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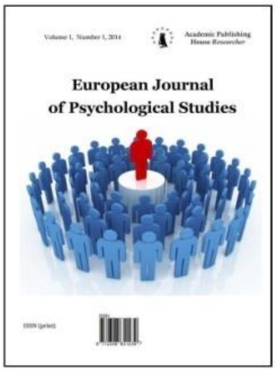

Primitive Concepts of the Natural World

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Abstract

The paper begins by refuting the anthropological dogma that 'collective representations' cannot be explained by psychological analyses of individual thought processes. Collective representations can only be changed and transmitted by individuals, so their thinking and learning must be integrally related to the collective representations they produce and sustain. Piagetian developmental psychology gives a uniquely valuable insight into how we learn, especially its distinction between pre-operational, concrete-operational, and formal operational forms of thought. Ethnographic data is presented to show that much of the collective representations found in pre-literate, small-scale societies does not require more than pre-operational thought, in the areas of classification, number, space, time, and causality.

Keywords: causality, classification, collective representations, cultural anthropology, developmental psychology, Piaget, primitive thought, space, time.

1. Introduction

Contemporary cultural anthropology rejects the notion of primitive society, not on any well-researched scholarly or scientific grounds, but merely on those of political correctness. A century and more of fieldwork has established without doubt, however, the essential characteristics of primitive society: small-scale, face-to-face groups, with simple technologies, organized primarily by the ascriptive criteria of descent, age, and gender, and without money, writing, or political centralisation. The attempts by such leading anthropologists as Leach (1982) and Kuper (1988) to deny the existence of primitive society have been dismal failures, as I have pointed out in detail (Hallpike 1992), and it is some of the characteristics of primitive *thought* that will concern us in this paper.

2. Discussion

Psychology and 'collective representations'

When anthropologists talk about the 'thought' of primitive peoples they are referring in particular to systems of classification, time-reckoning, number, causal explanations of events, notions of space, myths, magic, and belief systems. These are commonly referred to as 'collective representations' because they are cultural patterns of thought that have been inherited by individuals in the course of their upbringing. The very influential Durkheimian tradition maintains that it is these collective representations themselves that mould the minds of each individual so that they must be regarded as social, not psychological, in origin:

"Perceptions, emotions, evaluations of right and wrong, ideas of the causes of events – in short, whole systems of thought and feeling...exist transcendentally, independently of the individuals in whom they appear. They are what the French sociologists call *collective representations*, which pass from generation to generation, learnt in behaviour, continued in proverb and precept, in the technology and conventions and ritual, and, with the development of writing, in books. A man's psyche is social, not organic." (Gluckman 1949:75)

There is a good deal of truth in this account of culture and thought: sociobiologists, in particular, who try to reduce cultural and social phenomena to the motives and thoughts of individuals, need to pay close attention to what Gluckman is talking about, and realise that culture and society are *systems of ideas* with their own properties that indeed transcend the individuals who maintain them. That said, however, we must also recognise that the idea that culture could be completely independent of individual thought processes is impossible and nonsensical. Anthropologists have believed it, first, because they have not understood the process of learning, and have assumed it to be nothing more than the passive copying by children of what adults do and say, the bit-by-bit accumulation of knowledge like an empty bucket being slowly filled. This, as we shall see, is quite mistaken.

Secondly, they have not reflected sufficiently on the relation between individual thought processes and the collective representations of our own society. The Darwinian theory of evolution, for example, has certainly become a collective representation of modern Western society, but we know in detail about the thought processes by which Darwin and others developed it. Millions of students now absorb this theory in their biology lessons without personally having to go through all the steps that Darwin did, and some students will understand the theory much better than others. To this extent the collective representation 'Darwinian evolution' transcends the minds of particular individuals, but the minds of individuals nevertheless played an essential part in the development and transmission of evolutionary theory. Collective representations both mould and are moulded by the thought of individuals in a complex interactive process. Once, however, it is accepted that the thinking of individuals must be an integral part of the generation and transmission of collective representations, we have to ask how those individuals learn.

Piaget's theory of cognitive development

The traditional anthropologists' model of learning as passive copying of adult models is quite inadmissible, and we need to turn to developmental psychology instead, specifically to the work of Piaget. Here it is only possible to give a very brief outline of his theory of cognitive development, and it is assumed that readers already have some familiarity with it. He was concerned with how organized knowledge develops in the individual, but rejected the whole idea of learning as the passive absorption of knowledge, and regarded the individual as actively exploring his environment from birth onwards. He treated cognitive growth as an aspect of general organic adaptation to the environment, in which process neither the hereditary characteristics of the organism nor the structure of the environment are sufficient to explain the patterns of growth of the organism. Cognitive development, therefore, cannot simply be the product of biological maturation. Thought is a self-regulating system which strives to achieve equilibrium with its environment by constructing stable representations that transcend the variability and fluctuations of experience. Cognitive development proceeds through a series of stages that involve the successive reorganization of thought around action, imagery, and verbal representation, but it is important to realise that these stages are not rigidly bounded and on the contrary change gradually from one to the next.

In Piaget's theory thought begins in the sensori-motor stage, in the first 1 – 2 years of life, when the child uses actions alone to discover, for example, that objects continue to exist when they are not visible, that they remain the same size and shape when seen from different perspectives and distances, and that the child itself is an object among other physical objects. With the development of language and mental imagery the child becomes capable of symbolic representation of objects that are not actually present. But this involves the child in new difficulties: just as he conserved the permanence of objects and the constancy of size and shape at the sensori-motor stage, he now has to understand the constancies under change of quantity, length, weight, and volume, for example. So, a child in this pre-operational stage will not understand that water poured from a short, wide glass into a tall thin one remains the same in volume because he concentrates on the relative height of the glasses alone, on one dimension instead of two. He therefore does not realise that the increased height of the second glass is *compensated* by its decreased width, and also does not realise that the process of pouring can be *reversed*. In a series of objects of increasing size, he will also not grasp that an object can be *both* bigger than one and smaller than another.

It is only at around 6 – 7 years that the child becomes capable of thought at the concrete-operational stage. The change from pre-operational to concrete-operational thought can be summarized as:

"...the pre-operational child's thought is irreversible and attends to limited amounts of information, which are particularly the static states of reality. The concrete operational child focuses on several aspects of a situation *simultaneously* [my emphasis], is sensitive to transformations, and can reverse the direction of his thinking." (Ginsburg and Opper 1969:168)

The transition from the pre-operational level to that of concrete operations is therefore marked by the ability to construct stable systems based on mobile relations of reversibility and compensation, the notion of relative properties as opposed to absolute properties which inhere in things, the avoidance of centration or one-dimensional thought, and the avoidance of the contradictions inherent in image-based modes of representation. We find the progressive objectification of causality, involving the analysis of process and the use of explanations based solely on physical relations between things. Processes are no longer represented as sequences of static states, but as integrated systems of transformations. And in the case of classification, the child can now grasp the logical implications of class-inclusion.

Formal-operational thinking, involving scientific, hypothetico-deductive reasoning, only develops in adolescence in children who live in the appropriate literate socio-cultural milieu, and is not found in primitive societies. This brings us to an essential aspect of cognitive development, which is the social factors that promote it. Cross-cultural tests have repeatedly shown that experience of urban life, machines and technical processes, money and commercial activities, schooling and literacy, debate, and the experience of cultural differences are all particularly important factors in stimulating cognitive development. But these are not collective representations at all, in the Durkheimian sense, but simply aspects of social life and developmental psychology therefore allows us to relate individual thought to social life in a much deeper way than is possible for traditional anthropology.

Obviously, the factors favouring cognitive growth will be absent in primitive societies, and this is why we find that the great part of life in these societies can be handled at the level of Pre-operational thought. As Greenfield puts it, '...traditional non-technical societies demand only the perfection and elaboration of first ways of looking at the world' (Greenfield et al. 1966:318). It should be obvious that this developmental approach to primitive thought is a great improvement on the various discredited attempts to represent it as 'pre-logical' or 'pre-rational'. Pre-operational thought is simply more limited than concrete-operational thought, but still adequate to the circumstances of primitive life. For example, we shall see that concrete-operational classification can make use of taxonomic classes, all whose members are defined as having certain distinct attributes. Pre-operational classification, on the other hand, tends to make use of what is called 'functional entailment', which focuses on how things are related in ordinary life. So the question 'What do dogs and rabbits have in common?' is answered taxonomically by saying that they are both mammals, whereas in terms of functional entailment dogs chase rabbits. Taxonomic classification is logically more powerful and necessary for making conceptual distinctions, but the answer that dogs chase rabbits is not stupid or pre-logical, and perfectly sensible in the context of ordinary life.

The basic hypothesis is therefore as follows. Some ways of representing the world are more elementary than others and consequently will occur before more advanced representations in the development of every individual. In societies like our own these elementary forms of representation are inadequate for accommodation to the socio-physical environment, and so the individual is forced to reconstruct them at higher levels of mental functioning. But in primitive societies pre-operational thinking is perfectly adequate for coping with the demands of everyday life and does not have to be reconstructed at the level of concrete or formal operations. Their collective representations for the most part will therefore not demand a level of thinking beyond the pre-operational. Some have argued, however, that all societies need a basis of at least concrete-operational thinking. According to Professor Gustav Jahoda, for example, "It can be stated quite categorically that no society could function at the pre-operational stage, and to suggest that a majority of any people are at that level is nonsense almost by definition" (1980:116). On the contrary, one of the most obvious conclusions of this paper will be that pre-operational thought is a very practical and simple basis for the life of a primitive society, and even for some aspects of our own lives as well.

Classification

In Western society we are thoroughly familiar with taxonomic classification, which is based on classes defined by clear criteria which are common to all their members and distinguish them from those of other classes: examples are 'furniture', 'tool', 'vehicle', 'utensil', and so on. These are essential for logic, and the whole of science, law, philosophy, and administration and allow us to make general propositions about things and express abstract distinctions, such as between 'crimes' and 'torts, and to form classificatory hierarchies such as '*Homo sapiens* – primate – mammal – vertebrate' based on class-inclusion.

In pre-operational thought, however, we do not find taxonomic classes but 'complexes. These are based on relations of 'belonging' rather than of 'similarity' of criteria and are thus not composed of elements all of which have at least one criterion in common. In one Piagetian test children were given toys comprising four animals, four human figures, four kitchen utensils, and four articles of furniture; and asked to classify these objects in open boxes with the instruction 'Put together whatever goes together best.' The younger children merely constructed heterogeneous collections ('heaps') in each box, whereas children of four to five used the boxes to distinguish between collections. These were based not on taxonomic classes, however, but on complexes, associations of everyday life in terms of which the things were felt to belong together, e.g.

Pie (5; 0) Box A: (Baby + chair + chair)

Q. Why? (Pie puts the baby on one of the chairs, adds a man, and says):

A. The man is sitting with the baby. (He adds a pig)
The baby is playing with the pig. (Then a pot)
It's for the pig to eat out of. (Another man)
The man is looking after the pig (Piaget and Inhelder 1964: 41).

Tests of non-literate adults among the Kpelle of Liberia found that 'the dominant mode of classification in this pilot work was what we have called "functional entailment". A pair of objects was selected so that the first went with, or operated on, the second. For example, a potato and a knife were put together because "you take the knife and cut the potato". Very rarely was a large group formed, and we virtually never had a classification justified in terms of the way things look or their common membership in a taxonomic category' (Cole et al. 1971:79).

Luria conducted similar tests with illiterate peasants in Uzbekistan, demonstrating the same use of complexes and functional entailment. In one test the subject was given drawings of four common objects, one of the four being taxonomically inappropriate. The subject in this case is an illiterate male peasant aged thirty-nine, who is shown pictures of a hammer, saw, log, and hatchet:

Q. Which of these things could you call by one word?

A. How's that? If you call all three of them a 'hammer', that won't be right either.

Q. But one fellow picked three things – the hammer, saw, and hatchet – and said they were alike.

A. A saw, a hammer and a hatchet all have to work together. But the log has to be there too!

Q. Why do you think he picked these three things and not the log?

A. Probably he's got a lot of firewood, but if we'll be left without fire-wood, we won't be able to do anything.

Q. True, but a hammer, a saw, and a hatchet are all tools.

A. Yes, but even if we have tools, we still need wood – otherwise we can't build anything. (Luria 1976: 56)

Eleanor Rosch (1977) also established the very important fact that much classification of natural categories in ordinary life does not rest on a 'digital' enumeration of discrete properties when assigning a thing to a class, but rather, on an 'analogue' procedure which rests on assimilating something to a prototypical image of the ideal 'thing' – be it bird, colour, facial expression, or whatever. The notion of 'prototypical' classification as developed by Rosch is particularly compatible with complexive classification.

Number

Primitives are basically interested in counting simply as a means of reckoning totals, of tallying in fact, rather than in performing arithmetical operations like multiplication and division with the constituent numbers of those totals; and primitive number concepts are bound to concrete objects and not conceived as logical classes having a necessary relation to one another. But Piaget shows that the concrete-operational understanding of number has to be based on an understanding of logical relations, and in particular on the synthesis of cardinal and ordinal series, that is, of hierarchical systems of class-inclusion, and systems of asymmetrical relations (qualitative seriation) that is, such relations as 'bigger than', 'to the right of' and so on. It also needs the ability to equalize differences by partition of any class or series into units, and the establishment of one-one correlations between the members of two or more series.

The operational understanding of number, therefore, has to be clearly distinguished from the ability to manipulate sets of objects such as fingers and toes, stones, or cowrie shells and to perform elementary addition with them. Even where a culture possesses an extensive verbal system of numbers, we are not entitled, from that fact alone, to deduce that the members of that culture have an operational grasp of number. Such a conclusion would depend on empirical evidence of the way in which their numbers are used. But while the existence of verbal number systems is not in itself evidence for an operational grasp of number, there can be no doubt that a verbal system is an essential prerequisite for it, since if one has no terms for distinguishing verbally between groups of objects it would seem impossible for relational judgements of any complexity to be formulated.

The use of number and counting is closely related to measurement, but when discussing 'measurement' in the context of primitive society we must distinguish between simple standardization, as when a conventional length of cloth is sold in a market-place on the basis of an 'armspan', or grain by the gourd, etc., and the measurement involved in quantitative analysis, since mere standardization does not involve seriation or dimensional comparison. Primitive systems of measurement, in so far as they exist, tend naturally to be based on bodily 'units' which are often informal and ad hoc, and even if culturally defined are usually incommensurable and often confined to particular types of thing, so that they are mutually inconvertible. It must therefore be very difficult to construct any more than very elementary metric relations on such a basis, or to built up any awareness of the various dimensions based on systems of measurement. For example, in primitive societies no one measures a piece of ground by pacing it out and deciding that it is thirty paces wide by fifty paces long.

This lack of dimensional analysis also makes compensation much harder to grasp. Jahoda, Margaret Mead and others have claimed that no society could operate unless everyone could grasp conservation, but it should be emphasized that conservation is not a problem which commonly presents itself in primitive life. As we noted earlier, it is only when one dimension increases and the other decreases that dimensional analysis and an understanding of compensation is called for. But in the great majority of cases when primitives have to transfer liquids, they simply collect, say, water from a spring or from a well in gourds or bamboo tubes, which they bring home and either drink from directly, use as storage vessels, or pour into storage vessels whose capacity in terms of so many loads of water is known to their owners. In the course of four years' field-work, I cannot recall a single instance in which any conservation problem arose, whether a liquid or solid quantity, length, area, weight, or any other property.

Space

Perceptual space needs to be clearly distinguished from conceptual space. As Piaget and Inhelder say:

"...the child can already perceive things projectively and grasp certain metric relationships by perception alone, long before he can deal with perspective in thought, or measure objects through operations. In addition, his ability to perceive forms in this way (straight lines, curves, squares, circles, etc.) is far in advance of his capacity to reconstruct them at the level of mental images or representational thought...it is not until after 7 – 8 years of age that measurement, conceptual co-ordination of perspective, understanding of proportion etc., result in the construction of a conceptual space marking a real advance on perceptual space." (Piaget and Inhelder 1956: 13)

In Piaget's view, the first spatial relationships that are understood are topological in nature. Topological relationships are those of proximity, separation, order, inclusion, and continuity. Some preliminary discussion of these concepts will be necessary if we are to understand why topological space is easier to understand than Euclidean and projective space.

The basic characteristics of topological space are that its relationships are independent of distances, straight lines, angles, parallels, and co-ordinates, or, in short, of size and shape. Proximity or 'near-byness' is the most elementary spatial relationship, together with its complement, separation – that is, segregation of units or the discrimination of an object from its background. Separation of objects results in their ordering or succession, of which a particularly important case is symmetry (e.g. the order A B C/C B A). Ordered sequences also possess the property of enclosure or surrounding ('betweenness'), as when in the sequence A B C, B is enclosed by A and C. The centre of a circle is enclosed by the periphery and in three-dimensional space objects are enclosed within houses or boxes.

The dominant spatial concepts of primitive society are those of inner/outer; centre-periphery; left/right; high/low; closed/open; symmetrical/asymmetrical order; and boundary. These orderings are basically topological, as opposed to Euclidean or projective, and are associated with concrete physical features of the natural environment such as sky/earth, village/bush, and especially with the prototypical images of the human body and the house, and are closely integrated with moral values and social relations.

Relatively little work on primitive spatial concepts relevant to Piaget's theories has been done by cross-cultural psychologists, but the following observations by Gay and Cole on the spatial concepts of the Kpelle are worthy of note. Referring to the paucity of terms for Euclidean shapes, and the vagueness of such terms as are used, they say:

"It is tempting to say that they represent topological concepts rather than Euclidean concepts. That is, it is not so much the precise figure that matters, but the way in which space is divided. Thus the term *pere*, 'path', can refer to a straight line. However, it can be applied equally well to a curved or jagged line. These distinctions, which we require in English, are unimportant to the Kpelle. The important thing about that which they term *pere* is that it extends from one place to another place without crossing itself. It is therefore much closer to our topological concept of a path dividing a surface into two parts than it is to our Euclidean straight line" (Gay and Cole 1967: 53).

Notions of projective space are also undeveloped in primitive society. For example, we find that a shadow is not regarded simply as an area of absence of light, in a projective relation to an object and a light source, but as a kind of thing which emanates from people in particular. This assumption about the nature of shadows is the basis of a wide variety of collective representations concerned with shadow and soul, the magical vulnerability of shadows, their power to pollute food, and so on; however, these various, socially elaborated beliefs about shadows all rest upon the fact that the average member of a primitive society does not think of shadows in the concrete-operational sense, but as a real emanation from a person.

The absence of measurement and quantification, especially in relation to land measurement and surveying, is clearly a major factor in the general lack of Euclidean and projective spatial representation, together with the lack of representative drawing and mapping, which seem to occur in relatively few primitive societies. Only in societies where navigation is an important cognitive problem do we find that some projective and Euclidean concepts are regularly developed.

The tests of cognitive performance in primitive society conducted by psychologists, largely confirm Piaget's theory of the development of spatial concepts and strongly suggest, apart from the ethnographic evidence, that the average member of a primitive society which lacks navigation or the need for maps in the conveying of information will represent space in a predominantly pre-operational fashion. The available evidence suggests therefore that primitive concepts of space are not of a different *type* from those of literate industrial man, but that they are simply more elementary than those that our kind of society requires as the norm for its average citizen.

Time

If we walk from our home down to the shops we pass a series of landmarks on the way, and their order or succession as we pass them is a familiar part of our life. Events, too, like the daily sequence of tasks from getting up in the morning, through the meals and various activities of the day, to going to sleep in the evening, also form a familiar sequence like the landmarks on a journey, and the same is true of the year and cyclical changes in the seasons and their related activities. It is therefore possible to understand process simply by using the time concepts of succession or sequence, and also duration, how long something lasts in relation to something else. A succession of months makes up a year, and a year lasts longer than a month.

It is because succession and duration, which are concepts of time, have direct analogues in our understanding of motion in space, and process in general, that we can call this elementary understanding of time 'spatialized', and speak of both locations and events, for example, as near or far, long or short, and before and after. It is essentially a static mode of representation, as distinct from the mobile system of transformations that typifies the concrete-operational understanding of time, but for much of ordinary daily life it works perfectly well: someone with a pre-operational grasp of time will understand the following:

more time → more distance
more speed → more distance
more distance → more time

but these only apply when we are thinking about a single process, such as a man walking between his home and the market, or the yearly calendar. When we are trying to compare or co-ordinate two different motions, then the concepts of succession and duration are not enough, however.

At this point we have to introduce the idea of simultaneity, of two motions taking the same amount of time because they start and stop together, but which may cover different distances because they have different speeds. In the case of a single motion, time and space have a simple correlation – the more time you take, the greater the distance you will travel – but when two motions are involved, it has to be understood that differences in their velocity mean that one thing can take less time to cover the same distance, or to cover more distance in the same time, than the other. Concrete operational time, then, involves the co-ordination of duration, succession, and simultaneity, and means that time can no longer be represented simply in spatial terms.

Piaget's central point about the concrete-operational understanding of time is therefore that it involves the co-ordination of motions in space, and in order to be able to do this it should now be clear why we need to develop a thorough understanding of the mutual relations between distance (S), time (T), and velocity, (V) – that is, speed in a particular direction. So, to discover how far an object has travelled we need to know how much time it took, and how fast it was going. If it travelled for 3 hours at 4 miles per hour, then it must have gone 12 miles: S=TV. To know how long something took, we divide the distance by the speed, so that 12 miles at 3 miles per hour takes 4 hours, and at 6 miles per hour takes 2 hours: T=S/V. And to know how fast something has gone, we divide the distance by the time, so to go 12 miles in 3 hours is to go at 4 miles per hour: V=S/T.

The pre-operational child, however, has major problems with the co-ordination of these three variables of velocity, time and distance, in particular with the relation between time and velocity, because he supposes that there are simple co-ordinations between two variables, not three (as we saw earlier);

(a) If you go more quickly, you necessarily cover more distance (hence velocity is proportional to distance);

(b) If you cover more distance, you take more time to do so (hence distance is proportional to time);

(c) So if you go more quickly you therefore need more time to do so.

Here (c) comes unstuck, because it does not realise that going more quickly not only covers a greater distance than going slowly, but may do so in the same time as something else going more slowly, or in less time. So if the pre-operational child is shown two model cars, 1 and 2, start from two points A1 and A2 simultaneously, and travel on two parallel tracks towards B1 and B2 and then stop at the same instant:

1 A1 ……………………………………………………………B1
2 A2 ……………………………………………………B2

The will think that car 1 went on moving longer than car 2 because he associates greater distance with greater time. To understand this problem involves, first of all, a grasp of simultaneity: of course, we can all see if two things happen together, if it starts to rain just as we set off on a walk, or if the sun is setting when we come home, but the simultaneity of operational time involves two processes and judging when they both start and stop in relation to each other, which is essential for understanding the relation between time, speed, and distance.

A concrete operational grasp of time also understands that the amount of time taken for the journey has to be calculated by relating the distance covered to the *speed* at which someone travels. Without grasping this, the notion of time is therefore tied to distance and remains spatialized. This mutual relationship between velocity, time, and distance is a good example of operational thinking, because someone who understands it will also realise that distance covered is the product of the velocity and the time, and that speed is the distance divided by the time – a mobile system of transformations, as I mentioned earlier.

It should be noted that we, as well as primitives, can operate quite easily with the spatialized time-reckoning concepts of pre-operational thought. For example, despite the lack of time-reckoning among the Tauade, I was still able to communicate with them about the timing of activities, because we shared a common pre-operational grasp of time as a succession of events. While they had no words for week, month, or year, they still had a word that can be translated as 'time', *lova*: *oilova*, 'this time', 'now'; *telova*? 'What time, when?'; *opolovan*, 'olden time'. But what they really meant by *lova* was merely 'sequence of events', and *oilova* would more accurately be translated as 'this sequence of events', i.e. the sequence of events in which the speakers are presently involved. So when someone asked me '*telova* will you go to Port Moresby?', 'in what sequence of events will you go to Port Moresby?', I could reply 'after the plane has brought my letters to the mission', and what I said would be immediately understood.

In primitive societies, people are primarily aware of time through the processes of their ordinary life, and collective representations of time-reckoning are predominantly spatialized, that is, tied to sequences of events, while speed as such is irrelevant. One cannot compare the speeds of different sequences in relation to a common standard of time – chronologically – and the only thing that matters is the order in which events occur and their relative position to one another, so that they are like the static landmarks on a journey or a path. The series ABCDEFGHIJ could equally well stand for a path with landmarks or for a sequence of events, and what is important are things like order (A before D before H); inclusion (B between A and C); and proximity (H next to I and G, but not J or F). So J and A are far from E, while C and G are near, but there is no way of measuring how near or far independently of the series itself, since distance or length of time can only be specified in terms of the number of intervening elements in a sequence. This kind of space, as we have seen, is called 'topological' space, and it provides a very good model of primitive concepts of time as well, in which all the emphasis is on time as a sequence of events.

One of the major reasons that primitive time is essentially topological and dominated by succession is that it is basically qualitative, not quantitative and based on clocks and precise dates. That is, specific events are located only in relation to other events, e.g.: 'That village had not yet moved when my youngest son was born', or 'The Government came after I had been circumcised, but before I married'. Time intervals are also incommensurable with one another.

The time concepts of the Iraqw of Tanzania, for example, are basically topological. While they have words for years, months, and days, they only use these sequentially, not chronologically:

"They do not, however, use these standards of measurement comparatively to produce a general concept of uniform time, a chronology, that is, against which all events may be compared. Years, months, days, and hours are partitions of the flow of time, and in the way we use the term here, are topological. The creation of a uniform (e.g.Euclidean) space or a uniform time standard (e.g. a chronology) requires a logical act that the Iraqw do not perform." (Thornton 1980:171)

From her studies of illiterate Algerian peasants, Bovet also confirms Piaget's theory that pre-operational time is spatialized:

"...we have noted that the general error consists in judging duration according to the length of the tracks in the experimental situations, and not according to the speed of the displacements. In the same way, in the counts of journeys used as an introduction [to the tests], a longer duration was always ascribed to the person who had covered the longer distance. This dominance of length seems to show that, in the interrelationship of factors at work there – temporal and spatial orders, speed, length, and duration – the spatial dimension is the best structured aspect and accordingly the most easily differentiated. Even the temporal order reveals itself as still closely attached to the spatial order, as we have observed. As for speed, we have seen to what extent it is only apprehended with difficulty other than in situations of perceptible overtaking. Without doubt, the fact that it is not invoked with respect to duration is due to its very labile status." (Bovet 1975:121-2)

There are occasions, however, when a concrete-operational grasp of time would be relevant. The Konso, for example, have a luni-solar calendar, whose year of 12 months is necessarily 11 days shorter than the solar year of 365¼ days. This means that every 3 years or so, their calendar advances about a month on the solar year, but during my field-work the cycles of the lunar and solar years appeared to be properly synchronized. But while they themselves said that the months had always fallen in around the same seasons every year, this would have been impossible without some periodic correction. I was, however, originally unable to discover how they achieved this correction, and when I explained the problem to them they did not understand what I was talking about. Later, the solution to their calendar problem in fact turned out to be the familiar device of repeating a month if the dry season has not come to an end in the expected month.

But this in itself presents a further problem: if the solution is so simple why could no one explain it to me at the time of my first fieldwork? I think the answer is that I presented the problem to them in a way that they found incomprehensible. I had assumed that they had mental models of the lunar and solar cycles as distinct entities, 'revolving' at different speeds, and that they would have noticed over the years that the lunar cycle had a basic tendency to advance. But such an assumption in the case of non-literate peoples is quite unwarranted, as Leach (1954:118) has pointed out. The Konso are quite unaware of what I conceptualised as two cycles, moving at different speeds, and are merely concerned that the rains should come by the beginning of a particular month, and if they do not do so, simply repeat the month that has just passed. (Hallpike 2008:235-38) They are able to solve a problem in the correlation of two motions by the simple pre-operational technique of adding a month, which does not need any understanding of two cycles moving at different speeds.

Gregory Forth, on the other hand, in his study of time concepts of the Rindi in eastern Sumba, provides a good example of what does seem a genuine example of a concrete-operational grasp of time in a primitive society. The Rindi have institutional horse-racing on a circular track, and this involves a system of handicaps for horses of different sizes – and therefore speeds. In this system, the larger horses have to run farther than smaller horses, and therefore start at different points around the track, the largest ones in fact going almost twice as far as the smallest. While the race does not end at the same instant, because all the horses start simultaneously this handicapping arrangement, as he says, 'evidently entails the realization that larger horses will be able to run faster, and, more importantly in the present context, that within the same period of time, faster (i.e. larger) horses will be able to cover a greater distance', so that 'in the eastern Sumbanese horse race "distance covered" or "work done" appears indeed to be dissociated from "time elapsed" ' (Forth 1982:245). He does not claim that this is the dominant mode of time-reckoning in their society, but it is a good illustration of how familiarity with particular activities may involve the development of concrete– operational thinking. In other respects, however, he records that Rindi collective representations of time generally conform to the spatialized time typical of primitive society.

Causality

To understand primitive causality it is essential to avoid vague terms such as magic and *mana*, and to focus instead on the sort of basic cognitive processes which we have been considering. Three of these in particular claim our attention: the first is what is known as conceptual realism; the second is the inability to construct concrete-operational systems based on dimensional analysis and the relations between objects; and the third is this general lack of taxonomic classification and generalization based on logical class, as opposed to complexes and prototypes.

By 'conceptual realism' Piaget means that the pre-operational child is unaware of the mediatory function of the mind in the translation of sensory experiences into mental representations, because he cannot think about his own thought processes which are still dominated by imagery, concrete associations, and action. Because of his conceptual realism he derives the notion of force from his own muscular reactions to objects, and does not realize that his own muscular efforts are not the result of the body he moves; so stones, for example, seem to have strength inside themselves. His conceptual realism also leads him to credit objects with will and consciousness and to explain their existence and behaviour in terms of their significance and utility to man: 'Even towards the end of the pre-operational stage, there still remains a dynamism in objects, forces and purpose that explain their activity' (Piaget 1972). Because a clear distinction is not made between a reality which is perceived, and also a thinking process which mediates these perceptions and a language process in which thought is encoded, he is therefore unable to distinguish names and words from their referents and believes initially that they are inherent in the objects they denote. For the child, at this stage thinking is a physical process, identified with the mouth or with speech, and he supposes that dreams occur outside himself. This nominal realism is the assumption that words have an inherent association with their referents, such that knowing the name of something or someone is the essential means to power over it or him. The theme that speech is power is so prevalent in magic that it seems unnecessary to provide further ethnographic illustrations of it here.

In the same way, conceptual realism also prevents primitives from treating symbolic associations simply as subjective mental associations. We therefore commonly find that symbolic properties are also regarded as empirically real properties which may be utilized to bring about changes in the physical world. This is clearly the origin of many of the 'participations' noted by Lévy-Bruhl and others. Thus in portraits or photographs of a person, while we regard the representation simply as creating a subjective association in the mind of the beholder, the primitive, with no awareness of the mind, must perforce regard the sensations of familiarity produced by the representation as inhering in the representation, and not as in his own mind. The representation is thus conceived as having captured part of the essence of the original. We find ample evidence of conceptual realism even among the Pre-Socratic philosophers, and it should therefore come as no surprise that non-literate peoples are even less capable of forming any clear representations of the distinction between subjective and objective, of linguistic meaning, and of the cognitive aspects of thought.

In societies where people grow up surrounded only by the organic processes of nature, and never handle mechanical appliances or machines, there will be far less opportunity for developing the later concrete-operations especially those involving causality. This is partly because in such societies measurement and quantification are poorly developed, but also because the organic processes of nature are irreversible, not easily broken down into component elements, and do not generally lend themselves to the kind of experimental logic that machines do.

The fact that the primitive lives primarily in a 'people-centred' world, whereas we live in a more 'thing-centred' world takes on special significance in relation to notions of causality. For when reality is interpreted on the basis of how it affects human bodies there results a subjectification of experience that makes concrete-operational analysis of the world very difficult. It leads to explanations in terms of essences, the reification of properties, and the treatment of processes as substances, a world of forces which are awakened in things rather than being transmitted, and where the sensations of man are not clearly differentiated from objective physical properties. Here it is easy to see how psychic states, such as purpose, vitality, and responsiveness to the wishes or behaviour of men, may be attributed to material objects and events. This propensity is greatly augmented by the primitive apprehension of speech as having power in itself, through the adherence of names to the thing named, to control the real world, and by the parallel inability of primitives to regard symbolic associations as purely subjective.

Operational causality, however, is a universe of relations in which attributes are relative, as opposed to a primitive world of absolute substances and essences such as heat and coldness, heaviness and lightness, whose associations are static and irreversible.

As we saw in our earlier study of classification, complexive groupings and prototypical images are based on the functional, perceptual, and contextual associations which things have with one another in everyday life, not on taxonomic properties which are the basis of logical class. This inhibits the abstraction of those properties and qualities that are the basis of concrete-operational co-ordination, and the kinds of generalization about the material world that are the basis of scientific laws. Primitive peoples do not analyse natural phenomena such as 'light', 'fluid', 'lever', and so on into general and discrete taxonomic categories with clearly defined properties. The world is perceived globally, such that each phenomenon is considered in its context: rain-water, well-water, and stream-water, or sunlight, fire-light, shadows, and reflections, are all treated as separate entities, knowable only in relation to their other physical associations in particular circumstances, while categories are seen as entities having essential potency proportional to their generality. This has important consequences for notions of causality.

Thus conceptual realism, lack of concrete-operational co-ordination, and complexive classification and prototypical imagery are closely interrelated factors in the construction of primitive causality. It is these cognitive factors, rather than merely the simple projection of personal relations into the realm of nature, that are responsible for the frequently noted anthropomorphism of primitive notions of causality.

Finally, we must consider the absence of any real understanding of probability. Piaget, thinking of the difficulty experienced by pre-operational children in distinguishing between a chance regularity and a regularity produced by a definite cause, and of the child's belief in an underlying order and the prevalence of hidden causes, says: 'Since the primitive saw every event as the result of hidden as well as visible causes, and since he lacked the rational or experimental criteria to rule out even the strangest and most unforeseen connections, the pre-scientific mind could not have an intuition of probability as we have' (Piaget 1975: xiv).

In view of the very recent development of notions of probability and chance in our own civilization, we should not expect our notions of these concepts to appear in primitive society at all. But it is still possible for primitives to distinguish between statistical abnormalities and categorical abnormalities, and to have some conception of 'accident' in the sense of events that 'just happen', without needing any special explanation.

Piaget notes the emergence of intuitions of frequency and rarity at an early stage of cognitive development, and it is clear that animals, as well as people, base their strategies for survival on the relative frequencies of events they have actually experienced in the natural world. We therefore find a full awareness among primitives that some events are commoner than others, that in certain circumstances one out- come is more likely than another, and that some things never happen and others always do. There is also a universal awareness that some things happen in a certain sequence, and/or take place in a certain location or type of location. The use of a word roughly translatable as 'likely' or 'probably', as in the case of 'Are there crocodiles in this river?' – 'Probably', does not mean that such a person has a clear grasp of the total combinatorial possibilities of a situation, and has quantified his probability estimate accordingly, but simply that, on the basis of his experience he and others have often seen crocodiles in this river at this time of day – an unquantified use of 'probable' which is of course familiar to us in our everyday thought as well. The 'probability' of primitive society is therefore based simply on people's past experience, and has no relation to the combinatorial possibilities of a situation.

3. Conclusion

Instead of vague talk about the pre-rational and the pre-logical, the Piagetian approach to primitive thought allows us to analyse it in far more precise terms such as complexive classification, topological concepts of space, spatialized concepts of time, lack of dimensional conservation, and conceptual realism. We can sum up the basic characteristics of primitive thought in the following way:

(a) It is bound up in rigid, irreversible associations between the phenomenal attributes of things.

(b) While it constructs systems of relationships, these are of a concrete and affective type, and are not the systems of invariant relationships of operational thought, which are the basis of conservation, logical class, and mechanistic causality.

(c) It is not analytic – that is, it does not abstract taxonomic properties and use them as the basis for generalization, based on logical classes, and its main type of classification is complexive.

(d) Language is used as a means of social interaction rather than as a conceptual tool, and there is little or no awareness of language as a phenomenon distinct from speech.

(e) Consequently, we find no awareness of the possibilities of purely logical inference and deduction; words are often thought of as having power in themselves and names as having an inherent relation with the thing named.

(f) Primitive thought is unable to grasp the notion of mind as the mediating factor between the external world and the experiencing subject; correspondingly there seems to be no awareness of the body as an organized system distinct from the mind. It is this conceptual realism that is the basis of the projection of mental states into the external world, and of the parallel assumption that some mental states originate in the external world, with all that this implies for notions of causality.

(g) Primitive causality is also incapable of analysing process into a series of stages and reversible relations: primitive causal thought is concerned with metamorphosis, essences, absolute properties and the hypostatization of qualities, vitalism and volitional behaviour, while notions of probability are confined to intuitions of frequency and rarity, and take no account of the total, hypothetical possibilities of situations so that there is no idea of significant accidents.

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