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TECHNICAL METHODS IN THE PREHISTORIC AGE

There has often been criticism of the use which was made by certain sociologists toward the beginning of the century (Lévy-Bruhl in particular) of the adjective "primitive" to characterize the level of culture of peoples whom we formerly called "savage." The term "archaic" perhaps creates fewer difficulties, but its etymology nevertheless involves the inconvenience of intimating that the societies in question might be closer to the origins than ours. Certain anthropologists, attempting to find an objective criterion which would permit us to draw a line of demarcation between the so-called primitives and ourselves, use the term "peoples without writing" to designate the former—that is, they refer to a technique. It is true that there might be good grounds for specifying this criterion. Indeed, graphic representation can consist of rudimentary signs such as one sees on the messagesticks of the Australians or in the sketched stories, such as those with which the North American Indian covered animal skins. We can speak of writing from the moment that definite characters of precise conventional meaning appear; but from the pictogram to the abstract sign there are still many

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transitions.[1] For example, in the pre-Columbian epoch, the writing system of the Aztecs "constituted a compromise between the ideogram, phonetism, and simple drawing."[2] Egyptian hieroglyphics were not yet totally freed from their pictographic origins. In the evolution which led to our modern system, the first step was taken when syllabic representation was adopted. But writing ceased to be reserved for specialists and truly became a widespread institution when the alphabet was invented; and that discovery, made no doubt toward the year 1800 B.C. by the Semitic peoples, came more than three thousand years after the first step. In general, the term "peoples without writing" does not in itself specify that it must be understood as meaning "peoples without an alphabet"; thus there is some doubt about civilizations like that of the Aztecs, endowed with a rather elaborate pictographic system. There would be good reason, moreover, to ask ourselves if the technique of writing really constitutes a reliable criterion for establishing a distinction between societies which stagnate in archaism and those which open up to history. Certain writers, such as Marcel Griaule or M. Gurvitch, would be inclined to refute it and to seek other technical criteria, such as the use of machines or reference to creative characteristics.

But in another way technology in general might be, of all the human sciences, the best founded for giving an acceptable meaning to the ideas of primitiveness and archaism, for it actually has the documents which allow us to go back to the true origins of the culture, precisely in the absence of any written trace. Not only is it through the vestiges of technique that prehistory informs us in any kind of non-conjectural way concerning the life of early men but also it is easier to classify hierarchically, according to a line of probable evolution, the different instruments used by peoples than to classify their achievements in other areas.

Indeed, it is by the comparative study of certain techniques of tool-making that one is able to determine the stages in human evolution anterior to history. On this point, it is true, certain reservations must be made. Prehistory bases its chronology upon the materials it has available to it—that is, upon the tools which time has permitted to come

1. Cf. J. E. Lips, *Les Origines de la culture humaine* (Paris: Payot, 1951), pp. 206–10, and A. L. Kroeber, *Anthropology* (New York: Harcourt, Brace & Co., 1948), pp. 510–11.

2. J. Soustelle, *La Vie quotidienne des Aztèques* (Paris: Hachette, 1955).

down to us. Now it is certain that men, at the same time that they were chipping stone and perhaps even earlier, used instruments made of more perishable material—wood, for example. Nothing proves that the perfecting of these, from the stick to the bow or the boomerang, has always been on a par with that of flint objects; thus the classic differentiation among Paleolithic, Mesolithic, and Neolithic reveals only one aspect of progress and does not necessarily correspond to the more decisive stages in the development of technique. That must be borne in mind when, as several anthropologists have done, we seek to take the prehistoric schema as a model for a classification of archaic peoples living today. For example, if the Eskimo civilization reminds us in many respects of that of Neolithic man,[3] it occupies, on the other hand, a very high level in certain particular technical fields, such as that of clothing. This is true also for the Pueblo Indians in regard to pottery and the building of houses. We must recognize that it is precisely in the disparity of achievements according to different sectors that we find the great difficulty of any hierarchical classification of societies on the level of technology. Prehistory's imperviousness to this obstacle is based not on ignorance but on the fact that, in contrast to ethnography, it has a field of observation limited to the tools which the centuries and the millenniums do not destroy. Moreover, we are taking the word "prehistory" here in its narrow sense, since, truthfully speaking, the recent past of the pre-Columbian civilizations belongs entirely to prehistory in the wide but nevertheless precise sense of the term.

When we wish to study archaic technical methods in their entirety, and consequently to utilize at the same time the data of prehistory and of ethnography, we must, before any attempt at classification of the cultures is made, prepare an inventory of the different primitive techniques.

One complete and logical chart, which is often taken today as a basic reference, is that proposed by Mauss and which, by the vast field it covered, was in harmony with his definition, remarkable for its brevity: "I call technique an act which is traditionally efficacious."[4] After having

3. See, among others, C. S. Coon, *Histoire de l'homme* (Paris: Calmann-Lévy, 1958), p. 180.

4. Mauss, *Sociologie et anthropologie* (Paris: Presses Universitaires de France, 1950), p. 371. In his *Manuel d'ethnographie* (Paris: Payot, 1947), we find the definition of techniques as "traditional acts combined to produce a mechanical, physical, or chemical effect, acts which are known to be such" (p. 22). See also n. 34 below.

reserved a special place for physical techniques which,[5] like walking or swimming, presuppose only the presence of the human body, he classified in a first group the general techniques for general uses, such as the production of fire, the manufacture of tools; then he placed under the heading of special techniques for general uses, or general industries for special uses, basketwork, pottery, rope-making, treatment of glues and dyes; and, finally, he described in a third group the specialized industries for special uses: those of consumption, of simple acquisition and of production, of protection and of comfort, adding to them transportation and navigation.[6] M. Leroi-Gourhan has gone back to the general lines of this classification but has corrected and reworked it in several points. The basis of his over-all plan[7] was a division into three chapters: first, general techniques, subclassified in a new way, according to the means of the action and according to the materials to which these means are applied; second, special techniques, tending to transform nature; and, third, the pure techniques which uniquely and directly exploit the resources of the human mind or body. The same writer, approaching technology later from a slightly different point of view, divided this study into two principal parts. The first,[8] devoted to the means by which man makes something, reserved a special place for the means of transport but returned to the double classification of techniques according to the elementary means of action (percussion, use of fire, water, air, force) and according to the nature of the materials used (stable, fibrous, semiplastic, plastic, and pliable solids and fluids). The second part[9] concerned the techniques of acquisition (arms, hunting, fishing, cattle-raising, agriculture, mining) and those of consumption (food, clothing, housing). A study of technical methods cannot fail to

5. Mauss, "Les Techniques du corps," *Journal de psychologie* (1936), reprinted in *Sociologie et anthropologie,* pp. 363–86.

6. Mauss, *Manuel d'ethnographie,* pp. 22–68.

7. Leroi-Gourhan, "L'Homme et la nature." *Encyclopédie française,* VII (1936), 10:3–12:4.

8. Leroi-Gourhan, *L'Homme et la matière* (Paris: Albin Michel, 1943).

9. Leroi-Gourhan, *Milieu et techniques* (Paris: Albin Michel, 1945). It should be noted that the distinction between techniques of production and techniques of acquisition had been made by Plato, which shows clearly that it was already being used at a time when technique was still rather close to archaism (see P. M. Schuhl, "Remarques sur Platon et la technologie," *Revue des études grecques,* XLVI [July–December, 1953], 465–72).

profit greatly from these classifications furnished by technology and concerning the productions of technique, but it is not certain that such a study can adopt them entirely, for its subject and its point of view are not exactly the same. For example, there is manifestly a very great difference in method between hunting and cattle-raising, between fruit-picking and agriculture, which, however, are all to be classified under the heading of special techniques of acquisition. On the other hand, weaving, a general technique, and the special technique of clothing, imply methods which, without being identical, are nevertheless related.

Closer to considerations concerning methods, because they refer to *Homo faber* in action as much as they do to the technique which is its manifestation, would be the important differences emphasized by M. Bachelard between precise labor and heavy labor,[10] between the tools which are handled slowly and those requiring speed, or between those controlled by lengthy motions and, on the contrary, the instruments of brute percussion.[11] Anyone who has handled tools and done a bit of "puttering" will readily see, with Bachelard, that there are "mastery coefficients" which are different according to the material which one attacks and the mode of the attack. And the technical knowledge which is itself an act, a work of conquest, is certainly different according to the variations of this coefficient. What a long way there is from the rough chipping of a flint to the polishing of it! These are really two diverse aspects of the technical method.

However, the problem is complex, because for an identical type of tool the division line is not always similar according to whether one looks at its manufacture or at its use. Thus the use of the roughly cut Acheulian ax and that of the finely polished ax can be about the same if it relates in both cases to the felling of a large animal. If the object considered is no longer the ax but the animal, the distinction is rather to be made between hunting and cattle-raising. In both cases we see that it is not necessarily the consideration of the goal which matters here, since it is always a question, in the last analysis, of getting meat to use as food, and that it is nevertheless a long way from unskilled to skilled labor and from simple slaughter to patient domestication.

Technical methods are those of a struggle of man against nature. However, this struggle can take on the aspect of an aggression, or of a

10. G. Bachelard, *La Terre et les rêveries de la volonté* (Paris: J. Corti, 1946), p. 46.

11. *Ibid.*, p. 52.

clever annexation, according to whether man is content with wresting from nature what he needs or seeks to bend her to his desires and to make her docile. This distinction cannot, in any case, be substituted for the basic division among general, special, and pure techniques, but it must, especially in the field of archaic civilizations, be superimposed on that division or, rather, must cut through it perpendicularly. Indeed, a tool can sometimes serve the hunter as well as the herdsman, since it is obviously necessary that the latter kill cattle in order to eat them. And the same stake can serve for digging wild roots or tubers which have been grown.

On the other hand, as far as the instruments themselves are concerned, it is necessary to classify separately, as we have seen, the manufacturing techniques and the techniques of use. To construct a boat, you cut down a tree and hollow out the trunk, which is work related more to the art of forestry than to that of navigation. Similarly, the production of fire and its multiple utilizations bring into the picture very different kinds of technical knowledge.

In brief, the whole spread of technical aptitudes on the archaic horizon could be presented in the following way. Among the general techniques and the techniques of manufacture it would be necessary to distinguish from the point of view of methods those which are related to pure percussion and permit a simple, rough modification of the natural material and those which tend to shape, polish, fashion, and, above all, change the material. Obviously, it is often the material employed which suggests a given technique, as Bachelard has pointed out, so that this classification would coincide rather well with the one Leroi-Gourhan bases on the degree of solidity or fluidity of the materials. But what is important for the study of methods is the fact that, in one case, man obtains implements which do not differ essentially from what nature furnishes him, while, in the other case, he creates objects which are truly new. Thus the flaked or chipped piece of flint or the roughed-down stick is still a bit of stone or wood, while the vase is totally different from the lump of clay, and the basket is different from the reed. And, what is more, in making fire by friction, primitive man introduces something entirely new. In one case, that is to say, in what one might call "techniques of simple or direct manufacture," man takes the material furnished by nature, modifying it merely by gestures which are, although skilled and elaborate, nonetheless as natural as those of

striking or biting his quarry. In the second case, that is, in what could be termed "techniques of complex or indirect manufacture," *Homo faber* humanizes nature, as it were, and obtains completely new effects by accomplishing actions which are not at all suggested by any animal-like impulsion. Metallurgy obviously marks one of the peaks in this field, for it bends hard matter and subjugates it to the forms conceived by and for man.

As for the special techniques and the techniques of use, in which we must classify the pure techniques—those pertaining to the body in particular—they show, from the same point of view, an even sharper duality. Indeed, whether their goal is food, protection, locomotion, comfort, or pleasure, they imply different kinds of knowledge according to whether they tend to pillage nature or to domesticate it.

Thus, in a first category, linked to a method of *direct acquisition,* one might represent those techniques consisting by and large in taking things as they are offered by nature. If it is a matter of finding food, there are hunting, fishing, harvesting wild plants, gathering food from the ground, and digging roots. If he must defend himself, primitive man has war, in which he kills. For protection there is the use of caves and other natural shelters and the use of animal skins as clothing. As for locomotion, it is limited to the bodily techniques—walking, running, swimming. In a second category, characterized by the technical method which *organizes, bends, or subjugates nature* to the ends of man, the picture is quite different. Above all, cattle-raising and agriculture both contribute to feeding man. War no longer has as its aim to kill the enemy only but also to reduce him to slavery. To protect himself, man builds dwellings and weaves clothing. To move about, he has recourse to animal traction or to navigation. For personal comfort he has fire, which warms him and permits him to cook his food.[12] In sum, for the techniques of manufacture as for the techniques of acquisition, it seems that we may distinguish two types of methods. And, if we seek what may be in common between these two binary divisions, we perceive that it is particularly the time criterion which is indispensable in the case of techniques of manufacture and in those of acquisition. As far as the latter are concerned, it is obvious: the farmer

12. Plato made very clear distinctions, among the techniques of acquisition by capture, between those which are governed by struggle and those which procede by trickery. In the first, that is, in the area of violent acquisition, he placed war, hunting, and fishing (Schuhl, *op. cit.*).

who plows now will harvest only later the fruits of his labor, and the herdsman cares for an animal for a long time before eating it. The savage living by hunting and simple fruit-picking sees, as it were, no time interval between his action and the profit he derives from it. In the toolmaking field the same thing holds true. The polished ax represents a victory over impatience, a stretching-out of the technical time. It is no doubt because this slowing-down of action is contrary to natural impulse—for, in fact, it distinguishes human technique properly so called from that which merely prolongs animal behavior—that our ancestors first chipped stones instead of polishing them. Otherwise the evolutive order would have been turned the other way around. Indeed, contrary to what the layman thinks, it is more difficult to make a Paleolithic ax than a polished Neolithic ax. The former takes less time but requires a skill which is difficult to acquire.[13] The plurality of collective durations, on which Gurvitch has insisted, consequently assumes a particular aspect when it is materialized in technical achievements. This is the difference between the short duration of aggressive, quasi-animal technique and the patiently extended time of the technique which tends to shape and subjugate nature. The latter, insofar as both manufacture and acquisition are concerned, leads to establishing a typological distinction between the technical method of instantaneous or direct effect and the technical method of deferred or indirect effect.

Of course, this classification can be only approximative and cannot offer distinctions with clear-cut lines. And, above all, it is valid only on the level of archaic culture, where we find mingled together the technical method of simple or direct manufacture and of acquisition by force and the technical method of complex or indirect manufacture and of patient acquisition by a conquest which humanizes nature. However, this mixture can occur in variable proportions and balances, and we see that, from this point of view, archaic civilization shows different levels.

The notion of a unilinear evolution, marked out in the necessary stages, is easier for the mind to conceive concerning technique than it is for the other areas of culture. It is certain, for example, that the plow comes after the hoe and the swing plow and could not precede them in the history of progress. But this remarkable evolutive simplicity can

13. Cf. Kroeber, *op. cit.*, p. 629.

only be true, strictly speaking, for one kind of technique. When it is a matter of comparing one society to another, or of classifying different civilizations from the point of view of technique in general, one encounters difficulties with which, for example, prehistory does not have to be concerned insofar as it limits itself to a single criterion: lithic toolmaking.

Indeed, if we wish to compare archaic cultures with each other in the matter of technical methods, it would be vain to hope to establish a typology which is both general and strict at the same time.

In order to make a more thorough search for the elements of a typology of archaic societies from the point of view of the methods of technique, it would perhaps be advisable to go back to the first manifestations of *Homo faber* to see how his working activity is differentiated from that of the animal and how it is established little by little as truly specific.

It is not by the use of instruments and tools that we must characterize human technique, first, because we would thus eliminate the bodily techniques and, second, because certain animals have recourse to the use of tools. With them, however, it is a matter of specific, hereditary operating schemes or of occasional inventions, having no follow-up, depending on whether we are dealing with the manifestations of instinct or with the abilities of a particularly clever anthropoid ape. There are many well-known examples of this. They prove that the human technical method is characterized by tradition combined with invention.[14]

What were the first achievements of technical knowledge among the Paleo-Hominians? The *Sinanthropus* of Choukoutien possessed fire but probably did not know how to make it. The existence of a pre-Chellian lithic industry is still a matter of conjecture. But we do know that the oldest ancestors of man, going all the way back to *Pithecanthropus,* were already half-vegetarian, half-carnivorous. Consequently, they were hunters, and we can surmise that they could not have existed if they had not at least used stones or pieces of quartz to kill heavy game and clubs to knock out small animals and also to poke into the ground to dig up roots. If we next consider the upper Paleolithic man, tools, as Boule writes, could only tend "inevitably . . . towards a few

14. André Varagnac, in *De la prehistoire au monde moderne* (Paris: Plon, 1954), pp. 47–49, has aptly emphasized the importance of tradition in technical progress.

very simple ends—cutting, scraping, piercing,"[15] and toward making the blow of the human fist more efficacious. In the age of the mammoths, Neanderthal man, with the Mousterian industry of the mid-Paleolithic period, confines himself to perfecting the manufacture of flake tools by making a better distinction between the points and the scrapers. But in the upper Paleolithic period, while *Homo sapiens,* with his representatives from Grimaldi, Crô-Magnon, and Chancelade, is assuming his true physiognomy after the disappearance of the Neanderthalians, the industries include clearly specialized types: scrapers of flint, Aurignacian bone points, Solutrean leaf points, and, finally, Magdalenian sewing awls and harpoons of bone. It is probably during this period also that man learns to make fire. And, above all, this is the age of the great artistic creations, evidenced in the caves of Lascaux and Altamira. Still more recently Mesolithic man adapts himself to particular conditions of life: in a temperate and humid climate he works out Azilian and Tardenoisian toolmaking, as delicate as it is precise, while in the northern regions, to cut down trees and build boats and cabins, he makes the paring knife (*tranchet*), the pick, and the Campignian-type ax. There already existed at that time, as Varagnac says,[16] actual workshops producing carpenters' tools and hafted axes. We are at the dawn of a great change, and this era can be called proto-Neolithic. The evolution of techniques has still been revealed only by the differentiation of tools. However, technical methods all through the Paleolithic and even the Mesolithic periods in fact undergo no great changes except for two points: the production of fire and artistic creation (perhaps inspired, moreover, by preoccupations of a magic nature). On the whole, useful techniques remain limited to direct appropriation of natural resources: man kills the animals he hunts down, or which are captured in snares or caught in fishing; he digs up roots to be cooked; he dwells in natural shelters or protects himself from the wind by makeshift screens.[17] Perhaps, however, the Campignian men already knew how to harvest the seeds of plants in baskets in order to sow them —but they did not plow the ground. The big step forward was taken in the Neolithic period. That this term, etymologically, should desig-

15. Marcellin Boule and Henri V. Vallois, *Fossil Men* (trans. Michael Bullock from the 5th French ed. of *Les Hommes fossiles* [London: Thames & Hudson, 1957]), p. 149.

16. Varagnac, *op. cit.,* p. 59.

17. Lips, *op. cit.,* p. 12.

nate a new technique for stone tools is not without importance, for the polished ax marked, indeed, in the procedures of manufacture, a triumph for slow work over brute action and a concern for creating truly humanized forms. The simultaneous development of pottery and basketwork, more marked no doubt in the New World than in the Old, at the end of the period of pure and simple acquisition, is inspired by the same tendency to shape rather than to break. But it is the appearance of agriculture and cattle-raising which certainly constitutes the major contribution of the Neolithic. It is on a par, moreover, with modifications in the other industries. Flint, on the one hand, is in competition with harder rocks brought from a distance, and in the very working of flint a true division of labor appears which is particularly evident during the Robenhausian period. On the other hand, at the same time that basketwork and pottery, which quite probably also had their specialist-artisans, were being developed, the progressive abandonment of the nomadic life involves the building of real, if not comfortable, dwellings, such as the houses on pilings. Thus the principal techniques that we may observe today among peoples without writing are already all in place (with the exception of African metallurgy)[18] in the phase of prehistory called Neolithic or Holocene. And, moreover, the transition from the Paleo-Mesolithic to the Neolithic clearly gives the impression that the greatest change, insofar as technical methods are concerned, is effected at the time when man is no longer content to perfect the aggressive procedures of direct acquisition and of simple production but, on becoming a farmer, superimposes on them and gives preference to patient procedures which bend or subjugate nature to human ends and which are accompanied by complex or indirect techniques of manufacture. In the first phase, the human technical method seems to be differentiated from the possibilities of the anthropoid technical method only by the eminent role of tradition which permits improvements from generation to generation, but it is not differentiated by its orientation. In the atmosphere of the Holocene period, on the contrary, technical method seems to lose contact with animal impulse and tends truly toward humanizing nature.

If we now compare and collect into one whole the data of prehistory and of ethnography, we can ask what the elements of a typology of

18. Pre-Columbian metallurgy in America did not play a determining role in the whole development of techniques.

technical methods in archaic societies can be. We must immediately rule out not only the classifications which are entirely modeled on the schemas of prehistory[19] but also the traditional law of the three cultural conditions (hunters-fishermen, nomad-herdsmen, and sedentary farmers). The criticisms made of these typologies are well known and seem to be definitive.[20] In any case, it is clearly established that the domestication of animals, except that of the dog, has rarely, if ever, preceded agriculture. If we confine ourselves to the observation of technical methods, a binary typology suggested by prehistory (but nevertheless in no way dictated by the categories that prehistory justifies from the single viewpoint of the lithic industry) seems to avoid all these objections. Let us repeat that any typology (as is often the case in the human sciences) is valid only in general and that no society adheres perfectly to a category. What we can say is that there are two possible aspects to the technical method: one which consists, for man, in taking what is necessary to him, and the other which tends to humanize nature. And among the archaic cultures there are some which are dominated by the first aspect, and others by the second. What name shall we give to these two types, approximately designated? Certain technologists establish a distinction among "barbaric" peoples.[21] This term, which would be useful, unfortunately has a pejorative echo. Let us therefore simply use the term "peoples of primary stage" for those whose technical method is oriented toward direct acquisition and simple manufacture, like the Paleolithic men, and "peoples of secondary stage" for those whose technical method tends to humanize and domesticate nature through processes of complex manufacture, as was done in the Neolithic period. We mean here only the "dominant" characteristics of these cultures, since certain practices—for example, the production of fire—although they are complex and indirect, are known in the primary stage, an exception being made for certain peoples, like the Andamanese, who knew practically nothing of what belongs to the secondary stage.

19. E.g., the classification of Menghin in *Weltgeschichte der Steinzeit* (Vienna, 1941), which establishes a parallelism between the pre-Chellian culture and that of the Veddahs; between the Mousterian culture and that of the Tasmanians; etc.

20. G. Lucien Febvre, "La Terre et l'évolution humaine," in *L'Évolution de l'humanité* (Paris: Albin Michel, 1922), pp. 291 ff.; C. D. Forde, *Habitat, Society, and Economy* (London, 1934), p. 461; M. J. Herskovits, *Man and His Works* (New York: A. A. Knopf, 1948), p. 247.

21. Singer, Holmyard, and Hall.

With these reservations made, and they are important, can we hope to classify the "present-day primitives" according to the two types of technical methods, primary and secondary, with as much clarity as the Paleolithic is distinguished from the Neolithic? It is natural to place in the first category the hunting and harvesting peoples, such as the Tasmanians, the Fuegians, the Bushmen, the Pygmies, and the Australians, and in the secondary stage the farming Indians of the western United States, especially the Pueblos, the Indians of the great Central and South American empires, the Polynesians, and certain African blacks. On the other hand, for reasons we have given, we may hesitate over the case of the Eskimos and certain other peoples, such as the Indians of the eastern part of the United States, who tilled the soil a little but remained essentially hunters, or the Californians who, without practicing agriculture, improved the yield of wild plants by irrigation. And it would be necessary within each type to indicate precisely for a given technique the degree of advancement of knowledge. For example, concerning fire, there is obviously a great difference between the peoples who, like the Andamanese, preserve the flame as *Sinanthropus* did, without knowing how to produce it, and those who obtain it by striking pyrites together, those who produce it with great difficulty by groove friction, like the Tasmanians, and those who light it with more perfected equipment, such as the bow drill. Concerning lithic industry, the Pygmies occupy a place apart because they have so little of it; the Tasmanians have tools which resemble those of the Mousterian age and others which remind us of the Aurignacian; the Bushmen, like other African clans, seem really to be the direct heirs of the African Capsian, who corresponds to our upper Paleolithic man. But that does not change the fact that the Pygmies and the Bushmen have an effective weapon in the bow with poisoned arrows. It would also be necessary to make a distinction between the technique of hunting large game, practiced by these African tribes, and that of hunting small game, which, among the Australians, makes the boomerang very useful. As for agricultural peoples, their techniques can also show important shades of difference which we have already mentioned. The Pueblo Indians, for example, practiced irrigation on a large scale and with much success in the pre-Columbian period; but we must not forget that in all America, although the continent was a corn-producer, the plow was unknown, just as in Oceania. That does not alter the fact

that agriculture entailed among these peoples its full consequences, for example, the development of village handicraft and the construction of comfortable houses. Finally, the art of navigation has often evolved in an independent manner, utilizing a form of technical knowledge which is not always on the same level as that shown by the same people in other areas. Different circumstances can obviously explain this, for in an identical stage of technical knowledge we observe spectacular advances or delays from field to field. For the culture of the Eskimo, the very particular geographic environment explains many things. In a more general way, there can be no agriculture without arable lands, no metallurgy without ore. The natural environment also creates needs. Thus the cold obliged the Eskimo to dress warmly. But physical environment does not explain everything. The presence of ore does not create metallurgy. The Eskimos domesticated the reindeer, but the Canadian Indians did not know how to utilize the caribou in the same way. The American Pueblos were masters of the art of pottery, whereas the Maori of New Zealand made no use of the clay they had in abundance.

In brief, we can see that the typology which distinguishes two developmental stages in technical methods bears only upon the whole and does not rule out, in this or that particular domain, exceptions which are not always explained by the external circumstances. However, if one chooses within each of the two types characteristic examples of each stage, it is no less true that then the over-all differences are obviously applicable. Thus between the technical method of the Tasmanians and that of the Indians, what a divergence there is in orientation! The former take with great skill what nature offers them. The latter, as it were, use and consume almost nothing which has not been prepared for and adapted to the needs of man. If agriculture plays a determining role in this typology, it is because it functions at the same time as the school and as the evidence of the change in orientation. The growing of plants, as elsewhere the raising of animals, indeed implies a technical method markedly different from that of the hunter, fisherman, and gatherer, for it requires of man a victory over his natural impatience. His work is not immediately remunerative; he is controlled by foresight. It even implies the giving-up of what he could take immediately. This is in one sense not at all natural, or, if one prefers, it does not tend in the same direction as the technical invention of the

anthropoids, or, in a general way, in the direction of that of animals which are not guided by a complex instinct. Man practically turns his back on the impulses which appear in the techniques of the first stage. Clear proof of the difficulty of breaking with the first tendencies of technical knowledge seems to lie in the fact that one often has a great deal of trouble in bringing certain peoples who have remained in the first stage to adopt agriculture, despite all the advantages that it implies for them, whereas, on the contrary, they quickly and enthusiastically adopt new tools and instruments which do not involve such a change for them. Lips cites, among several striking examples, the case of the Bororos, traditionally hunters and pickers, to whom the Brazilian government gave ready-prepared lands, tools, seed grains, and food to live on until harvest time and who profited from the gifts by having a good time and by felling trees instead of cultivating the soil as they had been instructed to do.[22] In a word, the technical method of the second degree is distinguished from the other by the fact that it does not follow the natural impulse of *Homo faber*. It is reflective, patient, and organizing, while that of the first degree is intuitive, spontaneous, and aggressive.

After having distinguished the two principal aspects which technical method reveals in archaic societies, the next step would be to consider the method of the archaic techniques in its most general aspect, still within the framework of these societies. Its relationships with other human activities could thus be examined, so as to determine whether it is properly original or whether, on the contrary, it is reducible to other intellectual procedures with which we often see it associated (e.g., religion, magic, and science).

The fact that in many mythologies the inventors (demiurges) may be divine or quasi-divine beings, or rivals of the gods, could suggest a religious origin for techniques. Certain writers, Geiger, for example, have carried this theory quite far.[23] He, like Espinas, asserts that the wheel was first invented for ritual uses. Thus the first rotating instruments, in the Vedic epoch, served to light the sacrificial fire or to produce butter for offerings. The prayer-wheel is, he says, anterior to the vehicle wheel, and, even before men had the idea of cooking food or

22. Lips, *op cit.*, pp. 81–82.

23. Geiger, *Zur Entwicklungsgeschichte der Menscheit* (Stuttgart, 1871).

warming themselves, they were offering meat to the gods after having purified it by fire. Reubeaux[24] and René Hubert,[25] also citing the wheel and fire as examples, have defended an analogous thesis. Ruyssen has presented a judicious criticism, first, by showing that certain facts contradict the conclusions drawn by these writers from the Vedic documents and, second, by insisting on the absence of all mystic atmosphere, of all mystic arrangement of facts, insofar as simple techniques like that of the stone and the club are concerned. Over these man creates no problems for himself because he "literally sees himself working and succeeding," so that between his invention and the obtained effect "there is no room for the marvelous."[26] Finally, in the case of more complex inventions, aside from the likelihood that man did not get the idea of profiting immediately from the advantages they offered him, it is quite probable that the myths were forged after the fact to explain techniques over which men were still marveling and whose origin they had forgotten. It is probably in this way that the numerous legends concerning fire-making were born—certain of which, moreover, attribute this invention to events having no mystic aspects. Thus the Siberian Yakuts tell the story that an old man invented fire by chance while striking one stone against another for amusement. Often, too, the myth is worked out as an answer to questions which a curious mind naturally asks itself when faced with the results of a complex technique. Among the peoples who produce fire by rubbing pieces of wood together, we often find myths explaining how the fire was deposited in certain trees, from which it is later drawn.[27]

It is possible that in some cases it was on the occasion of the preparation of certain rites that practical discoveries were made; but that does not mean that they have a religious origin. For example, even if the first inventor of the wheel was the man who had conceived the prayer-wheel, in no way does that cause the technical knowledge to be derived from the mystic knowledge. It is as if, because the first fire-maker might have been, as the story goes in the Yakut myth, a man who did not

24. Reubeaux, *Cinématique,* trans. Debise (Paris, 1877), p. 77.

25. R. Hubert, *Manuel élémentaire de sociologie* (Paris, 1935), p. 127.

26. Ruyssen, "Technique et religion," *Revue philosophique,* October–December, 1948, p. 436.

27. J. G. Frazer, *Mythes sur l'origine du feu* (Paris: Payot, 1931), pp. 131, 273, 276.

know what to do with his hands, we were to conclude that the cause of technique is idleness. We must not confuse causes and circumstances. In any event, even if technique and religion are associated in the total social phenomenon, it is no less true, as Lecoeur indicated,[28] that the intentions and the interests of *Homo faber* and of *Homo vates* are not the same.

But the fact pointed out by Ruyssen, that myths flourish around techniques which largely and generally correspond to those which we have associated with the method of the second degree and not around the others—those techniques which are not a subject of wonder, their results being of the same nature as the premises and the action—is of great importance and develops logically from the very characteristics which have served us in distinguishing the two types of technical method from each other. We have, in fact, tried to show in another study[29] that anguish and mystic worry are aroused by the divine-will characteristic which emanates from every being, every thing, and every event which symbolize man's loss of his conditioning—in other words, that which measures the distance between animal nature and human nature. If that is true, we should not be surprised to see that the techniques of production or acquisition based on aggression or direct capture, which characterize the first type of method, do not generally have ritual or mythical extensions. On the contrary, inventions like that of metallurgy, which show man his capacity for demonstrating a technical knowledge of a different orientation, cause to well up in him the feeling of a contact with the divine-will element and bring in either religious rituals which project the invention onto a transcendant plane in order to justify it or defense reactions which are translated by interdicts. To the first of these two ritualistic solutions for the anxiety born of the technical method of the second degree belong the Promethean myths. These justify an invention having a divine-will appearance by projecting it onto the plane of the transcendant archetypical model and even by transferring the feeling of guilt to a hero who does the expiating, with all the rites which are found in this mythical atmosphere so aptly described by Roger Caillois.[30] As for the other solution, we can cite as

28. Ch. Lecoeur, *Le Rite et l'outil* (Paris: Presses Universitaires de France, 1939), p. 20.

29. J. Cazeneuve, *Les Rites et la condition humaine* (Paris: Presses Universitaires de France, 1958).

30. R. Caillois, *Le Mythe et l'homme* (Paris: Gallimard, 1938), p. 28.

examples the iron and the smith taboos.[31] And still we are speaking only of the techniques of manufacture. The mythical overtone of the technical method of the second degree is even more obvious in the area of use and of acquisition. We can think, for example, not only of agrarian myths concerning inventions but also of all the mystic of fecundity and of death and resurrection, which have brought many scholars to consider, and not without reason, that the birth of agriculture had created the framework of renewal which led to the great religions of salvation—with all the consequences which that represents, even in the history of morals. This subject deserves fuller development. We must limit ourselves to noting that the very study of the relationships between technique and religion leads us, not to see the second as heir to the first, but to appreciate more fully the difference between the two types of technical method.

The relationships of technique to magic are not of the same order, for magic does not propose explanations and etiological myths but claims to act directly upon nature and, consequently, establishes itself as a rival of technique. Whereas in religion the believer can obtain a practical result through rites and particularly through prayer only through the medium of a transcendant power, magic, on the contrary, consists in practices which are professed to be efficacious in themselves.[32] Like technique, it presents itself as a set of prescriptions. If magic has occasion to appeal to supernatural beings, to demons, these do not, like divinities, have their independent will but are scarcely more than figurations of the immanent power of the magical action. Therefore certain writers, such as Maurice Pradines,[33] have gone so far as to call this a "thaumaturgical" technique. That is a matter of vocabulary. However, it is more convenient and more in accord with current practice to distinguish magic from techniques properly so called by defining the latter as did Mauss. He, specifying the concise formula which we have

31. An inventory of these will be found in Frazer's *Tabou, les périls de l'âme* (Paris: Geuthner, 1927), pp. 190 ff.

32. Cf. G. Gurvitch, *Essais de sociologie* (Paris: Recueil Sirey, 1938), pp. 202 ff. (difference between the magical *mana* and the religious-sacred, based on the the opposition between immanence and transcendence).

33. M. Pradines, *Traité de psychologie générale* (Paris: Presses Universitaires de France, 1946), Vol. I, Part II, Sec. 2 (but this writer recognizes the fact that the claim to utilize the principles of magic as one would those of technique is based on nonsense [*ibid.*, p. 142]).

quoted, wrote, precisely to avoid this confusion: "The term 'technique' is given to a group of motions, acts, which are generally and for the most part manual, organized, and traditional, combining to reach a goal which is known as physical, chemical, or organic."[34] However, even when we adopt this narrower definition, the question of the relationships between technique and magic is not resolved. In the absence of identification, there may yet be affiliation or even a community of origin and principle. It is thus, according to Lévy-Bruhl, that the primitive mentality tends to understand all operations which have a collective character. When he thought there was a logical difference between primitive mentality and modern mentality, not only did he refuse, in answer to an objection of Louis Weber,[35] to find in technique a germ of rational and scientific knowledge hidden in primitive societies but also, as M. Davy has emphasized,[36] he conceived of the role of technique as a subordinate one. According to him, primitive men, while manufacturing implements according to procedures dictated by practice, immediately attributed their success to supernatural powers, not granting to secondary, mechanical causes a sufficient efficacy. For these people, he writes, "that instruments shall be well made is not the most important thing, but that they shall be successful."[37] Technique would consequently be inseparable from magic. Malinowski presented the relationships between magic and technique in a very different way, for he conceived of the latter as absolutely independent of the mode of knowledge described by Lévy-Bruhl under the term of prelogical primitive mentality.[38] Basing his conclusions particularly on his ethnographical observations among the natives of the Trobriand Islands, Malinowski believes that archaic peoples accomplish properly so-called technical operations in a very positive manner. Magic is not involved but is superimposed to the precise degree to which the success of the operations is not assured. Thus, among the Trobriand Islanders, naviga-

34. Mauss, "Les Techniques et la technologie," *Journal de psychologie,* January–March, 1948, p. 73.

35. *Bulletin de la Société Française de Philosophie,* 23d Year, No. 2 (April, 1923), p. 37.

36. G. Davy, *Sociologues d'hier et d'aujourd'hui* (Paris: Alcan, 1931), pp. 292–94.

37. L. Lévy-Bruhl, *Primitive Mentality,* authorized trans. by Lillian A. Clare (New York: Macmillan, Co., 1923), p. 306.

38. B. Malinowski, *Magic, Science and Religion* (New York: Doubleday, Doran & Co., 1954), pp. 25–26.

tion on the lagoons, involving no great risks, is carried out without any appeal being made to magic, whereas no one would risk going on the open sea without having recourse to magic.[39] Eugene Dupreel proposes an analogous interpretation of the archaic behavior by distinguishing between what he calls the "A technique," that is, "the aggregate of duly proved means," which makes success simply probable, and a "B technique," which is magical and is supposed to fill the gaps in the first technique by acting upon the margin of chance which the first admits.[40] To Malinowski's interpretation Lévy-Bruhl objected that, in societies other than those of the Trobriands, the use of magic is not at all restricted to enterprises of doubtful success.[41] Thus, among the Papuans of Kiwai Island, magic is no less indispensable for building a house than for building a boat. But Malinowski actually has clearly specified that the share which technique leaves to chance, to risk, and consequently to the action of magic can be very subjective. Thus in the Trobriand Islands the magician plays a great role in the cultivation of gardens.[42] This is not a very hazardous enterprise; but it involves a technique which is vital for this people and which, for that reason, brings in emotional factors which widen in their eyes the zone of unforeseeableness, creating, in short, as Nadel says,[43] artificial risks. With this reservation, Malinowski's theory seems clearly to account both for the fact that archaic peoples do not always trust their positive steps and for the minuteness with which they nevertheless accomplish them—proof that magic is superimposed upon the action as a complement but is not involved in it. Within these precise limits it is certain that, using Dupreel's terms, the B technique can appear as indispensable as the A technique and, in a sense, can facilitate the development of the A technique, because it gives man a greater illusion of security and prevents

39. *Ibid.*, p. 31. See his "Culture," in *Encyclopaedia of the Social Sciences,* IV, 636; *Mœurs et coutumes des Mélanésiens* (Paris: Payot, 1933), p. 144; and *Coral Gardens and Their Magic* (London: Allen & Unwin, 1935), pp. 435–44.

40. E. Dupreel, *Sociologie générale* (Paris: Presses Universitaires de France, 1948), p. 209.

41. Lévy-Bruhl, *L'Expérience mystique et les symboles chez les primitifs* (Paris: Alcan, 1938), p. 53.

42. B. Malinowski, *Argonauts of the Western Pacific* (London: Routledge, 1922), pp. 420–21.

43. S. F. Nadel, "Malinowski on Magic and Religion," in *Man and Culture,* ed. R. Firth (London: Routledge, 1957), p. 193.

him from yielding to discouragement.[44] It is even possible, as Mauss maintained, that magic has in certain cases led to true inventions,[45] but as an adjuvant circumstance and not as a cause. And we must clearly emphasize, on the one hand, that technique does not derive entirely from magic, as Gurvitch specifies,[46] since it develops without recourse to thaumaturgy in those cases in which it appears as directly efficacious, and, on the other hand, that magic is the auxiliary of technique under one alone of its aspects—for black magic would lend itself rather poorly to the optimistic interpretations of Malinowski.[47] Finally, technique, inversely, can arouse the magic appeal by the mystic atmosphere with which we have seen it to be surrounded when it emanates from the skill of the second degree and appears itself as thaumaturgical. Thus smiths often figure as magicians. Here, magic is the reverse of taboo and, like it, derives from the divine-will characteristic of the invention which removes man from his preceding conditioning.

But Malinowski, by disassociating technique from mystic mentality, and Mauss, by deriving it from magic, found themselves in agreement and also joined Frazer in the thought that technique is located on the path leading to science. When we limit ourselves to the observation of archaic societies, this thesis must evidently be posed with modesty. There can be no question of finding an elaborate science in these civilizations. Consequently, Malinowski, after having insisted on all the kinds of knowledge which are implied, for example, in the nautical technique of the Trobriand Islanders, declares that, "if by science be understood a body of conceptions, based on experience and derived from it by logical inference . . . then there is no doubt that even the lowest savage communities have the beginnings of science, however rudimentary."[48] Certainly, he adds, science, among archaic peoples, is not consciously worked out and formulated. But, if we had to conclude

44. O'Reilly, "Notes sur la théorie de la magie et de la religion chez Bergson et chez Malinowski," *Journal de la Société des Océanistes,* December, 1952, pp. 285–86. This writer compares Malinowski's position to the Bergsonian theory which defines magic as a means of insuring one's self against unforeseeablness and of fighting against discouragement.

45. Mauss, *Sociologie et anthropologie,* p. 69. Cf. also Hubert and Mauss, in *Année sociologique, 1902–3,* pp. 144–46.

46. Gurvitch, *op. cit.,* p. 207.

47. This is Nadel's objection (*op. cit.,* p. 194).

48. Malinowski, *Magic, Science and Religion,* p. 34.

from that that it does not exist, then by the same reasoning we should be led to say that these savages know neither law, nor religion, nor government.[49] In a word, his conclusion is clear: "We now know that primitive humanity was aware of the scientific laws of natural process."[50]

Actually, between technique and science there is not only the difference we find between the simple and the complex. The observation of primitive techniques permits this conclusion. Indeed, Malinowski's reasoning is valid only if it can be applied not alone to the practical activity of the Trobriand Islanders but also to all rudimentary technical activity. Now how does this activity, as we see it manifested, for example, in Paleolithic industry, differ from that of certain anthropoid apes? Between the action of flaking a piece of flint to make a Chellian hatchet or of digging up roots with the aid of a previously cut stick and the behavior of a chimpanzee who thins out a piece of bamboo with his teeth in order to fit it into another stick, we could not establish a very clear line of demarcation—unless it lies in the fact that the caveman transmitted his technique to his congeners and made of it a tradition, a basis for later progress. But, if the technical evolution is the result of inventions and traditions, it is by the first of these terms, not the second, that it might contain the embryo of scientific knowledge. Then, if Chellian industry is an implicit science, we have to say as much for that of the chimpanzee. In reality, there is no science which is not explicit science. Technique can utilize laws without a knowledge of the laws being implied. That is what the billiard player does, to go back to a comparison which Lévy-Bruhl has made famous. Goldenweiser aptly writes: "The logic observed in early tools and weapons, traps and snares, pots, houses, and boats, is the logic of nature itself, the logic of the objective relations of things, which through the medium of action, molds the mind so inevitably and smoothly as to be almost wholly unconscious . . . the aim in all of these pursuits is not to know but to do."[51]

Technical inventions can obviously put scholars on the path toward discoveries and new theories, and, inversely, the progress of physics and

49. *Ibid.*, p. 35.

50. Malinowski, *A Scientific Theory of Culture* (Chapel Hill: University of North Carolina Press, 1944), p. 196.

51. A. A. Goldenweiser, *Early Civilization: An Introduction to Anthropology* (New York: F. S. Crofts Co., 1932), p. 406.

of chemistry often carries with it important technical applications. In our time there is a sort of dialectic of progress which makes the techniques and the sciences co-partners, without however taking from them their specific nature, on which Gurvitch insists.[52] But in archaic societies there is no explicit science. Everyone recognizes that. It seems that, on this level, the simple techniques, by their direct efficacy which is apparently without mystery, do not set scientific knowledge in motion and that, if, on the contrary, the complex techniques do lead man to ask himself questions, it is of the religious apologue that he asks his answers.

Thus technique in archaic societies reveals a method, an intellectual step, which already appears in its specificity and at the same time offers two aspects which broadly sketch a binary typology. In a first motion, a technical method which seeks instantaneous and direct effects prolongs the animal impulse. In a second orientation, a method which seeks delayed and indirect effects substitutes organization for aggression by creating, on the one hand, manufacturing techniques of which metallurgy is the highest achievement on the archaic level, and, on the other hand, techniques of acquisition. These develop into cattle-raising and farming and all activities which evolve in an extended time and in whose practice man moves away from animal techniques in order to mold and subjugate nature according to his ends—in sum, to humanize it. But in these two forms technique does not become confounded by its methods with either religion, magic, or science.

52. Until publication of the author's book on the sociology of technical knowledge see Gurvitch, "Wissenssoziologie," in *Die Lehre von der Gesellschaft,* ed. Eisermann Stuttgart: Enke, 1958, pp. 433–34.