things to which we ordinarily attend." He calls the latter *schematic perception* (1950: 10).

While it remains an open question how far the purely psycho-physical dimensions of perception may be influenced by culturally constituted experiential factors, schematic perception, involving the meaningful aspects of experience, can hardly be understood without reference to an articulated world of objects whose relations and attributes become meaningful for the individual, not simply through the innate psychological potentialities he brings to experience but, above all, through the significance for experience that the development, patterning, transmission, and accumulation of past experience, in the form of a cultural heritage, have come to imply. The question: Is space perception native or acquired? though once hotly debated, is in actuality a pseudo-problem (see Gibson 1950: 228).[2] What Gibson argues against is an extreme form of perceptual relativism: "That perception is inevitably a constructive process which creates the world to suit the perceiver; that we see things not as they are but as we are."

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While "it is perfectly true," he says, "that perception can be fluid, subjective, creative, and inexact . . . it can also be literal . . . the student of human nature and society needs to remember this when he is in danger of assuming that men are the passive victims of their stereotypes and perceptual customs (1950: 210-11).

Psychologists repeatedly have emphasized that unlike other aspects of experience (e.g. color and sound), which are mediated through highly specialized sense organs, perception of space requires the participation of several sense modalities including, for instance, tactual kinesthetic components. There is no "spatial sense," equivalent to vision and hearing, by means of which we perceive such attributes of space as extension, shape, size, direction, locality, and distance. Such experience is "intersensory" by its very nature; yet is as primary as experience mediated by specialized sensory modalities (Stern 1938: 99). Furthermore, the role that differential linguistic and cultural factors play in the processes through which the spatial attributes of things become abstracted, conceptualized, expressed in traditional forms of speech, and made the basis of action cannot be overlooked in this case any more than it can be in the functioning of perception mediated through specialized sense modalities.

There is an additional factor, however, that has been neglected in discussions of space perception and spatial orientation. This is the peculiarly human capacity of achieving a level of psychological organization that makes possible the perception of the self as an object in a world of objects other than self. In addition to reference points anchored in the objective world, the human being constantly makes use of himself as a reference point. "Perceiving the world has an obverse aspect, perceiving oneself."[3] While we may, perhaps, assume this, it should not be forgotten that self-awareness as a universal psychological attribute of man is no more given at birth than the traditional schema of reference points to be found in a culture or the vocabulary of spatial reference. Self-identification and the perception of self as an object in relation to other objects is the result of a long socialization process, just as the skills underlying the achievement of a "sense of direction" only emerge from a complicated learning process.

Furthermore, in order to be spatially oriented in the widest sense, that is, beyond the field of immediate perception, the individual must not only be aware of himself but of his own position in some spatial schema. At the same time he must be capable of maintaining awareness of his own changes in position, and be able to assume the position of others in the schema with reference to himself. What spatial orientation in [human beings] actually involves is a constant awareness of varying relations between the self and other objects in a *spatial schema* of traditionally defined reference points. If I have a destination, beyond my limited field of vision, for example, I not only have to know where I am going but I have to know where I am now in relation to my goal and, as I move toward it, I have to be aware of the changing relations involved. In order to reach my goal and return to my starting point, I have to make use of formal or informal reference points. I may be guided, in part, by a "mental" map, but in any case, I have to maintain some kind of topographical or astronomical (Goodenough 1953), if not directional orientation, in which my own changing position must be appraised. Gibson points out that this type of locomotion -- that is, "the act of going to an object or place beyond the range of vision" --

represents a much higher and more complicated level of mobility than that confined to a spatial field where optical stimulation yields all the necessary cues because the goal-object lies within it. (Gibson, pp. 229-30). What we take for granted, without a close analysis of all the necessary conditions involved, is that the human individual will necessarily advance from the simpler to the more complicated level of finding his way about during the course of ontogenetic development. Yet this is certainly one of the vital points where the cultural factors that are an integral part of the spatialization of the [human] world play an outstanding role. The human being not only advances from a rudimentary to a more complex level of spatial orientation and mobility; the possibility is opened to him [or her] through various kinds of symbolic means to become oriented in a spatial world that transcends his personal experience. Place naming, star naming, maps, myth and tale, the orientation of buildings, the spatial implications in dances and ceremonies, all facilitate the construction and maintenance of the spatial patterns of the world in which the individual must live and act.

While striking cultural variations occur, possible universals should be looked for. Is there any culture, for instance, in which there are *no* names for places and topographical features in the environment of people? From the standpoint of human mobility and spatial orientation this practice would appear to have a generic human function. When integrated with individual knowledge and experience of the terrain it affords a schema of reference points for topographical orientation. Such points are not only a guide to action but, once known, can be mentally manipulated and organized in the form of "mental maps," and the spatial schema inherent in them communicated.[4] Maps among nonliterate peoples are, of course, the projection in the form of graphic symbols of space relations abstracted from knowledge already available in these "mental maps' rather than the outcome of such sophisticated techniques as surveying, serial photography, etc.[5] It is amazing how accurate such maps can be.[6] While maps are of limited occurrence among nonliterate peoples, names of topographical features and places appear to be universal.

Perhaps the most striking feature of man's spatialization of his world is the fact that it never appears to be exclusively limited to the pragmatic level of action and perceptual experience.[7] Places and objects of various classes are conceptualized as having a real existence in distant regions. Even though the individual never experiences any direct perceptual knowledge of them -- since information must be mediated through some symbolic means (the spoken or written word, graphic representation) -- such regions are, nevertheless, an integral part of the total spatial world to which he is oriented by his culture. For man everywhere has cosmic concepts; he is oriented in a universe that has spatial dimensions. The individual not only has heard about other groups of human beings he may not have seen; they are given a *locale*. He knows *where* the land of the dead is and something about it even though he has not yet visited it. Gods and spirits are given an abode and mobility in space; they not only exist but they exist *somewhere*; they may be "here" now and later "there." Likewise in Western culture, world explorations and science have accustomed us to accept as reliable all sorts of information about the location of distant peoples, about natural phenomena of various kinds, the location and contours of the land masses of the

earth, and so on, all beyond our direct perceptual experience. Astronomers, too, tell us about the spatial relations of bodies in the far-flung stellar universe. We assume, of course, that our knowledge of distant regions is more dependable that that of the primitive peoples we study, and this is undoubtedly true. At the same time it should not be forgotten that it is acquired by most individuals through symbolic mediation and that the qualitative differences of this knowledge are extremely recent in our own culture. We need only to compare the spatial orientation and knowledge of medieval man in Europe with our modern outlook to appreciate this. In *The Other World*, Howard R. Patch devotes a chapter to "Journeys to Paradise," many descriptive accounts of which are to be found in medieval literature. This author points out that "The Garden of Eden was universally believed to exist, and, although cut off from ordinary approach, was supposed still to be waiting for the saints before their ascent to Heaven. Medieval maps often showed its location" (Patch 1950: 134). In other words, it was a place located on the earth that might be visited by travelers, "even if they had to have recourse to supernatural means" (Patch 1950: 153). Even subsequent to medieval times there are references to such journeys and the author notes that, "when Christopher Columbus discovered the New World, he thought he was close to the Garden of Eden. . . ." (Patch 1950: 173). Today the Garden of Eden has disappeared from our universe; it has no spatial existence. Similarly, Dante could present to his readers an intelligible image of hell "pictured as a huge funnel-shaped pit, situated beneath the Northern Hemisphere and running down to the centre of the earth." If we now ask, *where* is hell, what answer can we give if the cosmographic picture of our universe defined on the basis of scientific knowledge, is accepted? As places heaven and hell in this universe are "nowhere."

What appears to be particularly significant in our human adjustment to the world is that over and above pragmatic needs for orientation and without any pretense to reliable knowledge of regions of space outside their personal experience, human beings in all cultures have built up a frame of spatial reference that has included the farther as well as the more proximal, the spiritual as well as the mundane, regions of their universe. What the recent history of Western culture demonstrates is the revolutionary challenge offered to the spatial orientation embedded in an older tradition when more reliable knowledge of distant regions, combined with the development of abstract mathematical concepts of space, established the foundations of the qualitatively different type of spatial orientation that is now possible for us.

The unique combination of factors that account for the distinctive mode of human spatial orientation has not always been clearly recognized. For a long period, dating back to the late eighteenth century when the idea of the Noble Savage had such a vogue, the problem was obscured because of the widespread notion that savages, as compared with civilized man, had an innate sense of direction. This notion was based to some extent on the exaggeration, if not misrepresentation, of the observations of early travelers and missionaries. Pierre Jaccard (1932), in a book which should be better known, calls attention to the excellent observations of Père Lafitau in 1724 on the Iroquois. Their later distortion by Charlevoix, he thinks, gave rise to "la legende de l'instinct d'orientation des sauvages." In the nineteenth century, after the concept of

biological evolution took hold, one of the prevailing ideas was that the "senses" of primitive man were more acute than those of civilized man, even though he might be intellectually inferior. Indeed, "savages" and the lower animals were thought by some to be alike in many respects. Haeckel (1868) in his *Natural History of Creation* observed that if one compared African Negroes, Bushmen, and the Andamanese with apes, dogs, and elephants, on the one hand, and with civilized man, on the other, one would be compelled to make a distinction, not between man and animal, but between civilized peoples on the one side, and savages and animals on the other. The question, then, of an innate or special sense of direction in primitive peoples became entangled with the more general question whether "primitive" mind and "civilized" mind represented psychological categories that had an evolutionary significance. Jaccard concludes:

> Si tous les sauvages possédaient des facultés de direction, inconnues de nous, on pourrait peut-etre accepter provisiorement l'hypothèse d'une différence de nature entre leur psychologie et la notre. Mais cetter supposition n'est plus meme premise aujourd'hui : il est en effect démontré que la plupart des non-civilisés sont tout aussi embarrassés que nous lorsqu'ils se trouvent dans une région dépourvue de repères, loin des horizons familiers de leur pays natal . . . loin de montrer la bestialité sauvages, les faits d'orientation lointaine de l'excellence des pouvoirs d'attention, de mémoire, et d'observation des plus intelligents d'entre eux . . . c'est de reconnaitre que les sauvages et les civilisés possèdent a des degrés divers une meme aptitude, plus ou moins développée chez les différents individus, selon les circonstances . . . l'hypothèse d'un sens particulier de la direction, affiné chez le sauvage et émoussé chez le civilisé, par suite des conditions d'existence, n'est pas plus soutenable que les interprétations basées sur une opposition entre l'intelligence et l'instinct. Aucune différence appréciable n'apparait entre les capacités sensorielles et les fonctions mentales élémentaires des diverses races humaines : ce fait seul suffit à démontrer l'erreur de toutes les théories attribuant aux sauvages des facultés d'orientation inconnues des civilisés.

We know now, of course, that even in studying animal behavior, the concept of 'instinct' is too categorical and affords us no help at all in explaining how animals find their way about. Despite the fact that we are still in the dark on many frontiers of this area of investigation, great progress has been made in our detailed knowledge of some of these determinants in vertebrates and insects (Beecher 1952; Bogert 1948, Wolfson 1952; von Frisch 1950). Astonishing as the performance of some of these creatures is with respect to their mobility, we can be certain that the crucial determinants are of a different order than those in human spatial orientation. Consequently, although at a very rudimentary perceptual level, there certainly is some overlapping in the spatial world of ourselves and other animals, the phenomenological differences must be very great indeed no matter what local cultural variables are among the human factors involved.[8]

The Spatial Orientation of the Saulteaux

Directional Orientation

From an abstract point of view it might appear that the basic directional orientation of the Saulteaux is equivalent to that of occidental culture, since they recognize four cardinal directions as fundamental reference points which can be roughly equated with north, south, east, and west. Actually, the equivalence is

not only historically fortuitous, it differs from our own directional orientation qualitatively and functionally in important respects.

The occidental directional schema is based on scientific knowledge that the Saulteaux do not possess. In our schema "true" north is taken as an absolute reference point; it is determined precisely by mechanical means, and instrumental correction for possible error is made under certain circumstances. Furthermore, the possession of a magnetic compass and the knowledge of how to use it enables us to check our directional orientation exactly at any time.

The Saulteaux, on the other hand, rely exclusively upon the direct observation of natural phenomena in order to maintain their directional orientation. Their most inclusive reference points are the North Star, the movements of the sun, and the "homes" of the four winds. Sometimes to these are added "straight up" (zenith), and "down" (nadir). The standardized and linguistically formulated cardinal directions of their culture, however, refer only to the four winds. It is through the traditional emphasis upon these that the wider aspects of their spatial universe are defined.

In their mythology the winds are anthropomorphic beings each associated with a complementary direction. The winds are brothers who at birth enunciate their personal relations to humanity. The first-born was East Wind, who said, "I shall be fairly kind to human beings." The next was South Wind, who said, "I'll be very good and treat human beings well, as long as any exist on this earth." The third child born spoke and said, "human beings shall call me West Wind. I'll be a little rough on them but I'll never be wicked." "Be easy on our mother," he went on as another boy popped out. This one said, "Human beings shall call me North Wind. I'll have no mercy on any human being. I'll treat him just the same as the animals." At this remark his brothers asked, "How do you expect human beings to exist if you are going to treat them like that?" (But no answer is given in the myth.) Shortly after this the brothers decided that they could not remain together any longer. The East Wind said, "I'll go live in the east." The West Wind said, "I'll sit opposite you at the other end of the earth." The South Wind said, "I'll go to the southern end of the earth," and the North Wind said, "I'll go to the northern end."

In another myth North Wind invites his brother South Wind to a trial of strength, but is unable to worst him. Then the South Wind invites his brother North Wind to come south for a return contest. All the South Wind did was to blow on him. After the first couple of days North Wind could hardly hold his head up. One of his eyes drooped and then the other. Finally, on the sixth day he had to give up; he was beaten. The South Wind said, "Now you know you're not the boss of everything." "And we know he is not the boss," added the narrator, "for, if he were, we would never have any summer."

For the Saulteaux, direction is only partially abstracted from *place*. That is, their conception has more the meaning "in the direction of such and such a place," "toward *x*." What we refer to abstractly as the cardinal directions are to them the *homes* of the winds, the places they come from. Similarly, east is thought of as the place where the sun rises; west, the place where it sets; south is the place to which the souls of the dead travel, and the place from which the

summer birds come. In a myth summer is stolen from a place in the south. Indeed, the Saulteaux equivalent for north, south, east, and west are *place names* in a very real sense, rather than abstract terms for direction. They are far, distant, it is true, but in myths at least, people have been there. They define the periphery of the Saulteaux world, being the "farthest" places, although not different except in generality of direction, from places in the immediate environment. Such a connotation exists in Western civilization side by side with the highly abstract one expressed in terms of angles and their measurement used in science. We say, "He lives in the West," or "The South grows cotton." The terms "Occident" and "Orient" are also used as nouns denoting places or regions. The latter arose at a period when, like the Saulteaux, the people employing them thought that the earth was flat.

I do not mean to imply that the Saulteaux terms are never used abstractly. But the degree to which this occurs is a function of the social situation. Abstraction is at its highest level when directional terms are employed in finding one's way about or in constructing a ceremonial pavilion. This may happen similarly with direction toward any place: a place, x, may be defined as "on the way to" y.

Thus it is inevitable that the directional orientation of these Indians is more flexible and less exact than our own, and that they must rely upon cues from several different classes of natural phenomena. Such limitations are intrinsic to the traditional means with which their culture provides them for ascertaining directional orientation. There are many instances of these limitations. I have heard Indians refer to the Milky Way, which is considered the path the Summer Birds follow flying north, as running north and south. This is not the case, but the approximate direction satisfies them. Another example is to be found on a map of Eagle Lake drawn by Adam Keeper, an Indian at Grand Rapids. On it he marked the four directions, but he was not aware of the discrepancy between his directional orientation and the measured directions of our schema. This is demonstrated by the fact that while he included a nearly ruled line representing the boundary between the provinces of Manitoba and Ontario, he made no use of it as one of his directional coordinates. Every Indian knows this line because it is actually cut out through the woods for miles and miles, and it runs exactly north and south. The fact that Adam ignored this cue shows the extent to which he has clung to his culturally constituted orientation in drawing the map, and the extent to which the local spatial interrelations of landmarks and contours predominated for him.

We can be certain, then, that the north of the Saulteaux is not our exact north and that the other directions they recognize are likewise approximate, more inclusive, than ours. For example, east means "in the general direction of east" and is closer to our everyday usage when exact reckoning is unnecessary. If an Indian is asked where the east is he will point to where the sun rises. From his point of view it is unnecessary to take into account the variations in the sun's positions at different seasons of the year and to arrive at a measured point on the horizon designated "due" east. What the range of their margin of error may be I do not know; but it is obvious that for the Saulteaux directions, unlike our own, are not fixed coordinates.

Qualitatively and functionally, therefore, the existence of a four-directional schema in Western culture, on the one hand, and in Saulteaux culture, on the other, presents only a superficial resemblance. The behavioral implications in the two societies are quite different. Western man has been freed from the direct observation of nature in so far as he depends upon mechanical instruments for the determination of direction, or does not need to maintain his orientation with respect to compass points at all so far as the pursuit of daily life is concerned. The latter is particularly true of urban populations where such directional orientation may be almost completely ignored. [9]

The Saulteaux, however, constantly maintain a directional orientation. Traveling in the open as they do at all seasons of the year, across lakes and through a network of waterways in the summer and over snowballed wastes in winter, the direction of the wind in particular is always noticed and their practical activities adjusted accordingly.

Knowledge of Terrain

This culturally defined framework of directional orientation, with its customary reference points in certain natural phenomena, exposes the basic and most inclusive schema through which the Salteaux orient themselves in a world of space. Closely integrated with it, and overshadowing it in importance, is the direct knowledge through experience of the topography of the country and the relations in space of one locality to another.

This direct experiential knowledge, however, varies greatly among individuals. Most of the Berens River Indians have never traveled any considerable distance from the locality in which they were born. There is also a marked sexual dichotomy in direct knowledge of the country. Women travel far less than men. There are certainly few, if any, women of the Pekangikum Band who have been to the mouth of the river and most of them have not been as far as Grand Rapids, halfway there. In contrast to this, most of the men of the Pekangikum Band have been both to the mouth of the river and Grand Rapids.[10] At any rate, it would be erroneous to assume that a first-hand, detailed knowledge of all parts of the river and its environs is possessed by any single individual. The terrain which is most familiar to these Indians is their winter hunting ground and the region surrounding the fishing settlement in which they live during the summer months. They are, in short, bound in their direct knowledge and experience to the areas with which their major economic activities are connected, a narrowly circumscribed spatial world which, even under modern conditions, has expanded very little. But within these limits the individual often possesses a phenomenally rich knowledge of the details of the terrain that contrasts sharply with his ignorance of parts of the country about which he has no direct knowledge[11] and of the still wider spatial world regarding which he sometimes entertains fantastic ideas.

In functional terms, it is not only the direct experience of the terrain which assists the individual in building up his spatial world; language crystallizes this knowledge through the customary use of place names. These in turn act as geographical reference points by means of which localities of various classes may

be organized in spatial terms. This is not to imply that in Saulteaux culture the range of their application is coextensive with the total number of lakes, islands, points, rivers, and streams that might be named. Place names function integrally with the geographical knowledge and experience of the individual. Consequently, the local place names referring to topographical features within the radius of a particular summer settlement[12] are not known to the Indians of other settlements and the same applies to those attached to the geographical features of the winter hunting grounds. On the other hand, the place names of the major lakes, rivers, etc., and a general knowledge of their directions from their home and vague distances such as "long journey," of the environs of the Berens River as a whole are known to every Indian, regardless of whether he has ever traveled them or not. Correlated with the directions, these reference points define the wider limits of the geographical environment in which these Indians think and act, just as the place names for more circumscribed localities serve to organize the space relations of their local environment.

Beyond the Berens River itself, and peripheral to it, only a few geographical localities are at all familiar to the average Indian. On the west side of Lake Winnipeg the names of the larger lakes are known and a few Indian reserves and trading posts. To the north, trading posts such as Norway House, Oxford, God's Lake, stand out, and such geographical points as Deer Lake and Island Lake. Of course, every Berens River Indian has heard of Hudson Bay and the rivers that flow into it. To the southeast Lake Seul is well known because long ago a number of Berens River families came from there. To the south there are a number of rivers that are familiar, particularly the Red River which flows north to Lake Winnipeg. Cities like Selkirk and Winnipeg are known, and Ottawa because the government is there. But no Indian has been to all these places, and I am sure that their location with respect to one another and to the Berens River district is not understood.

If any of these places is thought of spatially I am certain that it is only as the context of the reference requires it. Any idea of its relation to other places in a spatial schema that is conceived as a geographical continuation of the Berens River region itself is totally foreign to the minds of these people. This seems to indicate that without some graphic means as an aid, place names are only effective in organizing one's spatial knowledge within the limits of one's direct experience or through a limited extension to regions immediately peripheral to such experience. Outside of this they tend to become disparate and unorganized, verbally known places.

Native Maps

Within a familiar terrain, however, such as the part of the country which he has known since childhood, or his hunting ground, an individual clearly grasps the precise location and has some idea of the relative distances of every significant detail of the topography in relation to every other. When integrated with some inclusive directional orientation such knowledge needs only graphic projection, and we have a rudimentary map. It is significant, nevertheless, that this organization of the spatial perceptions of the individual into a coordinated whole, a "mental map" (Jaccard, p. 213), applies only within the narrow limits indicated. It is deeply imbedded in the 'active' experience of the individual.

That such a well-integrated organization of the spatial relations of certain parts of their geographical environment exists in some terms in the minds of some individuals may be inferred in several ways. I had in my possession maps of the National Topographical Series which are based on airplane photographs and on which the smallest lakes, rivers, and creeks are represented. In the first place a number of Indians who had never seen a detailed map of the part of the country with which they were most familiar almost immediately grasped the geographical relations on these once a few landmarks had been identified. But it was necessary to orient the map in relation to the observer. The Indians could not adapt themselves to looking at it in the conventional manner familiar to us with north at the top. They always had to have north on the map matched with north as it actually was from their point of view at the moment. Once they were fully oriented, it appeared as if they rediscovered on the map what was already organized in their minds. Some of them felt so much at home that often when I was trying to get them to delineate their trap lines or the boundaries of their hunting territories on the map, they would delay the process by side conversations with other Indians present, pointing to the outlet of some little creek where a moose had been killed or where some other event of interest to them had taken place.

Still more convincing evidence of the organization of the details of geographical relations in the mind of the individual was demonstrated by the objectification of such information in the form of maps which certain individuals drew for me. I secured five of these from three different men. That there is considerable individual variation in the ability to project such knowledge in graphic form is suggested by the admiration of other Indians for these maps. They said that it would have been impossible for them to perform such a task. The making of maps, however, was known in aboriginal days.

These aboriginal maps were intended to guide the individual using them through territory unknown to him. Their purpose was not to delineate a section of the country as such, but to indicate a route to be followed, and the emphasis was upon a succession of landmarks roughly indicated in their relations to one another and with only such other details of the topography as were necessary for the identification of the landmarks of primary interest. This is a very rudimentary form of map which does not require the refined abstract coordination of place, direction, distance, area, and contour that we expect. Areas and distances might be only relatively proportional, for instance, and yet such a crude delineation would serve its purpose.[13] The graphic emphasis upon a succession of landmarks is worth noting because it bears a close correspondence to the actual method of traveling about, just as the very limited geographical region for which detailed special knowledge is organized in the minds of individuals.[14] As might be expected, the narrow geographical limits of such organized positive knowledge bear an inverse relation to the ignorance of the terrain outside of the experience of the individual.[15] In this connection it is well to remind ourselves that without maps it would likewise be impossible for us to obtain any exact comprehension of geographical relations outside our experience.[16]

A startling illustration of this intrinsic limitation upon realistic spatial concepts of an unknown region is illustrated by the following episode. All the Indians were interested in a series of photographs I had taken of them, and some of them also were intrigued by the large-scale maps of their country, to which I have already referred. So, when one old man asked me to send him a photograph of the United States, I thought my interpreter had misunderstood him and that what he referred to was a map. But no! What he wanted was a photograph of the United States. Evidently the United States was to him a place regarding which he had only the vaguest idea and no notion whatsoever of its spatial extensity.

Travel

In addition to standardized reference points, i.e., named places and named directions, this includes a mass of impressions undiscriminated in speech but immensely important nevertheless. The characteristic manner of their procedure at all seasons, and whether traveling on land or water, can be reduced to a common principle. They always move from one point to another, rather than in a given direction towards a goal.[17] Directional orientation usually functions as the wider frame of reference to facilitate the step by step procedure.

In principle, this step by step procedure emerges in certain mythological narratives where it takes the following form; the protagonist is directed from point to point in a strange country by a series of old women. The first old woman he encounters not only directs him on his way, she tells him what to look out for, how to avoid obstacles to his progress, and so on. And finally, she tells him that he will come upon another old woman on whom he can depend for directional advice for the next stage of his journey. Of course, events occur as anticipated; the second old woman is reached who directs him to a third. The analogy to actual travel should be clear. Familiar landmarks in a journey correspond to the old women; they mark the nodal points in a geographical progression in space and while they fail to give advice in a literal sense, they are anticipatory signs of the particular features of the country in the ensuing segment of the journey that must be mentally prepared for before they are encountered.

A commonplace illustration of ordinary procedure is illustrated by the ascent of the Berens River from its mouth to Grand Rapids, a hundred miles inland from Lake Winnipeg. The river is not in its entire length the natural road we usually think a river to be, for in places it opens into lakes. On this portion of it there are approximately fifty rapids, all named, which function as the nodal points in the journey. It is these geographical items which are checked off, as it were, in traveling up and down the stream, and one's position on the river at any time, particularly when eating and sleeping, is always talked about with reference to this schema of rapids. They also function as anticipatory signs of the features of the country to be encountered between them. No wonder, then, that the local Indians thought it curious and even hazardous when some white men a few years ago ascended the river without a guide. They were probably equipped with the excellent maps that are available. To the Indians they would have no anticipatory signs to guide them; they would not know what to expect.

A journey I once made across Lake Winnipeg in a skiff with an improvised sail illustrates the step by step principle in terms of another mode of travel. It also happened that the early part of the trip was made in a heavy fog which obscured the ordinary visual cues. My guides were, of course, very familiar with the directions of landmarks. Leaving the reserve early in the morning we rowed along the shore to Flathead Point where we disembarked to eat breakfast. Pigeon Point was not visible, but we headed in that direction rowing all the way. The wind was from the northwest. We set sail for Commissioner's Island which we reached about two and a half hours later. The fog having lifted somewhat in the meantime, we were able to sight the island some distance away and adjust our course accordingly. From there we made for Sandhill Island which we reached in an hour and a half. We spent the night there. The next morning it was easy to reach Stony Point and then to follow the shore south to Jack Head.

An analogous principle of travel in winter is set up under quite different circumstances when an Indian lays his trap line and makes his rounds periodically. The relation of the traps to each other, to certain topographical features of the country, and to his camp define a spatial order in which he regularly moves from point to point.

In winter, however, during long journeys on snowshoes or with a dogsled, when darkness obscures familiar landmarks and a storm makes even the stars invisible, then directional orientation inferred from the wind must be depended upon as the main cue. Under these conditions one has no choice but to proceed in a given direction; it is impossible to follow the visible cues provided by a series of landmarks, and it is possible to lose one's way badly. If directional orientation by means of the wind fails, there is nothing to do but make camp and wait until weather conditions change and the usual cues can be picked up again.

Topographical cues are, in fact, so important that if masked by snow an individual may lose his way even on familiar ground. An Indian once told me of such an experience which he considered very humorous because the trail was one frequently traveled by everyone -- I had often used it myself in summer. But my friend missed his way one winter night when the drifted snow had radically distorted cues familiar even at that season of the year. On the other hand, there are well-known general patterns in the topography of their country which are used by the Indians as cues. The rocky ridges as well as the muskegs east of Lake Winnipeg, for instance, run east to west like the rivers so that whether it is cloudy or misty, night or day, a general orientation is possible. This pattern also can be used as a cue in winter when snow is on the ground. A Berens River Indian once went to fight a forest fire on the west side of the lake. He got lost because he was not familiar with local topographical landmarks and the muskegs had a different directional pattern. Not being aware of this latter fact, he relied on the muskegs and became disoriented. To an outsider general topographical patterns would not be obvious so that without any explanation of the actual cues being used it might appear somewhat mysterious how the Indians familiar with the country did find their way about in stormy or snowy weather and without a compass.

In connection with this dependence upon topographical cues it is interesting to recall the predicament of Wisakedjak, the culture hero of the Saulteaux, told in

a myth. Wisakedjak had been temporarily deprived of his sight by getting his head encased in a bear skull and the method he employed to find his way about was to ask each tree he bumped into what its name was. Wisakedjak wished to reach a lake since he thought he might find some people there, and he accomplished this by differentiating between trees that grew near the water and those that did not, adjusting his course accordingly.

If, as sometimes is the case in winter, there is a well-marked trail in the snow to be followed, then travel is greatly simplified. Under such conditions that Indian participates in one of the amenities of Western culture, the road, which we take for granted and which so enormously facilitates our movements from place to place. Neither directional orientation nor the use of such cues as the Saulteaux are compelled to employ are necessary in following a modern road. The contrast between this method of getting about and the other procedures described brings into sharp relief a basic difference in the pragmatic aspects of spatial orientation as demanded by Saulteaux culture on the one hand and Western culture, on the other.

Fear of Disorientation

The sharp contrast between the extremely intimate knowledge of a familiar terrain and the very hazy ideas which are entertained about other regions is sufficient, I believe, to account for a certain timidity on the part of these Indians in venturing into unknown territory unless accompanied by someone who is already acquainted with the region. While directional orientation can be maintained in unknown regions, the lack of all the well-known landmarks inevitably must lead to a certain amount of spatial disorientation. And there is always the possibility that one may really become lost. Hence, there is rational ground for apprehension.

A feeling of satisfactory spatial orientation, then, probably is one of the basic ties that bind the individual to familiar territory. The Indian would not analyze or express his feelings in such terms, but I think that it is a legitimate inference we are enabled to make from the very nature and character of his spatial orientation. It is likewise consistent with the basic role played by spatial orientation in all human behavior. For we, too, feel some sense of spatial disorientation in a strange city or country even when such orientation is less vital to our activities than to those of the Salteaux and under cultural conditions which offer an opportunity for a more immediate and adequate reorientation. Furthermore, the feeling of the Saulteaux themselves about the loss of an adequate spatial orientation was illustrated in their concern when on one occasion I had difficulty in finding my way back to our camp, and their admonitions on others to be careful and not to lose my way when I went about by myself. Since I never was lost and their concern at times seemed a bit silly to me, I think that their attitude in these situations is quite revealing.

The same apprehension on their part can be demonstrated in another way by the story of the Indian who found his way back home from a strange part of the country. Early in the nineteenth century, when the Hudson's Bay Company reigned supreme in western Canada, some Indians raided a post at Sandy Narrows in order to obtain knives, powder, etc. The leader of the party was a

man called Brimmed Hat. After he was apprehended it was planned to send him to England where he could observe for himself the power and magnitude of the white man's civilization. On the way to York Factory where he was to be put on a ship, Brimmed Hat escaped. This was near White Mud Falls on the Hayes River. Later he showed up again at Sandy Narrows, a distance of approximately three hundred miles as the crow flies. To the Indians such a journey was miraculous, and they believed he must have had the aid of supernatural helpers. First of all, he could not proceed in the usual way from one known point to another in a strange country. From our standpoint a correct directional orientation might have been a sufficient guide to him, combined, perhaps, with some general knowledge of the watersheds since Hayes River drains into Hudson bay and the Berens River is on a shed from which the rivers empty into Lake Winnipeg. Besides this, he had no gun, not even a knife, and no way to secure skins to make new moccasins.

Cosmic Space

The apprehension with which the Saulteaux individual views excursions into strange regions, combined with his lack of experience in any but a circumscribed environment, and the limitations imposed by his culture upon the acquisition of accurate knowledge of distant regions, offers him no critical basis for an evaluation of what is beyond his experience. It is no wonder, then, that the traditional dogmas of his native culture in regard to the wider reaches of the universe are so thoroughly reified and uncritically accepted as part of his spatial world.

There is the Land of the Dead, for instance, far to the south. There is a road which leads directly to it which deceased souls follow, and a few individuals are known to have visited the Land of the Dead and afterwards returned to their homes. They have given accounts of their journey and of what they saw there. I remember that my interpreter once told an old Indian that I came from the south and that the United States lay in that direction. The old man simply laughed in a wise way and made no comment.

The earth itself, according to Saulteaux belief, is flat, a notion that is, of course, supported rather than contradicted by the naïve observation and experience of all human beings. No Indian can be convinced that the earth is spherical. According to Saulteaux dogma the earth is also an island, and there is an account in mythology (the earth-diver motif) of how this island came into existence. Contacts with the whites and, in certain cases, acquaintance with maps in the geography texts of their children have strengthened rather than undermined this dogma. For many Indians have been told, and others have seen it indicated on the maps of the world, that the western hemisphere is surrounded by water.

A stratification of worlds within the cosmos is another item of Saulteaux dogma that defines certain space relations in their conceptual universe. Since the earth is flat, it is easy to understand how this additional feature fits the general scheme. While this idea of the stratification of worlds is developed in considerable detail in other parts of America and even among related Algonkian peoples (Alexander 1916: 275), the Saulteaux emphasize only the lower world

immediately below this one, although they assert that there are other worlds farther down as well as one or two above "the central plane" on which they live.

The world that lies just below is called *pitawákamik*. It is also peopled by *änicinábek*, Indians. These lower world people only differ from those living on this earth by being immortal. When they grow old, they then become young again. This underworld was once visited by some Berens River Indians. They went out hunting and saw some strangers whom they followed to the lower world. At first the people living there wanted to kill them. But when the lower world people found that the Berens River Indians were so much like themselves, their lives were spared. The same species of animals and plants are found in *pitawákamik* as up here, but when it is night there it is day here and vice versa.

I have never heard of a corresponding upper world inhabited by human beings. However, the idea of strata in the universe is exemplified in the account in one of the myths in which the youngest brother of *matcikiwis* climbs up a tree to Thunder Bird Land. Here the Thunder Birds appear in human guise. When the daughters of the "boss" of these creatures come to earth they appear as women and marry human beings.

Within this cosmic scheme certain spiritual entities are given a specific location. To some extent such cosmic positions are correlated with observable natural phenomena. Since thunder is heard only in the summer and usually towards the south, the Thunder Birds are associated with the south as the spiritual controllers of the summer birds and are believed to inhabit one of the upper strata of the universe. On the other hand, the controllers of the fur-bearing animals are given a northern position in the cosmic space. In other cases the cosmic position of certain entities seems arbitrary, and some have no determinate location.

From the standpoint of the Salteaux themselves, these concepts of cosmic space and the position of the various spiritual entities and other inhabitants within it, all are articulated as parts of an integral whole. It is in terms of the full sweep of this schema that we must endeavor to comprehend the qualitative characteristics of the farther reaches of their spatial world, as well as the relevant features of the proximate geographical environment in which they live.

Directional Orientation in Ceremonialism

Directional orientation, however, is not altogether confined to situations in which individuals are moving from place to place. The lodge erected for the Midewiwin, rectangular in ground plan, was always built on an east-west axis, as are the Wabano pavilions seen today. The entrance to both types of structure is at the east although two or more doors are made. The "place of honor" where the leader or leaders sit in both cases is on the south side near the east entrance. Another ceremony I witnessed, which had no superstructure, took place within a square bounded by stakes. The sides of the square were deliberately oriented in the four directions. In this case the entrance used was on the north side and at the close of the ceremony everyone left by the south "door." Graves are likewise oriented north and south as a rule; the deceased faces the south which is the Land of the Dead. Elsie Clews Parsons reported that the Pueblo Indians usually

avoid sleeping with the head in the orientation given the dead in burial. It never occurred to me to make inquiry on this point (1939: I, 98-99).

Dancing always has a conventional direction. It is what we call "clockwise," but the Indians think of it in directional terms, i.e., from east to south to west to north to east. This is likewise the order of birth of the four winds in the myth cited. In the smoking of a ceremonial pipe the leader turns the stem in a clockwise direction and sometimes pauses when the stem has faced in each direction. The symbolism of this act lies in the fact that by including all the directions all of the spiritual entities in the entire universe are the recipients of the smoke offering (Alexander 1916: 286-87).

The pavilion is a structural representation, in one sense, of the directions so that the opposites, north-south, east-west, and the order about the horizon may be recognized, but no further use is made of this.

The directional ordering of the Saulteaux spatial universe, therefore, is one that penetrates religious as well as secular life. And it is obvious that it has psychological implications qualitatively different from directional orientation in Western culture. The build-up of associations of north, south, east, and west with symbolic and mythological meanings makes the directions meaningful places. It further integrates other aspects of the culture and behavior so that a "living in" the world is experienced which has its own peculiar character. In other cultures directional orientation may deeply penetrate still other spheres of life and give the spatial orientation of the people a distinctive psychological cast.[18]

Conclusions

The development of man's mastery of space and the abstract concepts that have evolved along with it cannot be explained in any psychological terms which ignore the cultural factors involved. Human space perception is biologically rooted, but the level at which it functions in the individual is not reducible to innate capacities or maturational development. The process of socialization contributes experiential components that must be considered. Some of these acquired components of space perception are a function of the cultural milieu in which the individual has been reared. The cultural patterns of different societies offer different means by which spatial perceptions are developed, refined, and ordered. The spatial concepts of different societies also vary with respect to the degree of abstraction attained. There is also inter- and intra-societal variation in the utilization of different degrees of refinement of spatial perception in connection with different life activities. The variability is correlated with the fact that one set of conditions may demand very little in the way of spatial discriminations of a certain order (e.g., measurement), but considerable refinement in other respects (e.g., directional orientation).

Such considerations point to a wider historical question: "How have the cultural means themselves developed?" This is a matter for actual investigation, but our analysis of Saulteaux culture is suggestive in a negative respect. The point was stressed that the Saulteaux culture provided no incentive that would lead to the development of an abstract concept of area. On the other hand, they did draw crude maps in aboriginal days. The motive here was a very simple one:

to provide a guide for the traveler in a strange country. There was a demand for maps for this purpose.

If we could illuminate the conditions and purposes in any given society which are relevant to the refinement and development of space perception, we would approach an answer to the historical question.

Notes:

[1] In the preface to his *Perception of the Visual World* (1950: vii), Gibson remarks that, "The perception of what has been called space is the basic problem of all perception. We perceive a world whose fundamental variables are spatial and temporal—a world which extends and endures. Space perception (from which time is inseparable) is not, therefore, a division of the subject matter of perception but the first problem to be considered, without a solution for which other problems remain unclear. That a solution is lacking, most psychologists would agree. The existing theories to account for the spatial and temporal character of our perceptions are not very satisfactory."

[2] See e.g., Vernon (1937: 64), who says, "The problem, however, which today appears to us of greater importance is concerned with the relative importance of the various types of perceptual and ideational data which subserve spatial perception, and their mutual relationships and coordination."

[3] Gibson, p. 225, "perceiving the environment includes the ego as part of the total process. In order to localize any object there must be a point of reference. An impression of 'there' implies an impression of 'here' and neither could exist without the other."

[4] "The capacity of men for forming correct mental maps is very great," write the authors of Psychology for the Armed Forces (Boring 1945: 158), "although most persons do not use their capacities to the limit. Roads and street signs are enough to get them around in civilized familiar regions, and they do not feel a constant need to put everything into precise spatial relation. If they find more need for constant orientation, they would practice more on the building of their mental maps, would more easily find new and better ways of getting to old familiar places, would learn more rapidly to find their way around in new regions." The stress laid here upon the absence of need for orientation only serves to highlight the positive motivation that is found in many nonliterate cultures.

[5] The most comprehensive work on such maps is in Russian: B.F. Adler, *Maps of Primitive Peoples*. St. Petersburg: Imperial Society of Students of Natural History, Anthropology, and Ethnography, Bulletin cxix, 1910). An English resumé by H. D. Hutorowicz is to be found in *Bulletin of the American Geographical Society*, XLII (1911). Adler's work is based on 55 maps from Asia, 15 from America, 3 from Africa, 40 from Australia and Oceania, and 2 from the East Indies. There is an earlier, but less significant work (a doctoral dissertation): W. Drober, *Kartographie bei der Naturvölkern*, 1903.)

[6] Dr. E. S. Carpenter has called my attention to the maps obtained from Ookpuktowk and Amaulik Audlanat, two Eskimo of Southampton Island, by Sutton (see Sutton 1936). Sutton obtained these in 1929 when no accurate maps of the island were available. More than a decade later a modern map, prepared from aerial photographs, was made. Although I cannot reproduce the three maps here, the level of accuracy is certainly high in the Eskimo maps. Dr. Carpenter says, "Certain digressions, often shared, are immediately apparent. . . . But the striking feature is certainly accuracy, especially in the details of the shoreline."

[7] Cassirer, in the *Philosophy of Symbolic Forms, I* (1953), discusses the expression of space and spatial relations in language in brilliant fashion, and in *An Essay on Man* (1944), he devotes a chapter to "The Human World of Space and Time." In this chapter Cassirer differentiates (1) organic space, (2) perceptual space, (3) symbolic space, (4) abstract space. Organic space he conceives of as the "space of action," a level of spatial orientation that is nonideational and, in effect, is confined to animals . . . (p. 43). Perceptual space is more complex in nature; it involves "elements of all the different kinds of sense experience--optical, tactual, acoustic, and "kinesthetic" (p. 43). When we reach the level of symbolic space, we are on the borderline between the human and animal worlds. At a still higher level of human reflection and experience abstract space, i.e., mathematical or geometric space (p. 44) emerges, but only after many intermediate stages. "In primitive life and under the conditions of primitive society," Cassirer says, "we find scarcely any trace of the idea of an abstract space. Primitive space is a space of action; and the action is centered around immediate practical needs and interests. So far as we can speak of a primitive 'conception' of space, this conception is not of a purely theoretical character." While this latter point is true enough, the very fact that the cosmic aspects of the world views of primitive peoples involve spatial concepts, is sufficient to show that "practical needs and interests" are actually transcended.

[8] Revez (1937: 434 note) expresses the opinion that "Although the experience of space and perception of objects of animals seem to agree with that of our own, the theory of a general phenomenal agreement between animal and human perception is highly disputable from a logical and theoretical angle. ... Because of the lack of language and ideas, all animals must have a different space concept ... their objects must be perceived in a fundamentally different configuration and order than ours. ... Thus must be the case regardless of their particular stage of evolutionary development and their biological relationship to man."

[9] Jaccard (1932: 224) refers to a Malagasy who, traveling in Europe, was profoundly impressed with the ignorance of directional orientation he found. In contrast, he himself constantly endeavored to maintain his orientation.

[10] These remarks refer to the period of my investigations (1930-1940).

[11] Explorers frequently give excellent testimony on this point by their reference to the need for changing guides in the course of their journey (See Jaccard, pp. 217-19). Foureau, for example, who made the first journey from North Africa to the Congo via the Sahara and Lake Chad, complained that his high-priced guides "Ne connaissaient pas la pays au dela de quelques journées de marche. Les uns aprèsautres, arrivés à limite, cherchaient des indigènes pour les remplacer."

[12] I possess an outline map of the Poplar narrows settlement made by a local Indian which gives all the place names in the environs of this settlement.

[13] H. D. Hutorowicz says (cf. n. 11), "of course the fundamental purpose of all these primitive maps is to show routes to hunting grounds, fisheries, settlements, etc." The maps of primitive people are oriented in various ways. The Tungus do not employ the cardinal points but use the prevailing direction of a major waterway. The Turkomen peoples use the main direction of the mountain ranges. The comments of Steffansson on Eskimo maps are pertinent here. "These Eskimo maps are likely to be good if you interpret them rightly. Here are some of the points. They are more likely to have the right number of curves in a river and the right shape of the curves than the proper distance scale. They are most likely to emphasize things that are of more importance to themselves; for instance, portages they have to cross are of more

significance to them than mountains that stand to one side. . . . Primitive men are likely to confuse the time scale with the mileage scale--after a ten-day journey of say six hours each day, they are likely to dot these camps at equal intervals, although, because of better going, they may have made twice the average distance one day and half the average another." See Raisz (1938: 9).

[14] Hutorowicz (p. 692), "Like all maps of primitive or ancient peoples a Tungus map is truest of the region best known to the map-maker, and this region is usually shown to the central part of the map, so that nearer the border, distances and surfaces are likely to be less accurately shown. " The comparison of an early Roman map (p. 677), made in the reign of Augustus (the *Tabula Pentigernana*) with the maps of primitive peoples is interesting. "They differ greatly in the fact that the Roman map attempts to show the whole world as then known, while primitive map-makers confine themselves to regions with which they are acquainted; but both are alike in having no degree nets, and in being little more than sketches of routes; and in both cases, the author tries to present the information of greatest importance to himself, other facts being almost ignored."

[15] This may explain, perhaps, the geographical ignorance of the natives in certain parts of Malekula referred to by Harrison (1936: 100). "This difficulty of the natives not knowing a name or direction for any point a few miles away, this complete geographical ignorance of the Malekula ... is a handicap in travel, and particularly in taking a census. It means that one must cover all the ground oneself, and accept no negative statement as to the absence of villages."

[16] Raisz (1938: 1) quotes a neat analogy of the geographer P. E. James who, speaking of the individual's direct knowledge of the earth's surface, writes; "Like an ant upon a rug he may know very exactly the nature of the fabric nearby, but the general design is beyond his range of vision. In order to reduce the larger patterns in the face of the earth to such proportions that they can be comprehended in a single view, the geographer makes use of a map." From a psychological as well as from a historical point of view the last sentence of this quotation is of particular significance. Maps, by abstracting and transforming such spatial attributes as distance, direction, area, and contour into symbolic forms that are easily perceptible in all their spatial relations, not only enable the individual to comprehend these relations more abstractly; they enable him to make measurements and calculations and plan his practical activities in a wider spatial sphere. And in travel he need have no fear of disorientation. The importance of maps as basic instruments for a realistic mastery of space by man cannot be exaggerated.

[17] Cf. H. St. J. Philby (1933: 173), who describes the surprise of his Arab guides that he could march south on a compass course towards nothing, then turn due west and hit off the main camp that had been left the day before on a northeast course. Such a feat implies, of course, a developed geometry and abstract space concepts.

[18] Parsons (1939: I, 99) states that "the order of the cardinal directions establishes the conventional circuit which is the countersunwise or sinistral, whether in coiling baskets (Hopi second mesa) or in pottery design or in dancing, although now and again the sunwise circuit is followed. A striking illustration of how the circuit may be read into life is the view, held at Zuni, that eagles nest successively in four places and then repeat their nesting round."

In China categorical-symbolical thinking as applied to space and time has deep implication for all sorts of actual behavior (see Granet 1934: 86-114). Bodde states (1939: 201) that the Chinese are constantly made aware of directional orientation not only "by the layout of city streets along north-south and east-west axes," but by habitually thinking of the relations of household objects in terms of the directions. "When in China, for example, one wishes to have a

table moved into a different part of one's room, one does not tell the servant to shift it to his right or left, but to 'move it a little east,' or west, or whatever the direction may be, even if it is a matter of only two or three inches."

Such a custom is so strange to Western thinking that some years ago when a twelve-year-old boy was discovered who appeared to possess an unusual sense of directional orientation, the question arose whether this might not be an innate ability (de Silva 1931). Investigation of his personal history, however, gave the proper cue. The child's mother was left-handed and found it more convenient to substitute the cardinal directions for left and right in giving the boy directions about the locations of objects in the house. Consequently, he was brought up from babyhood to respond to orders such as "get me the brush on the north side of the dresser; go sit on the chair on the east side of the porch," etc. Experiment showed that the child's ability depended altogether upon correct initial visual orientation. He was easily disoriented when rotated a few times in a dark room.

References Cited:

Alexander, H. B.
1916 *Mythology of all Races, X: North America.* Boston: Marshall Jones.

Beecher, Williams
1952 The Unexplained Direction Sense of Vertebrates. *Scientific Monthly.*

Bodde, Derek
1939 Types of Chinese Categorical Thinking. *Journal of the American Oriental Society,* 59.

Bogert, Charles
1948 Why the Homing Toad 'Comes Home'. *Natural History.*

Boring, E. G. (Ed.)
1945 Psychology for the Armed Forces. Special Issue of *The Infantry Journal.*

Cassierer, Ernst
1944 *An Essay on Man.* New Haven CT: Yale University Press.
1953 *The Philosophy of Symbolic Forms, I*: Language. (Trans. R. Manheim). New HavenCT: Yale University Press.

Dolgen, Janet, David Kemnitzer and David Schneider (Eds.)
1977 *Symbolic Anthropology: A Reader in the Study of Symbols and Meanings.* New York: Columbia University Press [Hallowell essay, pp. 131-150].

Frisch, Karl von
1950 *Bees.* Ithaca NY: Cornell University Press.

Gibson, James J.
1950 *Perception of the Visual World.* Boston: Houghton-Mifflin.

Goodenough, Ward
1953 Native Astronomy in the Central Carolines. In *Museum Monographs.* Philadelphia; University of Pennsylvania Press.

Granet, Marcel
1934 *La Pensée chinoise.* Paris: La Renaissance du Livre.

Hallowell, Irving A.
1955 *Culture and Experience.* Philadelphia; University of Pennsylvania Press, [This essay, pp. 184-202].

Harrison, Tom
1936 Living With the People of Malekula. *Geographical Journal,* 80.

Jaccard, Pierre
1932 *Le Sens de la direction et l'orientation lointaine chez l'homme.* Paris: Payot.

Parsons, Elsie Clews
1939 Pueblo Indian Religion. [2 Vols.], Chicago: University of Chicago Press.

Patch, Howard
1950 *The Other World According to Descriptions in Medieval Literature.* Cambridge, Mass: Harvard University Press.

Philby, H. St. J. B.
1933 *The Empty Quarter.* New York: Holt.

Raisz, E.
1938 *General Cartography.* New York: Mcgraw-Hill.

Revez, G.
1937 The Problem of Space with Particular Emphasis on Specific Sensory Space. *American Journal of Psychology* 1.

Silva, H. R. de
1931 A Case of a Boy Possessing an Automatic Directional Orientation. *Science* 73.

Sutton, George
1936 The Exploration of Southampton Island, Hudson Bay. In *Memoirs of the Carnegie Museum,* XII.

Vernon, M.D.
1937 *Visual Perception.* Cambridge UK: Cambridge University Press.

Wolfson, Albert
1952 Day Length, Migration, and Breeding Cycles in Birds. *Scientific Monthly.*