IMAGES AND MENTAL MAPS

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ABSTRACT. "Image" and "mental map" appear frequently in the literature of environmental perception, often in an abstract or metaphorical sense. As psychological phenomena mental images do not play any essential role in spatial behavior, nor in abstract thinking. To account for spatial ability we need to postulate "schemata," rather than images and mental maps. The mental map, a special kind of image, does have its functions: for example, it is a mnemonic device; it allows mental practice which promotes assurance in subsequent physical performance; it is, like the real map, a way to organize data; it is an imaginary world, complex and attractive enough to tempt people out of their habitual rounds. To generate images focal attention seems necessary. In an inattentive state, skillful behavior in space is still possible under the guidance of somatic intelligence or schemata. KEY WORDS: *Attention, Imagery, Imagination-image, Memory, Mental maps, Percept, Schemata, Spatial behavior.*

IN the last fifteen years geographers have shown increasing interest in mental phenomena.[1] Perhaps no branch of human geography is now wholly innocent of what might be called a psychological perspective. With the new interest comes a new vocabulary. In geographical writing as in the literature of planning, architecture, and urban sociology, words such as perception, image, cognitive structure, perceptual space, schema, and mental maps occur with mounting frequency. What do these words mean? They are not neologisms. They look familiar, and perhaps for this reason writers who are not professional philosophers or psychologists tend to use them without earnest effort to clarify the words' meaning and importance. Image, for example, is an artificial likeness or picture of an object; it is also a percept sustained by current sensory input, a mental picture in the memory, and furthermore it could also mean a people's schematic and indirect knowledge of place, as in the expression "the European's image of the New World." Mental map may be the street plan a person recalls as he gives directions to a friend, or it could be the geographer's cartographic representation of people's attitudes toward places.[2]

Accepted for publication 6 January 1975.

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[1] In the early days of psychology the mind occupied the center of the stage and mental imagery was one of the most important concepts for understanding human behavior. With the growth of behaviorism in the 1920s, mental imagery began to fade as a serious subject for investigation in the English-speaking world. Behaviorists recognized only behavior: mental phenomena were simply identified with behavior. Since the 1960s imagery once more became a serious subject of study for scientific psychologists. Geographers are in an ambivalent position between these two psychological developments. Though geographers profess an interest in the mind their focus of study remains observable behavior. The mind appears as a sort of "ghost in the machine" that makes it easier to understand certain kinds of human action.

[2] It is not my purpose to review the extensive literature on environmental perception in order to show how key mental terms like image and mental map are used. Such a review would be a worthwhile and ambitious undertaking in its own right. By and large historical geographers use the term image in the same sense as historians, that is, as a people's concept of a place or region which they have not directly experienced and which can be expressed in words, pictures, or maps. Thus J. M. Powell, a geographer, spoke of "the nineteenth century protean images of Australia," and Howard Mumford Jones, a literary historian, spoke of the "image" and "anti-image" of the New World. Urban geographers, following Kevin Lynch (architect and planner), use image in the narrower sense of how people restructure in words and sketches the visual images of places that they have directly experience. Psychologists talk of image as a special kind of event that occurs briefly in an individual's mind.

The idea of mental or cognitive map was introduced by the psychologist E. C. Tolman to account for the fact that rats, and presumably also men, respond not

Words like image and mental map are loosely and variously defined. Have they become poetic metaphors kept in use out of habit, or do they in fact capture important facets of human geographical behavior? The purpose of this paper is to show that mental events are elusive but not ineffable, that they justify a rather special vocabulary, and that their study contributes fundamentally to the understanding of human activities in space. The approach is descriptive: mental phenomena are made more "tangible" by relating them to real life situations.

SCHEMATA

Interest in the mind rests largely on the belief that human actions, from finding one's way around town to discovering the New World, are guided by mental images and maps. Is this true, and if true, what is the specific nature of such imagery? It is assumed that complicated movements are guided by rational decisions and plans carried in the head. An assumption of this kind can easily lead to wrong inferences concerning the nature of the mental world. Elaborate actions taken by animals, including human beings, do not necessarily require "pictures" and "maps" in the head.[3] Take the example of small-brained animals which are capable of long-distance migration. The American golden plover swings from Arctic breeding grounds to the southeastern coast of South America and back. Its spatial ability is most impressive, yet it is unrealistic to suppose that the bird navigates its intercontinental course through consultation with intricate celestial and terrestrial charts in its head. Birds may not even have images as humans know them, much less mental maps. Their ability to traverse vast distances under different conditions of light and sky requires detailed explanation, which we do not yet possess. It seems unlikely, however, that the visual image, something like a picture, will be a component of any sophisticated explanation.[4] What needs to be understood is the animal's schemata (cognitive structures or coding systems) that enable it to respond appropriately to shifting patterns of environmental stimuli. The usefulness of the terms "schema" or "cognitive structure" lies in that they do not suggest "picture," whether material or mental.

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only to specific and successive stimuli in the environment, but to entire environmental fields. An animal appears capable of elaborating a "cognitive-like map" of the field and acting in it accordingly. Under the influence of Peter Gould and Thomas Saarinen, among others, geographers tend to see mental maps primarily as 1) cartographic representations of how people differ in their evaluation of places, and 2) freehand maps that people can draw—outlines of city streets and continents.

J. M. Powell, "Medical Promotion and the Consumptive Immigrant to Australia," *Geographical Review,* Vol. 63 (1973), p. 449; Howard Mumford Jones, "The Image of the New World" and "The Anti-Image," in *O Strange New World* (New York: The Viking Press, 1964), pp. 1–70; Kevin Lynch, *The Image of the City* (Cambridge: MIT Press, 1960); E. C. Tolman, "Cognitive Maps in Rats and Men," *Psychological Review,* Vol. 55 (1948), pp. 189–208; Peter Gould and Rodney White, *Mental Maps* (Harmondsworth: Pelican Books, 1974); Thomas F. Saarinen, "The Use of Projective Techniques in Geographical Research," in William H. Ittelson, ed., *Environment and Cognition* (New York: Academic Press, 1973), pp. 29–52. For the many, though by no means all, senses of the terms images and mental map, see Roger M. Downs and David Stea, eds., *Image and Environment* (Chicago: Aldine Publishing Company, 1973).

[3] In current academic thinking, "liberals" seek to deny basic distinctions between animals and people, whereas "conservatives" believe that the distinctions, based on man's high symbolic capacity, are important and should not be overlooked. Is animal territoriality essentially the same as human territoriality? Are animal systems of communication essentially the same as human language? Ethologists and behaviorists look hard for similarities, whereas humanists and linguists of the Chomsky school are primarily concerned with the differences. This debate is probably perennial, and it should certainly be encouraged.

[4] Susanne K. Langer criticizes the widespread tendency for anthropomorphic interpretation of animal migration and spatial behavior in *Mind: An Essay on Human Feeling* (Baltimore: The Johns Hopkins University Press, 1972), Vol. II, pp. 45–101. She notes (p. 90): "All explanations of animal pathfinding as navigation by celestial cues impute excessively high mental operations to birds, bats, cetaceans . . . and fish. Yet the amazing acts are patently observable, and typically are carried through without much hesitation, trial and error, or apparent misinterpretation of signals. Clearly there is something more than a use of zodiac signs and sun readings involved in the original orientation of migrating birds. Perhaps our search for the basic navigation compass in their external world is a vain effort, because neither birds nor beasts steer their essential courses by any compasslike means." It is at least clear that familiar landmarks play very little role in how pigeons find their way home, in striking contrast to human beings who depend on familiar landmarks and whose maps are systems of landmarks. When frosted contact lenses are put over the eyes of pigeons, they can still find their way home. See William T. Keeton, "The Mystery of Pigeon Homing," *Scientific American,* Vol. 231 (1974), p. 105.

Human beings have large brains. Our acts are rational, by which we mean that they follow mental or material plans. Intelligent action seems to require specific awareness, yet it is well known that not only complicated movements can be carried out without plan or image but that the intervention of imagery may well hinder performance. A beginning typist needs a plan of the keys, an experienced typist doesn't. His fingers fly over the keyboard. While typing he is totally unaware of the position of the keys. After typing he may be hard put to express verbally or through writing where the alphabets are located on the keyboard. He has to make a special mental effort to tell or depict something that his fingers can do effortlessly.

Consider the kinds of movement that interest geographers, those that involve changes of location at different scales. Begin with the young child who has learned to walk. He is soon able to totter about the room or in the backyard, not randomly, but from a starting point to a destination and then back. According to Jean Piaget, a mathematician might look at the moves objectively, that is, from an external viewpoint, and characterize the motor series as a group of displacements or as reversibility: the young child can be said to have learned to coordinate his displacement in a whole system which allows him to return to the point of departure. Does this mean that the child's tour is guided by an image or a plan that he can represent for himself? Piaget's answer is "not at all." Even children four and five years old, who can go from home to school and return alone, appear unable to represent their path of travel; they are not conscious of having and following a plan. Insofar as they are able to represent the path to school it is a kind of motor representation. A five-year-old child might say: "I leave the house, I go like that (gesture), then like that (gesture), then I make a turning like that, then I reach school."[5]

Adults, in the course of a day, make many highly complex yet undeliberated movements. Perhaps the most dramatic examples come from motoring. Many long-distance drivers and commuters have known the experience of "blanking out" while they are on a monotonous and familiar stretch of the road: their bodies take over the driving, responding to curves and even to traffic signals correctly, while their minds are empty or occupied with other things. Griffith Williams has collected cases of what he calls "highway hypnosis." Hypnosis can be variously induced, as, for example, by the gentle curves of the highway, the muffled purr of a smoothly running engine, the hum of the tires, the glare from the hood during daytime and from the road, lit up by headlights, at night. One driver describes his experience as follows:[6]

> I discovered this fact (amnesia) while driving at night from Portland, Oregon to San Francisco, California. The lights of a town approached and I realized that I had been in an almost sleep condition for about 25 miles. Inasmuch as I knew the road I had traveled was not straight, it was apparent that I had negotiated the road, making all the turns, etc. I did not remember the stretch of road at all . . . I purposely tried it several times after that and found that I could drive miles and miles without memory of it, and while resting. In each case, the moment any driving emergency appeared, I became fully awake.

It is a common tendency to infer the presence of deliberate thought and of articulated mental images when we see complex behavior. One feels that migrating birds must somehow carry celestial charts in their heads which they interpret with the skill of an astronomer, and territorial animals have mental maps of their

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[5] Jean Piaget, *The Child and Reality* (New York: Viking Compass Edition, 1974), pp. 18–19. In book after book Piaget argues that young children have a high degree of what he calls "sensorimotor intelligence," but denies that they are able to conceptualize their acts. He also denies "mental images" and "ideational behavior" to animals. "It is very hard to conceive of any representation because the animal has no semiotic instruments (language or the like), and to call up 'mental images' presupposes a capacity for evocation which is not only impossible to verify but is, moreover, superfluous, since there is, in this case, perception of that total field: the rat does not have to imagine the objects or events which are not perceptible at the time. All it has to do is to combine its motions and perceptions in assessing the indices more closely each time. It does not have to form a total picture as a draftsman or cartographer does. There is, of course, an overall system, but this is within the action schemata and not in representation." Jean Piaget, *Biology and Knowledge* (Chicago: The University of Chicago Press, 1971), pp. 263–64.

[6] Griffith Williams, "Highway Hypnosis: An Hypothesis," *The International Journal of Clinical and Experimental Hypnosis,* Vol. 11 (1963), p. 147. For a novelist's description of highway competence despite absentmindedness, see Christopher Isherwood, *A Single Man* (New York: Simon and Schuster, 1964), pp. 35–36.

area comparable to the maps that a geographer draws. Such beliefs are unproven. They are not likely to be true. Reflection on our own experience shows that deliberate thought of the kind we use when we play chess or plan a family trip is seldom employed in routinized circulations. Such movements are not controlled by any image or plan that can be represented in words, diagrams, or gestures; they manifest rather somatic intelligence.[7] The body is capable of responding to changes in environmental stimuli and adapting to them successfully in accordance with its own schemata. The nature of the schemata is little known, except that they are partly innate and partly the result of cumulative experience. Unlike the image, schemata and cognitive structures cannot be directly experienced: they can only be inferred.

The schemata of the lower animals appear to be largely innate. Their impressive motor skills are out of line with their modest capacity to learn, that is, benefit step by step from interactions with the environment. With human beings experience and learning clearly play a major role in building up the schemata. If people can type with great speed and drive a car over winding roads for many miles without thinking, it is nonetheless obvious that these motor skills have to be acquired first step by step. The aspiring typist must make a conscious effort to memorize the plan of the keyboard, and the novice driver has to be taught by a verbalizing, gesticulating teacher, or learn himself through the careful study of a manual containing diagrams and plans. Even the amoeba can learn. Human beings under hypnosis can initiate minor adaptive acts. Sustained innovative behavior, however, requires the cooperation of the deliberating mind. How important, then, are images and mental maps to thinking? What is the function of imagery in adaptive and innovative spatial behavior?

IMAGERY

A percept is sustained by the information in the environment: we see what is before us. An image, on the other hand, is something we see when the environmental stimuli do not appear to justify it. I may recall my comfortable bed at home when I am actually at a crowded party. When percept and image are examined closely, however, they can be shown to differ in degree rather than in kind. A percept, after all, is not a "snapshot" registering mechanically environmental information; the eye is highly selective of the stimuli to which it will respond. A memory-image, on the other hand, may be prompted by a current stimulus: cold air from the kitchen ice box can call forth an image of snowbound Minneapolis.[8] Ability to see is obviously important to human understanding, but what cognitive functions do visual images serve?

When people think, images may or may not arise in the mind. Images do appear involuntarily in dreaming and daydreaming. People can also deliberately summon scenes from the past. Sometimes such memory-images are so vivid that they are like pictures projected on a screen to which one can turn to examine the details. These are known as eidetic images. They decline in sharpness and frequency with age and verbal education. They appear to help children to affix the "concrete" sensory aspects of the environment in their minds; pseudo-sensory images give children time to appraise their surrounding world in their own way.[9] With adults the role of imagery in thinking and learning is less clear. Some people claim dependency on images when they think, others on words. Scientists may be visualizers or verbalizers; some make use of both images and words when they cogitate, and a few claim to use neither. One

[7] "Somatic intelligence," "animal intelligence," and "sensorimotor intelligence" are not metaphorical misuses of the word intelligence, which means a capacity for logical thought. H. H. Price argues that logical notions such as *not, or,* and *if* exist in preverbal thinking and in bodily movements that are enacted thoughts; H. H. Price, *Thinking and Experience* (London: Hutchinson University Library, 1969), pp. 123–43.

[8] "The commonsense distinction between mental image and percept is important and must be preserved. Nevertheless, we should not lose sight of the fact that the image that is usually called a percept is as much a construct of the nervous system as is a memory image . . . All images are the end product of a process of construction, and that the usual dichotomy of percept vs. mental image should be replaced by a continuum on which these opposed notions are ideal cases rarely if ever attained in reality." Robert R. Holt, "On the Nature and Generality of Mental Imagery," in Peter W. Sheehan, ed., *The Function and Nature of Imagery* (New York: Academic Press, 1972), p. 12.

[9] Gordon Allport, "Eidetic Imagery," *British Journal of Psychology,* Vol. 15 (1924), pp. 99–110; Leonard W. Doob, "The Ubiquitous Appearance of Images," in Sheehan, op. cit., footnote 8, pp. 319–20; and Mardi J. Horowitz, "Visual Imagery and Cognitive Organization," *American Journal of Psychiatry,* Vol. 123 (1967), p. 945.

study of scientists shows that anthropologists and psychologists tend to be verbalizers, whereas biologists and physicists tend to be visualizers.[10] Geographers were not included in the study. With their liking for pictures and maps, they are perhaps good visualizers.

The decline of imagery with age and with increasing verbal prowess suggests that images are a luxury in thinking, somewhat like illustrations in a book or slides in a lecture. Purely logical processes are not imageable, although the ability to envisage complex figures may help one to sustain a high level of thought. Mathematicians, for example, doodle. The weird lines and cones they draw may be suggestive models or symbols of N-dimensional space, but they cannot be its image. Napoleon has a low opinion of the intellectual role of imagery. He is reported to have said that those who form a picture of everything are unfit to command. F. C. Bartlett, interpreting this remark, said: "A commander who approaches a battle with a picture before him of how such and such a fight went on such and such an occasion, will find, two minutes after the forces have joined, that something has gone awry. Then his picture is destroyed. He has nothing in reserve except another individual picture."[11]

If imagery has only a supportive or marginal role in the more demanding kinds of thinking, what is its function in life's routine cognitive efforts? A geographer, for example, might ask: do mental or memory images help people to find their way about town? The answer would seem to be a clear-cut yes until we pause to examine what mental images are. An image is a percept of the past. Suppose you are in a city you have visited before, but in which you feel lost. Clearly it serves no purpose to close your eyes and summon images as memory aid. If what you now see, the percept, provides inadequate clues to orientation, then the past percept (image) can only be even less adequate, for the percept already contains memory traces of the past in addition to current information from the environment. Moreover, the images that can be recalled may bear little relation to your present difficulty, for the occasions that caused particular scenes in the continuous stream of past experience to be stored in your mind may not be relevant to your present dilemma. When you are lost you need a real map and the help of street names. Recalling odd images of shop windows, street corners, and statues are no help. Would they help if they can be spatially organized into mental maps?

MENTAL MAPS

A mental map is a special type of image which is even less directly related to sensory experience. An image which is a mental map rather than a "picture" is obviously a construct. In fact, no percept or image is a mere photograph of reality. A percept is not only the registering of current environmental stimuli but also an imaginative effort produced under the needs of the moment. To see is to create. An image is doubly a construct: it originates as a percept, and then suffers further transformation under the pressure of the occasion that prompts its recall. A mental map may be the image of a real map, that is, an abstraction of a real map which is itself an abstraction of reality. Maps can of course be created in the mind without recourse to pen and paper. The discrete images of a city—for example, scenes of shops, monuments, and street corners—can be restructured mentally into a plan. What is the use of such an image-plan? If we are in a familiar world and are merely going home in a routine way, no mental map (in the sense of an image-plan) is required: our clever moves through the scene need only the guidance of unfocused perceptual cues and imageless schemata. If, on the other hand, we are lost mental maps may help to the extent that they provide something to think with; they make it easier to focus and reorganize our thoughts. They cannot, however, be read off in the way that a real map can. If they are so clear that we can count the streets on them, then we are not lost and have no cause to appeal to memory images: percepts, themselves partial products of memory, suffice.[12] Mental

[10] Anne Rose, "A Study of Imagery in Research Scientists," *Journal of Personality*, Vol. 19 (1951), pp. 459–70.

[11] F. C. Bartlett, *Remembering: A Study in Experimental and Social Psychology* (Cambridge at the University Press, 1932), p. 220.

[12] Counting is not normally possible in memory images, even when they seem very vivid. Most sensory perceptions are in fact rather sketchy even when they seem sharp and full of countable detail. "When I look at the corrugated iron roof I am aware that I am seeing 'stripes', but I am certainly not aware of the number of these. To ascertain their number I must

maps, then, are not representable images that people carry in their heads as they go about their business, nor are they of real use when we are lost. Mental maps have other functions in geographical knowledge and behavior. Here are five examples.

1) Mental maps make it possible to give directions to a stranger. There are two ways of being helpful: one is to go with him, and the other is to tell him how to get there. We can tell him through speech, sketches, and gesticulation; but before we can tell we must summon an image of the route our enquirer has to take. We pause and then say, "Ah, yes. You go to the third traffic light, turn right and you will see a church at the end of the road; turn left at the church, go another two blocks and you will see the restaurant on your right." None of the features mentioned may be visible from where we and the enquirer stand. We call up a mental map which is then passed on to the enquirer. Unless the communication succeeds and the enquirer has a similar map in mind he will not know the way and will have to ask for directions again at the traffic light. Mental maps prepare us to communicate spatial information effectively.

2) Mental maps make it possible to rehearse spatial behavior in the mind so that when we are actually on the road we can act with a degree of assurance that we would not otherwise have. Such a mental exercise is not necessary when we move in a routine fashion in thoroughly familiar territory. It cannot be done when we do not know the way, for then we need to study a real map. Only when we think we know the way but are not absolutely sure, do we consult our mental map for the purpose of making mental trial runs. Modern man is footloose; he often has to go to places that are slightly known. These may be the most common occasions when mental maps emerge, because they serve a definite function. They allow mental practice, that is, the symbolic rehearsal of a physical activity. In driving, as in athletics, mental practice can improve physical performance.[13]

3) Mental maps are a mnemonic device. If we wish to memorize events, people, and things, it helps to know their locations or even to assign them to arbitrary locations. Suppose we want to retain in our memory the people who attended a party. One technique is to identify the individual guests with their places around the dining-room table. At a later date when the need to remember the partygoers arises, it is only necessary to reproduce the mental map of their sitting positions. This spatial mnemonic device, demonstrable in psychological experiments, has been known since Roman times. Orators found it useful because they often had to make long, fact-laden speeches. In *De Oratore* Cicero noted "that persons desiring to train this faculty (of memory) must select places and form mental images of the things they wish to remember and store those images in the places, so that the order of the places will preserve the order of the things, and the images of the things will denote the things themselves, and we shall employ the places and images respectively as a wax writing-tablet and the letters written in it."[14]

4) Mental maps, like real maps, are a means to structure and store knowledge. Just as not everyone is enamored of the real map and of the kinds of information it is best suited to contain, so not everyone has his mental wares arranged in mental maps. Presumably geographers have the greatest tendency to do so; yet the fullest verbal transcription of a mental map is that of an English novelist, Angus Wilson. The transcription is worth quoting at length because it says in some detail what imaging and images are like, how they develop, and under what condition they occur. Such accounts are very rare in social science literature despite the mounting interest in images and mental maps.[15]

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move my eyes along the roof, inspecting the 'stripes' one by one. And this is precisely what I can never do with my memory-image of corrugated roof." Brian Smith, *Memory* (London: George Allen & Unwin, 1966), p. 161.

[13] With regard to athletics, Alan Richardson says: "When a high jumper is waiting for his turn to jump and in imagination 'sees' and 'feels' himself going through the run up, take off, roll over and landing he is engaged in mental practice . . . Improved performance can result from this form of practice and that visual and kinaesthetic imaging abilities may well play a significant role in the amount of gain obtained by any particular individual." Alan Richardson, *Mental Imagery* (London: Routledge & Kegan Paul, 1969), p. 56.

[14] Frances A. Yates, *The Art of Memory* (Chicago: The University of Chicago Press, 1966), p. 22; and G. H. Bower, "Analysis of a Mnemonic Device," *American Scientist*, Vol. 58 (1970), pp. 496–510.

[15] Angus Wilson, *The Wild Garden* (Berkeley: University of California Press, 1963), pp. 119–20.

> I failed to learn my mathematics, but the order and pattern that I might have achieved from them were built deep into my preferred subjects of geography and history. If I remember at some moment a particular object that I have seen, say the Blue Mosque in Istanbul, then the natural tendency of my mind, if unchecked . . . , is to place this building in relation to other famous Istanbul mosques that I have seen, and these in turn I see visually on what I remember from the whole map of Istanbul in my Blue Guide. If I am tired and idle the picture will begin automatically to expand. Istanbul will appear on a map of Turkey beside the other Turkish towns I have visited, which will in their turn acquire visual details. This map will also be marked with the towns I failed to see, in feebler pictures of details that I have only read of. . . . On the edges of my consciousness, waiting to slide into vision . . . is a whole world map, appearing something like those demographic charts in which densely populated areas are heavily studded with black dots, Antarctica largely a blank. My map, however, has black dots of real experience and grey dots of imagination and, in between, varying shades to mark literary associations, historic events, the home of towns of people whom I have met when they were travelling abroad, and so on. Thus on my mental map the London area is a black splodge, Provence richly black, Antarctica (the scene of many of my ice fears) a heavy grey, Tehran lightly marked by my view of the airport in the early morning hours, overshaded because it is the residence of an old friend, cross-shaded by the word Mussadig and his pyjamaed form . . . Above this world map with its overlays or shadings and collections of *dramatis personae*, time spirals upwards so that each place too has its historical chart either dating personal experiences or bringing into mind its historic past.

5) Mental maps are imaginary worlds. They depict attractive goals that tempt people out of their habitual rounds. A mental map that is also an imaginary world has interest for historians and historical geographers because it helps to explain why people migrate. Goal-directed migration is characteristically human. True, animal movements in space can be described in the human terms of home, journey, goals. Animal goals, however, are more appropriately called "stations," pauses necessitated by biological needs, along routes that are essentially round trips. Human cyclical movement may also be of this kind. We leave home everyday to go to the office and on the way home we stop by the newsstand to pick up the evening paper. These trips can become so routine that we no longer think of office and newsstand as goals: they are stations in a round trip that begins and ends at home.

Quintessential human migration occurs when people deliberately abandon one home in favor of a distant and unseen goal. In the nineteenth century many Europeans left their homes for remote parts of the world of which they had no direct experience. They did not go blindly: the move was a calculated risk. They had images of their new homes based on hearsay, letters from relatives, and immigration literature. Indeed these attractive images were a cause of their desire to move.

Scottish farmers, while they toiled on the edges of the moors, could nevertheless envision sunny California. Such elaborated mental maps of unseen places are conceivable only in human beings. They depend on the ability to create images rather than on the ability to recall them. Memory-image can be distinguished from imagination-image. The latter is more arbitrary, often lacking firmness and context. A memory-image might show a friend riding a bicycle down a narrow path. As one continues to entertain the image its frame expands naturally and involuntarily to include the broader context of trees along the path and of fields beyond the trees. With imagination-image the components are put together deliberately and fancifully, that is, arbitrarily; for example, the friend may be perceived to ride an elephant rather than a bicycle. The friend is a memory-image and so is the elephant, but the two have never been seen together: the image is a creative construction, more or less arbitrary, and because of the arbitrariness it does not expand naturally into a broader context.[16] An imaginary world is an elaborated imagination-image. A Scottish farmer constructs California, his imaginary world, out of bits of his experience in the warmer parts of Scotland and from what he has read. The process of construction is not well understood. It is the fundamental problem in perception. Even the percept is not simply a registration of current stimuli. Imaginative construction affects all aspects of human awareness, and memory plays a role in all imaginative constructions. If it is puzzling that a Scottish farmer in his croft can envision sunny California, it is no less puzzling that the geography of distant places can be taught and brought alive to students who have never been there, or even that one person can understand the street directions given by another. The fact that we never simply see what is before us differs only in de-

[16] Smith, op. cit., footnote 12, p. 142.

gree from the fact that we can see "in the mind's eye" what we have never actually seen.

IMAGERY, SCHEMATA, AND ATTENTION

Imagery and schemata have been described separately. Their different functions in cognition and behavior are suggested by the relative importance of the role that attention plays. To see in the mind's eye places we have not visited requires such concentrated attention that the effort immobilizes us. Distant journeys begin in the armchair where Edens and Utopias are concocted. By contrast, consider the degree of imaginative effort and attention required in routine travel. We drive toward the city and as we do so we notice the prominent landmarks, the church spire to the right, the war memorial to the left, and the bridge ahead that has to be crossed. These we notice but between them are the numerous features that escape our attention; they are taken for granted. Orientation in a new environment is among the more difficult cognitive tasks, yet once the environment has become familiar and we have established a habitual route it is possible to move in it with only minimal focal attention, and without the conscious recourse to imagery.

Image, whether of the imaginative or the memory kind, is perhaps always the result of attention. Prominent features such as a tower or a bridge become the foci of our perceptual fields. We see them now, and they may return to us later as memory-images, but much cognitive activity in daily life is preattentive. Preattentive processes are limited to the immediate present; they affect immediate bodily motion and attention itself. Unlike focal attention, preattentive processes do not result in the storage of information that can be retrieved later as images.[17] They provide the parts out of which focal attention may synthesize many different scenes. When we say of a place that it looks familiar, what probably happens is that the act of visual synthesis is the same as an earlier one: the place can therefore look familiar even though it has undergone substantial physical change.[18] The act of visual synthesis is an effort of constructive attention that makes use of the partial clues and units provided by preattentive processes. This is not all: another and deeper level of cognition is involved. When we look at the college library, it is not just any building but one of a particular kind that has some special significance for us; it is also recognized in its spatial and temporal setting. These frames of reference are the subconscious schemata that guide perception and imagination. They are the third level of cognition that undergirds attentive and preattentive processes. Schemata, especially those of space and time, are in part genetically determined; in part they are the nonspecific but organized representation of past experience.[19]

What happens when attention wanes, as, for example, when we are tired? The power to envisage an imaginary world is lost. Objects around us lose their vividness and particularity. The mind is susceptible to invasion by memory-images. When tired and inattentive we can still drive a car or walk around obstacles in familiar space. It is the one cognitive ability we retain. Colin Wilson gives a picturesque account of how fatigue might affect attention and yet leave our motor activity more or less intact.[20]

> In the morning you might have noticed that one of the girls had nice legs and that the other had recently dyed her hair. Now they are merely "two girls"; the filter cuts out all unnecessary detail. If you are *very* tired, you might not even notice that they are girls; you are merely aware that there are two other people in the carriage with you. Later, you cannot remember whether they were men or women. The mind has progressed further in the direction of abstraction. It retains enough sense of time and place to steer you back home, but the "order" it imposes on the world is now of the most arbitrary kind, a few bare lines of latitude and longitude.

[17] Ulric Neisser, *Cognitive Psychology* (New York: Appleton-Century-Crofts, 1967), p. 93.

[18] Neisser, op. cit., footnote 17, p. 98.

[19] Neisser, op. cit., footnote 17, pp. 286–89.

[20] Colin Wilson, *Origins of the Sexual Impulse* (London: Arthur Barker Ltd., 1963), p. 66. Spatial ability necessary to human survival does not seem to require a high order of intelligence. Is this why professional geographers look offended when lay people expect them to know where the corner drugstore is? K. S. Lashley discussed an experiment by L. A. Pechstein in which rats and human subjects learned mazes of identical pattern, and in which the rats showed to rather good advantage. With simple enough habits the lower species, the feebleminded, and the brain-damaged can learn about as fast as a normal person; K. S. Lashley, "Learning: I. Nervous Mechanisms in Learning," in Carl Murchison, ed., *The Foundations of Experimental Psychology* (Worcester: Clark University Press, 1929), p. 535.

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Social scientists show increasing interest in mental phenomena; these can be very elusive. Behaviorists have reason to overlook them. If we are to study the mental world descriptions should be full and precise rather than encapsulated in metaphorical shorthand. Terms like image, pictures in the head, and mental map have tended to become vague entities that do not correspond to psychological reality. Metaphors have heuristic value if they are not taken literally. It cannot be assumed that people walk about with pictures in the head, or that people's spatial behavior is guided by picture-like images and mental maps that are like real maps. The study of people's mental world in the course of daily living requires that we do not impose on it the specialized categories of the academic and artistic professions. Geographers run the risk of seeing maps in people's heads, just as art historians are perhaps inclined to put undue emphasis on picture-images.

Perception is no longer a novelty among geographers. Much research has been done and published in recent years. It is in the nature of a new field to venture out boldly without too much concern for the appropriateness of terms, the significance of concepts, and logical respectability. A time comes, however, when a new field must pause in its flight to reconsider the soundness of its foundation and the kinds of questions it asks. Perceptual geography has reached such a stage. As we pause to examine concepts like imagery and schemata we may discover that mental phenomena have interest for us not only as academic geographers but as ordinarily curious human beings. Their study suggests answers to questions that all thinking people ask. How do we recognize places and find our way among them? Are our movements guided by something like pictures in the head? What is the relationship between perception and the imaginative faculty that enables us to envisage places we have not directly experienced? How is it possible to give street directions to another person? How can the geography of strange lands be taught? If the questions sound naive, it may be because—like the blunt queries of precocious children—they are deep.