Dear Editor,

We are pleased to resubmit the revised version of "For our world without sound. The opportunistic debitage in the Italian context: a methodological evaluation of the lithic assemblages of Pirro Nord, Cà Belvedere di Montepoggiolo, Ciota Ciara cave and Riparo Tagliente.". We would like to thank the reviewers and we appreciated the constructive criticism of their comments. Please find below our response to each of their comments (*italics* for the text of the reviewers).

Marco Carpentieri and Marta Arzarello

Reviewer #1

I suggest improving the figure of artefacts adding diacritic diagram (just adding arrows and numbers to the photographs or delivering the diacritic diagram that have been made as written by the authors). In fact, only with the photograph, it is hard to see the removal negative directions. Arrows or diacritic diagram will be helpful for readers.

Thank you for the suggestion. All the photographs presenting cores have been implemented with arrows and drawings of the negatives.

If possible, the authors could add 3D schemes like fig. 1 to deliver a better view of the described chaînes opératoires. Or some examples of such a 3D scheme could be added to show the archaeological refits and the reconstructed chaînes opératoires.

Unfortunately, no 3D schemes of the cores were performed. The experimental blocks were analysed with a 3D scanner but only to obtain a view of the initial morphology. An example of that has been reported in the supplementary data on Zenodo. The file is called "Experimental protocol". Regarding the archaeological cores and experimental ones, diacritic schemes on power point were realized and photos has been taken. Since arrows and removal of the negatives have been added to the photos already present in the pre-print, we believe that more 3D or diacritic schemes would have made the file too difficult to follow.

It may be helpful to better distinguish the archaeological and the experimental description. A solution could be to insert a sub-title.

Thank you for the suggestion. Since the purpose of this work was a methodological re-evaluation of the opportunistic debitage, the experimental collection has been realized in order to verify the versatility and stability of it as a method. For this reason, we believe that distinguish the archaeological from the experimental description would have made the delineation of the opportunistic debitage's operative scheme more difficult. In any case sub-titles for each site's technological analysis have been realized in the text.

I think the objectives of the experimentation could be more precisely explained.

In the supplementary data on Zenodo (file named "Experimental protocol) a detailed analysis of the objectives of the experimentation has been written. Moreover, to clarify this point the following sentence has been added in the text:

"The aim was to highlight and quantify the main factors affecting the flaking process by comparing each block's operative scheme with the resulting outcomes. Being able to follow the flaking's realization process all along, the following questions were addressed. Which are the main aspects influencing the volumetric evolution of the blocks? Are they identifiable? How much does the morphology affect the objectives of productions? Is there a concrete subordination to raw material morphology? And if so, is there any pattern distinguishable in the knapping activity?"

And finally, I invite the authors to deeply explain and clarified the use of « opportunistic », is it a method, a concept, a debitage? The authors must give a detailed definition for these elements. It is a central question in the paper and the proposed definition and explanation are not enough clear and complete. I also suggest you discuss the concept of « affordance » recently introduced in lithic technology by Eric Boëda, or also his proposal of the type C debitage (Boëda, 2013). It could give you the opportunity to clarify your position comparing the two proposals.

Thank you for this idea. The opportunistic debitage is a flaking method and the word "concept" used in the text has been removed (also from the title) in order to clarify its definition. A detailed explanation of the opportunistic debitage has been added in the text, in the introduction and conclusion chapter.

"The opportunistic debitage is described as "a method oriented to raw materials' massive exploitation without implying either a core's, or any surface, preparation. The striking platforms and knapping surfaces are created as far as the flaking activity is carried on. […] The opportunistic debitage include an infinite range of variants always coming from the same common operative scheme" (traduced by Arzarello, 2003). The term opportunism is defined as "a behaviour in which someone adapts his actions to each context in order to gain from them the most advantage".

Moreover, the definition of method used in the text has been reported and discussed. Regarding the concept of affordance and type C debitage introduced by Boëda the following sentence has been added in the text to contextualize the opportunistic debitage within the archaeological community:

"In this sense, the opportunistic debitage may be compared to the "Type C" one recently introduced by Eric Boëda (2013) with which shares the concept of subordination and adaptability to natural morphological criteria alongside the choice of natural suitable volumes for the start of flake production without any surfaces' preparation. The variability of the operative schemes used is always depending on and according to the natural morphologies available and to the cores' volume. In any case a surfaces' hierarchization (Levallois likewise; Boëda, 1994) or a subordination of the morphologies to specific technical criteria (such as in the Discoid and Quina method; Boëda, 1993; Bourguignon, 1997) is implied in the opportunistic debitage."

The entire paper is focused on the question of the opportunistic debitage. But you just cite the work of Forestier (1993) and Arzarello (2003) without give us a clear and complete definition of "opportunistic debitage". I encourage you to clearly define it here and explain deeply and in details why you consider it as a method, and more particularly as a single method (and not a "family" of methods, or common features of methods). This complete definition is lacking and does not allow us to follow the authors in their demonstration.

A complete definition of the opportunistic debitage has been added in the text (as shown previously). Concerning the definition of single method compared to the one of "family" we would like to clarify this point by adding that any flaking method is characterized by different technical behaviours (terms with which we mean the different ways of exploiting a knapping surface) such as unipolar, orthogonal, centripetal always responding to the same mental scheme.

The following sentence has been rephrased

"Therefore, the first evidence of Levallois production (Prepared Core Technology; Moncel et al., 2020b) and its earliest diffusion during MIS 12 and MIS 9 (Moncel et al., 2016; Pereira et al., 2016; Rocca, 2016) determined a shift in the flakes complex's methodological analysis at the expense of the opportunistic debitage from this chronological phase onwards."

Don't you think it is just a problem of terminology and scholar terminological traditions?

Certainly, there is a problem of terminology within the scientific community about the different ways used to describe and define some flaking method. However, as it concerns the opportunistic debitage's contextualization within the cultural traditions of Middle and Upper Palaeolithic, there is a lack in the methodological analysis of these contexts which, often, do not mention, or consider at all, these type of productions.

A map could be added with the location the the four main sites of the study.

Thank you for the suggestion. A map with the location of the four main sites has been added in the text.

You talk about dimensional analyses here, but you have to precise how you had performed them (cite reference if necessary). If you did them, why not to use them in your paper? I invite you to insert some numbers in your text when appropriate and to upload your database in supplementary data in an open science perspective.

The following sentence has been added in the text to precise how the dimensional analysis was performed:

"The technical dimensions of the items were measured according to the minimal rectangle or "box method" (Laplace, 1977). No size-categories were created, thus, a distinction on the basis of flakes' length was not required."

Moreover, the dimensions of the flakes for each site (length, width, and thickness) have been added in the text. A boxplot presenting the length/width ratio of the archaeological has been realized and implemented (Fig. 5 of the new version). The database realized for this work has been uploaded on Zenodo.

Be more precise in your sample selection. And as requested below for the table 1, give us more details considering the full assemblages and the sample to better appreciate the representativity of the sample.

Thank you for the suggestion. The table 1 has been implemented with the total number of pieces in each site and for each level identified. Regarding the sample selection's criteria, the following sentence has been added in the text:

"In order to do so, cores, flakes (length ≥ 10mm) and tools coming from the richest levels concerning the opportunistic method were analysed and studied."

A column with the total of lithic pieces contained in each SU could be added to show the part of the assemblage selected for the study. Other columns with the detail of the technological categories of pieces had to be added to better know the composition of the studied assemblages and their representativity (core, flake…).

The table 1 has been implemented in the text with the SU identified in each site and with the cores and flakes studied in this work.

I invite you to give us in "Material and methods" section a definition on these scheme or/with references. Please precise if for you bipolar corresponds to bipolar-on-anvil (as some scholars use it) or not.

By bipolar it is intended the bipolar-on-anvil technique. Regarding the definition of the core's exploitation/scheme, the following sentence in "Material and methods" has been added:

"Overall, the technical behaviours identified through the analysis of cores were divided into (I) unifacial and (II)multifacial, depending on the number of knapping surfaces exploited, (III) cores on flake and (IV) split fractures cores. The terms unipolar, centripetal, orthogonal, and bipolar, applied to cores' descriptions, indicate how one, or more, knapping surfaces were knapped."

I think you can use much more the refits in the paper and at least a figure can be added to show us an informative/representative refit.

Thank you for the suggestion. The use of the refits would be actually clearer to express the technical behaviours applied in the site of Cà Belvedere di Montepoggiolo and its analogy with the one of Pirro Nord. We believe that since the article already presents many photos another one would have made harder to follow the text's explanation within the pages.

It would be easier to read and visualize if you group the unipolar flakes from 1 to 4, etc.

Thank you for the suggestion. In all photos, the flakes have been grouped according to their scars.

Flakes coming from unipolar scheme… is a better way to name the flakes. I do not recommend to directly associate the scheme with flake like you did (unipolar flake, centripetal flake). Please consider this remark for the following figures.

Thank you for this suggestion. Directly associating the production's scheme with flakes' scar, could be misleading. For this reason, in each photo the following sentence has been added in the text:

"flakes with unipolar scars, flakes with orthogonal scars, etc…"

In this way, we only provide the flakes' scars orientation but do not directly define the production schemes.

Perhaps you can change some categorisation of the cortex on pieces: total by entirely cortical, other by more detailed categories (distal, proximal, central)?

Thank you for the suggestion. Since the purpose of this type of graphic is to show the relevance of flakes bearing lateral cortex, we do not believe that adding more detailed categories would be relevant to the analysis' aim. Of course, on the database uploaded on Zenodo, the cortex's distribution has been described precisely.

Give a number of déjeté points by block to have a more precise idea of what you mean by "great number". Indicate the ratio in the total number of removals, it can be helpful.

The following sentence have been modified and implemented in the text:

"The experimental collection also yielded a great number of déjeté points: corresponding to 23% of all flakes The frequency of two orthogonal margins (the lateral and the distal one), forming a point, often adjacent to a natural backed edge, turned out to be very high in centripetal exploitation (36% of all déjeté points; Fig. 9 n° 8, 10-12)".

Distal debordant is not used in lithic technological terminology, it is called plunging flake. The debordant part of the flake is by definition situated on the lateral part of the flake. If you want to keep your terminology, please insert a reference defining it properly, or give a precise definition of your terminology.

Sorry for this mistake. We removed from all the graphic, and in the text, the term "distal debordant" and replaced it with plunging flakes.

The following sentence has been rephrased.

As a matter of fact, the ratio between unipolar removals and orthogonal + bipolar ones are closer when only the centripetal reduction sequences are selected.

The following sentence has been rephrased.

As a result, this may gradually generate a greater awareness in the knapper's mind during the knapping activity leading to hierarchized reduction sequences and, eventually, obtaining morphologically predetermined products.

You could explain here more precisely what you mean considering "morphological flaking-predisposition".

The following sentence has been added in the text:

"With this term we want to indicate the presence of natural suitable angle and convexities as the guiding line not only for the blocks' selection but also during the knapping activity as well."

Why do you use the singular? You show and demonstrate that you have different methods. You can group them in a "family"/a group of methods if you want but you cannot say different methods = a single method. I think you have to rephrase to deliver a more complete explanation.

Thank you for the suggestion. The following sentence has been added in the text:

"On the other side, it underlines how the opportunistic debitage persists during middle Palaeolithic resulting in being as much as an efficient and independent method (if compared to Levallois and Discoid) replicated through several technical behaviours (i.e. unipolar, orthogonal, centripetal, bipolar) for the manufacturing of functional products."

The following sentence has been rephrased in this way:

The formation of nervure-guides happened simultaneously to the flake's extraction being equally exploited as natural edges.

The following sentence has been rephrased in this way:

As stressed above, this strategy resulted, eventually, in semi-tournant behaviours involving, initially, natural edges then by progressively exploiting ones created during the production, recalling the laminar conception.

The following sentence has been rephrased in this way:

For this reason, orthogonal and bipolar debitage were likely to happen, both leading to a centripetal conception of knapping surfaces. That is: the same extraction's surface was more frequently knapped as the core's volume decreased.

The following sentence has been rephrased in this way:

The production focused on parallel removals which gradually involved the entire surface allowing a better control over the flakes' morpho-technical criteria, granted by an easier convexity and guiding arrises' management.

The following sentence has been rephrased in this way:

As a matter of fact, on the same core, a centripetal debitage often developed into a unidirectional one, or vice versa leading to short reduction sequences. In this case, it was the experimental work's merit to verify and validate how the morphologies could dictate how the objectives of productions were achieved, generating a wide number of diversified technical behaviours still originated from the same mental scheme. For this reason, from a methodological perspective and given the definition of method used for this work *"Le mot méthode revoit uniquement à l'étape de production: liaison entre la représentation abstraite de l'objectif et sa concrétisation. … il s'agit de l'ensemble des démarches raisonnées –schéma opératoire– suivi pour réaliser les objectifs fixés"* (Boëda, 1994), there is no such difference in the several technical behaviours (i.e. unipolar, centripetal or multidirectional debitage) used to achieve flake production since the purpose they are applied for (i.e. mental scheme, method), remains the same. It is the opportunistic method which differentiate itself in multiple types of debitage according to the raw material morphology and quality.

The following paragraphs has been rephrased this way:

The presence of more complex flaking methods within the Mousterian sequence of Riparo Tagliente (alongside the opportunistic debitage), implying either a surfaces' hierarchization (Levallois) or a strong subordination of the raw material's morphology to specific technical criteria (such as discoid and laminar), certainly played an influencing role in how the opportunistic sequences were achieved resulting in a greater flaking-technical awareness. As a sign of this, several experimental cores showed a greater affinity both with discoid reduction (Fig. 26 n° 1) sequences and the laminar ones. In the first case, the centripetal debitage was addressed, regarding the convexities' management and the use of cordal-like removals. In the latter, the experimental cores presenting an elongated morphology together with a low width,

were exploited through semi-tournant removals, often implying the presence of central nervure-guide (like a crest; Fig. 25 n° 3,5).

For these reason, one can assume, in a broader chronological perspective, that it was indeed the great versatility of the opportunistic debitage to represent, as seen in its earliest evidences (such as in Pirro Nord and Cà Belvedere di Montepoggiolo), the groundwork for the rising of such highly specialized and predetermined flaking method. By this, it is meant that starting from a deep subordination to morphological criteria to achieve an efficient functional flake production (which is the basic being of any flaking activity) a greater technical awareness may arise, leading to a possible subordination of the morphology to the technical criteria. As a matter of fact, this aspect, represent the starting point for Levallois and Discoid methods. However, their success, from middle Palaeolithic onward, did not prevent the opportunistic debitage to persist during the whole Pleistocene, both in a qualitative and quantitative way.

Why do you use for the first time here (except in the title) the word concept associated with opportunistic? You always associate opportunistic with method all along your paper. Concept and method are not the same. Please clarify this or explain the use of this word.

The term "concept" has been removed from the text, when related to the opportunistic debitage.

The following paragraph has been rephrased this way:

As observed in this work, its flexibility and capability to be efficiently adopted through different chronological and cultural phases always maintaining a steady mental scheme are the main features that outline a flaking method by definition. Therefore, the opportunistic debitage may be, indeed, the" *link between the abstract representation of the object and its realization*" (traduced by Boëda, 1994) since it connects a series of technical behaviours and gestures for its realization (Tixier et al., 1980) not only in a synchronic perspective but mostly in a diachronic one. However, it must be reminded that, as a flaking method, it will always be a partial aspect of the human groups' material culture: useful for the identification and interpretation of specific behaviours but far from being its unique constituent.

Reviewer #2

First of all, in the introductory section, a bit of the discussion around the definition problems of the SSDD and other systems such as Quina, branched/ramified productions, etc. is missing. This would give greater consistency to the debate and to the problems raised in this work.

Thank you for the suggestion. The following sentence has been added in the text to address the debate around the definition of the opportunistic debitage and other flaking methods:

"The variability of the operative schemes used is always depending on and according to the natural morphologies available and to the cores' volume. In any case a surfaces' hierarchization (Levallois likewise; Boëda, 1994) or a subordination of the morphologies to specific technical criteria (such as in the Discoid and Quina method; Boëda, 1993; Bourguignon, 1997) is implied in the opportunistic debitage."

Moreover, the following sentence regarding the branched/ramified productions has been added:

"In the end, a contextualization has to be made regarding the branched/ramified productions (Bourguignon et al., 2004; Romagnoli et al., 2018; Mathias and Bourguignon, 2020; Mathias et al., 2020) and their role within the opportunistic debitage. Since they are considered highly dependent on the flaking method used for the main production (Bourguignon et al., 2004) and stand as a specific behavioural aspect of the human groups related to techno-economic issues (Mathias and Bourguignon, 2020) they may represent one of the several technical responses or adaptation through which a flaking method (the opportunistic one in this case) is achieved (Romagnoli et al., 2018)."

Regarding to section 3, in table 4, it would be interesting to see which are also the removal directions of the core-on-flakes. I also wonder if there are kombewa-type flakes and, if there are, what is the explanation given and to which operational chain they belong (are they independent? Why and how?).

The core-on flakes from Pirro Nord present the same exploitation of the other cores (multifacial-unipolar and multifacial-orthogonal) and for these reasons have been considered as an outcome of the same common operative scheme. Regarding the presence of kombewa-type flakes, some kombewa *sensu latu* are attested. We believe that they represent a specific adaptation process related to the technical behaviours applied in the site and to the available morphologies (such as small cobble and pebble). That is why we considered them as equivalent to the rest of the production.

The paper should also include more sub-sections with unequivocal titles helping the reading, which is dense and sometimes difficult to follow. Each sub-section would be devoted to one idea.

Thank you for the suggestion. For each site, a sub-section has been introduced regarding: the raw material exploitation and collections, the production's goals, the flakes' analysis and the experimental collection.

On the other hand, when the authors talk about "Pirro Nord and Cà Belvedere di Montepoggiolo's flakes share common features. Quadrangular non-standardized shapes are widely attested, slightly longer than larger and with at least one cutting edge, usually on the lateral margin (Fig. 4,5). The dimensional range of the flakes, bearing or not cortex, is quite homogenous, confirming the shortness of the reduction sequences", it would be a good option to present a detailed graphic device with the typometry of the elements analysed. Likewise, quantify and measure the negatives of the last removals from cores. This would allow us to see the sizes and their relationship with the objectives of lithic production, the economy of the raw material, etc.

Thank you for the suggestion. A boxplot presenting the length/width ratio of the archaeological flakes has been added to the text. The number of removals from the exhausted cores have been quantified and put in the database uploaded on Zenodo. Measures about the last removals from cores were taken. However, these ones were considered not so relevant to the purpose of this work since its aim was a methodological evaluation of the opportunistic debitage focused on the identification of the main technical behaviours.

In this same section and in the following ones, we think that in figures 4, 5, 7, 14, 22 and 23, it would be positive to add the profiles and striking platforms of the pieces to see the morphology, if they are some prepared, etc. In the same way, it would help to better understand the analysis of the archaeological cores drawing on the photos with the negatives removals, adding the direction of the flakes with arrows, making a drawing of the cores with a diacritical lecture, etc. (for example in figures 2, 3, 12, 14 and 21 in the same way as in figure 1).

Thank you for the suggestion. In every photo showing cores (both from the archaeological and experimental collections) drawings of the negatives and their directions have been added. Regarding the striking platforms, since all the flakes from all the sites present mostly flat and natural butts, we believe that adding their striking platforms would have been superfluous. Moreover, since any core or surface's preparation was attested, the profile of the flakes was highly dependent on the natural morphology available and on the blocks' volume.

Also, it is necessary to highlight the piece that is being discussed when explaining some relevant point in the text, since otherwise it is difficult to follow what the authors are trying to underline. In most cases, reference is made to the figure but not to the part. For example, it would be better to put Fig. 2.1, 2.2, or 2.3.

Thank you for this suggestion. Reference to the specific pieces have been added in the text to better follow the discussion.

Finally, a paper on lithic strategies without drawings of some relevant artifacts, schemes of the main reductions' methods, etc., seems odd.

Thank you for the suggestion. We believe that photographs with drawings (removals and their directions) could be enough to give an overview of the main characteristics of each lithic assemblage, especially if compared with an experimental collection.

Finally, we think that there is a lack of a section dedicated exclusively to the data discussion provided in the paper. This would be compared with other sites in the area and others in the nearby European region. This would help us to have a broader view of the resource management carried out by these populations in Western Europe and along a chronological range as broad as the one covered in this study.

Thank you for the suggestion. We believe that the aim of this work revolves around a reconstruction and delineation of the opportunistic debitage as a flaking method, achieved with the support of a notable experimental collection, covering four important sites. For these reasons we think that a section exclusively dedicated to the comparison with other nearby sites would have made the text longer and more difficult to follow. Moreover, especially for Ciota Ciara cave and Riparo Tagliente the contextualization of the opportunistic debitage, as already mentioned in the text, is harder since few attention is payed to the identification of this particular method for the Middle and Upper Palaeolithic. In any case, we are considering your proposal for our next work, which will broaden the issues shown in this text and we would like to thank you for pointing it to our attention.