
Going after the new without reinventing the wheel: On the necessity of learning and teaching different approaches to lithic analysis

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Abstract:

Brazilian archaeology developed following the same phases that the discipline as a whole went through: an initial emphasis on Historical Culturalism, followed by criticism that culminated in a range of possibilities, from the indiscriminate rejection of everything that had been done before, to a more balanced stance with the incorporation of new concepts. Specifically, we can say that there was a schism between the first professional archaeologists, interested in building historical-cultural knowledge, who sought to understand artefactual variability based on the shapes and possible functions of artifacts, and a younger generation guided by the Processualist approach, who started from the principle that the diversity of stone tools would reflect the relationship between man and environment and could be understood based on the different manufacturing techniques. Over time, criticism of the use of morphological approaches led to technology becoming a supposedly superior and more suitable method of analysis for the characterization of lithic artifacts. In Brazilian archaeological research, this reasoning has been consolidated over time and, consequently, limited not only the use of other perspectives, which could be complementary to the characterization of artifacts, but also the identification of distinct cultural groups. Considering that technological analysis understands that there are several steps involved in the manufacturing process of lithic tools and that the development of these activities occurs in an orderly manner, within a certain time and space, we present in this article some approaches that deal with the notion of Models of Sequence (Bleed 2001). The main objective is to show that even if they consider the development of activities as a process that occurs in an orderly manner, similar concepts are not necessarily substantially identical. To begin the discussion about the different approaches, we first deal with the French method called *chaîne opératoire*, certainly the most recognized in Brazil. Possibly, its establishment in Brazilian literature is due to successive years of teaching, learning and reproduction of key concepts, without major investment in improving and applying other methods. To this end, we discuss the North American-influenced analysis model called Reduction Sequence, exploring basic concepts capable of differentiating it from the French school. Next, we present the method called Minimum Analytical Nodule Analysis, an approach focused on the macroscopic observation of the raw material, operationalized in a very similar way to the refitting method. Subsequently, we explored the Japanese concept called *Gihō*, aimed at analysing laminar industries. In conclusion, we draw a parallel between these approaches, showing that some of them require a specific context to be applied or even that their inferences will only be possible in the long term and from dense collections.



Keywords: lithic technology; theory; method; *chaîne opératoire*; reduction sequence; sequence model

1. Introduction and historical background

As the very concept suggests, lithic reduction is a technique that consists of the transformation of a rock by removing material from it, be it by polishing or flintknapping. The common principle involved in their analyses is that the process is composed of a sequence of successive events that denotes a spatial and a temporal dimension (Bradley *et al.* 2010: 6). A common example is the classic notion that the starting point of any implement is the procurement of raw material that once selected, due to its favourable qualities for obtaining products, will be literally destined to be transformed into a specific tool to accomplish specific tasks. The modification of a natural stone into an artefact (*sensu* Dunnell 1971: 117) is then performed by a series of technical actions (bifacial or unifacial reduction, percussion or pressure, retouched or not, *etc.*) dictated by cultural norms that will eventually result in a formal artefact (Araujo 2019: 80-82), culminating in singular shapes like bifacial points, hand axes, limaces, blades, and so on. It is in the totality of this process that there is a chronological order that provides clues as to where specific activities were conducted (space) and what was the succession of the technical action (time). By extension, this effort in understanding what groups did in the past would also help the archaeologists to infer possible activities linked to human behaviour in different environments.

In this paper we will focus on a specific case study (Brazilian archaeology) to illustrate a more widespread phenomenon in academia, which can be thought as a multi-step mechanism of cultural transmission: 1) adoption of a new method by a set of scholars (generation G1) in a scenario of experimentation and trial-and-error; 2) publication and development of a specific jargon composed of “key words” that are related to the method; 3) transmission of the method and its attached jargon to students (generation G2); 4) transmission of the jargon (but not necessarily of the original method) to generation G3. It is important to note that G1, or early adopters, could be exposed to different methods and their choice was eventually based on what was perceived as a new and stimulating way of dealing with some subject, in this case lithic industries. However, from G2 on, the start of specialization in the teachers’s method implies, in most cases, diminishing amounts of erudition, here meaning knowledge about different ways of dealing with a given set of problems. By G3, the strength of the jargon and the lack of erudition will lead researchers not just to believe that the method is the best one, but even worse, to consider it as the ‘only way’ to approach any given problem for lack of knowledge about the very existence of other methods or ways. In many cases, the original method embraced by G1 is simply lost. Once the proper jargon is mentioned (and here the classic term “mouthtalk” coined by Elman Service (1969) comes to mind), there is a tacit recognition among G3 that the original method is being applied, what can be far from true. This happens because G3 never actually read the original papers that introduced the method, neither the critiques to the method, and much less other proposals that do not reproduce the same jargon and, therefore, are dismissed right away.

Brazilian Archaeology passed through the same phases that happened in the discipline everywhere: an initial emphasis in culture history followed by critiques that culminated in a range of possibilities, from the wholesale rejection of everything that was made before to a more balanced posture of incorporation of new concepts (see Araujo & Okumura 2021 for a historical review). More specifically regarding lithic studies, a schism happened between the first professional archaeologists who were interested in building a nation-wide, culture historical knowledge inside the National Program of Archaeological Research (PRONAPA), and younger archaeologists who were more oriented towards the Processualist approach. The

criticisms were directed to the use of the general shape of artifacts (mainly bifacial points and plane-convex scrapers) and the lack of technological attributes in defining the industries, which is a valid claim. However, a lot of misunderstanding was involved in the accounts that later researchers began to provide about the earlier, cultural historical constructs (see Hilbert 2007 for an excellent account). To give an example, in spite of the fact that it was common in the first PRONAPA attempts to make clear that much variability existed inside of the overarching label of “archaeological traditions”, trying to convey this variability using the concept of “archaeological phases”, in the following decades many researchers started to make critics to the PRONAPA as “lumping together the archaeological variability” when, in fact, those who made the lumping were critics of the “phase” concept (*e.g.*, DeBlasis 1996; Koole 2007; 2014; Prous 1991: 154) and, therefore, not related to the PRONAPA.

Be as it may, critiques to the use of shape of the artifacts as potentially informative and the view that technological attributes would constitute the panacea for the improvement of Brazilian lithic studies were made in two fronts: one coming from a Processualist or anglophone strand (*e.g.*, Bueno 2010; Dias 2007; Hoeltz 1997) and other coming from a French or Techno-typological strand (*e.g.*, Fogaça 1995; Morais 2000; Vilhena-Vialou 1980). This cross-fire was almost enough to kill any attempts to continue using any method or writing any paper who did not praise technology as the “right and only way” to address archaeological lithics in Brazil.

Nowadays in Brazil the study of stone tools is predominantly driven by the concept of *chaîne opératoire*. This approach, now quite consolidated (and no longer only for lithic tools), is strongly reaffirmed as the only one capable of providing plausible inferences about the ordering and application of the methods and techniques necessary for the manufacture of the objects. However, what few researchers acknowledge is that this construction in an operationalized way is not and has never been exclusive to the French approach. Any analytical system that considers the development of activities as a process that occurs in an orderly manner within a certain time is in agreement with the “Sequence Models” or SM (Bleed 2001). The study of SM is mainly possible through technological analysis, since it has the primary characteristic of understanding the various stages involved in the process of making the instruments (Andrefsky 2005; Crabtree 1972; Inizan *et al.* 1999), whether of a single artefact or a whole assemblage composed of numerous flaking products. It is precisely in the connection between technological analysis and the study of the sequences that, at least in Brazil, was responsible for the legitimation of the concept of *chaîne opératoire* as the only possible paradigm for lithic studies. This hegemony is not bad in itself, but we can perceive strong signals that a term (in this case *chaîne opératoire*) is being used without the proper knowledge of its historical development, and its actual meaning. These signals suggest that, at least in Brazil, G3 is using the jargon rather than the analytical approach.

In the following sections we will present a brief but necessary analysis of the development of the *chaîne opératoire* concept, and also present other ways of dealing with lithics that are totally ignored in the Brazilian literature (and perhaps in other parts of the world). Our hope is that the broadening of the interpretive landscape, at least among younger researchers can avoid theoretical and methodological straightjackets, as well as the reinvention of the wheel.

2. The concept of *chaîne opératoire*

The concept of *chaîne opératoire* was established first in Ethnology in a context of technological development and rational study of techniques. This was an original trend in French anthropology, strongly influenced by the notion of “production chain” observed in

industrial activities, rooted in the idea that the work is performed by a succession of identical items which are progressively assembled (Audouze & Karlin 2017: 2; Delage 2017: 159).

Marcel Mauss (1926: 5-7) incorporated these ideas in his 'Manual of Ethnography', where he understands that the primary objective of Ethnological science was to observe societies in order to know their social facts. Within its study plan of a society, he included the analysis of "social physiology" which, within its scope, aims to observe and register the technique. Since they would indicate "all arts and crafts of production", these observations would culminate in the understanding of a specific technology (Mauss 1926: 11-22).

To Mauss (1926: 407) technique is an "effective traditional act" and "there is no technique and no transmission if there is no tradition". In order to make historical and ethnographic observations of the *habitus* that govern social life, the technique would be registered considering the human body as "man's own instrument". In this sense, the technical process encompasses a set of conscious and unconscious, gestural and intellectual, collective and individual knowledges that depend on the relations of agents among themselves, and on their relation to the laws of matter (Karlin 1991: 102).

André Leroi-Gourhan was a former student of Marcel Mauss and was strongly influenced by his teacher's ideas. His name became very famous among the French prehistorians who attributed to him the creation of the *chaîne opératoire* concept, affirming that "he opened so many new paths, sometimes in a few sentences and without further development, that even analysis of technical acts as social products can justifiably be considered to derive from his thinking" (Audouze 1999: 168; Bar-Yosef & Van Peer 2009; Inizan *et al.* 1999). Unfortunately, Leroi-Gourhan was not very fond of explaining his concepts or their origin, being more interested in demonstrating rather than in exposing their scientific basis (Audouze 1999: 168; Riede 2006: 55). The first time that the term explicitly appeared was in his book *Le Gest et La Parole* in 1964, where the word *chaîne* went far beyond a technological definition, suggesting an interchange with the word *enchaînement* (translated as sequencing), meaning a link between different elements in the areas of human paleontology, linguistics and cognition, revealing Leroi-Gourhan's thinking about humans and humanity, overcoming biological, technological or cultural divisions (Delage 2017: 163-164; Djindjian 2013: 93).

Robert Cresswell, another student of Leroi-Gourhan, defined the concept in the 1970s suggesting that "a *chaîne opératoire* is a series of operations that transform the raw material into a product, either a consumer object or a tool" (Cresswell 1976: 26). Similarly, Sellet (1993: 106) defined the concept with the "aims to describe and understand all cultural transformations through which a specific raw material had to go through. It is a chronological segmentation of the actions and mental processes requires in the manufacture of an artifact and in its maintenance into the technical system of a prehistoric group". This concept was also used as a way to show "the internal logic of an activity (...) which presents itself as a sequence of acts, gestures, instruments that accept a technical process with its more or less predictable main steps" (Karlin 1991: 109). Those ideas manifested themselves as a pillar of the "Ethnology of Techniques" where the understanding of the succession of events is nothing more than a simple way to characterize the elements and the stages of a material transformation, controlled by an agent (Lemonnier 2013: 178-179). By grouping sequential gestures, the ethnographer was able to document the *chaîne opératoire* through which a technique is initiated, implemented and completed (Tostevin 2011: 42).

The effective introduction of this ethnological analytical model in archaeology took place in the 1964 when Leroi-Gourhan, leading a team composed of names such as Michel Brézillon and Claudine Karlin, carried out a project in a Magdalenian (Upper Paleolithic) site in Pincevent (France). From this moment on, Leroi-Gourhan began to devote himself more to the archaeological research than to his area of origin, Ethnology. The site in question has approximately 4500 m² and is located in a low terrace on the Seine river, in a wide valley.

The group settled in this area more than 20 times about 14,000 years ago, where they most often went to hunt reindeer during the autumn migration when the river was still full and the animals had to cross it, thus being an easy target (Karlin & Julien 2019; Leroi-Gourhan & Brezillon 1964).

The formation process of the site included frequent and regular flood events with such a gentle deposition that, over time, the various layers of Paleolithic occupation were clearly separated by a clayey soil that, once dry, preserved even small fragments at very fine undisturbed stratigraphic levels, giving the impression that the activities had taken place a little while ago (Leroi-Gourhan & Brézillon 1964). Those layers preserved a high density of artefacts, composed of large and small concentrations of materials, allowing not only a technological analysis approach but also a high number of refittings, which included even faunal vestiges. The association between all refitted artefacts (lithic and fauna) allowed, albeit in a fragmentary way, to infer about individuals and their performances, enabling not only considerations about the number of people who inhabited the place but also the elucidation of specific activities carried out in restricted areas, such as the observation of the level of ability of the knapper by looking at their products as well as aspects of social organization of these families (Karlin & Julien 2019).

The preservation conditions made this site an ideal case study for the characterization of cultural entities as the various archaeological remains and areas of activity, preserved *in situ*, allowed the study of the objects, relationships between them, and also the relationship between objects and people, thus achieving the primary objective of the concept of *chaîne opératoire*, which consists of the documentation of the “chronological segmentations of the actions and mental processes required in the manufacture of an artefact and in its maintenance within the technical system of a prehistoric group” (Sellet 1993: 106).

It is worth noting that the reduction model proposed by French scholars is strongly concerned with deciphering the knapper’s intention that would be revealed by the reconstruction of all events (the knappers choices of action, the use of the tool, its maintenance and discard) that are materialized in the archaeological record and that is what they call “history of the tool”. That approach was already known in Ethnology under the name of *School of Cultural Technology*, which understood that each technical fact would correspond to a cultural or social fact., Thus, as approaches expanded the study of the technical systems by emphasizing that all variants must be considered (Lemonnier 1992) and the ethnographer is able to document the *chaîne opératoire* by grouping sequential gestures (Tostevin 2012: 42) observed in the living systems. Influenced by this notion, both archaeologists and ethnologists saw in the gesture an opportunity to study the past behavior (Shott 2003: 99).

Balfet (1991) shows two units of possible interpretation that will depend on what the researcher will determine as significant: one based on the premises of Leroi-Gourhan in the *Evolution et Techniques* (Leroi-Gourhan 1973) when the analyst tries to “highlight the internal logic of an activity” observed by the “sequence of acts, gestures, instruments constituting a technical process with its major more or less predictable stages” and the second in the level of *facts* which comprises “all the operations that a human group organizes and carries out” according to the technical knowledge that they possess but with a specific end: “the satisfaction of a socially recognized need” Balfet (1991:12).

This approach is deeply rooted in the notion that the process of knapping has a chronological segmentation both of the actions and the mental processes required for the elaboration of a given implement. A description of the operationalized method is offered by Inizan *et al.* (1999: 15-16) in a diagram (Figure 1). The *chaîne* is mainly composed of two ideative units: 1) the conceptual scheme that is “of intellectual nature” and will guide the knapper to produce predetermined tools by specific social behaviour and 2) as a consequence,

the sequence of technical operations is reflected in an operative scheme. Those, in fact, are theoretical attempts to understand both the processes involved in the knapping sequence and discontinuities represented by the lack of diagnostic ‘stages’ or ‘phases’ since, according to Balfet (1991: 17), the “operational chains combine as distinct stages of a technical activity”. The terms stage and phase are not well defined and most of the time seem to be used as synonyms. Generally they share a common notion that the manufacturing requires a series of stages and each of them has specific objectives (Kooyman 2000: 170).

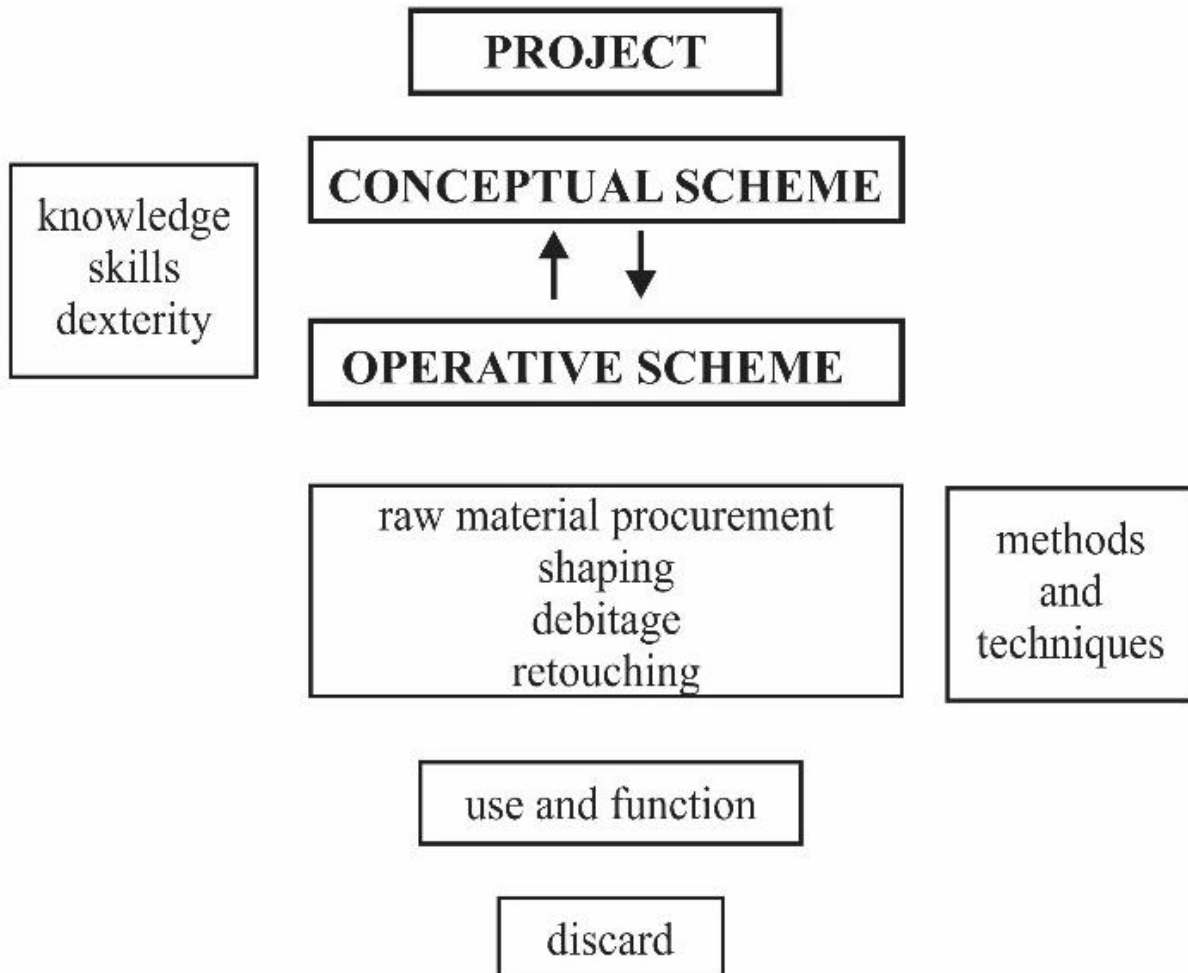


Figure 1. A classic diagram proposed by Inizan *et al.* (1999) illustrating how the notions of technical system are organized. It is not clear why the boxes do not show any arrows connecting them. Modified from the original.

Understanding the ways of life of human groups is a common objective for ethnologists and archaeologists, however, the objects of study strongly separate these two fields. The former directly observe living human groups, inferring about gestures and actions that can literally be seen and would allow them to determine, within their field of interest, what will constitute a significant unit of observation and what will be listed as an operative chain. Thus, in Ethnology, the definition varies according to the technical process described, the method used for recording and what level of descriptive analysis can be chosen as a relevant unit of analysis (Balfet 1991). There may also be an understanding that symbolism, represented by rites and magic, can be inseparable from technical practices and the analysis of operative chains, and these observations are consolidated as a way of recording the most diverse aspects of a culture (Lemonnier 2013). Unlike them, the archaeologist has only fragmented records

and must find a definition that induces the maximum use of the information at his disposal (Karlín 1991; Lemonnier 1986).

Imported from Ethnology from Marcel Mauss's *Les Techniques du Corps* (1934) and from Leroi-Gourhan's ethnological and prehistoric research, the *chaîne opératoire* concept was disseminated throughout Western Europe. The technique, for Mauss, consisted of using energy through the body and Leroi-Gourhan made the body a tool responsible for applying energy in the physical world, bringing the product of this physical action to the field of study (Tostevin 2011: 42). The understanding of the action and gestures performed would give access to the “doing mind” and made it possible to understand the strategic decisions made by human groups, making the *chaîne opératoire* concept a “diagnostic technology”, an analytical approach that expands the mere material characterization by allowing access to the artisan's mind, since the technical action of knapping is something intentionally planned, loaded with “beliefs, expectations, desires and deliberations” and therefore every the technical action has “mental antecedents” (Schlanger 1994). In this way, archaeologists practically aimed for the same methods and goals as the ethnologists since they started to understand “the technical framework, the succession of gestures, the instruments and the people who made them, in order, later, to connect each technological subsystem with other aspects related to their socio-cultural environment groups (Delage 2017: 158).

3. The reduction sequence concept

The idea that a technological analysis would be a proper manner to reveal the actions of the prehistoric artisans existed in American Archaeology long before the popularity of the concept of *chaîne opératoire* (Tostevin 2011: 47). William Henry Holmes, an intellectual star of the "Smithsonian Group" of anthropological scholars, became a famous figure in North American archaeology mostly because of his development of the ‘Reduction Sequence’ concept. Although he never actually defined his approach, it can be understood in a broad sense as “the culturally and physically patterned way that people reduced pieces of stone to useful tools” (Shott 2003: 95) demonstrating the life history effects on stone tool typologies (Tostevin 2011: 47). Without importing any theoretical framework from neighbouring sciences, Holmes outlined the concept through the study of a “quarry debris arranged in a sequence from natural cobbles through reduction ‘stages’ to finished products” (Shott 2003: 99).

Assuming that the act of flintknapping is a manner in which a specific piece of rock is transformed by a ‘continuum’ series of reduction sequences, which happens in a specific space in a chronologically ordered way, the ‘stages’ exist as materialized pieces of this whole process and so “their validity must be demonstrated, not assumed” (Shott 2003: 101).

To Bradley *et al.* (2010: 6) the term ‘stage’ is related to discontinuities in space or time and has to be documented by the archaeological record. The authors exemplify this by showing that some bifacial knapping requires three stages: 1) raw material selection, 2) shaping, thinning and regularization and 3) finishing. If the stage 1 (or any other) is not present in a particular assemblage, then there is a spatial break, because this activity was performed somewhere else, and also a time break because the sequence is chronologically fragmented. This definition presumes a detailed knowledge of the context and production technology, so the analyst can perceive the attainment of particular knapping goals that are used to define these breaks between the stages. The term ‘phase’ has a similar definition but it is reserved for those cases where there is continuous reduction, with breaks not demonstrated in the assemblage, but deduced by what seem to be discontinuities in the goals of the production sequence (Bradley *et al.* 2010: 7). It is the achievement of specific goals that are used to define the breaks between stages.

Shott (2003) expresses his own opinion about the French and North American approaches, assuming that both are substantially the same thing but his opinion on the subject is almost a subtle provocation when he says that “the enthusiasm for *chaîne opératoire* reveals more about archaeologists than it does about the stone tools they study”. In the course of his paper, he states that the main difference between those two is the emic characteristic that strongly marks French thought. The Reduction Sequence approach is specific to the study of stone tool technology while *chaîne opératoire* covers all material culture behaviour, past or present (Tostevin 2011: 352).

Tostevin (2011: 354) agrees with some of Shott's statements but adds two theoretical points. First there is a theory conflict in the French school since they “view *chaîne opératoire* itself as a high-level theory that provides both its own questions (...) and its own analytical methods”. Second, the focus on the emic goal would be successfully achieved by the identification of ‘technical choices’. Regarding the latter, Tostevin (2011: 355) criticizes that ‘choices’ are only valid if proved by the archaeological record and, if so, they would be an emic unit of analysis. The author extends the reasoning by saying that emic units should not be understood as evolutionary strategies since specific choices can occur to the detriment of the advantages offered by a technical solution.

4. Minimum analytical nodule analysis as a sequence model

Minimum Analytical Nodule Analysis (MANA) is a methodological approach that has the purpose of highlighting the stages that occur within a SM, such as obtaining raw material, production and maintenance, discarding instruments.

Every standard analysis of lithic technology has in its protocol a field reserved for the identification of the raw material. Generally, the type of material and dimensions are noted, as well as observations on the cortex and patina. Together, these data allow us to think about obtaining locations (pebbles, blocks, fixed cores, *etc.*). This is the classic way in which technology deals with the raw material attribute. Precisely in the macroscopic observation of the rocks, the MANA approach has its starting point for technological inferences, making it a highly effective paradigm in artefacts that have discrepant color, intrusions and cortex, not necessarily being applied only to different raw materials.

The MANA approach behave similarly to the operationalization of analysis by refitting, an approach that proliferated in the 1990s, since both are based on the macroscopic observation of the raw material. Artefacts are divided into groups, defined as “nodules”, composed of paradigmatic classes (Dunnell 1971: 100-105), which must share similarities in colour, cortex, texture and inclusions (Knell 2012; Larson & Kornfeld 1997). Other attributes can be observed as long as they work as a differentiating element, such as burn marks and patina. These groups, which share physical characteristics observed macroscopically, are called “Minimum Analytical Nodules” or MAN. Led by this approach, the studies start from the premise that the analyst can rationally divide the artefactual assemblage into several MANs and each of these units must include artefacts that were removed from the same block (that is the reason why they have to share physical attributes), thus representing a limited set of events (Knell 2012; Prasciunas 2014).

In both MANA and refitting, the grouping is conducted from the macroscopic recognition of the raw material, in which an arbitrary cut is imposed, disregarding flakes smaller than one or two centimetres, due to the difficulty of recognizing specific attributes, thus avoiding misunderstandings in the association of certain material to the group (Larson & Kornfeld 1997). Once the nodules (MAN) are properly separated, they are analysed by technological and/or morphological approaches. Some authors use the concept of *chaîne opératoire* in a simplified way to order events based on the technological and sequential

aspects of the search, manufacture, use and disposal of instruments (Lindström 2019; Mansrud & Eymundsson 2016).

Larson & Kornfeld (1997:10-13) offer some examples of the inferences that can be made. If the nodule is composed of a single piece, such as a single instrument or a single flaking product, the technological behaviour indicated by it reflects an activity performed outside the site area. When the group is composed of many pieces, possibly formed by *debitage* flakes, it is proposed that the events occurred intra-site. If formal artefacts and many flaking products are present in these nodules it is understood that the manufacturing, use and discard activities took place *in situ* (Larson & Kornfeld 1997:10-12). Thus, in this scenario, the observation of MANs seeks inferences about human mobility. In the case of a short occupation, it is expected that there will be little production of lithic material and that the main instruments will be taken away. In contrary situations, MANs are expected to show possible tool kits, in addition to flaking products. Also, according to Knell (2012), it allows inferences about the transport strategies of these instruments.

From this perspective, the interpretation of the variability of the MANs suggests scenarios based on areas of activity at the site. For Larson & Kornfeld (1997), who understand that there should not be a dissociation of the archaeological and anthropological perspectives, the variations in the configuration of the MANs are the result of the choices made by prehistoric groups with regards their needs. For Knell (2012), different technological strategies can change as a consequence of sites with different functions. From this perspective, the latter approach seems to be linked more to the ideas of the Processualist approach.

5. *Gihō*: The Japanese sequence model

As a last example, there is another approach, unknown in Brazilian archaeology, named as *Gihō* and dedicated to the study of laminar cores.

The late Pleistocene lithic industry in Japan is marked by the appearance of microblade assemblages. These instruments caught the attention of researchers because they were technologically complex and lasted only 2000 years (Bleed 2002). This techno-typological concept was pioneered in the studies of M. Yoshizaki in the 1960s in Hokkaido (Takakura 2010), an island in northern Japan where the largest number of assemblages of microblades associated with the Upper Palaeolithic were found (Nakazawa & Akai 2017).

Gihō's analyses began on the basis of typological (morphological) descriptions, which were subsequently expanded by refitting exercises and later by replications (Bleed 2001; Ikawa-Smith 1975). These studies, conducted between 1960 and 1990, almost completely described the reduction sequence of cores and resulting types of microblades in Hokkaido (Nakazawa & Akai 2017).

Theoretically, this approach understands that human behaviour is highly standardized and, as such, the classification may actually reflect cultural entities (emic types). Conceptually linked to Historical Culturalism, Japanese archaeology could be understood as “theory free”, as these conclusions came straight from the detailed presentation of data and analyses that could be easily connected with the primary sources of evidence (Bleed 2002: 95). This is possibly one of the reasons why Japanese researchers understand that this sequence model is extremely useful, in which a distinct step within this sequence would correspond to a specific technique and, from this technique, it would be possible to broadly map human occupations (Bleed 2001).

The classification of the types of cores and microblades based on the *Gihō* method led the Japanese to elaborate a techno-typological description with the creation of a “chronocultural” scenario that, despite allowing them to contribute considerably to the study of lithic

materials, today have been the target of criticism that question the real capacity of typologies and the *Gihō* method to address issues that are not strictly chronological, since the variability in the reduction sequences can also be related to the availability of raw material, format and quality (Takakura 2010).

6. Discussion

In Brazil, a school of technological analysis has never been developed. The *chaîne opératoire* concept prevails in all contexts of sites and collections, with the promise of achieving Archaeology's primary goal of understanding the relationships between objects x objects and objects x people. As already explained above, the application of this anthropological method in archaeology took advantage of a very favourable context (Pincevent), which in the long term, corroborated by refitting efforts, validated it as a powerful analytical tool. However, archaeological sites like Pincevent are extremely rare, and in Brazil the concept has been applied to contexts where its application is far from granted: low-density assemblages, surface sites (which may imply a palimpsest composed by several different occupations) or even to a single instrument, with low or no investment in refitting, which is one of the *chaîne opératoire* main methods. Even so, in the Brazilian context lithic technology is understood as being practically synonymous with the *chaîne opératoire*, as if one were inseparable from the other, mostly due to lack of knowledge about other methods.

What is evident is that even though they are substantially similar, the sequence model analyses are not identical. The French model, strongly influenced by anthropological approaches, emphasizes a notion that the study of techniques is the only way to understand the 'choices' made by societies within a universe of possibilities. This behavioural approach is somewhat difficult to access by the archaeological record since the objects of study are not living people, but fragmentary material records of past behaviour. The question is not how effective the *chaîne opératoire* is in the field of technical study, but how capable it is to actually access the "doing mind" in order to register gestures, symbolism and effectively expose the choices. It also appears to be a theoretical contradiction since the proponents of the method use "choices" and "norms" in the same discourse. While the first suggests a universe of possibilities, the second determines something that must be socially accepted and culturally transmitted. Disregarding this ambiguity, if considered in ideal contexts that should present a high density of objects, in the long term, and from the investment in refitting, the method will certainly allow the understanding of the reduction sequences. It may assess the craftsman's skill and, only at the end, will it tell the life history of the assemblage. Gestures and intentions, on the other hand, will hardly be discovered by the analyst.

Anyway, each approach has its limits. The grouping of MANs, for example, is susceptible to the heterogeneity or homogeneity of the raw material, affecting the separation between the flaking products of the "original block" (Larson & Kornfeld 1997: 14), which would cause a spatial or temporal fragmentation in the analysis. On the other hand, if the question is to understand possible breakage patterns, the MANs facilitate understanding as they point out differences in the quality of each raw material (Amick & Mauldin 1997). The possible abandonment of the *Gihō* was due to the excessive focus on the link between types and emic representations, but while it was valid, it characterized the Japanese laminar industries establishing a chronological hypothesis. As for the Reduction Sequence model, in order to speak in stages, it is necessary to have a previous knowledge of the collection, the kind of data that can only be generated in the long term or from the study of dense collections, but its results do not exceed the empirical record.

Lastly, we have an increasing amount of evidence that shape is an important aspect of formal artifacts, the ones that were produced following some kind of mental template or

cultural model (Okumura & Araujo 2014). The single-minded emphasis in technology and consequent disregard of shape is deleterious to the study of lithic industries which show this particular class of artifacts. In other contexts, where formal artifacts are totally lacking (e.g., Araujo *et al.* 2017; Moreno de Sousa & Araujo 2018), there is not much left besides technological analysis. Ironically, in these very simple lithic industries where flakes and splinters are used right away, without any further modification, the concept of *chaîne opératoire* will not be very useful. Other approaches, such as cortex ratios (e.g., Lin *et al.* 2015) should be better suited. In short, as always happens in archaeology, context is everything.

7. Conclusions

If we consider all those approaches as different theoretical units of analysis applied in lithic assemblages, we can conclude that they have been used uninterruptedly for approximately 130 years all over the world. French, American, Japanese and many other scholars arrived at the same principal idea by their specific trajectory, experiences, context and at different times. That is not a surprising factor considering that stone tools can only be manufactured by an orderly sequence of reductions and that mechanical fracture patterns are limited.

As we mentioned, in Brazil the concept of *chaîne opératoire* prevails in several contexts and assemblages that do not lead to a real application of the method, except in the most banal way. Claiming to be an analytical approach that sought to revise “typologies”, and in some cases to redefine traditions, the generic conclusions that a given collection is “composed of *débitage*, *façonnage* and retouch flakes”, or that people “went after raw materials, flaked them, used them, and later discarded when they were not useful”, were not enough to achieve the primary objective of understanding the relationships between objects and the relationship between objects and people. Added to this, there is little investment in refitting, or in associating lithics with other artefacts such as faunal remains or with other approaches such as traceology or residual analysis, which would help answer questions about subsistence, adaptation and ways of life. The point here is not about the validity of the concept of *chaîne opératoire*, but rather about its (covert and misunderstood) theoretical underpinnings, and its empirical application, which is limited to specific contexts. The lithic analysis literature is thriving with new approaches that should be evaluated and eventually incorporated by young researchers (e.g., Holdaway & Phillipps 2021; Iovita *et al.* 2021; Rezek *et al.* 2020), but for this to happen a broadening of the interpretive horizon duly accompanied by a critical posture are mandatory.

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Buscando o novo sem reinventar a roda: Sobre a necessidade de aprender e ensinar distintas abordagens aplicadas ao material lítico

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Resumo:

A Arqueologia brasileira se desenvolveu seguindo as mesmas fases pelas quais passou a disciplina como um todo: uma ênfase inicial no Histórico Culturalismo, seguida por críticas que culminaram em um leque de possibilidades, desde a rejeição indiscriminada a tudo o que foi feito antes, até uma postura mais equilibrada com a incorporação de novos conceitos. Especificamente, podemos dizer que houve um cisma entre os primeiros arqueólogos profissionais, interessados em construir um conhecimento histórico-cultural, que buscava entender a variabilidade artefactual a partir das formas e possíveis funções dos artefatos e outros mais jovens orientados pela abordagem Processualista, que partiam do princípio de que a diversidade dos instrumentos refletiria a relação entre homem x ambiente e poderia ser entendida a partir da compreensão das distintas técnicas de manufatura. Com o passar do tempo, a crítica ao uso das abordagens morfológicas fizeram com que as análises tecnológicas se constituíssem como um método de análise supostamente superior e mais adequado para a caracterização dos artefatos líticos. Nas pesquisas arqueológicas brasileiras, este raciocínio tem se consolidado ao longo do tempo e, conseqüentemente, limitado não somente o uso de outras perspectivas, que poderiam ser complementares à caracterização dos artefatos, como a identificação de distintos grupos culturais. Considerando que a análise tecnológica entende que existem diversas etapas envolvidas no processo de manufatura dos instrumentos líticos e que o desenvolvimento dessas atividades ocorrem de forma ordenada, dentro de um determinado tempo e espaço, apresentamos neste artigo algumas abordagens que lidam com a noção de Modelos de Sequência (Bleed 2001). O principal objetivo é o de mostrar que mesmo que considerem o desenvolvimento das atividades como um processo que ocorre de forma ordenada, conceitos semelhantes não são necessariamente substancialmente idênticos. Para iniciar a discussão sobre as diferentes abordagens, tratamos primeiramente do método francês denominado *chaîne opératoire*, certamente o mais reconhecido no Brasil. Possivelmente, seu estabelecimento na literatura brasileira se deve aos sucessivos anos de ensino, aprendizagem e reprodução de conceitos chave, sem grande investimento em aprimoramento e aplicação de outros métodos. Para tanto, discutimos o modelo de análise com influência norte-americana denominado Sequência de Redução (Reduction Sequence), explorando conceitos básicos capazes de diferenciá-lo da escola francesa. Em seguida, apresentamos o método denominado Minimum Analytical Nodule Analysis, uma abordagem com foco na observação macroscópica da matéria-prima, operacionalizada de modo muito similar ao método de remontagem. Posteriormente, exploramos o conceito japonês denominado *Gihō*, voltado para análise de indústrias laminares. Como conclusão, traçamos um paralelo entre essas abordagens mostrando que algumas delas requerem um contexto específico para serem aplicadas ou mesmo que suas inferências só serão possíveis a longo prazo e a partir de coleções densas.

Palavras-chave: tecnologia lítica; teoria; método; *cadeia operatória*; sequência de redução; modelos de sequência