Toward a representation of early humans' experience of space

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1. Any organism is in constant interaction with its proximal and distal environment. Surviving means the capacity to negotiate the spatial constraints within which it is embedded. It implies an adaptive competence to process relevant spatial information including gravity. Hominins shared the legacy of the common ancestor of primates which was adapted to arboreal life. Bipedalism afforded new means of interacting with the environment but the conservation of adaptations to tree life was a mixed blessing: while keeping one's balance and benefitting from rich chromatic vision remained an advantage, the lack of adequate evaluation of distance beyond a relatively close threshold was a limitation that deprived early humans from an adaptive perceptual and cognitive handling of perspective, a handicap that still puts humans at a disadvantage compared to the descendants of the tetrapod that evolved as terrestrial quadrupeds and the birds.
2. The geographical mobility of *Homo erectus* and its successors show that this spatial handicap was likely overcome through cultural means such as the recording of memories in narratives or graphic representations that extended the representation of space beyond the immediate environment. The human representation of space is indeed dependent on memory since humans can only perceive the portion of space that lays in front of them until distance blurs the details or obstacles block the view. Contrary to the peripheral vision of the equids, for instance, humans need to change their position to scan the whole scope of the space in which they are immersed. The spatial cognition of contemporary humans has two main sources: on the one hand, the episodic memory of paths, vistas, and beacons; on the other hand, the semantic memory of local and global maps, and narratives. An important part of enculturation is the learning of the collective memory of spatial knowledge. We can reasonably assume that early humans possessed such spatial knowledge dependent on the culture in which they were born. However, it cannot be reasonably assumed that their perception, conceptualization, and representation of space was anything close to those of contemporary humans.
3. Obviously, we cannot use our current experience of space as a standard reference to understand the way in which early humans perceived, conceptualized, and represented their spatial environment. We belong to what historians have dubbed "the culture of space and time" that emerged during the last few centuries in Europe and spread to the whole globe. It is, however, easier said than to fully realize the implications of the differences when we try to understand the archaeological record

from prehistoric and protohistoric times and even to interpret pre-modern historic data. How to access such long-past states of mind is a persistent challenge for archaeologists. Two heuristic paths are possible: first, we can attempt to imagine the experience of earlier humans by eliminating all the conceptual and technological tools that allow us to measure and represent space both through our own experience of geographical mobility and the cognitive affordances of our collective memory made of the cumulative knowledge embodied in graphic representations and narratives. Secondly, we can examine the spatial experience of the few extant populations of hunter-gatherers to which we have access. Both virtual subtraction and ethnographic investigation are risky methods but they may complement each other in a productive way.

4. Another, probably more reliable approach is to explore some inferences from comparison with other primate species. We can indeed assume with a high degree of certainty that early humans were both territorial and social. Territorial does not mean exclusively sedentary but is compatible with some forms of mobility within a range that is periodically covered and occasionally protected. Sociality, on the other hand, ensures that the memory of the spatial affordances of the range and the availability of food and other resources is distributed among the members of the group and is communicated both vertically and horizontally. The descriptions of “ape cultures” are usually focused on the making of tools and the observation of particular social behaviors, but the knowledge of the physical surrounding and its relevant characteristics is necessarily a crucial part of the shared knowledge of the group that is acquired during development and reinforced through common experience. Bands of chimpanzees know where and when various kinds of trees come to fruition within their range. Patrolling and fighting intruders suppose some familiarity with the paths, beacons, and borders of a particular territory. There are, however, necessary limits to the spatial cognition beyond the range although this expanse of space is within visual and acoustic reach. The interface between territories is a place of confrontation that defines the relative safety of “home space” as opposed to a hostile periphery. Penetrating that other space is rife with dangers but it also provides opportunities for expanding the group’s range and adding this spatial knowledge to its cultural capital.
5. An important aspect of the relation to space is to cognitively process it through distance evaluation from both egocentric and allocentric points of view. Whether an object or agent is within my reach or whether I am within their reach is a matter of life and death. Equally relevant to survival is the spatial relationship of objects and agents in the allocentric space. The use of body parts and gestures as standards of metrics is undoubtedly very ancient in the earliest forms of referential verbal communication. Hands, arms, feet, steps, and the maximum reach of a thrown stone for instance,

provide units of spatial evaluation that enable the control of spatial information. However, contemporary humans have inherited from their tree-dwelling ancestors a limited capacity to evaluate relative distances. This inability to process perspective beyond a certain threshold was certainly a perceptual handicap once bipedalism brought early humans in the open space of the savannah environment. If two beacons in the horizon appear close to each other while they are in fact quite distant from each other, such a visual misinformation has to be corrected through cultural means such as graphics or narratives once experience has revealed the true situation.

6. This perceptual constraints necessarily impacted the relationship of early humans to the diurnal and nocturnal sky that must have appeared much closer to the ground than it does to us. Modern humans' perception is biased by the knowledge of the inconceivable distances provided by the astronomical sciences. With industrialization and urbanization, the perceptual and conceptual divide between terrestrial and sidereal domains has dramatically increased to the point that the night sky has become a mere backdrop whose brilliance is offset by city illuminations. In the absence of atmospheric pollution and competing intense electric light, it can be assumed that not only celestial objects appeared much closer, and that earth and sky were experienced as a continuum, a kind of dome resting on the edges of the lands. Bipedalism greatly facilitated the scrutinizing of the upper part of the enveloping space which, with sustained attention, is as rich in patterns and events as the lower regions of lands and seas. Ethnographic research among indigenous populations has shown that familiar animal and other relevant forms are readily identified with naked eyes in the night sky where polymorphic nebulae can be perceptually foregrounded against the starry backdrop.
7. Another important difference in the experience of space between early and contemporary humans is the scientific distinction between animate and inanimate. Modern science has taught us that mindless physical forces such as gravity or magnetism explain the movements of objects according to the physical laws of nature. Biological dynamic is spontaneously interpreted as being goal-directed with various degrees of conscious motivation and planning. In interspecific interactions, the fight or flee reflex determines behavior but experimental evidence show that humans and higher primates have evolved a capacity to represent others' intentions when they assess the probability of their next move. This competency has been dubbed the "theory of mind", meaning that the egocentric point of view is complemented by the ability to make allocentric hypotheses regarding the state of mind of others, in other words, to assume that they possess a mind which enables them to similarly evaluate situations and act according to their understanding of these situations. Organisms endowed with this evolved capacity have a marked advantage since they can

anticipate the probable strategies they will have to counter in the competitive games of life and death. However, the “theory of mind” can become a liability if it is generalized to all sources of dynamism whether biological or not. Volcanic eruptions, earthquakes, landslides, storms, eclipses, and other meteorological phenomena can be interpreted as intentional and call for counterstrategies such as sacrifices or other rituals designed to placate their “anger”. This kind of behavior is still observed nowadays in some indigenous cultures. On the basis of the emergence of the “theory of mind” in the human cognitive competence, it is very likely that early humans were dealing with their environment, both terrestrial and sidereal, as if it were animated with some form of intentionality rather than being inert and submitted to mindless forces. Their space was not an empty container of living agents but was certainly perfused with animacy and intentionality.

8. For the modern mind, space is an affordance we take for granted like the air we breathe. We have indeed eliminated the other species which, until relatively recently, were able to enforce their own claim to ownership of space. For early humans, space was necessarily a shared commodity. Human ranges were overlapping with the ranges of many other species which could stand their ground as well as, if not better than they could do themselves. It is conceivable that early tribes could come with some form of territorial agreements, willingly or not, with other tribes, but predators and other territorial animal species were not amenable to such primal civility. The relationship to a vital space that is forcefully conquered, temporarily borrowed, or opportunistically stolen implies a sense of occupancy markedly different from our regulated use of surveyed and groomed space. Our civilized institutions and technologies have indeed domesticated space to the extent that wilderness is preserved only as a touristic attraction or a rhetorical trope with the exception of some rare truly wild areas that cannot be easily accessed, explored, and exploited.
9. The fact that early humans could have only a direct knowledge of their immediate spatial range and the memory of their experience of past exploratory forays beyond their usual horizon did not preclude them from having a sense of a wider space within which their own niche was embedded. It can be assumed that at least two sources of information were available to them: first, the cumulative memories of past generations conveyed through narratives; secondly, the evidence provided by migrating animals that obviously were coming from afar and transiting through their range, and the movement of water ways and clouds. More decisive, though, was the vantage point of hilltops and cliffs that could reveal vast expanses of land. However, such sources of spatial information carried their own limitations for at least three reasons. Surveying could be done only by walking in a landscape that was mostly opaque and hostile, and cumulative knowledge was necessarily constrained by the

early humans' short life span. Moreover, we know that, in oral cultures, the maintenance of collective memory cannot be sustained beyond a limited number of generations. When migrations occur either in search of resources or as a way to escape dangers, the spatial knowledge preserved through collective memory can quickly become irrelevant. Finally, the perception, cognition, and representation of space may also be strongly biased by beliefs arising from the "theory of mind" through endowing directions and places with magical powers or taboo values. The origin of the modern understanding of space as open, neutral, and differentiated exclusively by economic notions of ownership and opportunistic affordances can be traced back to the advent of the Neolithic era and its exponential development in the Age of industrialization.

10. History and Prehistoy are deeply concerned with human mobility and routes are traced on modern maps, assigning plausible points of origins and approximate times of arrival based on the dating of the archaeological record. With our ingrained modern perspective on space, enhanced by 21th century's achievements in astronomy and geography, we trace the routes of migrations over tens of millennia with reference to Western virtual constructions of the various part of the globe that was colonized quite recently by Europeans. There cannot be any doubt that – like many of our contemporaries – early humans assumed that the earth was broadly flat in spite of the peaks and throughs of which they had direct experience. Prehistoric migrations must have been a slow, half-blind process during which there was no sense of drastic changes in the environment, except, of course, when water ways or maritime transportations were involved. Furthermore, it is plausible that mobility was caused by needs rather than wanderlust because resources were getting scarce or hostile newcomers arrived.

Although it cannot be totally excluded that spatial information was exchanged through tribal social networks, we can assume that, even in that case, early humans could not have benefited from visual comprehensive representations of the space beyond the reachable horizon. Knowledge of the contiguous terrains might have been cumulated across several generations but it seems reasonable to assume that the kind of maps to which modern humans are accustomed is a recent cultural innovation. However, the necessary limitations to the knowledge of the spatial environment may have been compensated to some extent by the information derived from the observation of the nocturnal sky that appears to be represented with precision in the prehistoric rock art. The correlations between the dynamic patterns in the sky and the animal migrations that were crucial to their survival may have prompted early humans to project upon the land the celestial configurations they could represent and which were obviously extended beyond their range in a space beyond their horizon.

11. There seem indeed to be strong evidence that early humans paid intense attention to the nocturnal sky and carefully represented that diversely patterned space in their rock art. Paleo-astronomy is a relatively recent discipline that cast an interesting light upon the complex combination of zoomorphic and geometric designs that can be identified on the walls of caves, the sides of cliffs, and the surface of boulders. The psychology of human vision has provided strong evidence that minimal cues can prime the illusory perception of biologically meaningful configurations in the environment -- for instance, we are prone to "see" a face when we encounter two dots aligned within an area proportional to the position of two eyes on a face. Moreover, experimentations have shown that our cognition generally biases our perception – the brain anticipates visual perceptions on the basis of our memory of past experiences. This is why humans are driven to recognize in the apparent chaos of the nocturnal sky the zoomorphic patterns with which they are familiar. For example, indigenous populations in South America readily assimilate a particular celestial *nebula* with the shape of lamas, an animal that is a vital resource in their environment. In the same manner, some remarkable clusters of stars can stand out visually against the background of apparently less ordered luminous dots. Naturally, the tendency to recognize familiar patterns also applies to the perception of our terrestrial environment that is rich in geomorphic diversity. The visual experience of the surrounding space of early humans was very likely suffused with zoomorphic interpretations.
12. The above considerations call for some constructive remarks. **First**, it should be obvious that space for early humans was a markedly different experience compared to the modern mind's understanding of the physical environment. As full-fledged members of the urban, educated elite, archaeologists share the contemporary common sense view that space is something out there, a measurable exteriority representable, on the one hand, as bits and parcels of a jigsaw puzzle defined by individual ownership claims and national borders; and, on the other hand, as a metric matrix forming an universal network of dimensions. For this modern mind, nature is something we visit or explore as a pastime or a game of retrieval; fieldtrips are mostly safe expeditions scheduled during the favorable seasons. More generally, nature is construed as a spectacle that tourists with disposable income can contemplate from secured vantage points. Only rarely can a limited immersive experience provide some inkling of the pre-modern experience of space. **Secondly**, the modern mind holds a firm categorial distinction between what is animate and what is inanimate, each category commanding a different kind of behavior. Navigating a world devoid of such distinctions or in which the parting lines define other cognitive oppositions is an experience of space that totally escapes the mental grasp of the modern

archaeologists. Their incredulity towards such beliefs literally blind researchers on a crucial system of spatial values that necessarily impacted early humans' physical and cultural behavior. **Thirdly**, the space of early humans was necessarily a shared space not only with other human groups but, perhaps more importantly, with other animal species. Although it is not unthinkable that groups which had split into subgroups could have some form of hunting territorial agreements, it is more likely that the occupation of highly desirable grounds because of their proximity to water, shelter, game, and a supply of stones (mostly as projectiles for defensive purposes against predators) caused intense competition. Moreover, these territories coincided or overlapped with predatory species with which the possibility of negotiation was excluded. In a sharing of space that was not supported by an enforceable civil legal system, constant encroachments and struggles to push back are the rule of the day. Holding one's ground in a perpetually contested context was the most pressing imperative. To achieve this goal it is very likely that early humans had accumulated considerable knowledge about the animal species that were relevant to their own survival, particularly concerning their use of space for grazing, migrating, sheltering, hunting, and breeding, as well as their visual and acoustic communication signals that provided reliable information about their location, movements, and moods. **Fourthly**, the visual contiguity of the sky with the earth and its apparent proximity to the ground constitute an experience of space that we find difficult to fathom. We get inklings of this relatively compact perception through our interactions with hunter-gatherer tribes for which the sun, and particularly the moon are within conceivable reach. Their cultures commonly relate celestial motions, both periodic and unexpected ones, to their understanding of on-going terrestrial events to the extent that we may doubt that what happened above them was perceived as fundamentally distinct of what they experienced on the ground, all the more so since many animal patterns in their environment were recognizable in the images formed by nebulae and constellations. Mapping the sky may have been then more important than mapping the earth, if only because it was much easier. **Fifthly**, the modern mind conceptualizes space almost exclusively in terms of visual information but this sensorial reduction is probably due to the mediation of the built environment and the compelling surveying and measuring it entails, that geometrizes, so to speak, our perception, and to the fact that the safety of the civilized space of the international order construes space as the an endless kaleidoscope of landscape and spectacles. We can assume that the space that was experienced by early humans through the relentless construction of their transient ecological niches was a multimodal space as much tactile, acoustic and olfactory as visual because the whole sensorial array of the human primates was crucially relevant to their immediate survival.

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