Maps and Mapmaking
DENIS WOOD
School of Design, North Carolina State University, Raleigh, North Carolina

Growth, Development, History

RANDALL and Chandler, my two fine sons, have lived with me since before they were born. For eighteen years I have supported their growth and participated in their development, helping them turn from all but helpless infants into the assertive and all but autonomous hulks who last summer roamed around Manhattan on their own. I think, though, that they always felt like this, that is, capable of purposeful action. They always felt more or less powerful, more or less autonomous ... or at least no less so than they do now. There was never a time when they felt like the babies or toddlers or little kids they appeared to be from my perspective. ‘Baby’ and ‘toddler’ and ‘little kid,’ after all, are adult words for children who, however small and muscularly undeveloped, hardly ever say of themselves, “See how weak we are,” but usually, “Look at us! See how strong we are!” Tom Watterson plays in the gulf between these perceptions. In one of his Calvin and Hobbes strips Susie asks Calvin if she can play with him and his tiger. “Hobbes and I are not playing,” Calvin archly informs her. “We’re doing important things, and we don’t need you to mess them up.”

Which is exactly how I felt about things when I was growing up, that is, that I was competent, that I was strong, that what I was doing mattered, was important. I don’t think I was that different from other kids I knew, but I was sufficiently secure in my feelings to send off my idea for a rocket to Charlie Wilson, then Eisenhower’s Secretary of Defense. And the response I received from the Deputy Director for Special Activities did nothing to diminish my sense of being, at age nine ... on the cutting edge. But I know I am different today. Looking back I see that I can do things now that I could not do then, however grownup I may have believed myself. I have more practice at thinking. I can reverse operations and start in the middle to work my way out in either direction. I have a bigger vocabulary and can make more subtle discriminations. I can get into movies that once I couldn’t. Because I have a job I can even pay my way. There are a lot of things I can’t do too. I can’t sit on my mother’s lap like I used to, or fit into the clothes I wore when I was nine. I can’t play with toys the way I did, insinuating myself unselfconsciously into the very cab of the little truck that once filled my hand.

If I try to disentangle the threads twisted together in this braid of my experience, I can easily grab hold of three. The most obvious is simple physical growth: I weigh 150 pounds more than I did when I was born, and stand four feet taller than I did then. But I’m not just bigger: I’m better integrated. I can do things that require the subordination of one part of my body to another, that force me to differentiate short-term lusts from long-term needs. Not only can I ride a bike and dance and do aikido, but I can type and speak and write, as now, in complicated sentences. So the second thread is that of development, that is, my increased differentiation, articulation, and hierarchic integration. This development did not occur in a vacuum but in the United States in the fifties and sixties when certain things were possible and certain things weren’t. No matter how often we dressed up in what we wanted to believe was the costume of a medieval knight, I could never ride off to King Arthur’s court. That was a historical possibility ... foreclosed, precisely as Russia’s Sputnik opened the way to the scholarship moneys that permitted me to attend graduate school. And obviously the third thread is history, the way my growth and development was — and continues to be — shaped by the ceaselessly changing social and physical environments that I at the same time collaborate on bringing into being.

These changes in me and my kids constitute the central reality of my experience and I see these three faces of the unfolding we call life at every scale. Systems, processes, things of every kind seem to get bigger or smaller, to grow more or less hierarchically integrated, to interact with other things engaged in similar processes to make our history. We see such an unfolding taking place at the scale of atoms and molecules in the stories we currently tell about the early history of the universe. A similar unfolding at the scale of biological organisms makes up the story we call evolution. It is similar processes we see occurring in colleges and corporations, in families and cities, in national governments. In each domain I cannot help seeing the same three threads of growth and decay, of development and pathogenesis, of history.
Maps Themselves Don't Grow (or Develop)

Though it would be silly to ignore the way maps come into being and subsequently disappear, I do not wish to claim that the map artifacts themselves grow or develop. Sanborn insurance maps may have grown, layer upon pasted layer, as the cities they mapped changed - as they grew and developed - the maps interacting with the insurance and firefighting systems of the cities they represented to help bring forth the history they would in time come to embody. The stick charts of the Marshall and Caroline Islanders also grow this way: they literally get larger, coconut palm rib by cowry shell, and stick by stone. The ephemeral maps of the Inuit, scratched in the dirt, traced in sand and snow, or allowed to evaporate in the air, also grow this way, to say nothing of the sketch-maps we casually make, mark by mark. And yet there's an important sense in which all of these undoubted maps are quite marginal to what we mean when we talk about maps in an unselfconscious way. The reference then is to printed maps, typically produced in enormous numbers on high-speed offset presses. Except at the edge where the ink is being laid onto the paper at a hundred miles an hour, these maps don't grow, at least not in the way we ordinarily use that word. They are slapped out - shh! shh! shh! - onto the paper elevator at the end of the press, and except as they fall apart from constant use or are chewed up by the dog or rot (or fail to rot) in a landfill, they don't decay either. Nor do they much develop. We might scrawl a note or a route or a destination on a map, and so increase its level of differentiation, but this is not often the case and usually the map artifact itself neither grows nor develops.

But Mapping and Mapmaking Do

What do grow and develop, however, are the systems or processes or things we refer to when we say 'mapping' or 'mapmaking.' These words do not mean the same thing. "Mapping," as Robert Rundstrom has pointed out, "is fundamental to the process of lending order to the world." What he is speaking of here is the way we humans make and deploy mental maps. Maybe thirty years ago the unqualified assertion that humans created and used mental maps could have been greeted with caution (if not downright skepticism), but not in an age when it is possible to assert without being in any way provocative that bees make and use mental maps. Remarks being made by biologists today eerily echo those made by psychologists twenty years ago. In 1969, the psychologist David Stea, pondering the geometry of mental maps in humans, assumed that "all persons form conceptions of those significant environments too large to be perceived, i.e., apprehended, at once." In 1989, the biologist Talbot Waterman, pondering the geometry of mental maps in animals, observed that "whatever its modality the basic geometry of animal maps is a matter of great interest but little certainty." What is remarkable here is the absolutely taken-for-granted existence of the animal maps in question. Given today's widespread assumption that animals make maps, it is hard to imagine that adult humans don't; and, evidently, humans and their immediate predecessors have used mental maps for millions of years, an ability selected for by their self-evident utility to an increasingly mobile genus. That is, the growth, development and history of the mental map are questions of evolution, the gradual appearance of the trait taking place over the many generations it took anatomically modern Homo sapiens to evolve. It remains an ability that flowers in us now - today - as we grow, develop and interact with the world in our modulation from fertilized egg to adult. Whether ontogeny recapitulates phylogeny may be moot, but the universal ability to make and deploy mental maps in all human populations is not.

There is, therefore, no doubt of the mapping abilities of those we still term 'primitive.' It is time to acknowledge that people like Catherine Delano Smith and Malcolm Lewis are simply wrong when they speak of human groups with cognitive abilities less than ours. Relationships among spatial cognition, the ability to make maps, and their actual production is not straightforward, and the failure of the latter cannot be taken to indicate an absence of the former. Anyone who has tried to collect so-called 'mental sketch-maps' from college students knows how often maps exhibiting no more than 'topological relations' are collected from individuals who have manifestly mastered 'formal operations.' Everywhere we find examples of those whose behavior in this or that local domain is more like that exhibited in earlier developmental stages than the level achieved and exhibited globally. It is simply not possible to assess general levels of intellectual development from the 'sophistication' of this or that isolated gesture. This is not only because we develop abilities over different contents and in different domains at different rates, but because we enter each new content area and domain in some sense as if each time we were starting again from scratch. We then proceed, microgenetically, as fully operational adults, to pass through sensorimotor, preoperational, concrete and formal operational stages - to refer only to Piaget's typology.

How disturbing, then, to read in Lewis's "The Origins of Cartography" of "cultures in which cognitive development, even in adults, terminated at the preoperational stage." This would mean, for every content domain, that these adults could repeat but not reverse operations (for example, they wouldn't be able to reverse a route to return home), would fail to justify assumptions (even in pointed debate), would find it difficult to de-center from a given aspect of a situation (that is, to take another's point of view, including those of gods or animals in rituals and celebrations), and would be unable to coordinate perspectives (which is to say they wouldn't be able to create an 'areal view') among other limitations. Such adults, in other words, would be behaviorally indistinguishable from say, your five-year old, and therefore (presumably) incapable of producing anything we might recognize as a map.
Bluntly put, no such culture of Homo sapiens is ever known to have existed.

But if the cognitive attainments of individuals is invariant across culture, what is it that is 'primitive' about 'primitives'? Very little probably. Certainly the use of 'primitive' which was widespread to describe non-Europeans when the history of cartography was struggling into existence was unjustified. Such judgments concerning the sophisticated worlds of the Dogon and Hopi can only be explained by ignorance fueled by chauvinism (a behavior evidently preoperational in its inability to decenter from the labeling social group). Yet rejection of the pejorative implications of 'primitive' cannot be allowed to mask the reality that differences exist among groups. Just because a squirrel can map its environment doesn't mean it can communicate this knowledge to others. Just because bees can both map and, through their notorious waggle dance, communicate their knowledge to others, doesn't mean they can make maps, that is, produce the artifacts we unhesitatingly accept as such. And just because humans can make maps, doesn't mean that they do, at least as a matter of course, in their everyday taken-for-granted world. Although 'development' may seem appropriate only for describing systems that change over time, the term, as used by physicists, biologists, and psychologists (Heinz Werner, Piaget) characterizes the degree of organization of any system. In this way it may be used to compare different co-existing systems, and I will be using 'development' in this way to compare the degree of organization of the mapmaking systems of different societies. Yet at the same time it is the sense of transformation, from being unable to map the world, to being able to, to being able to communicate it to others, to being able to produce artifactual maps, to living map-immersed in the world that I am most thinking of when I speak of the growth, development, and history of mapping and mapmaking.

To Live Map-Immersed in the World

What exactly do I mean when I refer to being map-immersed in the world? I mean being so surrounded by and so readily and frequently consulting and producing maps as to see them as no different from the food that is brought to the table or the roof that is overhead or the culture in general that is apparently reproduced ... without effort. Three years ago I tried to understand what this might mean by collecting every map my family encountered, used, or produced in its daily life. Intending to keep this up for thirty days, I gave up after twenty, so numerous were the maps involved.

On the second day into the period my then fourteen-year-old son, Randall, produced two elaborate maps of "Rebel Installation SR 543-k3" for the role-playing universe he was then running for a group of friends; during the period in question he was obsessively involved with these maps. My son Chandler, then twelve years old, made two maps during the period for a school project on France. One was of departments, capitals, and major rivers; the other for a tourist brochure of attractions along the Seine ("France: The Country of Romance"). He also spent a lot of time during this period drawing elaborate plans for water parks (he drew as many as four or five a day); produced a map for a role-playing scenario; and quite spontaneously created a map of the world, apparently stimulated by a visit from Tom Saarinen who projected on our dining room wall slides showing maps from his National Geographic Society study of world views. During this period, nine maps were drawn for Pictionary games in attempts to evoke 'Brazil,' 'Taiwan,' 'Los Angeles,' 'Illinois,' 'East Coast,' 'trip,' 'map,' 'area code,' and 'foreign.' Maps were used in the game, Risk, and showed up on packaging, in advertising, and as editorial content in newspapers and magazines. Maps played central roles in numerous social situations. On the first day, I gave my wife, Ingrid, maps of bus routes I had collected for her in Spokane and Portland to use in her capacity as a member of the Raleigh Transit Authority. On day two, the two of us consulted a pair of Amtrak maps to plan our summer train trip. On the third day, I found my older son with Volume 4 of The Mid-Century Edition of The Times Atlas of the World. "What's up?" I asked him. "Do you think you could Xerox this? I need it for my report on the Canary Islands." Two days later, Ingrid took our Goode's off the shelf to show Chandler the route of the trip we'd planned for the summer. A day after that, Randall and his friend, Garland, used a city road map to clarify the bike route we'd taken to see Beverly Hills Cop II. This led to a discussion of distances in which Garland used the map's index to find Walden Pond Road, and then he calculated the distance he'd biked to get there. Five days later, Randall took a city road map with him on his Sunday bike ride to Wake Forest. Five days later still, on a bus trip with my father to pick up some replacement speakers, we conferred about our route while consulting the map on a bus-stop kiosk. On the way home, when he observed that we were following a different route, we looked at the map on the bus schedule. Talking on the phone two days later, we each consulted our own copy of a city map as we tried to find various locations pertinent to our discussion. Two days later, a friend came by to deliver a pair of maps we needed to have mounted on foam core for a presentation to the Raleigh City Council. On our way to the stationers, we delivered to another for a tourist brochure of attractions along the Seine ("France: The Country of Romance").

How different all this is from the experiences I have had in Zinacantan, a community of Tzotzil-speaking native Americans in southern Mexico's Chiapas highlands. In the many days I have passed there in the home of my friend in Spokane and Portland to use in her capacity as a member of the Raleigh Transit Authority. On day two, the two of us consulted a pair of Amtrak maps to plan our summer train trip. On the third day, I found my older son with Volume 4 of The Mid-Century Edition of The Times Atlas of the World. "What's up?" I asked him. "Do you think you could Xerox this? I need it for my report on the Canary Islands." Two days later, Ingrid took our Goode's off the shelf to show Chandler the route of the trip we'd planned for the summer. A day after that, Randall and his friend, Garland, used a city road map to clarify the bike route we'd taken to see Beverly Hills Cop II. This led to a discussion of distances in which Garland used the map's index to find Walden Pond Road, and then he calculated the distance he'd biked to get there. Five days later, Randall took a city road map with him on his Sunday bike ride to Wake Forest. Five days later still, on a bus trip with my father to pick up some replacement speakers, we conferred about our route while consulting the map on a bus-stop kiosk. On the way home, when he observed that we were following a different route, we looked at the map on the bus schedule. Talking on the phone two days later, we each consulted our own copy of a city map as we tried to find various locations pertinent to our discussion. Two days later, a friend came by to deliver a pair of maps we needed to have mounted on foam core for a presentation to the Raleigh City Council. On our way to the stationers, we delivered to another for a tourist brochure of attractions along the Seine ("France: The Country of Romance").

How different all this is from the experiences I have had in Zinacantan, a community of Tzotzil-speaking native Americans in southern Mexico's Chiapas highlands. In the many days I have passed there in the home of my
friends I recall seeing but a single map: it was in the textbook of one of the older boys who was studying Spanish in school. It was something I took pains to see, being curious about what he was learning in class. Maps appeared nowhere else in their home, unless perhaps in the logo of a Mexican government agency crudely stenciled on the burlap of the bags used to store corn. Maps were not drawn in the context of games or in the talk about the community that flowed endlessly around the fire. Kids did not discuss their day with their heads over a map. Fathers and sons did not trace out bus routes. Mothers and daughters did not turn to the atlas to work out a summer vacation trip. There were no books in the home, no magazines or newspapers. The mental atlas was continuously consulted. Geographic names peppered every discussion. Detailed knowledge about the twists and turns of paths was taken for granted. The layout not only of the town they lived in, but also of the large nearby Mexican center of San Cristobal, was frequently referred to, as was indeed the geography of the state of Chiapas. At the time when there was much talk about our first landing on the moon, I witnessed my friend’s father use a cup of coffee and his fingers to describe to his mother how on its return the capsule would splash into the ocean and be rescued by a ship. I did not get the feeling that the explanation made much sense to her for whom the moon and the Virgin remained fused in a syncretic amalgam worked out in the centuries following the Conquest. It was no lack of cognitive ability that interceded, however, but a lack of knowledge about the world of NASA and Apollo and the astronauts imbibed in Life magazine and television and through twelve or less mandatory years of schooling. Certainly my friend or his peers drew, and helped to construct and interpret the maps and airphotos introduced into their lives by the anthropologists of the Harvard Chiapas Project, but maps were not a deep part of their living. You see photos of them with government functionaries peering at maps at the founding of an ejido, and we know that their ancestors twenty and more generations ago produced the lienzos that even today are used in the courts to adjudicate land disputes, but maps do not play the role in their lives that they do in mine. Maps remain special, rare, precious.

Some Societies are Bigger than Others
What is the difference between my Zinacanteco friends and me, between their world and mine? If I follow my first thread, it is simply that there are more maps in my world than in theirs. I have no idea how many maps I have in my house, but the number is enormous. Even in homes less involved with maps than mine the number is high, even if they’re only the ones in the phone book. Most maps may be crammed into glove compartments or kitchen drawers, but it is precisely that casual taken-for-granted quality that is the point. Most of these maps exist in editions running into the hundreds of thousands. The world these maps encode is much larger, too. Raleigh has more people living within its boundaries than there are Tzotziles altogether, that is, than there are Zinacantecos and Chamulas and Pedranos and all the rest of them, each with their own ‘center,’ their own patron saint, their own ... world. And whereas these ‘centers’ are not integrated into a larger Tzotzil world, and scarcely into a Mexican one, mine is self-consciously knit into many larger overlapping ones.

The greater size of my world, the greater number of persons integrated into it, has two implications. In the first place, maps are required for us all to keep track of each other and what we’re up to. Maps manage this by connecting us through them to all the other aspects of the vast system of codes, laws, contracts, treaties, covenants, deeds, and so on in which we have immersed ourselves. But in the second place, maps allow us to keep track of each other: the specialization required for mapmaking demands a population so large that mapmaking is required to permit it to function. I imagine there is some threshold above which mapmaking emerges in a society and below which it doesn’t, not because its members are incapable of making maps, but because the society is too small, with too little specialization to either require or support it. What is this population? It would be interesting to try and figure out, but I am hypothesizing that it will be rather large, much larger, for example, than traditional Micronesian or Inuit groups taken as a whole. The wonderful abilities of the great Micronesian pilots confirm rather than undermine this thesis. Theirs is the navigational skill of a Mississippi tow boat pilot, and the two groups of pilots are treated with an equivalent extravagance of position and praise. The Micronesian pilots and teachers undoubtedly make their well-known charts (though increasingly these are made by others for sale as curios), but there is little other evidence of mapmaking and map-using in their society (until recently, that is, until its integration into ours, into the world society of post-Fordian capitalism). In the society of the tow boat pilot, on the other hand, other kinds of charts are used by other kinds of pilots to sail the oceans, fly the skies, and ply the roadways; nor is anyone surprised by individuals who make their living sailing, and who fly for fun and use road maps to get around their home port. Besides these direct navigational aids, such pilots might be expected to consult weather maps, bathymetric diagrams, charts of rivers and ports, plans of his ship. They are immersed in a world of maps and charts and plans in a way their Inuit, Zinacanteco, Micronesian counterparts are not. And this is related to the simple size of the society of which they are parts, for tiny societies seem to be less capable of differentiating themselves to the degree that larger ones can.

Some Societies are More Developed than Others
Clearly, however, sheer size would be more a liability than an asset were the population not differentiated, specialized, hierarchically integrated; and indeed were these conditions not met it could be doubted that a society could grow
so large. Certainly there is labor specialization among the Mixtecs — the women herd, the men hoe, and there are shamans, musicians, others — but the greater part are farmers, terrific generalists. There are no air conditioner repairmen among the Mixtecs, no lawyers whose practice is limited to problems with pension funds, and certainly there are no surveyors, cartographers, map engravers, copy camera operators, plate makers, pressmen, or sales representatives for commercial producers of maps. It is the development of this system of production — with the technology it implies of generation, manufacture, and distribution — that in the end most radically differentiates mapmaking cultures from those that aren’t.

Are societies with high degrees of labor specialization more advanced than those that aren’t? Doubtless this choice of word is not simply wrong but subtly and probably intentionally misleading. Yet such societies are more developed, if by that we mean that they are more differentiated and hierarchically integrated. In addition to simple growth in the size of the society and the sheer number of its maps, the varieties of maps — and the relationships among them and to the society that generates and uses them — have grown increasingly differentiated, articulated, hierarchically integrated. Furthermore, the mapmaking and distribution system is increasing in each of these ways even as I type this. That is, not only is our society more developed with respect to mapmaking than that of the Micronesians and the Zinacantecos, it is developing at a more rapid clip, that is, it is differentiating, articulating and reintegrating itself more rapidly in this domain of mapmaking. Stephen Hall’s Mapping the Next Millennium constitutes a sketch of this wavefront.

But because of this are we better off in any deep way than the Tzotzil? Are we happier? Are we more satisfied? Do our days pass with greater intelligence? Hard to say, though what is easy to say is that the Tzotzil are in our orbit as we are not in theirs. The mapping impulse was deeply implicated in the Spanish Conquest, and the hold of the landlords over the subsequent centuries was insured and perpetuated in maps. This is to say that it was the differential development of mapmaking — embracing in this word the whole technology of generation, manufacture, and distribution — no less than other differences between the Spanish and, say, the Aztec, that resulted in the domination of the latter by the former. Thus are we catapulted into history.

**Our Histories — Entwined — are Different**

Evidently the making of artifactual maps originates in many impulses, even as writing does, but neither seem to develop in the absence of a need to keep written records. Denise Schmandt-Besserat’s hypothesis for the development of writing in Mesopotamia invokes the necessity for accounting in long-distance trade; Mary Elizabeth Smith’s hypothesis for the development of picture writing among the Mixtecs involves the complexities of land ownership amidst dynastic turmoil. And there are others, but almost all of them assume that what was at stake was control of social processes in rapidly expanding groups. A variety of media ranging from the linguistic through the logographic to the purely pictorial — and including mixtures of each — were used to record qualitative and quantitative information in both spatial and temporal dimensions. Signs which originally developed as names in narrative descriptions of lineages or routes were adapted as pictures on maps — and vice versa. Over time, in accordance with structuralist principles, the notation systems differentiated: temporally ordered information (such as lineages and routes) that was recorded using logographic and linguistic means developed into what we recognize as writing (toward history and descriptive itineraries); whereas spatially ordered information (like land ownership, the number of sheep in various fields belonging to different owners, and routes) that was recorded using logographic and pictorial means, tended toward what we recognize as maps. While these two traditions increasingly diverged, for numerous generations they were not readily distinguishable. The use by the Mixtec of strings of footprints to link both places on the groundplane and generations of rulers is a case in point, but as David Woodward has shown, the two traditions are not firmly separated, even in the European tradition, until the dawn of the modern age.

In societies in which these graphic systems ceased growing or shrank, development of mapmaking likely slowed or ceased as well. This is in accordance with Jerome Bruner’s insistence “that cognitive growth in all its manifestations occurs as much from the outside in as the inside out,” and his observation that “one finds no internal push to growth without a corresponding external pull, for, given the nature of man as a species, growth is as dependent upon a link with external amplifiers of man’s powers as it is upon those powers themselves.” By positing growth as the engine driving development and so producing history, I am insisting that the three threads twined together in my experience are indeed incapable of being meaningfully teased apart in human experience generally. In growing societies, the continuous need for increasing hierarchic integration first produces a simple enlargement of the mapping function, but then its ceaseless branching. Thus the state, in its pre-modern and modern forms, evolves together with the map as an instrument of polity, to assess taxes, wage war, facilitate communications, and exploit strategic resources. In Brian Harley’s words, “Stability and longevity quickly became the primary task of each and every state. Against this background, it will be argued that cartography was primarily a form of political discourse concerned with the acquisition and maintenance of power.”

Smaller, less developed societies have no need to map land ownership, tax assessment districts, the topography of tank attacks, subsurface geology likely to contain oil, sewer lines, crime statistics, congressional districts, or any of the rest of things we find ourselves compelled to map.
This doesn't mean they don't create in their heads dense, multilayered, fact-filled maps of the worlds they live in. Writing recently of the Mayoruna and Maku, the Arara and Parakana, the Arawete and the Guaja - Brazilian "peoples so remote and little known that few outside their immediate geographic area have heard of them" - Katherine Milton has observed that whereas life in any given year may revolve around the village for a while, sooner or later the groups she has worked with will spend months traveling through the forest and living on forest products. Such peoples carry everything with them at such times, but, "the most important possession the Indians carry with them, is knowledge." In keeping with what I would imagine of a people who do not write, Milton also notes that, "tropical-forest Indians talk incessantly, a characteristic I believe reflects the importance of oral transmission of culture." Others have made similar observations for groups as far-flung as the Zaire Ituri and native Australians; and indeed the converse - the silence demanded by the private act of reading - has been increasingly the subject of attention. In sum, the differences that exist between our mapmaking (and print reading) society and the oral societies Milton describes are not in fundamental cognitive abilities, but in the consciousnesses that different life-ways inevitably produce.

Mapmaking cultures differ from non-mapmaking cultures by the need, among other needs driven by mapmaking, to fill in the blanks. It must be insisted upon that this is not a disinterested cartographic activity, but the result of the same intertwining of polity and mapmaking just described, an activity required for the stability and longevity of the state. This is to say that, in a very important sense, the map requires and justifies as it records and demonstrates transformations in control over the land, that is, the appropriation of land in the name of science and civilization, the state and human progress. Mapmaking societies ... reach out, not of course to make maps more comprehensive, but in the unfolding of the dynamic that their growth and development have helped to set in motion, and in which the cartographic enterprise is an essential and committed partner. In so doing, mapmaking societies subsume whatever they can - for example, the labor and culture of those they encounter - and in this way their growth is fueled and their development pushed from without (that is, by conquest, appropriation, and seduction) as well as from within. Stripped from those encountered by these mapmaking societies ... ripped off ... is not only their place, their energies, and their knowledge about plants and animals, but their language, myths, rituals, customs, and artifacts. It is not only explorers, missionaries, soldiers, slavers, trappers, miners, loggers, and colonists who have encroached on such peoples, but anthropologists and their predecessors. Characteristically, I am able to pull from my shelves, Xingu: The Indians, Their Myths (as the Xingu are unable to pull from their shelves anything about me), and read from its dustjacket that "as a source of ethnographic data for structural and comparative analysis, [the myths] are invaluable." There is nothing we of the ever-growing mapmaking societies will not take and use. It is in this way that the great developing cultures - the 'West', the 'East,' the 'Islamic nation' - increasingly differentiate themselves from the less-developed societies and cultures they ever more voraciously consume. What distinguishes 'the West' most tellingly from the Kamaíura or the Ainu or the Navajo is not this view or that, but that in 'the West' ... there are so many views, that whatever it is - the origin of the world, or the relationship between humans and nature - it is seen so many more ways than it is among the Hopi or the Bororo or the Inuit. In the end there are not just so many more maps, but so unfathomably many more kinds of maps. It is in this way that mapmaking fuses its growth and development with history, in the transformation of the world from a mosaic of peoples to a mosaicked people.

A way in which I, driven by my own growth and development (interactively with the history of those around me), fathered two sons, who even as I write are sitting in the next room glued to a monitor where, in SimCity, thematic maps flash onto the screen to record and embody the 'city' my sons are attempting to create. I am not terribly happy about this. I would rather they were out in the woods, or if not the woods then exploring the city whose pavement runs hard beneath their feet. But in the mapmaking society we live in this is what it's come to.

Notes


"The Multiregional Scientific American, *Evolution of Humans,*" 68, and, for a slightly different perspective, "The Origin of Modern Humans," *Science,* 239, 1988, pp. 1263-68. There has been an explosion of work implicating the hippocampus (part of the posterior forebrain) in mammal orientation, taking off from John O'Keefe and Lynn Nadel's provocatively titled "Maps in the Brain," *New Scientist,* 27 June 1974, pp. 749-51 (but watch for the dual use of 'map' in this literature). Are animal maps linear or areal? Waterman (p. 179) says, "No doubt animals have both linear and two dimensional types," where what strikes me is that this question, so often raised about mapping in humans, is now asked routinely of mapping in animals. But the most taken-for-granted tone about animal mapping appears in a recent issue of *National Geographic* where Eugene Linden quotes Swiss biologist Christophe Boesch to this effect: "According to Boesch, the chimps maintain a mental map of places where they have left stones from previous sessions. When a panda tree is fruiting, they seem to know the direct route to the nearest stone hammer, often retrieving rocks out of sight more than 200 meters away. Boesch believes that this feat is based on an 'evolved mental map,' a sense of Euclidean space that does not usually occur in a child before the age of nine" (Eugene Linden, "Apes and Humans," *National Geographic Magazine*, 181, March 1992, p. 26).

"That is, mental mapping as we know it today appeared when our brain as we know it today appeared. When was this? It is widely accepted that anatomically modern *Homo sapiens* originated in Africa between 100,000 and 400,000 years ago. See C. B. Stringer and P. Andrews's "Genetic and Fossil Evidence for the Origin of Modern Humans," *Science,* 239, 1988, pp. 1263-68, and, for a slightly different perspective, "The Multiregional Evolution of Humans," *Scientific American,* April 1992, pp. 56-83. In answer to the more specific, "When does the modern brain evolve?" Philip Lieberman is to the point: "The reorganization that makes voluntary control of speech possible is one of the defining characteristics of the modern human brain. It undoubtedly had occurred 100,000 years ago in anatomically modern fossil hominids as Jebel Qafzeh and Skhul V, who had modern human vocal tracts ... . The archeological evidence associated with Jebel Qafzeh and Skhul V is consistent with their possessing a fully modern human brain - one adapted for complex syntax and logic - but an earlier origin cannot be ruled out. Although much of the enlargement of the prefrontal cortex may derive from the specific contributions of speech and thought, it enters into virtually all aspects of behavior. Therefore any cognitive activity that enhanced biological fitness could have contributed to its development." Given the presence of mapping skills in phylogenetically prior organisms such as birds, fish, and bees, can it be doubted that mapping was one of these human cognitive activities? After all, the brain Lieberman describes as coming into being 100,000 years ago is our brain, one manifestly capable of mental mapping. See Lieberman's recent, *Uniquely Human: The Evolution of Speech, Thought, and Selfless Behavior*, Harvard University Press, Cambridge, MA, 1991, pp. 109-10. For a radically different approach to the problem based on an analysis of stone artifacts, see Thomas Wynn's *The Evolution of Spatial Competence*, Illinois Studies in Anthropology, no. 17, University of Illinois Press, Urbana, 1989. Using an explicitly Piagetian framework, he unequivocally states, "The most straightforward, and perhaps the most unexpected, consequence of this Piagetian analysis is that hominids had achieved operational intelligence by 300,000 years ago, and perhaps earlier" (p. 89).


here. Catherine Delano Smith's article, "Cartography in the Prehistoric Period in the Old World: Europe, the Middle East, and North Africa," in the Harley and Woodward volume is far more problematic, for it was clear from the beginning that Lewis was actually talking about consciousness rather than cognition, but what Smith is talking about is entirely unclear. See my review article of Harley and Woodward in Cartographica, 24, Winter 1987, pp. 69-78.

The historical use of this term is traced by Catherine Delano Smith in, "Prehistoric Maps and the History of Cartography: An Introduction," in Harley and Woodward, op. cit., pp. 45-49. Code words for 'primitive' that appear in the literature include 'pre-literate peoples,' 'naive cartography,' 'naive cartography' and so forth and so on.

Heinz Werner, Comparative Psychology of Mental Development, International Universities Press, New York, 1948. Werner's idea of development is extremely powerful, but his treatment of 'primitive man' is problematic. Unlike Lewis and Smith, he does not deny operational capacity: "So far as the primitive man carries out technical activities in space, so far as he measures distances, steers his canoe, hurls his spear at a certain target, and so on, his space as a field of action, as a pragmatic space, does not differ in its structure from our own" (p. 167); but he does qualify this space once it is made a subject of representation and reflective thought (where Werner's use of 'representation' is not Piaget's): "The idea of space for primitive man, even when systematized, is syncretically bound up with the subject" (p. 167).

I am not absolutely certain what to make of this, but certainly he is speaking here of what others would refer to as 'consciousness' or even 'world view,' both of which are assumed to have deep connections with lifeway in general, that is, with economic structure and social organization (with what some economists might refer to as 'level of development'). Most theorists concur that this nexus of forces - shorthanded as 'hunting and gathering economy' or 'feudalism' or 'post-Fordian capitalism' - has a decisive effect on the way those who reproduce it 'see the world,' to the point where they need to keep written records; and that men such record-keeping pushes the development of mapmaking. Mapmaking as a lifeway develops as it becomes differentiated. This means that more societies will engage in mapping than will become mapmaking societies.

Again, what has been integrated here have been not only the topo sheets, property maps, congressional district maps, and so on, but the maps of the ley-liners, the Flat Earth Society, those who believe in a hollow earth, and the like; to say nothing of the volumes of maps illustrating novels and games of fantasy and science fiction, ad infinitum.


Again, mapmaking may originate for navigational purposes - as among the Micronesians - or to represent the "footprints of the Ancestors" - as among native Australians, or as cadasters - as (perhaps) among the Egyptians and Babylonians - but it does not seem to develop, that is, undergo differentiation, articulation and hierarchic integration, in the absence of a need to keep written records. I am arguing that such development only occurs when societies grow to the point where they need to keep written records; and then such record-keeping pushes the development of mapmaking. Mapmaking as a lifeway develops as it becomes differentiated. This means that more societies will engage in mapping than will become mapmaking societies.


There are many examples in Smith, ibid.


Population growth is widely accepted as the primary causal agent of many developmental processes, most notably as an es-

35 J.B. Harley, “Silences and Secrecy: The Hidden Agenda of Cartography in Early Modern Europe,” *Imago Mundi*, 40, 1988, p. 57. But this was the point Harley was making increasingly in the final years of his life, that cartography was political discourse in the service of the state.

36 In addition, of course, to the acknowledged stick-chart, dhulan, bark painting, and so on. The point, to reiterate, is not that these peoples do not make maps, but that the maps they make remain relatively isolated, unusual, special, rare – in contrast to the taken-for-granted character of maps in a mapmaking, that is, map-immersed, society.


38 Ibid., 39.

39 Ibid.

40 Actually the most eloquent testimony comes from the André Kertész collection of photographs entitled *On Reading*, Grossman, New York, 1971, but it was Marshall McLuhan who first characterized it as a problem of consciousness in *The Gutenberg Galaxy: The Making of Typographic Man*, University of Toronto Press, Toronto, 1962. For McLuhan it was type – and reading – that silenced the human voice, producing the alienated consciousness we have today, making the modern state possible no less than the map: “print created national uniformity and government centralism, but also individualism and opposition to government as such” (p. 235). For a more focused attack on the impact on consciousness resulting from the reading (and writing) of printed books, read Alvin Kerman’s completely convincing *Printed Technology, Letters and Samuel Johnson*, Princeton University Press, Princeton, 1987.

41 Indeed it is precisely this process of appropriation and the consequent acculturation that is the focus of Milton’s research among the Mayoruna and the Maku.

42 Nor did this happen only in the past. The expropriation of land and cultural capital from indigenous Americans continues unabated in the rainforests of Brazil and Venezuela, as well as elsewhere.


**Abstract** In much discourse about maps and mapmaking, confusion reigns between the undoubted and universal human ability to navigate and to store and represent routes and/or other information in conventional form, and mapmaking, that is, the regular social and taken-for-granted (if not universal) production of conventional artifacts – ‘maps’ – embodying such knowledge. Of the enormous number of human societies, only a few have been making maps and of these most have matured during the past five hundred years. That it is not ‘traditional’ but modern ‘advanced’ societies that are mapmaking reflects not differential abilities at any fundamental level, but different aims and goals. It is the territorial ambitions of modern states and their proto-state predecessors, and the implicit resource exploitation and long-distance trade that preeminently call mapmaking into being. The development of science in general and cartography in particular occurs in these rapidly developing societies to further their goals and ambitions.

**Résumé** Dans plusieurs traités sur les cartes et sur la cartographie, une confusion règne entre l’indubitable habilité universelle de l’homme de naviguer, d’entreposer et de représenter sous forme conventionnelle des parcours, d’autres informations, ou les deux, et la cartographie que l’on accepte normalement comme la production d’artefacts conventionnels représentant une telle connaissance, soit les cartes. Des nombreuses sociétés humaines qui ont existé, seulement quelques-unes ont confectionné des cartes et la plupart d’entre elles ne sont parvenues à leur maturité qu’au cours des cinq cents dernières années. Que ce ne soit pas des sociétés traditionnelles mais plutôt des sociétés modernes avancées qui fabriquent des cartes reflète non pas des habiletés différentes à quelque niveau fondamental, mais bien des visées et des buts différents. Ce sont les ambitions territoriales des états modernes et des états primitifs qui les ont précédés, ainsi que l’exploitation explicite des ressources et le commerce déployé qui exigent, en tout premier lieu, l’existence de la cartographie. Le développement de la science en général, et de la cartographie en particulier, survient dans ces sociétés qui se développent rapidement dans le but de poursuivre leurs buts et leurs ambitions.