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The means of complexity in a lithic reduction sequence

[Marta Arzarello](#) based on reviews by [Antony Borel](#) and 1 anonymous reviewer

A recommendation of:

Cédric Gaucherel and Camille Noûs. Platforms of Palaeolithic knappers reveal complex linguistic abilities (2020), PaleorXiv, wn5za, ver. 6, peer-reviewed and recommended by PCI Archaeology. [10.31233/osf.io/wn5za](https://doi.org/10.31233/osf.io/wn5za)

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The paper entitled “Platforms of Palaeolithic knappers reveal complex linguistic abilities” [1] submitted by C. Gaucherel and C. Noûs represents an interesting reflection about the possibilities to detect the human cognitive abilities in relation to the lithic production.

The definition and the study of human cognitive abilities during the Lower Palaeolithic it has always been a complex field of investigation. The relation between the technical skills (lithic production) and the emergence of the linguistic abilities is not easy to investigate due to the difficulty of finding objective data to refer to. The proposition, made by C. Gaucherel and C. Noûs, of a formal grammar of knapping as a method to study the syntactical organisation of the reduction sequences, constitute a new and theoretical useful approach.

In order to effectively and precisely define the gestures linked to a specific reduction sequence, for example that of the handaxes shaping, a very large number of variables should be taken into consideration (morphology and quality of the raw material, experience of the knapper, context, percussion technique, forecast of use of the handaxe, etc.). But since a simplification, that brings more elements than the classic one [2,3] is needed, the “action grammar approach” can be a good instrument to detect the common

element in a shaping reduction sequence. Furthermore, one of the advantages of the proposed methodology lies in the fact that the definition of the different STs (Stone Technology) can be done according to the technological specific characteristics to be studied and to the type of instrument produced.

The deconstruction of knapping sequences could help to detect the degree of complexity of the different steps of the reduction sequences also thanks to the identification of the sub-actions types. The increasing/decreasing of complexity is a very complicate concept in lithic technology. Since at the base of the lithic production there are two basic concepts (angle between the striking platform and the debitage surface - convexity of the debitage/façonnage surface) which are simply declined in an increasingly complex way, it is not easy to define uniquely in what exactly consists the increase in complexity. The approach proposed in the paper “Platforms of Palaeolithic knappers reveal complex linguistic abilities” can help to have new evidences, according to the identification of the required cognitive abilities.

The proposed example of formal grammar still needs to be confirmed on archaeological collections, but it is probable that a practical application will allow to further develop the methodology and possibly to highlight additional possibilities of the approach.

Bibliography

- [1] Gaucherel, C. and Noûs C. (2020). Platforms of Palaeolithic knappers reveal complex linguistic abilities. Paleorxiv, wn5za, ver. 6 peer-reviewed and recommended by PCI Archaeology. doi: [10.31233/osf.io/wn5za](https://doi.org/10.31233/osf.io/wn5za)
- [2] Inizian, M. L., Reduron, M., Roche, H. and Tixier, J. (1995). Technologie de la pierre taillée. Préhistoire de la Pierre Taillée 4, Cercle de Recherches et d'Etudes Préhistoriques d'Antibes, Meudon.
- [3] Tixier, J., Inizian, M. L. and Roche, H. (1980). Terminologie et technologie. Préhistoire de la pierre taillée 1, Cercle de Recherches et d'Etudes Préhistoriques d'Antibes, Meudon.

Revision round #1
2020-05-24

Dear Cédric and Camille (all those who are part of it), Your preprint has now been read meticulously by two experts (A. Borel and an anonymous expert) and by me. We all agree that your research is innovative and very well structured from the theoretical and methodological point of view. Although it is a first step in the

research and even if the application of the methodology to archaeological lithic assemblage will not be very simple, the use of a MGA (Minimalist Grammar of Acrion) for the analysis of the co-evolution of tool-making technology and language is very original and could lead to excellent results. The improvements proposed by the referees will be very helpful to better define the terminology used in lithic technology. In addition to their comments, I believe it is important to modify the statements that define Oldowaian and Acheulean as "simple technologies". First, because between the two macro-cultures there are very substantial differences and secondly because some methods used during the Lower Palaeolithic persist for a long time even after (for example the discoid debitage, 1,2). Instead of talking about "simples technologies" perhaps it would be better to use "simpler and more intuitive reduction sequences" (the SSDA/opportunistic method, for example 3). As the authors give great importance to abrasion and the preparation of the striking platforms for the handaxes shaping, it should not be forgotten that this behaviour is also influenced by the use of the organic soft hammer. The proposed approach is decidedly excellent, but in the future (if an experimental activity will be made) it would perhaps be better to concentrate solely on *débitage* or on *façonnage*. I kindly ask you to review the paper in a maximum of one month, following the indications of the referees. Please submit the revised preprint with a detailed point-by-point reply. After I will be very happy to recommend it, pending suitable minor revision.

Very kind regards Marta Arzarello

1. Boëda, E. Le débitage discoïde et le débitage Levallois récurrent centripète. *Bull. la Société Préhistorique Française* 90-6, 392-404 (1993).
2. Boëda, E. De la surface au volume analyse des conceptions des débitages Levallois et laminaire. in *Paléolithique moyen récent et Paléolithique supérieur en Europe* 3, 63-68 (Mémoires du Musé de Préhist. d'Ile-de-France, 1998).
3. Forestier, H. Le Clactonien: Mise en application d'une nouvelle méthode de débitage s'inscrivant dans la variabilité des systèmes de production lithique du Paléolithique ancien. *Paleo* 5, 53-82 (1993).

Preprint DOI: <https://paleorxiv.org/wn5za>

Reviewed by [Antony Borel](#), 2020-05-18 23:20

[Download the review \(PDF file\)](#)

Reviewed by *anonymous reviewer*, 2020-05-20 17:15

The paper entitled “Platforms of Palaeolithic knappers reveals complex linguistic abilities” deals with a quite debated issue in the field of Palaeolithic research: the link between knapping activities and the origins of language. This is a very interesting and interdisciplinary line of research, involving biology, cognitive neurosciences, linguistics and finally Palaeolithic archaeology. In this field of research, it is widely accepted that the first cognitive change in human evolution can be identified in the management of the mechanics of the conchoidal fracture, followed by the production of shaped tools. The aim of the present research is to propose a formal approach to study linguistic abilities from knapping. The objective is pursued through the application of the Minimalist Grammar of Action (MGA), inspired by the most recent formulation of Chomsky’s grammar of action to the study of lithic reduction strategies. The method is here tested concerning the simplest gestures related to knapping activities and to issues regarding “platforms preparation” in shaping activities. As a result, the proposed theoretical approach underlines that some strategies of lithic reduction sequences appear similar to the linguistic concept of central recursion, thus suggesting the presence of syntax and of a grammar structure in knapping activities. The application of such a formal approach, would contribute in the identification of the cognitive abilities related to the development of stone technologies and to the great debate about the evolution of human language.

The theoretical framework, the methodology and the results are clear and well exposed as well as the aims of the proposed research with regard to the current issues about the development of human cognitive abilities and the relation between knapping activities and language.

Although the results are very interesting and a wider application of this methodology is desirable, I have some remarks about the terminology used concerning lithic technology that often appears unclear, thus generating some confusion and misunderstandings. Also, the bibliographic references concerning lithic technology needs to be improved.

Line 80 “we mainly focus on the literature and on our own experience of knapping in Mode 1, i.e. Oldowan, and other simple core reduction sequences, i.e. early Acheulean”. Bibliography is needed concerning definition of Oldowan and early Acheulean.

Lines 102, 130 and 186 What does the author refer to with “simple tools” and “simple flake tools”? If unretouched artefacts are what is meant, it would be better to use just the term “flakes”.

Line 133 “The central hypothesis is that high-order syntax and cognitive abilities possibly exist as early on as the Oldowan epoch”. The reference is probably to the lithic industries dated back to 3.3 Ma from Kenya. Bibliographic reference is needed.

Line 140 “...techniques of reduction...”: not clear if the author refers to the knapping technique (hard hammer direct percussion, soft hammer direct percussion, bipolar on anvil technique, etc...) or to the knapping method. Shaping a biface is not a knapping method but is part of the concept of façonnage. This distinction needs to be clarified in the text.

Line 152 It would be better to clarify what it is intended with “simple actions of the early Acheulean”. This will help in the understanding of the results and discussion section.

Line 158 Different knapping techniques, like on anvil percussion, are well attested since the first appearance of lithic reduction strategies. Direct percussion by hard hammer can for sure be considered one of the simplest knapping techniques but I am not sure if it is the simplest one.

Lines 178-179 Inaccurate terminology: the surface to strike is the “platform” or striking surface; the point to be strike on the striking surface is the point of impact.

Line 187 More bibliographic references are needed

Lines 186-215 Some clarifications and distinction have to be made in this section. First, the conceptual difference between débitage and façonnage needs to be made explicit. Even if in terms of gesture both during débitage and façonnage we have the detachment of flakes (in this case through hard hammer percussion), the aim for which the flakes are detached are very different, being flakes the aim of the production (débitage) or the waste of the knapping activity (façonnage). Line 189 - “...platforms on cores are noted even at Oldowan sites...”: platform is a general term that indicates the presence on a blank of a surface that was intentionally struck for knapping activities, be it prepared or not; therefore, if a “stone” is identified as a core, it has to have at least a striking platform. The presence of faceting cited in the text always refers (concerning the cited references) to chaînes opératoires of handaxes shaping, and this has to be made clear. Bifaceted (dihedral) and some multifaceted butts are mentioned in de la Torre 2011 but no confusion has to be made between the intentional preparation of a striking platform through faceting, which is characteristic of predetermined knapping methods, and the presence of negatives of previous detachments on the butts, that can occur during reduction sequences using as striking platform a previous flaking

surface. Finally, the term “core” referred to handaxes preforms is not appropriate. Line 214: for clarity, add some examples of “any other kind of action different to that of faceting”.

Line 406 Instead of “tools” it would be better to use the term “flakes”.

Line 438 For clarity it would be useful to make examples of “simpler tools”.

Lines 456-457 “ST3 – faceting of the platform in order to detach the intended flake”: this sentence could be misunderstood, since it can be intended as the preparation of the striking platform to detach a predetermined flake, being the flake the objective of the knapping activity. It has to be made explicit that we are talking about shaping.

Line 561 Techniques or methods?

Line 561 “...some techniques are drawn entirely from modern knapping rather than archaeological evidence”: the sentence is referred to knapping methods or techniques? In both cases experimental works in lithic technology are strictly related to archaeological issues and we have archaeological evidence of all the techniques and methods experimentally realized by modern knappers.

Line 580 Concerning platform preparation is necessary to specify that this is observed in handaxes shaping processes, not concerning debitage.

Line 587-591 “...faceting and grinding in Acheulean (or earlier) assemblages remain under-discussed in primary archaeological studies, possibly because they have not yet been found. This study highlights the clear need for such discussions on the basis of formal and rigorous models”. I do not agree with this sentence, mainly because platform preparation (through faceting or grinding) during handaxes façonnage is a debated issue also in most of the studies cited in the text. Attention has to be paid towards the correct identification of an intentional preparation: e.g. as underlined by Kumar and Pappu 2015, in many cases faceted butts originates from the remnants of flake scars arising from bifacial flaking of the handaxe edges. In earlier assemblages (Oldowan), mainly characterized by debitage, no intentional preparation of the striking platforms is documented.

Line 596-598 Not clear if the author refers to knapping or shaping activities or to both.

Finally, some typos should be corrected:

Lines 125-126: “...following (Pastra and Aloimonos 2012) to...” bracket should be deleted.

Line 434: Upper Palaeolithic

Lines 461 and 536: Lower Palaeolithic

Line 513: “ot”, it should be “not”

Figures Fig. 1 should be improved, in particular figure 1b. The reference to this figure concerning handaxes shaping (i.e. line 187 and 198) is not appropriate. More pictures or schematic renderings could support what the author present in the text.

Author's reply:

Dear Marta, I thank you very much for this positive evaluation of our paper. I did my best to improve it, according to the relevant corrections proposed by the reviewer. I sincerely hope this new version will convince you and interest PCI archaeology. Best wishes. Cédric.

[Download author's reply \(PDF file\)](#)