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Here and now or a previously planned strategy? Rethinking the concept of ramification for micro-production in expedient contexts: Implications for Neanderthal socio-economic behaviour

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ABSTRACT

Ramification is the term used to classify branched productive sequences in which a functional item (the flake) was exploited as a productive item (the core). This technological behaviour was present in Europe and the Levant beginning in the Lower and Early Middle Palaeolithic, but ramified productions were intensely developed in the Late Middle Palaeolithic. Traditionally, ramification has been interpreted as a well-structured behaviour, implying its integration into the provisioning strategies of past humans. This viewpoint has significant implications for the understanding of technological evolution in Neanderthals, suggesting specific cognitive and socio-economic capacities. Ramified procedures were characterised by high flexibility due to the versatile patterns of the core-on-flake and are described in the literature as corresponding to several different knapping concepts and technical procedures. This research aimed to describe the role of ramification in the Late Middle Palaeolithic. We analysed two assemblages from the Abric Romaní site (located in the north-east part of the Iberian Peninsula) characterised by informal, expedient technologies. The focus was on the spatial and temporal fragmentation of the ramified sequences based on the identification of single technical events. The reduction of the scale of analysis and the resulting implementation of temporal resolution of the stone tool assemblages in such expedient contexts allowed us to understand ramification from an innovative perspective, setting aside our bias toward well-defined productive methods associated with preconceived economic and mobility patterns. The results showed that ramification reflected a range of behaviours, implying a variety of planning proficiency, economic strategies and social interactions. This means that 'ramified production' is not meaningful unless is linked with a detailed description of human choices and an understanding of temporal and spatial relationships between knapping events. Furthermore, the results showed that, to approach behavioural issues, we as researchers must change our unitary vision of assemblages and enlarge the scope of categories to which we apply that vision.

1. Introduction

The concept of 'ramification' in the study of past technological behaviour was introduced by Bourguignon et al. (2004) to identify the process that allows the diversification of a production sequence into several phases in which flakes previously obtained are later exploited as cores. This means that the technical role of a flake changes from that of an object ready to be used (with or without retouch) and which possesses a functional edge and a prehensile portion to that of an object which serves as raw material stock for production and which possesses a specific volumetric construction suitable to be divided into tools. While during the last century, the

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categories 'tool' and 'core' were unambiguously distinct and each was related to a specific and complementary sphere of human behaviour, since the late 1990s, it has become clear that these classes of artefacts are not always easily distinguished (Newcomer and Hivernel-Guerre, 1974; Tixier and Turq, 1999; Bernard-Guelle and Porraz, 2001; Bourguignon and Turq, 2003; McPherron, 2007; Romagnoli, 2015).

Several studies have shown that the dual role of flakes used as cores was present in Europe and the Levant since the Lower and Early Middle Palaeolithic (e.g., Delagnes, 1993; Geneste and Plisson, 1996; Ashton, 2007; Assaf et al., 2015), but it seems that ramified productions where intensely developed starting in the European Late Middle Palaeolithic. They have been interpreted by some authors as a planned behaviour well integrated into provisioning strategies since the beginning of the reduction sequences (Bourguingon et al., 2004; Rios-Garaizar et al., 2015). The studies have traditionally focused on the final products issued from these branching exploitation strategies. They are recognisable because of the presence on their dorsal surface of a portion of the lower surface of the original flake used as a core (double ventral surface). They were short flakes, often microlithic, with a sharpened cutting edge. Researchers have usually highlighted the 'searched' characteristic of the ramified micro-production according to several aspects: the systematic production of small blanks in Middle Palaeolithic industries; the edge modification through retouch; the presence of use-wear traces on the functional edge of ramified blanks and on micro-flakes in general; the linked chain of detachments on the core-on-flake during the reduction sequence; and the relationship between ramification and distant raw material resources (Bourguignon et al., 2004; Rios-Garaizar, 2010, 2012; Claud et al., 2012; Villaverde et al., 2012; Lemorini et al., 2015; Rios-Garaizar et al., 2015). Neither these characteristics were mutually exclusive, nor were all present on the same assemblage.

The relevance of understanding ramification as a structured production process in the Late Middle Palaeolithic lies in the interpretation of the technological evolution of Neanderthals. It suggests not only changes in cognitive capacities, such as improved planning behaviour, but also an increasing complexity of activity organisation, including new tasks and social division of labour (Rios-Garaizar et al., 2015; Mathias, 2016). Furthermore, several studies have linked ramified production to recycling (see: Barkai et al., 2015). However, there is no general consensus on this issue, and some studies have asserted the need for the identification of a spatial discontinuity between the core-on-flake sequence and the previous sequence from which the secondary production branched (Vaquero et al., 2015) or the presence of unambiguous evidence of sequential flaking, such as double patina and obsidian hydration band thicknesses, to associate the exploitation of cores-on-flakes with recycling (Amick, 2007).

The flexibility of cores and flakes that results in the possibility of these artefacts having different technical roles at different times or even being multi-functional (this option cannot be excluded due to the difficulty, in many archaeological cases, of identifying the order and the possible temporal gap between sequential events) suggests that ramification implies a complex and dynamic pattern of production, use and discard events. This dynamicity engenders the ambiguity of classes and types of artefacts as universal and generally applied categories. This, in turn, implies that, as researchers, we must focus on the degree to which each artefact fits with each category and analyse in detail, on a case-by-case basis, the economic significance of human choices rather than use an analytical approach in which exclusive, immovable and rigid categories are used to describe and understand human behaviour. Only by changing the analytical approach to be more flexible it is possible to understand the variable patterns of cores-on-flakes as responses of Neanderthal groups to their physical and social environments (Hovers, 2007; Kuhn, 2007). Examples of this high degree of variability include the presence of structured ramified production processes on the Levantine Mousterian that were systematically applied to strictly locally available raw material (Goren-Inbar, 1988; Hovers, 1990); the systematic development of ramified sequences on distantly located resources in northern Iberia (Rios-Garaizar, 2010); and even the association between ramified sequences and independent debitage production of small tools.

It is the authors' opinion that a central aspect in the interpretation of branched production strategies is the mobility of the cores. Bourguignon et al. (2004) identified an underrepresentation of micro-production with respect to core-on-flake exploitation and suggested the mobility of part of the ramified sequence. The mobility of the cores-on-flakes has important implications in three main domains when approaching this issue from a behavioural perspective.

1) *Planning and task organisation.* There is a clear distinction to be made between the knapping proceedings in the same place where the tools are used and later transformed into cores-on-flakes, and the fragmentation of the ramification sequence in different places and at different times. These are two different processes in terms of planning. In the first case, the ramification could have simply been the response to knapping constraints or a quick way to obtain sharpened edges as a response to immediate needs. In this case, a low level of standardisation of procedures and products as well as of morpho-technical characteristics of cores-on-flakes could be expected given that the activity was quite extemporaneous. This opportunistic behaviour does not reflect the original idea proposed by Bourguignon et al. (2004) and supported by other colleagues that ramification was a planned behaviour. However, it is sometimes very difficult to identify the degree of 'opportunism' and of technical investment in archaeological contexts. Furthermore, an apparently opportunistic behaviour could be a strategy based on the provisioning of places as explained in the following part two. In this case, ramification would be a strategy related to human mobility (see below). The second picture paints a different scenario in which the location and timing of ramified products, and consequently of tasks for which the products are needed, had been foreseen and all or some of the flakes were transported as a stock of raw material. In this case, flakes would likely be quite big; they could be easily reduced in size during the following phases of production. Their use as tools before or during their exploitation as cores cannot be excluded *a priori*. This scenario must be distinguished by intra-site spatial discontinuity in ramified production, which can be associated with recycling (Vaquero et al., 2015). In the case of recycling, the displacement of the different phases of ramified production sequences in different intra-site areas may have resulted from responses to immediate needs and may reflect a specific human response in using the site as a raw material provisioning area. In each case, it is possible that the behaviour was systematic, suggesting a certain degree of planning in the stockpiling of the site for future visits.
2) *Human mobility strategies.* It may be intuitively proposed that ramification allows raw material productivity to be maximised but also that it minimises the costs of raw material provisioning. This consequence could have been advantageous in cases where exogenous resources were not available near the site and were characterised by specific chemical and physical features strictly linked with the function and the use-life of tools. At the same time, maximisation of productivity could have been beneficial in the case of time stress during tasks. It could also have been conditioned by the mobility of the human group and, thus, was

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