Logicism: a French view of archaeological theory founded in computational perspective

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Theory in archaeology has largely been an anglophone enterprise, and perhaps too inbred for its own good. The main French school, known particularly from the work of Alain Gallay and Jean-Claude Gardin, was well represented at a CNRS–NSF conference on 'Symbolic, structural and semiotic approaches in archaeology', held at Indiana University, Bloomington (IN) in October 1987, where a small group of American, British, French and Swiss archaeologists met to confront their theoretical views. Here Alain Gallay sets out the fundamentals of the 'logicist' position.

For many years, the anglophone literature on archaeological theory has dominated the European scene. Even though interest in epistemological problems remains marginal on the continent, we would like to show here:

- that a theoretical reflection does exist in the French-speaking archaeological community although most everyday archaeological practice is not affected by it;
- that this thought, related to the currents of logical empirism and positivism, is radically different from some of the most recent anglophone approaches, which run closer to the subjectivist trend; and that it may constitute one of the few ways that would allow the social sciences in general, and archaeology in particular, to emerge from the deadlock these studies find themselves in, when it comes to going beyond the descriptive level.

This survey does not provide a full panorama of theoretical archaeology in the French language; it concentrates on a well-defined current of thought, that could be called the logicist trend inasmuch as a label is needed. This paper does not cover the non-theoretical, empirical approaches, practised with a certain success by many archaeologists, nor the works whose theoretical basis is borrowed from the anglophone literature.

Logicist archaeology thus defined is not completely free from contradictions. Its positions seem to be more or less radical. Also, in many cases, one may observe an important gap between theoretical thought and real practice in empirical research (see e.g. Gallay 1981a). This situation, however, is not surprising since the adjustment between theory and practice cannot be achieved smoothly and without some contradictions.

Although mainly based on the works of J.-Cl. Gardin, our interpretation of this movement is personal. The following lines are by no means the manifesto of any given group, yet they derive largely from some of the propositions made at the Bloomington meeting. I shall try only to bring forth the coherence of some of the more basic points by proposing a logical sketch of their interrelations.

An appendix to the bibliography lists the French-speaking communications presented at the meeting at Indiana University. They will eventually be published; since their titles may be revised, we will quote them with proper reserve. The references given in the text are under the form (Author, Bl.) meaning: name of

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the author, communication given at Bloomington. We wish to emphasize here how much the present reflections owe to the works and discussions that we have held with their authors.

Theoretical archaeology on the anglophone side

It is not our aim to give a complete review of this subject. The currents of thought are many-sided, and the accelerated rythm in which 'new' approaches are being proposed to us, from the New archaeology to the numerous so-called post-modern archeologies (structural, cognitive, processual, contextual, symbolic archaeologies, amongst others), makes it difficult to synthesize the anglophone side.

The papers presented at the Bloomington conference show well this diversity. Two main currents of thought were discernible.

First, for some, it is possible to discover laws that preside over the development of human societies. This mechanistic point of view admits that history possesses its proper laws, and that these could be modelled on the laws of science. These laws affect every cultural domain, from the most elementary techno-economical structures to the highest ideological aspects.

Archaeology can lead to the complete reconstruction of past societies with their technological, economical, ethnical, social and ideological features.

The language of epistemology and philosophy of science may serve to establish the foundations of our approach to the empirical world, and provide the logical basis to our interpretation of material remains.

The second current of thought concentrated on the search, other than in art or science, of a third way. Its characteristics seem to be the following:

- In the Universe, man forms a highly complex specific entity. The intrusion of symbolics in his culture makes him a totally exceptional being. It is thus impossible to use the same approaches in the study of man as those that have proved their worth in the natural sciences.
- The Human Sciences thus form a 'third culture', distinct from Art and Literature as well as from the Science of nature.
- It must particularly concentrate on the reconstruction of symbols and world-views that, thanks to their originality, establish the specificity of human societies and set up their cultural choice.
- The approach to human reality, present and past, must take into account the subjectivity as well as the cultural and affective identity of the observer.

This position brings the hermeneutic current to mind (Gardin, Bl.). It is only by integrating the observer's personal and social parameters that we can reach understanding from 'inside' human phenomena.

Consequently, it is not possible, nor desirable to validate the proposed constructs by referring to empirical facts. Such constructs can only be regarded as comments on reality, about which we are merely able to express personal judgement. The proposed constructs thus turn out to be short-lived and cannot generate cumulative knowledge.

A positivist criticism

These positions may be subject to a positivist criticism, opposed to the emerging trends in the Human Sciences.

This criticism is inseparable from the ideas that J.-Cl. Gardin has developed over a number of years within the context of logicism. Logicism is a reflection on the epistemological nature of archaeology, and further, of all human sciences. It is based on the analysis of archaeological 'constructs', or more simply of archaeological publications. Thus, logicism does not concern, in a first step at least, the archaeological remains themselves, but what archaeologists say about them (Lagrange 1973; Gardin 1974; Gardin & Lagrange 1975). The need for such a reflection appeared very early in the development of archaeology, ever since the applications of first mechanized and then computer techniques were used in the creation of data-banks. Logicism is therefore analogous to the utilization of computers insofar as their use demands very strict logical and formal requirements. This practical epistemology is free of technical problems inasmuch as it tackles the question of the scientific status of the analysed constructs. The main concerns consequently focus on both the formal qualities of these constructs and their efficiency in mastering reality, which amounts to asking not only what they 'are' but also what they 'do'.

The logicist analysis of archaeological texts would nevertheless remain futile if it did not

pursue the search for a new rhetoric in better accordance with the requirements of scientific knowledge. From the very beginning, experiments have been carried out to that end in the preparation of codes (Digard *et al.* 1975; Gardin 1978) and data-banks, in the field of typologies (Gallay 1981a) as well as in the explanatory sphere (Gallay 1981b). They have permitted a better understanding of the qualities and limits of this approach.

We will also underline the fact that logicist research follows in a way, the same stages as the ones used in the realization of an archaeological construct.

The first works focussed on problems connected with the description of objects and their integration into data-banks (Gardin 1958; 1963).

In the 1970s, J.-Cl. Gardin devoted himself to the study of the 'intermediate' stages of the constructs. He particularly confronted the problems posed by the University of Geneva in 1976–7, and his response was the origin of his 'Theoretical Archaeology' (Gardin 1979).

Today, it is the interpretation of data that lies at the hearth of the reflections concerning the application of artificial intelligence and expert systems in archaeology (Gardin 1987; Gardin *et al.* 1987).

We can now summarize the main lines of our criticism of anglophone theories as seen from a scientific as well as logicistic point of view.

1

Human societies form extremely complex systems that are open to their environment. Knowing that the diachronical evolution of an open system is not foreseeable, it is therefore impossible to propose laws of history. Archaeologists use the notion of system in a naïve way, which does not at all correspond to its application in science. The chosen variable are far too general and as a rule can neither be subject only by a rough estimate to quantification nor tested and confirmed through facts. How can one discover, in archaeological facts, anything plainly expressing social hierarchy, complexity of a society, population density, potentialities or ecological limits of a given region? (Gallay 1986a).

2

Archaeological constructs usually present themselves as a structure whose lower and more secure parts concern material remains, while the higher ones, also the most fragile, concern the social and ideological context of the evolution of societies.

In the intermediate levels, we usually find propositions of a spatio-temporal nature (attribution of remains to a certain period and a particular region) and then others of a technological and economical purport.

At the lowest level, complex inference chains are based on material remains. Analysis and synthesis of data allow us to reach progressively at the highest level the conclusions of the work:

'EXPLANATION' AT THE HIGH LEVEL: MEANING
ideology and symbolic structures
society and historical events
technology and economy
spatial and temporal coordinates of remains
description of material remains
DESCRIPTIVE BASE OF OUR CONSTRUCTS: MATTER

A wide consensus seems to exist in the archaeological community concerning the ways to deal with the lower parts of the structure. Therefore, we need not elaborate on this subject, even if technical problems remain (easily controllable though not always mastered). Divergences become more visible, from one school to the other, as one rises in the hierarchy of 'explanations'.

Logicist archaeology addresses words of caution to the anglophone archaeologist eager to reach ever more quickly the higher explanatory levels. It is certainly desirable to gain ground in this direction but the way to do so is still to be discovered. The partial nature of the remains always sets an absolute limit on our reconstructions, at a level which is at present rather difficult to locate.

3

Criticism of semiological and philosophical approaches can be based on the idea that language is a tool which allows the capture of realities 'out there', external to the obsever.

Since these realities are numerous and the apprehension of them fragmented, we should try to clarify the univocal relations that hold between languages and realities.

– The language used in epistemology and philosophy of *science is concerned with*

scientific discourse and not with the phenomena to which scientific discourse refers.
- The language of science basically concerns the physical world. It is nevertheless assumed that it can apply to the intellectual and symbolic activity of man.
- Man has always tried to apprehend the world with means other than those proposed by science, in particular with symbolical concepts. The languages created to that end, myths, beliefs, are distinct. They are not of the same nature as the language of Sciences. It is therefore utopian to use the language of philosophy of science to apprehend the physical world of archaeological remains. It is also necessary to distinguish clearly the languages of early man, which are made up of symbolical constructs. Only then would it be possible to avoid a confusion frequently made in certain works that claim their belonging to symbolical archaeology.

Faced with this, we may ask whether an examination of the practices of natural sciences rather than any human science, would not throw some light on the kind of symbolic tool which is needed for apprehending the archaeological reality. In fact, one cannot help being struck, as we shall see further on, by the similarity in the approaches of disciplines such as cosmology in astrophysics, plate tectonics in geology, evolutionary biology in the life sciences, and the study of the evolution of human societies in anthropology and in history – all those studies that are concerned with the change of complex things over time (Gallay 1986a).

Let us quickly add that similarity does not mean that languages used in these different approaches are identical, but rather that the epistemological issues are comparable.

4

We think there is no 'third culture'. The social Sciences have always presented a hybrid position resorting simultaneously to scientistic, if not scientific method, and to literary approaches. There are only two ways to apprehend the world, the one used by Arts and Literature, and the other proposed by Sciences. To mix the two somehow results in a regrettable waste. It is consequently useful to play the game of science, even for human affairs, although this way seems, at first sight, long, difficult and far too reductionist. This conclusion seems to impose itself when the meagre results obtained by the contribution of the 'symbolic and structural' approaches in archaeology are compared to the progress achieved by the most traditional archaeologies.

J.-Cl. Gardin's analysis (Bl.) focuses on:
- The so-called structural approaches proposed by anglophone archaeologists, where the influence of structuralist works in French (F. de Saussure, Cl. Levi-Strauss) is clear, although this influence has become minor in France itself.
- The logicist trend, more specifically dedicated to the analysis of archaeological discourse (see for example the pioneer work by Lagrange & Bonnet 1978). Its conclusions perfectly agree with our position (Gallay, Bl): we do not see what the novelty and the specificity of a so-called 'structural and symbolic archaeology' could be. Any approach of a complex phenomenon in a systemic way, calling upon entities and relations, may be considered structural. Therefore, this designation is a platitude. The notion of structure is useful, but the concept, widely used in all sciences, is not new. As to the world of symbols, it is advisable to distinguish clearly the observers' symbols, whose nature and performances the logicist trend tries to study with precision, from the symbols of the observed which are beyond the reach of archaeological research, because of their supposed or real arbitrariness.

5

The introduction of subjectivity in the approach adopted by anglophone archaeologists leads to a logical contradiction that is enough to impose the kind of dissociation between object and subject, that led to the growth of the sciences of nature in the 18th century.

Anglophone authors simultaneously insist on:
- the benefits resulting from integrating personal subjectivity in our approach of human reality;
- the necessity of criticizing this very subjectivity, on the basis of the ideological and social context in which the subject evolves.

It is clearly impossible to integrate subjec-

tivity and at the same time try to get rid of it by underlying its probable roots in the researchers' social, ideological or personal history. A more economical path, in the perspective of practical epistemology, is to try to eliminate it.

Although not everyone agrees with this (see Molino, Bl.), it seems to us possible to reduce if not suppress the part of subjectivity in our interpretations by observing a double reorientation, namely a restriction of our cognitive ambitions and a systematic call on validation.

It is evident that the material remains studied by the archaeologist will never permit the reconstitution of all aspects of the life of early man. Therefore, we shall probably have to definately renounce trying to attain certain ambitious objectives, particularly those concerning the organization of society or religious beliefs. On the other hand, we must maintain a dialogue with reality, which means suggesting only those explanations that can be confirmed by facts and results that other researchers are able to reproduce through other ways. A shared subjectivity, bearing on a limited part of the external world and to confirmations by facts, cease to be a subjectivity and becomes a reality till proof of the contrary. Science does not proceed otherwise. Logicist archaeology thus find itself opposed to the trends developed by certain anglophone authors under consideration, since it tries to limit subjectivism as much as possible through a continual dialogue with reality.

Structuring the various approaches

Astrophysics, plate tectonics, evolution biology and archaeology have in common the following features:

- they are empirical sciences, whose respective domains include the Past.
- the evidence for past phenomena is subject to various distortions: reduced information, effects of perspectives, etc.
- in all cases, reality is systemic and therefore exhibits an uncertain and uncontrollable component in its historical evolution.

These different disciplines consequently find themselves at the junction of three specific forms of knowledge, whose structure and heuristic limits should be fully understood:

1

History, that is to say the reconstitution, on the basis of incomplete informations, of various scenarios that have characterized the evolution of things throughout time. History is, as P. Veyne (1971) has shown, essentially descriptive. Through a patient work of reconstruction which involves cross-comparisons of historical documents, the scholar tries to reconstitute events and facts based on a forever partial documentation. He may complete his information by assuming certain regularities in order to give more consistency to the proposed narratives. The clear boundaries of such a game are of two sorts:

- The documentation is incomplete, the proposed scenarios are therefore amenable to revisions as new discoveries are made.
- History is observed and cannot be explained insofar as it is concerned with evolution of complex systems in time. There are no laws of history.

2

Regularities, empirically induced from the examination of scenarios according to a primitive intuition of the presence of a certain coherence in our world. We can call this empirical knowledge, unexplained, that constitutes the foundation of most human actions, 'artisan knowledge'.

In archaeology, it can be found in three forms, in a decreasing order of accuracy:

- numerical correlations between two categories of phenomena, continuous or discontinuous;
- typologies integrating two or more spheres of reality, after each one has been partitioned;
- discursive relations expressed in natural language, which can be formalized as sequence of re-write expressions: 'IF Pi THEN P_{i+1}'.

The limits of typological knowledge, implicit or explicit, are well known:

- a correlation between two phenomena does not necessarily provide an explanation of either;
- empirically perceived regularities can be based on a poor knowledge of reality, even though they give us a predicitive control over the latter;
- the most profound theories are often counter-intuitive.

3
Laws, expressing, to a degree, our understanding of certain partial aspects of reality, thereby justifying the reference to regularities. Instead of the word law, we prefer the term mechanism, better adapted to the practical epistemology that we are trying to promote and nearer to the everyday scientific processes. These mechanisms are the only admissible explanations in a scientific approach. It is necessary to distinguish this concept from the notion of 'explanation' in the broad sense as it is sometimes used in archaeology. In fact, explanations are often nothing but regularities of a higher order (Gallay, Bl.).

The limits of this kind of approach are clear:
- the underscored mechanisms can only explain restricted areas of reality;
- they can only be brought to the fore by observation of the living world: any hope to discover mechanisms by the sole observation of the past is utopian;
- the only possible explanations are of a functionalist kind;
- they bear on the genesis of regularities built up on empirical observations, and in no case on historical scenarios, so that we have to reject global causality in history.

Let us conclude this section by underlining the close convergence between this triple opposition 'scenarios – regularities – mechanisms' and the three stages of archaeological research distinguished by J.-Cl. Gardin (1979), 'description, typology, explanation', except for the slightly different meaning given to the term 'explanation' (FIGURE 1).

The presentation of scenarios in history follows an eminently descriptive pattern. The perception of regularities always results from a typological approach. Finally, explanations at a higher level often refer to a mechanism of some sort.

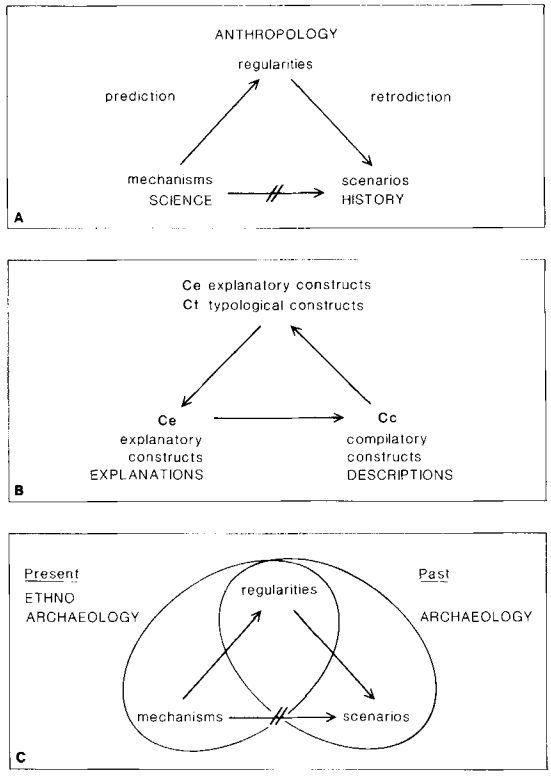

FIGURE 1. *Articulation of various approaches in sciences of the Past.*
A *Relations between history, anthropology and science.*
B *Relations between the different stages of archaeological research.*
C *Relation between archaeology, as a descriptive and typological discipline and ethnoarchaeology, a typological and explanatory discipline.*
Notice the perfect homology of the three diagrams.

The analysis of archaeological constructs

Aware of the extreme fragility of our current archaeological constructs, the logicist approach first grounds itself on a critical analysis of the latter. Through schematizations of archaeological reasoning, it attemps to reveal the foundations of the proposed interpretations as well as their flaws. Yet, beyond this purely critical aspect, the search for new patterns of thought and expression becomes apparent.

Starting from the 'sense' archaeologists attribute to phenomena, the logicist approach tries to specify the 'measures' which, when applied to archaeological remains, would be able to account for the generation of that sense (Francfort, Bl.).

Logicist schematization

The analysis of largely interpretative works shows that we are in the presence of networks of interrelated propositions, which can be formalized as chains of IF . . . THEN expressions. It is therefore possible to represent the argu-

mentation observed in a written paper as a graph whose nodes are the various propositions formulated by the author while the arrows indicate the authorized derivations. This kind of structure brought to the fore by J.-Cl. Gardin (1979: 175–202) allows a stricter, more logical form of writing or formulating texts originally written in the discursive style; it also helps to detect deficiencies in the argumentation.

In particular, a basic feature of archaeological constructs then becomes manifest, namely the fact that many derivations presented by archaeologists as if they were necessary are in fact merely plausible (Gardin *et al.* 1981).

This kind of ambiguity in analysis of material remains has two origins:

- Material remains are only a very small part of the living reality; relying on them alone entails a huge loss of information, which compromises the high level objectives we would like to reach;
  - Archaeology, as an empirical science, is mostly confronted to inference problems whose solutions are never univocal (Gallay, Bl.).

Relations to expert systems

As it was recently brought out (Gardin *et al.* 1987), the logicist schematization presents an undisputable similarity with the structure of expert systems in which rules of production also take on the form of propositions of the IF ... THEN kind (FIGURE 2). It is therefore tempting to try to formulate traditional works according to the principles that govern the formation of an expert system. These rewriting exercises are undoubtedly useful insofar as:

- they make it possible to propose firmer diagnoses about remains of the past, by bringing out the deficiencies and the limits of the inferences sequences and thought processes;
- they underline all the 'gaps' (or conceptual jumps) in the reasoning process, which in fact increase in number as one tries to reach interpretations of a higher level (of a social or ideological sort, Francfort, Bl.).

In the present state of research, however we must be careful not to confuse these analytical approaches with the creation of operational expert systems, applicable to the interpretation of various corpuses (Fischer 1987).

The reasons for this are the following:

1 The proposed reconstructions are most often based upon the sole publications, in which the argumentation is never totally explicit, without direct collaboration with

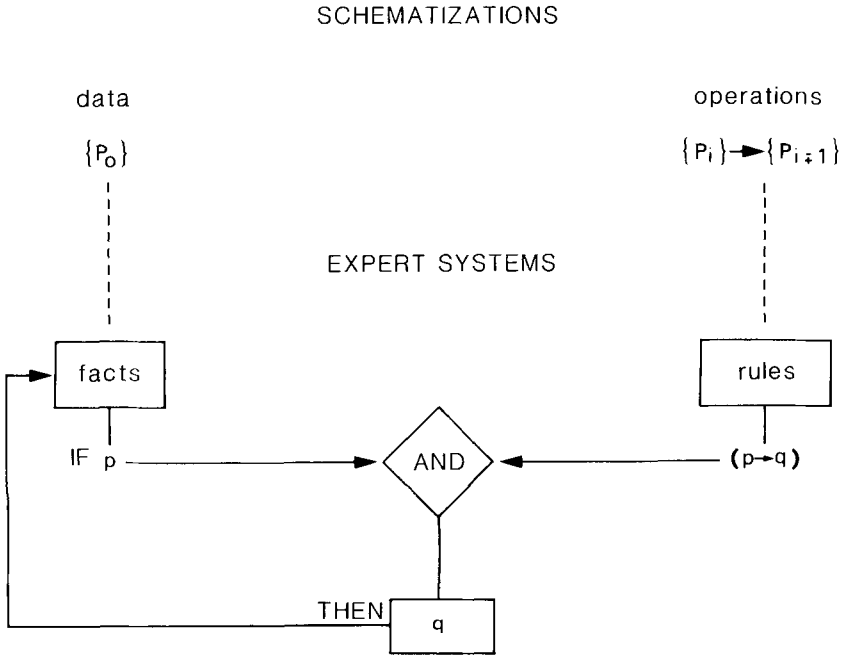

FIGURE 2. *Analogy between the normal structure of logicist schematizations of archaeological constructs and expert systems. (After Gardin 1987, figure 3.)*

the authors. It is therefore difficult, if not impossible, to restore all the mobilized implicit knowledge that is nevertheless necessary to constitute an expert system.

2 Two strategies are available to the analyst, according whether he favours a forward chaining (from facts to meaning) or a backward chaining (from meaning to facts) in choosing the corpus needed for the construction of the expert system (FIGURE 3). In both cases, the limits of the exercise are evident, as explained below.

3 In the case of forward chaining, it may be tempting to cumulate various interpretations of the same corpus, as proposed by different authors.

The rules derived from several traditional and generally diverging constructs are most often multivocal. Therefore the diagnosis very quickly proves impossible as one ascends in the construct (Lagrange & Renaud 1983; 1984).

4 In the case of backward chaining, it is possible, as already suggested in the introduction to this section, to begin with the interpretation given by the author and seek the foundations of the construct in various facts.

One then realizes that the resulting explanations are more often than not of an *ad hoc* nature. The expert system does simulate the reasoning of a given author (or group of authors), but remains unuseable in other contexts; its application to other corpuses may lead to aberrations.

H.-P. Francfort (Bl) gives an excellent example of this situation in his experiment with an expert system revolving around the notion of State and based upon the most commonly accepted reasonings followed to establish the existence of such a social entity (Childe, Wright, Tosi, Johnson, etc.). The expert system, taught by these examples what the defining characteristics of a state are, can be applied to other corpuses. It suggests that the Neolithic of Wessex, as well as societies of ants, should be regarded as State societies.

Whatever the case may be, traditional archaeological discourse remains too loose to authorize the creation of real tools for the formation of diagnoses other than in the 'lower' parts of our constructs. The building of pseudo-expert systems nevertheless remains very useful as a first stage of the analysis; it enables us to assess the great frailty of archaeological constructs of the higher levels. Thus we observe that no true measure of archaeological facts usually exists, as a basis for 'making sense' of them, except in the lower parts of our constructs. It is therefore incumbent upon us to restrict our ambitions and offer a better definition of the true ground of archaeological knowledge.

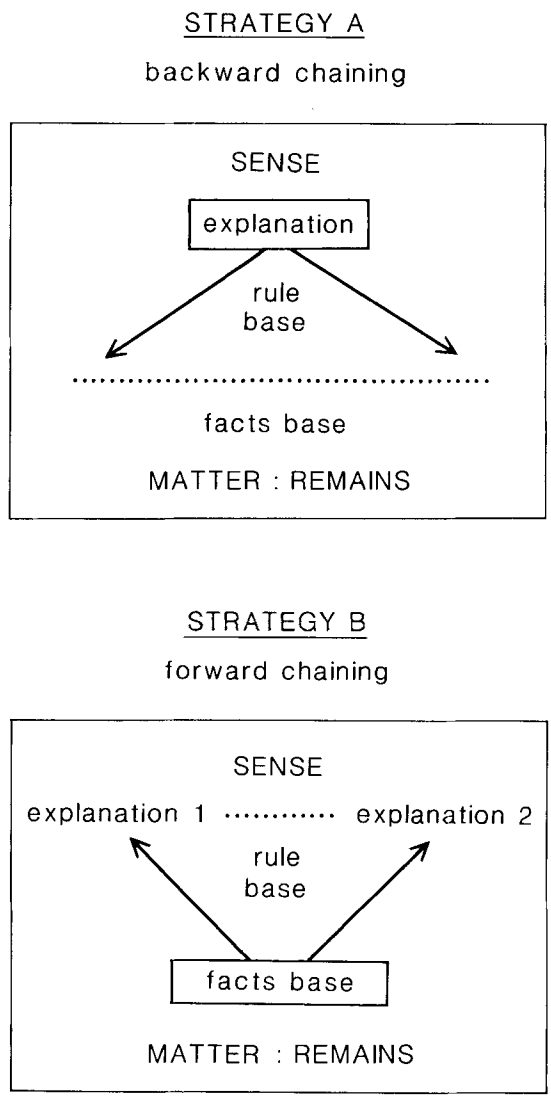

FIGURE 3. *The two strategies used in the design of expert systems based on the logicist analysis of archaeological constructs.*

The ground of archaeological knowledge

Logicist analyses must accordingly lead to a search for a better relation of sense ('explanation') to matter (the remains), through proper measures, the word 'measure' being taken in the literal as well as figurative sense (Francfort, Bl). The movement is here opposite to the preceding one; we begin with measure in order to reach meaning following an empirical process.

The reality of archaeological remains

Given the freedom of archaeological discourse, the remains discovered in the course of an excavation, seem to exhibit a relative reliability, even granted that the subject partially composes its object of study while digging, collecting, recording and providing a first description of the preserved traces (Molino, Bl.). Therefore, the archaeologist's first duty to explain the presence and the nature of these remains, whose formation is far from being simple.

Restricting the questionnaire

We shall never lay enough stress on the limited character of the remains. Contrary to the suggestions made by certain historians, we would accordingly restrict ourselves to the sole questions that can be resolved.

'The price to pay for the control of our inferences is the impoverishment of our concepts, in keeping with the local and relative aspect of our approaches' (Francfort, Bl.).

Technological sequences and production of remains

One of the most promising fields of research is indisputably the study of technological sequences that underlie the production of archaeological remains (Francfort, Bl.; Perlès, Bl.).

Man is a producer of objects, objects which are the main reflection of his palaeontological and historical trajectory as Leroi-Gourhan admirably demonstrated in his book *Le Geste et la parole* (1964/75). Therefore, it is not utopian to build a history of man on the basis of material objects whose preservation through time is possible.

This history may be based on the study of the operational sequence leading to the observed object, be it palace or hut, pottery, tool or jewel, temple or tomb, and beyond that to the remains that have been preserved to this day.

By concentrating on a history of the production of remains (including, at an intermediate stage, the production of objects), we may eliminate the problem of consumption, which is out of reach on account of its negative nature.

The two aspects of our remains, their form and their position in space (the only criteria allowing a distinction between archaeological and natural objects) are the result of a sequence of technological acts (and of perturbations due to the influence of the natural environment) which can be identified quite easily and whose signification, needless to say, extends far beyond the strict context of production techniques.

Thus, C. Perlès (Bl.) attemps to bring out the various operational sequences leading to chipped lithic remains, as they are found in excavations, often in large numbers, and expressing the various strategies binding man to matter: acquisition of raw materials, production and maintenance of tools.

In his approach of the proto-urban site of Shortugai, H.-P. Francfort (1984, Bl., & forthcoming) follows a closely comparable procedure by attempting a characterization of the discovered remains in terms of the quantity of processed materials and the complexity of the operational sequences.

The introduction of measure

This kind of approach alone gives us some hope of a valid relation between sense and matter by means of true measures (Francfort, Bl.), as well as of a way out of the two deadlocks with which archaeology is today confronted. Some measures do not lead to sense, when data analysis techniques, much in fashion amongst the archaeologists, are applied to badly posed archaeological problems, they provide no useful knowledge, although the technique may be formally correct. Other measures lead to too much sense, when major physico-mathematical models, like catastrophe theory, the general systems theory or the theory of order by fluctuation, are applied to badly defined archaeological realities in a metaphorical way.

Though the need to introduce measure has been felt in every science, it is nevertheless advisable to recall the necessary conditions of its application.

1 The problems posed by the introduction of measure, or in a more general way of any kind of indicator, differ from the problems

posed by the theories, for the indicator is not part of the produced theory.

2 The choice of an indicator or of any measuring device must be an application of some law of physics, through a clear isomorphism (such as the expansion of a column of mercury as a function of temperature) linking the observation to the measured phenomenon. Thus, on the site of Shortugai, H.-P. Francfort (1984; 1988) uses an indicator borrowed from the laws of thermodynamics and based on the following three criteria: matter, information and energy; it enables him to measure, through different levels of the site, the evolution of the complexity of the technological sequences leading to the formation of remains.

An objective estimator of man's action on his environment is thus provided, conventionally linked to the notion of urbanization.

3 The phenomenon to be measured must be precisely defined. It is therefore necessary to give a preliminary definition of the phenomenon that is to be studied, and a non-ambiguous relation must be set down between a material fact and its signification.

4 This relation can only be founded on known mechanisms of the production of remains.

This last comment accounts for the need to construct a reference knowledge allowing a reasonable formulation of the relations between material facts and signification. This question will be taken up in the last paragraph.

The construction of a reference knowledge

One cannot stress enough the original nature of the questions that must be resolved in archaeology. As Molino emphasizes (Bl.) 'the correlations that we try to bring out cannot be compared to the correlations established in sociology (or as a general rule in any human science) for we do not have the means to know more about those activities beyond the traces they left'.

The remains never talk for themselves, and sense, beyond mere description, can only come from outside (FIGURE 4).

Faced with this particular situation, archaeology, oddly enough, lacks a science of reference. Palynology applied to the archaeological record is based on a knowledge of botany and cannot be conceived as an isolated development, for palynology depends for its insight on the regularities observed by botanists. This situation is the same for all the other so-called 'subsidiary' sciences such as geology, zoology, etc. In the same way, it is in the study of the living reality that archaeology must find the foundations of its hypotheses relating to the observed regularities, by establishing privileged links between material facts and their signification. Ethnoarchaeology meets this requirement and now seems indispensable to many researchers (Aurenche 1982; 1985a; 1985b; Aurenche & Calley 1984; Aurenche & Desfarges 1983; Roux 1985a; Gallay 1986b).

Actualism (Molino, Bl.) has been criticized, however, insofar as the usable references all belong to the context of *Homo sapiens sapiens*: it is hard to imagine how to establish a usable comparative knowledge in the case of the most ancient hominid groups. The objection is of importance, yet it is not totally insuperable.

1 We must first draw attention to the fact that comparable situations also exist at the level of *Homo sapiens sapiens*. The first urban civilizations of Mesopotamia or Middle America have no equivalents in the present world that might help us to understand the structure of such societies. The problem is therefore much more general than the above objection would lead us to suppose.

2 This problem can be partly solved if we recall the limitations imposed upon our quest of knowledge and the necessary restrictions of the fields of investigation for which these references are needed. This vision does not exclude broader conceptions but the latter will proceed from the crossing of local approaches that may include, as far as the most primitive hominids are concerned, the primates still observable today.

3 Such recombinations will certainly make for a better apprehension of situations that have no equivalent in present or recent contexts.

Whereas archaeology is entirely situated on the main road from regularities to scenarios (Gallay 1986a), ethnoarchaeology lies on the road from mechanisms to regularities (even if the documents it uses are historical ones).

This articulation permits us to lay stress on the central position of the regularities that provide the link between both disciplines (FIGURE 1C).

For a long time, ethnoarchaeology has

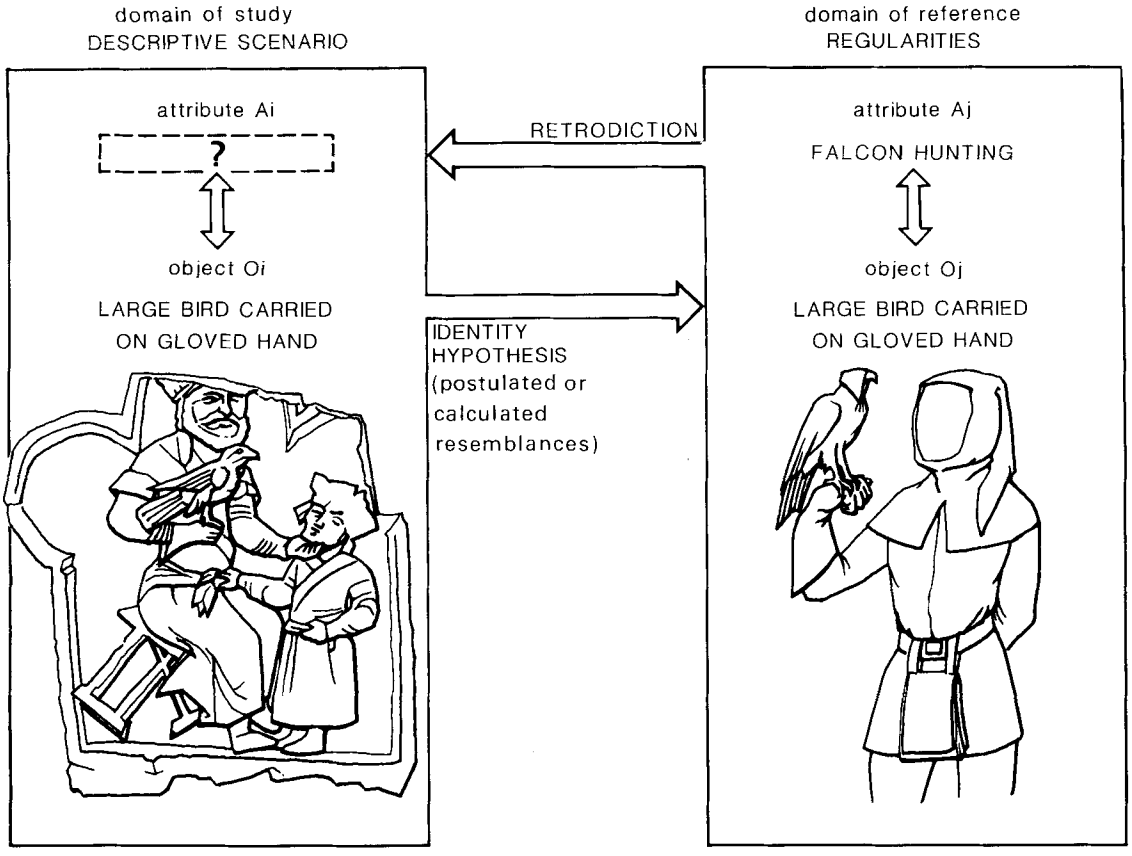

FIGURE 4. *The mechanism of archaeological interpretation according to J.-Cl. Gardin. The interpretation of material remains proceeds by confronting archaeological fact with external observations. The above example concerns the interpretation of a stele depicting a man carrying a large bird on his gloved fist. (After Gallay 1986: figure 23.)*

searched for its identity: it was notably accused of giving only negative reports concerning the eminently ambiguous nature of the remains.

Numerous works place themselves in this perspective: their results are limited to a warning against the possibility of making material facts say what the archaeologists want them to say (Gallay 1981a; Roux 1985b). It seems to me that this situation results from an improper centring of the objectives, exclusively dedicated to the study of regularities. In my opinion, we should give more attention to the study of mechanisms belonging to the field covered by ethnoarchaeology in order to come out of the deadlock. One cannot help but be struck, in this connection by the convergence in the design of numerous recent ethnoarchaeological research works.

Thus, A.M. & P. Petrequin (1984) study the development of archaeological layers as they form beneath the huts of sea- and lake-side settlements of the Cotonou lagoon in Benin. The proposed model is based on the comprehension of human and natural mechanisms that determine the distribution of the remains in the refuse layers. Its relevance for the analysis of archaeological levels in Northern alpine lake dwellings is consequently unquestionable. V. Roux (Bl.), exploring the relationships that may exist between the wheel manufacture of pottery and the concept of craft specialization, shows by means of psychomotor tests that learning the

potter's wheel is incomparably longer and more difficult than learning the coil method. Specialization and the wheel manufacturing technique seem to be linked in a univocal way in the direction *Pi* (wheel manufacturing technique) to *Pi* + 1 (specialization). One of the mechanisms of the appearance of pottery specialization is consequently demonstrated on firm experimental bases provided by disciplines outside archaeology.

We have ourselves suggested, in a study of Touareg campsites (Gallay 1988) that the only means to 'understand' the spatial distribution of remains abandoned around a campfire lies in the description of the operational sequences bound to these remains: the preparation of a meal, the consumption of food, the laying-out of a spatial area dependent on lavatory customs, etc.

In the first two cases, the search for mechanisms leading to the observed regularities allows useful overlaping with other scientific disciplines. As they increase, these overlaps will be the sign of a growing intergration of etnoarchaeology and archaeology in the field of science.

Conclusions

In relation to the diversity of approaches reflected in the anglophone communications presented at the Bloomington conference, the contributions of the French-speaking group display an indisputable coherence and remarkable convergences.

By their implicit or explicit reference to logical positivism, they distinctly depart from the subjectivist trends that presently dominate theoretical research on the English-speaking side. We have tried to give here a coherent image of those various positions.

Beyond archaeology, the logicist approach questions the very foundations of the human sciences by denying the possibility of creating a third culture situated between science and literature and by giving itself the means to dissociate the subject from the object. This wager does not go without a reduction, maybe only temporary, of ones cognitive ambitions but the game seems worth while. Moreover, the literary approach comes out as winner seeing that, rid of its scientific obsessions, it is now open to all kinds of audacities, subjectivities and beauties.

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