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Chapter 5

Syntheticity unpacked: French approaches between contextualism and organicism[495]

"[...] *I deliberately dismissed the path of functional typology. It is for the lack of data on the behaviour of prehistoric men based on their activities with their tools, for the lack of power, at least at the moment, to discern the intentions of use, that I devoted myself to grasping the intentions of knapping instead.* [...] *For a term to be precise and unequivocal, it must contain in itself the intention of the craftsman who has knapped a prehistoric tool.*"

– Jacques Tixier (1978 [2012]: 115, 117; my translation)

"[...] *Every society therefore comes into view first and foremost through the features of its adaptation to its environment. But this notion deserves to be properly evaluated: it signifies, in our opinion, the adaptation to particular natural conditions mediated by social prerogatives acting according to an internal dynamic. In this sense, these natural constraints operate only on the bark of a society, and not on its core. Thus, the preference of privileging a more or less collective approach to hunting, to promote technologies which allot hunting equipment a more or less prominent place, both respond to social imperatives that are independent of the conditions of the natural environment. In the same way, it is never the environment that imposes on a human group the need to become a farmer or a shepherd, but it is the proper evolution of man and his societies that may lead to it. Admittedly, the environment can hinder or promote such a behavioural transformation, but it does so in a passive manner. It is in this sense that the environment is not a cause but a means of this evolution. The technological and economic expressions of a culture thus reveal an "alloy" of external and internal determinants perfectly independent of one another.*"

– François Bon (2009: 243; my translation)

Abstract

This chapter analyses a range of case studies drawn from French lithic inquiry and investigates whether research in this tradition can be organised into 'contextualistic' and 'organicistic' strands. The structural categories of the respective two world theories are employed in order to demonstrate that this is indeed the case. Four cases of 'contextualistic' inquiry and three cases of 'organicistic' research are identified and discussed in detail. 'Contextualistic' trends in the French scene make use of Pepper's categories of 'texture' and 'quality' in order to interpret the lithic evidence. These perspectives, including traditional *chaîne opératoire* research, stress the 'relational' constitution of lithic data and insist on the 'context-dependency' of both data and findings. French strands of lithic 'organicism,' by contrast, seek to resolve what they identify as 'fragments of experience' by placing them into meaningful 'nexuses.' It is shown that the respective approaches place heavy emphasis on the 'conflict-driven' and 'heterogeneous' character of reality, as well as on the 'stage-mediated' nature of organic processes. Pepper's framework therefore greatly enhances our understanding of the epistemological orientation of French technological research. It also reveals that the French lithic inquiry cultivates a 'whole-centred' approach.

If French lithic research in Palaeolithic archaeology exhibits a strong 'synthetic' conviction, we would expect that the main research trends can profitably be described in terms of Pepper's relatively adequate 'synthetic' world theories – 'contextualism' and 'organicism.' Like in the Anglophone case, successful reconciliation between the key features of French lithic inquiry and Pepper's 'synthetic' theories can therefore explain (i) why even counteractive forces in the French scene are able, *grosso modo*, to meaningfully interact with one another and coevally demonstrate that (ii) lumping French lithic research into a single higher-level category makes sense, at least when it is contrasted with Anglophone

[495] The French original of the opening quotes are given in **Appendix Q.8** and **Q.5**.

inquiry. Arguably, the characterisation of French lithic analysis as the dynamic interplay between 'contextualistic' and 'organicistic' modes of thought helps to unearth some key aspects of the cognitive peculiarity of the French tradition, including its distinct ways of marshalling and interpreting lithic evidence.

In the two parts that follow, I will first break down four exemplary cases of 'contextualistic' research in the French scene and then present three symptomatic examples of 'organicistic' reasoning therein. Again, these examples consist of a combination of individual case studies and larger discursive formations. These cases are taken as paradigmatic of French lithic inquiry (see **Appendix III.4** for a detailed discussion of case study design and selection).

5.1 **Tropes of contextualism in French practice**

5.1.1 ***« Lecture », mental refitting, and schémas diacritiques***

Certain operational cornerstones of *chaîne opératoire* analysis (Brézillon 1968; Tixier 2012 [1978], 1980) and of the 'technological approach' in general (Tixier et al. 1980; Pelegrin 1988, 1990; Perlès 1991a; Inizan et al. 1999 [1995]) provide a direct entry point to modes of contextualistic inquiry prevalent in the French tradition. I will first reiterate some key features of contextualistic thought, and then show how these features can be retraced in French technological research.

The key category of contextualism is *context-dependency*, or the *situatedness* of collectable facts in the world. To recall, qua 'synthetic' world theory contextualism presupposes that contexts have interpretive priority over facts (parts) and legislate on how they are to be connected; parts, in the view of contextualists, are fundamentally dependent on their wholes and thus necessarily 'whole-endowed.' It is the *unity* of facts that requires the most attention according to contextualism.

Two regulative ideas guide the contextualistic enterprise of mapping varying contexts in their complexity and diversity: (a) *polyvalency* – the dogma that the same facts may have a fundamentally different meaning when they appear in different contexts – and (b) *inter-action* – the idea that facts are connected by relations and that these are always to be regarded as, minimally, bidirectional affairs.[496] The latter specifies the belief that connections between facts cannot be carved out or found in the facts themselves, but can only be elucidated by returning all facts into their original context. The root metaphor of 'situationality' thus generally motivates scholars to study the world in its radical *relationality*, as a web of interconnected nodes (parts) framed by a context (whole). It is possible to show that these two interpretive notions – 'polyvalency' and 'inter-action' – are directly reflected in how lithic technical systems and/or *chaînes opératoires* are studied by French technologists.[497]

French practitioners typically identify relations among lithic artefacts, techniques, and technical processes in a well-defined assemblage context as the basal units of analysis (e.g., Tixier 2012 [1978]: 32; Pelegrin et al. 1988; Valentin 2011: 111). Instead of concentrating primarily on discrete artefact traits, attributes, and/or other 'atomistic' measures, scholars try to understand how lithic objects relate to one another and what sorts of connections explain why specific objects and object-groups can be found in their respective lithic assemblage(s) (cf. Valentin 2011: 80f.). The granting of epistemic primacy to *qualitative* and *relational data* is a result of this general research configuration (cf. Tixier 2012 [1978]: 67; Perlès 1987; 1991a; Boëda 1988, 1994); it is a deeply built-in feature of what is commonly referred to as the 'technological approach' in France (e.g., Tixier 1980; Tixier et al. 1980; Perlès 1987, 2016; Boëda et al. 1990; Geneste et al. 1997; Bon 2002; Bourguignon et al. 2004).

Indeed, the objective of technological research in this tradition is to reconstruct 'technical systems' which are defined by the articulation of physical objects (lithics), techniques, methods, concepts, corpora of knowledge, and bodily gestures (cf. e.g., Pelegrin 1988; Geneste 1991; Boëda 1991; cf. Chap-

[496] I deliberately use the spelling 'inter-action' here to emphasise the concept that 'action' takes place in-between two or more action-givers. Interaction is thus not interpreted as correlation, co-variation, or as a 'tie'-relationship as in 'formism' or 'mechanism,' but instead as a co-constitutive relationship potentially changing the status of the involved action-givers themselves. Interaction in 'contextualism' is a dynamic relation that informs the functioning and character of the whole. It may in fact be highly telling that some French lithic specialists also prefer to use this particular spelling (Ploux 1988; see quote *infra*).

[497] The strong emphasis that French scholars typically place on the idea of a 'technical system' is illuminating (cf. Geneste 2010 [1991]: 421-424; Soressi and Geneste 2011); this notion signals that *systemic articulations* are regarded as the key features of lithic technologies and that it is ultimately their 'wholeness' which defines them. Approaches that reconstruct lithic technical systems in this manner are 'synthetic' by definition.

ter 3)[498] – and hence by the various ways in which these heterogeneous factors *inter-act* with one another to form integrated technical wholes (Inizan et al. 1999 [1995]: 14). A 'technical system' in this sense is always characterised by the 'interpenetration' of observable and deducible facts – a structural category proper to contextualism:

> "[...] Each of the artefacts featuring in the same assemblage has potentially a different fate. This situation proves the opportunity to recognise the inter-actions between each technical process – at best identifiable from a sidescraper whose micro-traces indicate skin-working, a burin which served to work animal antlers, etc.– and each technical chain. [...] In reality, however, a multitude of modalities is envisageable, depending on whether the nature or plan of inter-action establishes a correspondence between a process and one or more chains, whether or not each chain participates in multiple processes, or whether the same artefacts successively take part in several processes within the same operational sequence, either in the same physical form [blank] or after transformation [tool]. At the scale of assemblages, the entirety of these modalities or only certain ones may be represented, illustrating strongly different behavioural attitudes towards the organisation of technical activities. The importance of this type of information has already been emphasised multiple times [....]" (Ploux 1988: 39; my translation [for the original French quote, see **Appendix Q.9**])

It follows that each of the elements participating in a technical system potentially co-shapes any other element; description of the whole therefore requires the specification of the entire web of 'co-constitution.'[499] The classic strategy with which to approach this problem is the study of technical wholes from three interrelated perspectives – these perspectives are sometimes re-cast as complementary 'levels of analysis.' Technical wholes, accordingly, can be defined by their (a) 'structure' (*structure*); their (b) 'operation' (*fonctionnement*); and their (c) 'function' (*fonction*) (see Sigaut 1991, 2012: 52-54; cf. Geneste 2010 [1991]: 423f.; Valentin 1995: 16, 24; Soressi and Geneste 2011: 337).

'Structure' thereby refers to the specific arrangement of sub-units that make up a technical whole (see e.g., Boëda 1991: 40f.). These sub-units are often identified as sub-structures or sub-systems and respond to the question 'what is it?' and 'what does it consist of?' (Sigaut 2012: 53); 'structure' thus defines the whole as it formally comes into view if inspected from an external perspective. The category of 'operation' addresses how the technical whole functions internally (*idem*); it responds to the question 'how does it work?' and consequently seeks to provide a dynamic description of internal processes, movements, and/or relations insofar as they help to clarify the role and status of the various parts or sub-units of the system.[500] This category is crucial and seems to be quite specific for 'synthetic' interpretations of lithic technology. 'Function,' finally, defines the finality or goal-directedness of a technical whole; it responds to the question 'what is the point of all this?' and generally theorises the effects of the internal organisation (interplay between 'structure' and 'operation') (*idem*). This latter category defines how the whole is externally-related – for instance, its place and role within a larger 'super-structure.' The category thus helps to recognise the function of a whole in an even larger whole, explaining why technical systems are regularly re-cast as sub-systems of broader socio-economic formations (e.g., Perlès 1987: 22; Geneste 2010 [1991]: 423; cf. Inizan et al. 1999 [1995]: 14).

This tripartite conception of 'technical systems' can be clarified considerably with the help of Pepper's structural categories of contextualism: the 'structure' of a technical whole and its mode of

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[498] This conceptualisation of 'technical systems' is inseparable from the historical formation of the 'technological approach' in France and *chaîne opératoire* research in general (e.g., Karlin 1991; Perlès 2016). It represents the coalescence of several potent strands of research, most notably of what is sometimes called 'Anthropology of Techniques' and the 'History of Techniques.' The former, also known under the label *technologie culturelle* (cf. Bensa 1996), was instrumental in bringing forth *chaîne opératoire* theory and methodology. It was spearheaded by Robert Cresswell (1983, 1994, 2010) and Pierre Lemonnier (1976, 1983, 1986) and led to the establishment of *Techniques & Culture*, a platform for interdisciplinary research into human technicity (cf. Roux 2013: 27). The second strand of inquiry, based on the disciplinary legacy of history and sociology, is represented by Bertrand Gille and his seminal *Histoire des techniques* (1978), perhaps with the addition of Jean Baudrillard's (1968) *Le système des objets*. The 'systemic' conception of technology itself is probably even older, having already made its way into French Palaeolithic archaeology through the work of Gilbert Simondon (1958) and others. Systemic thinking is since then an irreducible ingredient of French technological thought (cf. Séris 1994; Lemonnier 2012).

[499] This accounts for the 'contextualistic' belief that we can only presume that nothing can be presumed – which is simply to say that there can be no fixed categories on which one can confidently base all inquiry independently of the character of the context in question (see Chapter 2 for details).

[500] Again, the term 'dynamic' is not innocent here; a dynamic description is nothing less than a description that takes seriously the genuine and differential contribution of *all* elements that make up the technical whole. To regard technology as a 'dynamic system' in this sense reiterates the 'contextualistic' conviction that nothing can be 'absolute' and everything must consequently be context-dependent (see *supra*).

‘operation’ delineate the key aspects of the specific ‘texture’ of a technical system (or context) – that is, its ‘technological architecture’ – whereas the interrelationships between ‘structure,’ ‘operation,’ and ‘function’ provide insight into the ‘fusion’ of the texture-giving elements – i.e., how the ‘infrastructural’ features come together – thus clearing the view for the immanent ‘quality’ of the whole. Taken together, the three categories thus provide the contextualistic frame of reference in which technical ‘inter-action’ can be meaningfully examined. To study the ‘spread’ of the ‘quality’ of a technical whole among its texture-giving parts then simply means to isolate distinct sub-units of ‘inter-action’ and to expose their spatiotemporal organisation (cf. Pelegrin et al. 1988):

> “[…] [The] unfolding [of the *chaîne opératoire*] presents itself as an enchainment of different means organised in time and space, so that the technical chain can be broken down into several spatiotemporal operational sequences.” (Ploux 1988: 41; my translation [for the original French quote, see **Appendix Q.9**]).

This implies that even the categories of space and time are interpreted from a contextualistic vantage point. They are seen not so much as the dimensional axes of a predefined ‘Newtonian’ space-time grid, but as context-dependent variables themselves. Space and time are re-cast as whole-categories that help to illuminate the articulation of objects and processes – they make sense as interpretive categories only if they facilitate the ordering and grouping of the encountered technical relations.[501] This typically results in the identification of spatial and temporal features which are specific to distinct technical contexts; a predisposition that paves the way for the recognition that different *chaînes opératoires* bring forth distinct spatio-temporal matrices. This fact simply reflects the contextualistic conviction that ‘quality’ is spread out differently in dissimilar technical wholes.[502]

It should not be surprising, then, that the temporal unfolding of a *chaîne opératoire* (*« déroulement »*) depends entirely on its organisation (e.g., Geneste 1985: 170, 178-183) – i.e., how many stages are distinguishable, how many kinds of gestures, techniques, and technical objects participate in a single stage (including their own temporalities), whether and when the technical chain branches off into various sub-chains, and so forth (Pelegrin 1988; Bourguignon et al. 2004; Rocca 2013; **Fig. 27, 28**). Similarly, each technical whole typically brings forth its own distinctive spatiality – that is, a specific pattern of how the various parts of a ‘technical system’ arrange themselves in space (cf. Boëda 1993; Delagnes et al. 2007, 2012). This spatiality can be understood in ‘volumetric’ (e.g., Boëda 1994; Pelegrin 1995; Bourguignon 1997) or ‘geographic’ terms (e.g., Geneste 1985, 1988; Julien and Rieu 1999; Audouze 2006; Delagnes 2010; Mevel 2010; Valentin et al. 2013), depending on the scale of analysis and the ‘technical system’ in question. The fact that key differences between varying lithic technologies or technological conceptions are generally described as disparities in the ‘volumetric organisation’ of reduction processes gives voice to this interpretive matrix (cf. Valentin 1995: Annexe [Première Partie], 2011: 17; **Fig. 29**).[503]

All of this highlights a certain *relativity* of the spatial and temporal characteristics of a ‘technical system,’ a relativity that is distinctive for contextualistic reconstructions. Moreover, the amenability of spatial and temporal determinations to change and their requirement for context-sensitive

[501] This demarcates a key difference between French *chaîne opératoire* approaches (COA) and the classic Anglophone ‘reduction sequence’ approach (RSA). RSA typically presumes dimensional time and thus draws lineal artefact-consequences from the passing of time, e.g., that artefact dimensionality/size diminishes and/or cortex ratios decrease; the space-time is a constant is conceptualised as given, so that its particular effects can be measured in individual artefact characteristics. The direction of inference is *upwards*, from dimensional time to specific artefact features. COA, by contrast, generally draws spatiotemporal conclusions (staging of technology, reduction depth etc.) from the organisation of the encountered artefact totalities; the spatiotemporal structure of technology is reconstructed in a *downward* direction, following from the nature of the technical system.
[502] We can therefore say that different technical wholes typically possess distinct *temporalities* of ‘operation’ and procedural presence/ongoing.
[503] Almost the entire range of new technological definitions and/or re-definitions of long-standing ‘industrial’ complexes that were proposed after the ‘technological revolution’ yielded *volumetric definitions* of lithic reduction systems. Examples are the various methods and modalities of the Levallois concept (Boëda 1986, 1988, 1993 1994), the ‘Clactonian’ method (Forestier 1992, 1993; Amiot 1993), the Châtelperronian (Pelegrin 1995; cf. Roussel 2011), the Discoid conception (Boëda 1993; Jaubert 1993; Mourre 2003), Quina technology (Bourguignon 1996, 1997), the MTA (Soressi 2002), the Early Aurignacian and Protoaurignacian (Bon 2002; Le Brun-Ricalens and Brou 2003), the Badegoulian (Cretin 2000) as well as smaller-scale technical entities such as the ‘Pucheuilian’ (Delagnes 1993), the ‘Orvillian’ (Perlès 1977, 1982), the ‘Belloisian’ (Valentin 1995), the ‘Néronian’ (Slimak 2004, 2007), or the ‘Hoabinhian’ (Forestier 2000, 2010). More recent work on lithic technology follows a similar lead (e.g., Klaric 2003; Teyssandier 2003; Montoya 2004; Boccaccio 2005; Faivre 2008; Renard 2010; Langlais 2010; Ducasse 2012; Mevel 2017).

analysis are direct consequences of the 'polyvalency' condition;[504] this enshrines the conviction that lithic artefacts without context are incapable of unambiguously informing us about their volumetric and/or temporal position (chronology, core geography, reduction stage, etc.) in a technical process. In this way, each lithic artefact comes into view primarily as a spatiotemporally 'situated' part, the informational value of which depends completely on our ability to determine its relative place in the technical context to which it belongs.

This pervasive 'polyvalency' of physical forms culminates in the conception that the same lithic shapes and even the same groups of artefacts might recur in different technical contexts even though their technological role, status, and/or signification may differ vastly across these contexts (cf. e.g., Coudenneau 2013: 300-307; **Fig. 30**). The prototypical example of the application of this logic of reasoning is that of the Levallois point (*« pointe à Levallois »*) (e.g., Boëda 1986: Fig. 177, 1991: Figure 6, 2013: Figure 84; Texier 1995; Mourre 2003; Bourguignon and Turq 2003; Locht 2004; Goval et al. 2016). Boëda (1986) has summarised the dilemma as follows:

> "The Levallois point may result from different knapping conceptions, which a determination by simple typological means cannot bring to light. Only the technological analysis of the knowledge used to realise it can reveal the potential variability of the volumetric conceptions of cores and the methods that result from it." (*ibid.*: 263; my translation [for the original French quote, see **Appendix Q.10**])

According to this general assessment, different systems of handling a volumetric core-matrix during blank exploitation have the potential to produce objects that look like Levallois points.[505] A striking example is the Discoid *débitage* system, which cyclically produces so called 'pseudo-Levallois points' when the core convexities are rejuvenated (Boëda 1993, 1995a; Mourre 2003). Several 'pyramidal' structures of blade extraction, especially simple convergent methods, similarly yield triangular blanks, slightly elongated or not, that *prima facie* appear to be Levallois point-like (cf. Coudenneau 2013: 300). It follows that the mere presence of objects resembling Levallois points in a lithic assemblage is not sufficient to identify with certainty the technology of which these objects are a product.[506]

Only a detailed 'map' of intra-technological relationships is thought to provide researchers with the means to determine the technological implication of similar-looking lithic objects, even as they appear across different technical contexts.[507] The general idea, typical for contextualism, is that while forms do not fully determine their context, contexts *constrain* the quality and frequency of the total range of forms they host; the resulting multipolar and multidirectional determination of lithic artefacts through significant wholes is a characteristic facet of contextualistic thought.[508]

Returning the totality of lithic pieces to their technical context(s) ultimately requires the solution of a '4D' puzzle (cf. Valentin 2008a: 285) – the reconstitution of the volumetric and temporal position of each three-dimensional lithic object in its technical system (Geneste1985; Boëda 1994;

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[504] The cognate concept of 'polysemy' is for instance employed by Valentine Roux (2013: 18f.) to describe this condition. For an explicit use of the term 'polyvalency' in lithic research, see Coudenneau (2013: 300-307) who distinguishes three different variants of lithic polvalency: (i) polyvalency of functions (*polyvalence de fonctions*); (ii) polyvalency of forms (*polyvalence de forms*); and (iii) polyvalency of productions (*polyvalence de productions*).

[505] It is also clear that the potentials are not the *same*. But the significance of these differences and their quantitative and qualitative effects cannot be known *a priorily*. It is for this reason that fact-based 'contextualistic' analysis becomes indispensible.

[506] This reoccurence of similar forms in different contexts is the basis for the 'contextualistic' critique on the 'formistic' root metaphor of 'similarity.'

[507] This effectively issues a plea for finding technical differences where similarity in forms prevails. In contrast to the management of 'equifinality' in 'formism' and 'mechanism,' the calibrating factors are viewed to be found in the *same domain of reality* – namely, in the technical domain. Similar forms might be instantiated by different contexts not because these contexts are similar, or at least driven by similar imperatives, but because the morphometric space of lithic reduction is limited and variability must thus be revolved *internally* – through the study of inter-actions and inter-relations.

[508] It is of course clear that contexts are rarely complete because lithic pieces have been removed in the past and/or because sites have only been partially excavated; this also generates a problem for 'contextualistic' inquiry but the problem is formulated differently than by other world theories. Part of this difference can be captured if we refer to the proposed distinction between 'semantically-orientated' and 'syntactically-orientated' archaeological research by Plutniak. According to Plutniak (2015: 44), the notorious incompleteness of the archaeological record can be conceptualised as an *incompleteness of the empirical data* which needs to be overcome by adequate epistemic techniques such as analogy and/or interpretation. As he puts it (*idem*), archaeology then becomes "mostly a way to get an understanding of the meaning of material remains and to draw a restitution of the past." This is what he calls 'semantic-oriented' archaeology. But incompleteness can also be regarded as an *epistemic feature of how we ought to construct archaeological arguments and knowledge*. This view is generally sceptical of too much interpretation and calls for a strict "control of archaeological enunciation" (*idem*). Archaeology in this view is regarded as "the study of the transformations of a set of artefacts over time" (*idem*). This is what Plutniak names 'syntactic-oriented' archaeology. It should be clear from what has been said thus far that the 'semantic' proclivity is more typical for French lithic research whereas Anglophone approaches tend to be more 'syntactic.'

Pelegrin 2005).[509] The puzzle is four-dimensional because three-dimensional objects – blanks, cores, preparatory elements, etc. – are pieced together to form larger three-dimensional *complexes* of objects (e.g., core sequences or burin-spall sequences). Yet, the puzzle metaphor is only partially adequate. Puzzling together lithic artefacts is rarely a straightforward or self-evident undertaking. Unlike puzzle pieces made from cardboard or plastic, lithic assemblages are notoriously incomplete and direct artefact-conjoins are therefore often the exception rather than the rule; 'physical refitting' is therefore generally difficult and cannot be expected to be a reliable, context-independent baseline of knowledge-production.

Additionally, 'physical refitting,' unfortunately, reconstructs above all the mechanical succession of artefacts and not necessarily, let alone automatically, the 'inter-actions' of objects and processes as they account for technological meaning (i.e. the systemic functioning of a technical whole). Moreover, if 'physical refitting' is possible, it typically leads to a fragmentary reconstitution of the technical spatiotemporal sequence(s) (*chaîne opératoires*) because there are always artefacts that have been exported from archaeological sites and the sites themselves are rarely excavated *in toto*;[510] this collides with the intrinsic ambition of French technologists to holistically reconstitute hominin technicity. The central issue is that 'physical refitting' remains naturally incomplete and thus almost always part-centric.[511]

If one wants to capture technical wholes, one therefore has no choice but to make sense of puzzle pieces which only imperfectly fit each other.[512] To respond to this problem, French technologists have devised two interpretive strategies – (i) 'mental refitting' (*« remontage mental »*) and (ii) technological 'reading' (*« lecture »*) (cf. e.g., Pelegrin 1986; Boccaccio 2005: 38). These two prisms of technological analysis unequivocally confirm that lithic research in the French tradition subscribes to the contextualistic project. They will be disentangled in the following to flesh out this point.

Technological 'reading' – or *« lecture »* in French – is the practice of deciphering technical stigmas and their interrelationships on individual lithic artefacts as well as to interpretively arrange objects in a technological space to understand their signification (cf. e.g., Inizan et al. 1999 [1995]: Chapter 6; Pelegrin 2005).[513] *« Lecture »* always has a dual significance: first, intra-artefact relationships are mapped in order to understand the character of the present artefact-wholes before, secondly, the artefact 'maps' determined in this way are related to other co-present artefact 'maps' in order to devise a comprehensive technological 'super-map' of all artefact inter-actions (cf. Pelegrin et al. 1988; Boëda et al. 1990).[514] This approach is *dynamic* since it requires an ongoing cross-adjustment of interpretive strands and scales within a cyclic structure of hermeneutic inference (cf. Chapter 3). Marie-

[509] Typically, the determination of the frame of the '4D' puzzle is part of the puzzle-solving: in practice, lithic assemblages are regarded as consisting of a number of sub-puzzles (sub-contexts) which are part of the bigger assemblage puzzle.

[510] The issue is of course aggravated when lithic assemblages are to be compared because the unstable success rate of 'physical refitting' threatens to undermine the comparability of different assemblages (if compared through the prism of refits); refits from different assemblages often provide different insights, are unequally complete, frequent, and/or technologically representative.

[511] This is another reason why refitted sequences are often used as parts and contextualised with other pieces of information to reconstitute technical wholes. 'Contextualism' thereby seems to have the somewhat unique capacity to cope with heterogeneous parts; relating partially refitted sequences with non-refitted lithic artefacts and their characteristics is regularly achieved in French 'contextualistic' lithic research.

[512] It is no mere coincidence that practices of 'mental refitting' (sometimes also denominated 'virtual refitting') are widely used to study animal bone assemblages (cf. Christensen 1999; Averbouh 2000); these are often highly fragmented and preservation renders bones per definition imperfect to conjoin. The method has therefore, rather ironically, been discussed more extensively in branches of zooarchaeology (e.g., Averbouh 2001).

[513] The deliberate use of the term 'reading' here can be seen as a tacit admission of the difficulty of the task. Not only is the problem of understanding lithic technology seen analogously to understanding a written text, the term also signifies that each piece must be inspected multiple times – it must be 'read' and 're-read' until intelligibility has been reached. This tacit analogy also points to a residual ambiguity of all reading procedures, no matter how refined they are. This is why technological reading is only the beginning of inquiry, not the end of it.

[514] The identification of parts and wholes is dynamic and may shift dependent on the problem context at hand. With regards to an individual object and its technological reading, the object is the whole and its features (scars, ridges, platforms, morphology, convexities, etc.) are the parts. When it comes to the reading of an assemblage, artefacts turn into parts and the assemblage itself becomes the whole. In reality, the situation is even more complicated since various intermediate categories of technological signification may be invoked to explain the overall variability of facts. Such intermediate categories can be different technical systems or modalities if the assemblage is too heterogeneous to explain the variability it hosts by reference to one single super-whole. Mousterian lithic assemblages are the prime example for the necessity of introducing intermediate wholes. These assemblages are thought to be the result of multiple co-occurring technical systems. In such a scenario, we are facing at least three levels of changing part-whole relationship and hence a truly nested structure of cyclical inference. The resulting reasoning process is unmistakably 'hermeneutic' in character (see Chapter 3).

Louise Inizan and colleagues (1999 [1995]) specify this general inclination in *Technology and Terminology of Knapped Stone* with respect to individual objects:

> "[…] it is necessary to go through the process of reading a stone object before attempting to study the lithic assemblage it belongs to. From the perspective of [a] technological study, a stone object, be it a tool or a waste product, is part of a technical operation, all elements of which are interdependent. Moreover, in such a perspective, the reading of an object brings into play the raw material used, as well as the technical actions and the knowledge, which together work towards the conception of the tool, in the broader sense of the term (tool, weapon, tool component…). It is therefore essential to have an in-depth understanding of the basic document, in the present case each lithic object of an assemblage, in order to enrich subsequent inferences." (*ibid.*: 89)

Practices of technological reading typically require engagement with the *schéma diacritique* of a lithic object (e.g., Boëda 1994: 21; Crassard 2007: Annexe 3.1). Reconstructing this *schéma diacritique* constitutes the methodological cornerstone of any *chaîne opératoire* analysis (Tixier 1978 [2012]: 121; Pelegrin 1995). The *schéma diacritique* is a simplified graphical representation of an object, which sets spatially distinct parts of an object into chronological relation (cf. Dauvois 1976: 195-201; **Fig. 31**). For the most part, this amounts to a contextualistic interpretation of 'reduction histories' as they are reflected in scar inter-relationships of particular lithic objects. In its most basic form, devising a *schéma diacritique* implies the study of truncations and overlaps between scars to distinguish groups of scars and to order them chronologically – it is an attempt to capture the spatiotemporal dynamics of working a lithic object (cf. Soriano 2000: Annexe 2 [411-413]; Crassard 2007: Annexe 3.4 [234-285]; Roussel 2011: Chapitre 5). It is no mere coincidence that this way of 'reading' object biographies co-developed with new ways of drawing lithic artefacts that emerged in the course of the 'interpretive turn' ushered in by Tixier and his followers (e.g., Inizan et al. 1999 [1995]: Chapter 7).

To embark on a *« lecture »* approach to understanding the organisation of lithic assemblages usually also means to plunge into practices of 'mental refitting' – *« remontage mental »* in French (Pelegrin 1986; Le Brun-Ricalens 1993: 134; cf. Inizan et al. 1999 [1995]: 90).[515] In the words of Jacques Pelegrin (1995: 23f., my translation):

> "[…] We must then call upon what may be referred to as *mental re-fitting*: the study of each lithic object, according to its morphology, the presence and position of cortex, and the order and characteristics of the negatives of removals (visible on both blanks and cores: observation of 'diacritical schemes') attested by a short preceding sequence, can enable, by mentally juxtaposing each object with all other objects and with the untreated blocks, the reconstruction of the specific systems of which the lithic objects are the outcome (an essential notion formalised by J. Tixier 1978).) Such a mental operation, which re-arranges the pieces in the three dimensions of space and according to the order of their detachment, allows one to access a "technical logic," for which a good practice in the study of collections is mandatory and which always profits from experience in knapping hard stones (cf. the *technological reading* of lithic pieces: J. Tixier et al., 1980, p. 35)." (original emphasis changed from bold to italics [for the original French quote, see **Appendix Q.11**])

'Mental refitting' always seeks to identify and retrieve technical relationships of co-constitution. It aims to elucidate how particular characteristics of lithic artefacts 'inter-act' to produce certain systemic technological outcomes. 'Mental refitting' therefore qualifies inter-artefact relationships that specify key technical consequences, morphological and/or technical complementarities, or specific 'logics of knapping' rather than to map artefact-centred similarities or correlations (cf. Perlès 1991a; Pelegrin 2005);[516] it implies nothing less than to mentally juxtapose and compare all artefacts in a given set of artefacts in order to find a well-defined spatiotemporal place for each artefact; the technical characteristics of each lithic artefact, in other words, must be interpreted in light of the characteristics of all other artefacts that are present in the assemblage. The procedure therefore practically relies on multiple and recurrent steps of sorting and pre-sorting an assemblage – 'mental refitting' gives voice to an *embedded mode of hypothesis-testing* (see Chapter 3). However, in contrast to 'physical refitting,' 'virtual' or 'mental refitting' only enables a general reconstitution of *chaîne opératoires*,

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[515] This term already appears in Tixier's *Méthode pour l'étude des outillages lithiques* (1978 [2012]: 124), although the precise formulation he uses there is "mental reconstruction" (*« restructuration mentale »*).

[516] For the notion of 'technical logic' (*« logique technique »*), see e.g., Perlès (2009) and Chevrier (2012: 769f.). [See also Boris Valentin in [Devenir Archéologue] *Les outils en pierre préhistoriques*, available on YouTube (URL= https://www.youtube.com/watch?v=MB4CD145z40, uploaded on the 9.2.2016)]

without capturing subtle knapping details or intra-assemblage differences in lithic knapping performances (Ploux 1983).

The evaluative criterion for a successful *« remontage mental »* is a fairly pragmatic one: successful working.[517] 'Mental refitting' aims to specify constitutive technical relationships that 'work,' those that remove interpretive problems or the 'blocking' of 'strands' in Pepper's sense. This 'workability' is assured by disbanding any remaining inconsistencies within the proposed reconstruction of lithic technology in a given assemblage. 'Mental refitting' hence also showcases the 'dispersive' nature of *chaîne opératoire* research in France. Rather than to extract and to thereby pre-select artefact-traits to be examined, technological inquiry takes the artefact *as it is* and relates it to all other artefacts *as they are*.[518] The objective is to determine a set of 'inter-active' principles and a global organisational structure that, taken together, 'harmonise' as many object relationships as possible – this is the interplay between Pepper's (1942: 238) categories of 'texture' and 'quality,' both diagnostic for contextualism as an epistemic endeavour.

'Mental refitting' makes room for a hyper-'dispersive' approach to lithic facts. In the spirit of contextualism, it enables the effective integration of background experience and epistemic ready-mades such as individual knapping expertise or first-hand knowledge about other lithic assemblages. It urges scholars, for instance, to effectuate 'physical refittings' and to study them technologically – even if the thereby reconstructed sequences are naturally fragmented (cf. e.g., Cahen et al. 1980; Ploux 1988; Karlin 1991; Bodu 1993; Pigeot 2004; Julien and Karlin 2014). The reason is of course that 'physical refits' – if they inform about technology[519] – can be used as an additional layer of background information to enhance the interpretation of the observed facts (e.g., Delagnes and Roche 2005; Bachellerie et al. 2007; Delagnes et al. 2012).[520] This general focus on aspects of 'quality' and 'texture' of lithic technologies combined with a strongly 'dispersive' strategy of handling evidence unmistakably identifies this mode of reasoning as contextualistic.[521]

Last but not least, contextualistic inquiry in French lithic analysis aims to relate systemic 'inter-action' with technical practice and to discuss them both in their social and historical situatedness (e.g., Pigeot 2004; Schmider and Roublin-Jouve 2008; Audouze 2010). The assemblage context is recast as a reflection of its wider socio-historical context – lithic assemblages make accessible *« systèmes techniques »* which themselves take part in larger sociocultural systems (Perlès 1987; Valentin 2011: 114). Lithic assemblages are viewed as a context of objects as much as they are seen as a context of practices – of what can be termed 'technical *habitus*' (*ibid.*: 58). Therefore, technological readings (*« lectures »*) typically entail a specification of applied 'knapping techniques' and 'technical gestures' (Pelegrin 2000; cf. Bon 2009: 143). These, in turn, are interpreted holistically as a reflection of hominin cognition, psycho-motoric aptitude, and socio-technical choice (cf. Perlès 1991a).

'Knapping techniques' include interpretive categories such as soft and hard hammer percussion, *« pierre tendre »* (soft stone percussion) as well as direct, indirect, and tangential modes of detachment (Pelegrin 2000, 2005, 2011; cf. Soriano et al. 2007). These techniques are thought to imply particular ways of instrumentalising the body and of coordinating mind, hand, and torso – they imply *percussive movement* that necessarily refers to an embodied knapper (cf. Bril 1984). This, in total, constitutes the (historical) *knapping context* – a context that is identified as the transcendental condition for observing particular configurations of artefacts and stigmas of knapping. In the end, 'knapping techniques' are thus interpreted through the lens of Mauss' *Les techniques du corps* (1935) and are

517 This 'cognitivist' category is of course rejected by those who embrace 'materialism' as the guiding philosophy of science and it is thus no surprise that 'mental refitting' has become a prominent target of critique (e.g., Tostevin 2000: 67; Chazan 1997: 728) – both from the perspective of 'mechanism' and 'formism.' Some of the prominent friction points in debating Levallois technology (Bar-Yosef and Van Peer 2009) can in fact be reconstructed along similar lines.
518 This ushers in an anti-reductionist plea against artefacts as such. Describing lithic artefacts by their traits rather than in their globality can then simply be viewed as a reductionist manoeuvre; even individual artefacts tend thus to be interpreted 'synthetically' – a basal difference to 'analytic' conceptions of artefacts that cannot be overemphasised.
519 These types of refits are sometimes referred to as 'technological refits.'
520 'Contextualism' thus actively supports the positive mobilisation of general background knowledge, epistemic experience, and a 'prejudice structure of knowledge' [*Vorurteilsstruktur des Wissens*] – epistemic qualities that are typically cultivated within hermeneutic and generally 'unlocked'/'open-ended' frames of reasoning.
521 Note that for Tixier the difficult-to-solve problem of integrating insights from refits into quantitative lithic studies provided a strong incentive to re-orient technological research into the realm of qualitative inquiry (see e.g., Tixier in Tixier 1980: 14).

understood to echo speci-fic contexts of socialisation and learning – particular ways of using humanity's 'first instrument': the *body* (*idem*).[522]

'Technical gestures' are more complex entities and they refer to more general aspects of technology-body interlinkage(s) (Leroi-Gourhan 1968; Balfet 1991);[523] they are often used as a vehicle to reveal how bodily aspects of hominin technicity relate to volumetric aspects of core exploitation. Knapping is generally seen as a process through which technologies and hominin bodies become enchained and resonate with one another.[524] A technical gesture is nothing less than a specific mode of handling a particular volumetric structure (e.g., a 'core' or a 'biface') – giving voice to the idea of situated human-matter inter-action(s) (e.g., Pigeot 1987; Ploux 1988; Bodu 1994: 87f.).[525]

An obvious example of a particular mode of volume management is the involvement of events of re-orientating a core during lithic reduction – in which the volumetric matrix is turned and a new sequence of removals effectuated. Another example is the study of directionalities and angulations of knapping and their effects in relation to reconstructed volumetric structures (cf. Koehler 2011: Fig. 11).[526] This 'gestural' dimension of lithic technology is seen as central to any form of hominin technicity because it forms an irreducible part of the 'technical milieu.'

The study of 'rhythms of knapping' and 'progressions of knapping' represents another coordinate of mapping hominin-technology 'inter-action.'[527] Building on the early work of Pigeot (1983, 1987: 24) among others, this type of inquiry revolves around interpretive concepts such as *« débitage frontal »* (frontal débitage), *« débitage tournant »* (rotational débitage), *« débitage semi-tournant »* (semi-rotational débitage) and/or *« débitage demi-tournant »* (half-rotational débitage) – concepts which are designed to describe the distinct articulation of embodied knappers and the material and non-material correlates of their core extraction technologies (cf. Ploux 1988: Fig. 25, 26; Bodu 1994; Valentin 1995: Annexes [17-19]; Bon 2002: 40; **Fig. 32**).[528]

That this type of lithic research is still very much alive becomes clear if one invokes the recent study *Initialisation and progression of the core reduction* by Valentin and colleagues (2014), where

[522] This concept resonates with the ambition to portray prehistoric humans in their *l'homme totale* nature (technicity, cognition, and sociality are *imbricated* into each other) and to depict human technicity as a *« fait social total »* (cf. Marchand 1999a; Pigeot 2004: 255; Valentin 2008: 58-61) – both Maussian tropes.

[523] This is the reason why French researchers have pondered already early on drawing from the science of *« Ergonomie »* to elucidate handling modalities of lithic tools (cf. e.g., Perlès 1974: 818).

[524] The central point is that 'technology' is conceptualised *inclusively*, i.e. in very broad terms (see e.g., Balfet 1975; Sigaut 1994). Generally speaking, technology therefore includes corporeal practices and the instrumentation of the hominin body itself. This essentially mirrors Marcel Mauss' (1935) well-known notion of the body as humanity's 'first instrument.' The idea is that *bodily techniques*, as long as they display efficacity (material consequentiality), are as 'technical' as any other technique (cf. Sigaut 2007, 2012: 64f.). The implication is that technology can only be studied comprehensively if sensomotoric aspects of technicity are taken into consideration; an implication that has led to classifications and inventories of technical gestures (Leroi-Gourhan 1943) as well as the detailed investigation of motor actions of the human hand (e.g., Sigaut 2012: 37-56). The French notion of *« technologie »*, literally the 'science of techniques,' still carries this connotation (in contrast to the English term *technology* whose ordinary meaning is largely restricted to artificial productions). In France, there is an entire branch of socio-ethnological research dedicated to this topic. André-Georges Haudricourt (1946, 1964, 1987) and his 'gestural anthropology' are probably the most important manifestations of this particular approach to human technology (cf. Bert 2010; Sigaut 1978, 2012). Yet, what is perhaps most critical about this angle of research is that the concept of adaptation – at least compared to Anglophone interpretations – is *inversed*: rather than to view tools as an adaptation to the external environment, tools are instead regarded as *adaptations to human gestures* (« L'outil est adapté au geste et non inversement »; cit. Haudricourt 1987: 158); adaptation is thus internally directed, a factor that appears to undermine evolutionary 'adaptationism.' The associated pattern of thought ultimately gives way to definitions of tool-use and tool-functionality in terms of gestural factors – a predisposition explicitly reflected in François Sigaut's (2012: 92f.) distinction between 'true tools' (*outils vrai*/*outils nécessaires*) and 'auxiliary tools' (*outils auxiliaires*/*outils prothèses*): while manual gestures either assist or enhance the mode of action of the latter tool category, the mode of action of the former category remains *original* – i.e. no manual gesture would be able to perform a similar action of its own accord. There are thus several reasons why the emergence of 'true tools' is likely to mark a key threshold in technological evolution.

[525] 'Bodily techniques' are not necessary consciously executed and 'knapping techniques,' insofar as they can be viewed as 'bodily techniques,' must therefore be interpreted as a part of the socialised *habitus* (*sensu* Bourdieu 1972) of ancient hominins; that French lithic experts often employ the term 'algorithm' to describe embodied patterns of knapping (e.g., Forestier 1993; Soriano 2000: 285-287) underscores this largely 'unconscious' and 'pre-programmed' status of 'knapping techniques.'

[526] This typically requires that volumetric conceptions are reconstructed by finding an efficacious spatiotemporal 'place' for each artefact in an assemblage – a place that illuminates both the 'quality' and 'texture' of the technical context. In a second step, thereby reconstructed volumetric structures of lithic technology are related to particular methods by which each structure is exploited and maintained.

[527] This testifies to an inclusive concept of technology that involves 'more' than just material artefacts. The analysis of 'gestures' and 'techniques' as cornerstones of technological practice including their relationships to aspects of body instrumentalisation is firmly rooted in French 'gestural anthropology' in the wake of Georges-André Haudricourt and the 'Early' Leroi-Gourhan. For Leroi-Gourhan (1993 [1964/65]: 283, 309f.), the key concept was the evolutionary liberation of the hominin hand which establishes a certain 'freedom' to manipulate raw material volumes in a multitude of different ways.

[528] See also Marchand (1999b: 216, 2014: Figure 37), Bordes and Tixier (2002: 183), or Roussel (2013) for additional examples.

the authors devise a set of new interpretive concepts to shed light on core reduction habits reflected in 'symmetric' or 'dissymmetric' trajectories of core removal (**Fig. 33**). The widely cited work of Le Brun-Ricalens (2005) on the status of carinated endscraper technology in the Early Aurignacian represents a cognate attempt to disentangle aspects of rhythmicity and spatiotemporal patterns of lithic reduction (**Fig. 34**).

I cannot go into much detail here, but this approach provides ample opportunities to re-think variability at the interface between individuals and social groups – and hence to re-examine contextual aspects of lithic knapping such as 'skill,' *« savoir-faire »* (know-how), and 'social learning' (cf. e.g., Ploux 1988: Fig. 25, 26; Ploux and Karlin 2014; Leroyer 2016; Perlès 2016: 227; see Chapter 3). What remains important, however, is that these aspects are analysed by an exposition of various types of intra-technology *relations* and are hence explored from 'within,' without necessarily invoking much *a priori* or 'analogical' reasoning. It comes as no surprise that such inquiry into hominin technicity, including the 'gestural' dimensions of handling dissimilar lithic technologies, tends to inaugurate *technology-specific* insights – a classic fingerprint of contextualism and its preoccupation with *historical singularity*.[529] This general mode of reasoning groups under the umbrella of *« Palethnologie »* and seeks to 'rehumanise' the past through the study of ancient 'modes of life' (*« modes de vie »*) (e.g., Leroi-Gourhan 1971; 1983b) and their linkage with particular 'modes of doing' (*« manières de faire »*) (e.g., Pelegrin 1995: 35f.; Pigeot 2004: 178, 255)[530] – research that typically puts technical details centre stage and reflects an ongoing concern with 'novelty' and 'change' as structural categories.

We can thus conclude that *chaîne opératoire* analysis in its various manifestations – i.e. 'technological reading', 'mental refitting,' and the examination of *schémas diacritique* – attests to a deeply contextualistic logic of inquiry. Lithic assemblages are considered as 'situated' wholes; they have to be examined in terms of 'quality' and 'texture,' both in their synchronic integratedness ('spread,' 'fusion') and their infrastructural variability ('strands,' 'references'). In the process, 'qualitative relationships' are identified as the key loci of technological information (Perlés 2016: 223);[531] technical systems, therefore, tend to be studied with regards to their historical specificities. The resulting lithic knowledge claims are corroborated by their *workability* – that is, the overall consistency and 'barrier-freeness' of the totality of invoked arguments, assertions, and observations. This leads to an ongoing and generally open-ended exploration of contextual factors to characterise technological practice and knowledge, but the primary context of interpretation rarely exceeds the limits of the 'technical milieu' (cf. Pelegrin 2004).[532]

5.1.2 *Renard and Ducasse's structural techno-economics*

Renard and Ducasse's *De la rupture typologique à la fracture socio-économique* (2015) provides a second example of contextualistic reasoning in French lithic analysis. The paper proposes a synoptic re-interpretation of the Solutrean-Badegoulian transition in South-Western France. It draws on important doctoral research on the techno-economic organisation of the Solutrean (Renard 2010) and the Badegoulian (Ducasse 2010, 2012); the paper also integrates newer insights into non-lithic domains of material culture, most notably organic technology (e.g., Pétillon and Ducasse 2012; Baumann 2014). In general, the paper's approach marks a comparative shift in technological research and signi-

[529] This aligns with the structural category of 'novelty' (Pepper 1942: 235f.) and has also been described as a key interpretive category in French lithic analysis by Catherine Perlès (2016: 232).

[530] According to Jacques Pelegrin (1995: 35f.), specific *« manières de faire »* ('ways of doing') are coextensively interlaced with particular *« manières de voir »* ('ways of seeing') (cf. Pigeot 2004; Audouze and Valentin 2010: 35), again suggesting that distinct technical practices go hand in hand with characteristic cognitive operations. Following this trail of thought, one may conclude that particular ways of working stone reflect aspects of how ancient people have seen their world – stone working hence imbricates tropes of past cosmologies.

[531] Some of these 'qualitative' relationships – e.g., 'logical' and 'complementary' links – cannot, in principle, be 'quantified.'

[532] It cannot be overemphasised that the idea of the 'technical milieu' already demarcates a 'contextualistic' category; it defines the totality of means, objects, resources, agents, ideas, body techniques, etc. which are readily available in a given society-level context of technicity. It follows that, in order to understand a material correlate of a specific 'technical milieu,' it is required to scrutinise as many of the intra-milieu relationships that define the place of the material object in the milieu as possible. One may note that the idea of the 'technical milieu' already makes its appearance in the *œuvre* of the 'Early' Leroi-Gourhan (1943/1945), although he speaks of the 'internal milieu.'

fies the emerging potential of lithic scholars to bring to bear their 'localised' expertise in new and innovative ways.[533]

The main thesis, supported by an ongoing revision of dated evidence, is that the Solutrean-Badegoulian transition in South-Western France was associated with a radical re-organisation of societies on almost all functional and ideational levels. Accordingly, new taphonomically reliable archaeo-stratigraphic and radiometric data are summoned to support a rather swift and saltatory scenario of Solutrean-Badegoulian succession between 24 and 21 kya (*ibid*.: 196-198);[534] this sudden turnover is thought to be reflected in the evolution of the associated lithic technologies as well (*ibid*. 201). The authors argue that careful comparison of the two technical systems reveals two strictly opposing techno-economic conceptions, implying a true Badegoulian 'revolution' and thus a 'palaeo-historical' shift of considerable anthropological significance.[535]

De la rupture showcases a preoccupation with two of the key structural categories of contextualism – 'novelty' and 'change' (cf. Pepper 1942: 235) – and epitomises the contextualistic core intuition that no context is identical to any other context, re-casting contextual wholes as critical difference-making factors. The resulting mode of 'world-making' is particularistic rather than nomothetic; facts are born out of changing 'situationalities,' and an ongoing re-organisation of contexts and their contents is seen as the historical *status quo* rather than the exception.[536] According to Renard and Ducasse (2015), this is precisely how we should make sense of the transformations that led from the developed Solutrean to the Badegoulian. As signalled by the title of their paper, the observable typological 'rupture' between the two complexes can be considered a consequence of a pervasive 'fracture' between two techno-economic systems. In this light, the Badegoulian appears as a true 'palaeo-historical' contingency not predictable from the Solutrean substrate: it systematically breaks with the latter's systemic logic and implies a fundamentally new 'way of living.'

The same contextualistic logic is employed to present the lithic evidence and to define the technological 'context' of its comparison; the aim is to expose the common threads that run through the Later Solutrean and the Badegoulian, necessitating the disciplined comparison of the technological 'mean signatures' of the two techno-cultural entities:

> "[...] we have opted for an "integrated" and qualitative presentation of the data by contrasting two complexes: the younger Solutrean on one hand (i.e., the *Solutreén à pointes à cran*) and the Badegoulian on the other (i.e., the *Badegoulien ancien* and *récent*).The proposed hypotheses are thus based on a synthetic view "averaging" each of these complexes, a undertaking necessary to putting them into perspective in the broadest possible sense" (Renard and Ducasse 2015: 195; my translation [for the original French quote, see **Appendix Q.12**])

This cognitive strategy is both 'synthetic' and contextualistic – it concentrates on the main features that hold techno-cultural wholes together in time and space ('spread' of 'quality') and thereby defines the contexts of comparison. The important point is that this approach precludes any form of direct confrontation of artefact features and traits because, to become comparable, these must first be translated into context-level characteristics. The comparison of entire technical contexts, typical for contextualism, can only be effective if one investigates resemblance in terms of the 'quality' of each context, reconstructed by a detailed exposition of its techno-economic infrastructure (its 'texture'). What are effectively compared this way are larger configurations of relations, rather than merely the composition of object-level properties.

The details of Renard and Ducasse's technological analysis are highly diagnostic and may serve here as an illustration. The first aspect of note is that the authors, in line with our expectations, base their interpretation almost exclusively on an evaluation of technological 'structures,' by which they mean qualitative wholes defined by second- and higher-order relationships. Such relationships specify the connection(s) between two or more groups of interrelated artefact nodes. They theorise how 'dis-

[533] We can recognise this trend as an attempt to counterbalance the 'contextualistic' dilemma of being trapped in one's own context of research; the comparative manoeuvre acknowledges this condition but hopes to bring different contexts into new dialogue by confronting them in terms of both 'quality' and 'texture.' This, in turn, greatly motivates the drawing together of complementary lithic and non-lithic expertise.
[534] This part of the argument is crucial since it aims to reject alternative explanations based on population movements and/or the gradual integration of Solutrean and Badegoulian signatures.
[535] Their argumentation, therefore, implies a resolute critique on persisting notions of gradual 'transition' (processes e.g., baptised as *« désolutréanisation »* or *« magdalénisante »*).
[536] See also Bon (2009: 243, 337) for a similar view.

order' and 'fusion' produce intelligible technical contexts and the place of individual objects, operations, and other technical processes in these contexts:

> "The status of each of these [lithic] productions is thus defined with regards to the entire lithic technical system in order to assess the techno-economic investment that is respectively conferred on them as well as their level of mutual dependence (integration or disjunction of objectives, economic "hierarchy"). Solutrean and Badegoulian lithic productions can hence be compared step by step and aspect by aspect in order to measure their degree of techno-economic affinity." (Renard and Ducasse 2015: 194; my translation [for the original French quote, see **Appendix Q.12**]).

A pivotal disparity in techno-economic structure between the Developed Solutrean and the Badegoulian is thought to become evident when the relationship between the production of 'domestic' elements of technology and elements that support 'hunting' activities is examined in detail (Renard and Ducasse 2015 : 201). This provides a typical example for 'infrastructural' reasoning since a context's 'quality,' its global structure, is elucidated by analysing the interplay of significant sub-structures, so that the resulting architecture of sub-structures may be mobilised to describe the context's 'texture':

> "[…] the techno-economic approach shows that between the Solutrean and the Badegoulian, it is the structuring of the technical system itself which seems to have undergone profound changes. The Badegoulian of the French South-West appears indeed as a moment of total overhaul where the techno-economic architecture of the system of production and the management of lithic equipment is completely reworked […]. This reorganisation is reflected in particular by a new economic relationship between domestic tools and hunting weapons, a new balance of which we propose to explore the correlates in terms of the spatio-temporal organisation of activities." (*idem*; my translation [for the original French quote, see **Appendix Q.12**]).

The above quote further suggests that the authors tacitly galvanise a concept of 'functional equilibrium' to make sense of technological 'infrastructure;' they look for stable relationships between the two technical sub-systems ('domestic' vs. 'non-domestic') to draw techno-economic conclusions. To find context-internal equilibrium conditions between technical spheres dealing with 'domestic' tools and those dedicated to 'hunting' equipment is nothing less than an attempt to characterise the 'operation' (*fonctionnement*) (*sensu* Sigaut 1991) of a technical system by removing all 'blocking' strands and other epistemic obstacles that inhibit overall interpretive consistency. 'Internalist' equilibrium considerations can thus clear the view for the 'texture' of a technical context and help to work out the structural and functional division of labour that defines it.

The authors emphasise that different equilibrium solutions seem to specify the Developed Solutrean and the Badegoulian respectively; each context is depicted as an original integration of different types of lithic production and different systemic trade-offs can consequently be observed (Renard and Ducasse 2015: 198-203, Fig. 2). This type of reasoning expresses a proclivity toward portraying structural 'novelty' and spelling out its contextual corollaries; additionally, this approach again highlights the fact that 'infrastructural' differences in technological organisation are thought to reflect marked differences in the 'quality' of the techno-cultural contexts in question. In a manner characteristic of contextualism, it is thus the 'qualities' of contexts that are ultimately compared in order to gauge similarity and difference.[537]

The process by which the 'texture' of two or more technical systems is explored is equally informative and reflects a more general approach to Upper Palaeolithic technicity that is currently influential in the French scene. This approach rests on two complementary pillars. The first pillar is the distinction between a 'domestic' and a 'hunting-oriented' component of lithic technology (cf. Ducasse 2012: 153; Renard 2010), put forth by Bon (2005, 2009) and others (e.g., Geneste and Plisson 1986; Geneste 2010 [1991]: 437f.; Texier et al. 1998; Tartar et al. 2006; Teyssandier et al. 2010; Pelegrin 2011; Bachellerie et al. 2011; Anderson et al. 2015).[538] 'Domesticity' thereby refers to everyday activities tied to the needs of sustaining human settlement – i.e., scraping and cutting duties performed primarily at occupational sites – while the 'hunting' domain includes all activities focused on the extraction of

[537] This is of course very different in 'mechanism' or 'formism' as we have seen, where discrete features of parts or selected ties between/relationships among these parts are mobilised to assess similarity and difference in lithic technology (see Chapter 4).
[538] The purpose of this distinction is to theorise the differential contribution of parts that form sub-structures in a technical system to the overall 'function' (*fonction*) of the system; it is their differential interplay that is considered key to determining aspects of 'quality' and 'texture' of the technical whole and to investigating how the system generally works.

animal resources, in particular meat and fat, which require the killing of these animals – i.e., duties facilitated by specialised lithic implements that are parts of armature and weaponry systems. Although the involved spatial dynamics are certainly important, the focus remains economic; the goal is to separate lithic production modes and modification strategies that result in differentiated tool-kits ('domestic' vs. 'hunting-oriented') and thus reflect a diversification of economic needs. This amounts to nothing less than an inquiry into the economic 'status' and 'role' of different functional parts in a larger technical system.[539] The inclination is of course deeply *relational* – the resultant approach enables the investigation of how technical components of potentially dissimilar economic status relate to one another on the systemic level, e.g., whether or not the components are technologically 'integrated' or 'disintegrated.'

The second pillar is the proposal, popularised by Jacques Pelegrin (1995, 2000) and others (cf. e.g., Tsanova et al. 2011; Valentin 2011: 31; Langlais et al. 2012), that lithic technological evolution in the Upper Palaeolithic was driven largely by a need to prepare and maintain well-defined projectile technologies, tethered to new hunting tactics (cf. Pelegrin and O'Farrell 1998; O'Farrell 2004). The resultant research objective is to identify 'levels of hierarchisation' within and between blank production systems and to assess whether particular ways of organising lithic reduction respond to the 'needs' of particular mobility and hunting systems. The guiding idea is that lithic technicity in the Upper Palaeolithic was *anchored* in the production of more or less well-differentiated projectile blanks and that the emerging key problem is thus to also support other 'domestic' needs (e.g., Valentin 2011: 66; Bordes and Teyssandier 2011).[540] From a contextualistic perspective, this dilemma can be reformulated in terms of the structural categories 'quality' and 'texture:' the fact that technical systems foreground the manufacture of blank-types destined to become part of the hunting equipment pertains to the overall 'quality' (immanent total meaning) of the technical systems. The price of this technological 'quality' is the need of organising the system in such a way that the full spectrum of tasks can still be supported, and eventually impacts the 'texture' of the system (grammatical relations). The analysis of 'technical intentions,' that is, the techno-economic 'purposefulness' of a lithic system, then simply consists of the determination of the distinct liaison between 'quality' and 'texture' which leads to distinct patterns of systemic 'operation' (cf. Pelegrin 2011: 146).

Renard and Ducasse (2015: 194) integrate these two angles of inquiry to show that the fabrication of hunting equipment in the Developed Solutrean appears to have a radically different techno-economic status than in the Badegoulian (**Fig. 35**). In the Solutrean, armature and projectile point production are found to lie at the heart of the technical system and the entire system appears to be oriented towards the generation of suitable blanks to support this 'non-domestic' component of technicity (*ibid.*: 198). This privileged status of the hunting-related 'strand' of lithic technology is signalled by a number of interrelated organisational features which typify the techno-economic architecture of the Solutrean.

First, blank production is 'diversified' and furnishes a panoply of 'domestic' tool types – e.g., scrapers, burins, and borers – but these types are neither tied to a specific *chaîne opératoire* dedicated to produce them, nor are they manufactured on the blanks of 'primary intention' that are extracted from the dominant blade production system.[541] Instead, 'domestic' tools are primarily produced from

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[539] The objective, again, is to determine the 'operation' (*fonctionnement*) of the system in light of the orchestration of its parts.

[540] The important point is that such a shift in the nature of the economic problem-situation is possible. Other 'qualities' of a technical system may face other kinds of economic issues – technologies may, for instance, be oriented towards 'domestic' production, therefore requiring the 'non-domestic' tool domain to be supported by 'infrastructural' means. The activities enabled or facilitated by a technical system and the technological problems it generates are therefore always a product of the dynamic interplay between the 'quality' and 'texture' of a technical context; they cannot be defined or known without knowledge of the technical context itself.

[541] Lithic products of 'primary intention' are not just 'intuited' but are *determined* in the course of careful 'synthetic' examination. The main point is that 'technical intentions' are not extracted from individual lithic artefacts and their characteristics, but can only be studied in the light of system-level properties. A technical system is 'purposeful' or 'directed' insofar as it has a 'function' (*fonction*) – typically referred to in the French literature as its 'finality' – and blanks of 'primary intention' are those blanks that serve or support the respective systemic 'function.' This also means that assessments of the sort implied by categories such as blanks of 'primary intention' depend entirely on the determination of the immanent 'quality' of a technical whole. The inferred structure of 'intentionality' therefore generally mirrors the 'texture' of the technical system in question; 'intentionality' can then be hierarchised by evaluating how systemic 'quality' authors a specific systemic 'function' and how the two articulate (or not) with the documented systemic 'infrastructure' ('texture'). All of this is perfectly 'contextualistic' since all of these categories can be defined only in mutual dependency and are amendable to constant modification and correction; it is ultimately the inter-relationality between them that enables conclusions about the 'purposefulness' of a technical whole and the status of various parts (e.g., lithic artefacts) within all of this. 'Purposefulness' defined in this sense is a genuinely 'contextualistic' category.

by-products and preparatory blanks that arise during blade production and its maintenance. The raw material base of these 'domestic' tools is rather heterogeneous and represents a mix of local and non-local materials of varying quality, larger endscrapers constituting perhaps the only exception to this configurational logic.

Secondly, the treatment of 'domestic' elements contrasts with the handling of large blades accounting for the blanks of 'primary intention.' These blanks are either transformed into *pointes à cran* or provide the raw material for different variants of 'laurel' leaf points. Secondary modification (retouch etc.) of these pieces attests to elevated levels of 'economic investment' (*ibid.*: 199); for instance, they regularly exhibit secondary surface shaping (*façonnage*) by means of flat pressure flaking – a treatment that is completely absent in the 'domestic' sphere of production. Although the raw material spectrum covered by these 'non-domestic' tools is also diverse, the diversity is primarily a function of high-quality raw materials, testifying to the 'mobility' of the objects and the 'planning' and technical 'anticipation' involved in their production. Some of the extra-large 'laurel' leaf points can even be interpreted as *couteau de chasse* (hunting knives) and hence emerge as a supplement to the primary 'hunting gear' in the form of projectile points (*ibid.*: 201).

Thirdly and certainly related to the previous point, many of the bifacially shaped objects seem to be 'over-designed.' They can be interpreted as signalling economic 'over-investment' and embodying a high level of 'technical competence' (*« savoir-faire »*), perhaps even reflecting the 'valorisation' of certain 'non-domestic' needs (*ibid.*: 203f.).[542] The resulting relative imbalance between 'domestic' and 'non-domestic' spheres of lithic production is interpreted in terms of a proper *hierarchy of techno-economic organisation* (*ibid.*: 203): 'domestic' and 'hunting-related' (*« cynégétique »*) needs are regarded as well-separated and infrastructurally differentiated. While the production of 'domestic' blanks appears to be 'embedded' and is thus not implicated in the overall 'quality' of the technical system, there is an over-accentuation and elaboration of technical means of assembling projectile elements and other specialised tools that support hunting trips.

This general architecture of the Solutrean contrasts markedly with the lithic evidence from the Badegoulian. Renard and Ducasse (2015: 201) argue that domestic and *cynégétique* needs in the Badegoulian are deeply entangled with one another and seem to be fully integrated. The respective *chaînes opératoires* are thought to evince an 'imbrication' (overlap) of 'domestic' and 'nondomestic' needs. This techno-logical structure is captured by the notion of 'ramification.'[543]

In contrast to technological organisation in the Solutrean, Badegoulian technical systems are based almost exclusively on the production of flakes (Renard and Ducasse 2015: 201). These flakes vary in shape and size, are often slim in character, and are used as blanks for tools but also as volumetric matrices for the production of bladelets and micro-bladelets. In addition, the raw material base for the manufactured tools is largely of local origin. The articulation of all of these factors is interpreted as *non-hierarchical strategy* of volumetric exploitation, capable of quick-and-easy adjustment to local circumstances (*idem*). Badegoulian lithic technology is consequently seen as inherently 'transformative' and relatively flexible in its ability to satisfy different production needs. It follows that the distinction between objects of 'primary intention' and objects of 'secondary' or even 'tertiary intention' makes little sense in such a technological context – a finding that speaks to the basic difference in 'texture' between Badegoulian and Solutrean techno-economic contexts.[544]

In total, Badegoulian technological organisation is viewed as expounding to a *plurality* of coexisting 'technical intentions,' which are enshrined in a single sequence of continuous but structured lithic reduction (Renard and Ducasse 2015: 202). Moreover, the centrality of flake matrices in the techno-logic of the Badegoulian is thought to reveal the *polyvalency* of this blank-type in this particular context as well as the fundamental 'pliability' of the techno-economic systems it hosts.[545] *De la rupture* therefore proposes to understand the differences between Solutrean and Badegoulian techno-economic organisation in South-Western France as the symptom of an abrupt transition from differen-

[542] See also Geneste and Plisson (1986), Renard and Geneste (2006), and Pelegrin (2007, 2013).
[543] The structural analogy for this 'arboreal' or 'dendritic' organisation of lithic reduction is derived from previous work on variants of the French Mousterian (Geneste 1991; Bourguignon et al. 2004).
[544] However, one might nevertheless speak of a 'nested' structure of blanks since flakes that are used to produce micro-flakes or bladelets are often blanks themselves (core-on-flake system) – this is of course precisely the significance of a 'ramified' techno-logical structure.
[545] Renard and Ducasse (2015: 202) speak explicitly of *« matrices polyvalentes »*.

tiated and highly specialised production systems with a clear focus on projectile weaponry and hunting equipment to more integrated modes of production in which 'domestic' and 'nondomestic' needs were expediently satisfied. With Pepper we can conclude that the difference in techno-economic 'quality' between the Developed Solutrean and the Badegoulain pertains to a clear-cut disparity in the 'texture' of the two contexts, which is expressed in the differential relationship between 'domestic' and 'non-domestic' domains of lithic organisation.[546]

In typical contextualistic fashion, Renard and Ducasse (2015: 203-206) further suggest that these disparities in techno-economic organisation can be brought into dialogue with structural differences between some of the non-lithic domains which are tied to the respective lithic systems. They highlight mobility systems and their associated organic technologies (*idem*). We can thus characterise their approach as *hyper-relational* – intra-technological relations are used to describe the 'structure,' 'operation,' and 'function' of a technical whole, only to analyse the interconnections between the whole and other wholes of its wider 'super-structural' surrounding; this amounts to nothing less than the introduction of a higher level of analysis, on which wholes again become parts and are examined in their systemic interplay.[547] It also shows that we are dealing with a 'soft' ecology approach, where 'interpenetration' is the regulative idea and everything potentially shapes (and is shaped by) everything else. The advocated contextualism is 'refined:' categorically distinct domains of reality (lithic technology, mobility, organic technology, etc.) are understood to be massively intertwined,[548] and a 'dynamic' interpretive holism takes centre stage.[549]

This holism enables the exposition of 'palaeo-historical' articulations of *l'homme total* ('the complete man') (see **Appendix II.3**);[550] human realities can be reconstructed in their totality since even the study of a single context of reality (e.g., technical) allows conclusions about other contexts (e.g., mobility, worldview, cognition, etc.) to be drawn. The reason is unmaskingly contextualistic: everything is interconnected with everything else and thus points to everything else.[551] *L'homme total*, however, is always 'situated' since each broader historical context ('super-context') is substantially unique, reflecting contextualism's commitment to 'novelty' and 'change.' The consequence is that, if techno-cultural entities such as the Solutrean or Badegoulian are re-cast as significant contexts of interpretation, they tend to yield divergent descriptions of *l'homme total*. The *homme total* of the Solutrean thereby differs from *l'homme total* of the Badegoulian.[552] This is probably precisely what is referred to when Renard and Ducasse (2015: 194) stress the 'anthropological signification' of the systemic changes they observe at the Solutrean-Badegoulian boundary. The two contexts ultimately showcase different instances of being human.[553]

The authors enunciate that the Developed Solutrean and the Badegoulian were characterised by two distinct ways of organising activities in space and time, which they identify with "two quasi

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[546] Again, what is identified as 'domestic' and 'hunting-related' varies between the two structural wholes and is thus context-dependent. In sum, this approach therefore provides a prototypical example for the 'contextualistic' tendency to delineate and compare context-specific features of the same kind.

[547] We can thus speak of reality as a highly structured and granular entity. There are several levels of analysing 'texture' and 'quality,' so that one can examine 'texture'-'super-texture' relations and so forth. From the perspective of 'contextualism,' the purpose of such continuous exploration of lower and higher levels of analysis and their inter-linkage is to determine to 'spread' of the ultimate explanatory contexts.

[548] This is perhaps where Pepper's structural category of 'fusion' comes into play. According to Pepper (1942: 243), the 'quality' of a context always exhibits some degree of fusion of the details of its 'texture' – an aspect that secures the unity of 'quality' and 'texture.' Thus, 'fusion' motivates scholars to conceptualise the world as an *entangled whole*.

[549] Interpretation is exhaustively 'synthetic;' the idea is simply that every aspect of reality is potentially implicated in any other aspect of reality. It follows that technicity, sociality, cognition, and so forth are systematically embedded in each other; each of them consequently has implications for all others, or, in other words, analysis of any of them may deliver conclusions about all others. Needless to say, conclusions become much more robust as more aspects, domains, and/or categories of reality are taken into account. To a certain degree, contexts that by definition enshrine only parts of reality can then be viewed as 'microcosms' of the whole of reality. French-type *chaîne opératoire* analysis aims to do precisely this: to provide an account of technical systems as 'microcosms' of society, cognition, practice, and body instrumentalisation, to name but a few (see e.g., Bon 2009: 143, 213 for an explication).

[550] For a detailed discussion of Mauss' *l'homme total* conception, see e.g., Schlanger (2012).

[551] Cf. **Appendix II.3: Fig. II.1** for the interplay between the 'contextualistic' constitution of worldly affairs and the regulative idea of the *l'homme total*: the vision of the *l'homme total* can be brought into fruitful contact with what Hans-Peter Hahn (2013: 34f.) has identified as the 'pound-cake model' (*Rührkuchenmodell*) of sociocultural realities.

[552] We can interpret this as a reminder of *deep time alterity*, in the sense that even humans that biophysiologically resemble modern humans are likely to have been very different from us in how they lived, thought, and behaved. Placing emphasis on facets of 'alterity' is a regular feature of 'contextualistic' reasoning (see Chapter 2).

[553] In Éric Boëda's 'organicism,' this inclination gives way to what I call a 'radical anthropology of alternative humanities' (see second part of this Chapter).

oppositional solutions of anticipating needs" (Renard and Ducasse 2015: 203, my translation). The Solutrean techno-economic profile, with its high potential for functional differentiation, is shown to correspond to a settlement system that is characterised by a 'complementarity' of distinct techno-economic site profiles in geographic space (*idem*). Techno-economic differentiation in the Developed Solutrean is therefore thought to be reflected in a diversity of site functions. The 'texture' of lithic technology, in other words, is shown to be mirrored in the 'texture' of the mobility system. By contrast, the techno-economic structure of the Badegoulian appears to correspond to a settlement system comprising a multitude of sites with relatively 'stable' techno-economic profiles, but hosting a rather diverse set of activities (*ibid.*: 203f.).

For Renard and Ducasse (2015: 203), this structural difference provides further evidence that hunting activities played an outstanding role in the Solutrean, potentially betraying a strong 'segmentation' of the social realm and the extraordinary socio-political status of some individuals (cf. Renard and Geneste 2006; Pelegrin 2007, 2013). The situation in the Badegoulian appears to be very different. Badegoulian technology comes into view as a technology *« tout-terrain »* ('all-terrain') centred on 'adaptation' and 'travelling.'[554] This is taken to suggest that Badegoulian society was probably more 'collective' and mobility likely took 'cyclical' forms (Renard and Ducasse 2015: 203).[555] The inherent 'technical suppleness' (*« souplesse technique »*) of the Badegoulian is regarded as having enabled the relative stability of lithic toolkits across a vast geographic extent, which explains the spatiotemporal homogeneity of this techno-cultural complex at large (*ibid.*: 203, 205). This homogeneity can be contrasted with the relative spatiotemporal heterogeneity of the Developed Solutrean, which is known for its well-delineated regional groupings that are often centred on distinct styles of projectile heads (cf. Smith 1966). Thus, there seems to have been a proper 'cultural geography' in the Solutrean (*ibid.*: 205; cf. Ducasse and Renard 2012),[556] whereas a similar structure-giving geographic moment is missing in the Badegoulian.[557]

The cognitive strategy is to relate specific *« manières de faire »* ('modes of doing'), identified in the realm of lithic technology, to particular *« manières d'occupation »* ('modes of occupation') reflected in settlement patterns, in order to evoke associated *« manières de penser »* ('modes of thinking').[558] Different contexts of past reality are compared in terms of their configurations to demonstrate that they share a similar structure; this is then taken as evidence for a stable 'super-structure' regulating the observed structures.[559] The strategy, in a manner characteristic of contextualism, is also decisively 'dispersive' since the search for the unifying super-structure that provides 'quality' to its elements is guided by the *proliferation* of fact (addition of contexts). Moreover, knowledge is corroborated by a pragmatic principle of verification: one context is taken as a training ground to develop a consistent and beneficial interpretation of its 'texture' and 'quality'; the structural features of the latter are then retraced in added contexts on a similar level of analysis. If the structural qualities of the training context turn out to be helpful in elucidating the added contexts and their links to the original training

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[554] An obvious metaphor to circumscribe Badegoulian lithic technology, although not explicitly mobilised, is that of the *mountain bike* or *amphibian vehicle*.

[555] The authors explicitly refrain from the use of theoretical models in the vein of Binford and others to characterise the kind of mobility they are most likely facing (Renard and Ducasse 2015: 204). This seems counterintuitive at first glance (Badegoulian mobility seems to conform to a 'residential,' Solutrean mobility to a 'logistical' one). However, the underlying contention seems to be that *deep time alterity* cannot be taken lightly. The argument is that mobility is not explained or illuminated by simple categorisation, but by taking seriously its idiosyncrasies and relating it to other characteristics of the same reality in order to flesh them out. This comes close to saying that there can be no *a priori* categories within which one can meaningfully place mobility systems of the deep past – a prototypical argument of 'contextualism.'

[556] This detail is important since the technological centrality of hunting-gear production mirroring that of projectiles and other 'hunting-related' weaponry is directly reflected in the fact that these products became a factor in catalysing regional fragmentation during the Solutrean. In other words, the fact that these pieces and not others played a role in organising proper 'territories' attests to their more-than-functional significance.

[557] For the specific corpus of theoretical literature on 'cultural geography' typically referred to by French scholars, see e.g., Bonnemaison (2000), Claval (2001, 2003), Chivallon (2003), Allemand (2004), Rasse 2010, and Di Méo (2008); for an explicit treatment of the topic in French Palaeolithic archaeology, see Bon (2009: Chapitre III) and Chevrier (2012: Chapitre III.3).

[558] The authors deliberately evoke these notions in some of their section headings: e.g., *Deux manières d'occuper le territoire ?* ('Two manners of occupying the territory?') (*ibid.*: 203) and *Pour deux manières de penser le territoire ?* ('For two manners of thinking the territory?') (*ibid.*: 205).

[559] The way in which this 'super-structure' is conceptualised of course varies among French practitioners. An example is François Bon who, in *Préhistoire. La fabrique de l'homme* (2009: 324), explicitly declares: "[…] [b]ut the important thing is to recognise the articulation of these various domains – economic, technical, religious – around the ideological structure that renders a human group a true human society. And this without starting from the assumption that the most accessible domains, like those pertaining to the techno-economic identity of a given population, act in the form of a more powerful determinant than other components of the same society." (my translation [for the original French quote, see **Appendix Q.5**])

context, the interpretation is found to be 'workable.' This confirmative strategy is typical of developed forms of contextualism.[560]

As a last manoeuvre, Renard and Ducasse (2015: 204) argue that the distinct logic of 'domestic'-'nondomestic' interaction in the Developed Solutrean and in the Badegoulian is supported by the nature of economic investment in organic tools in both periods (**Fig. 36**). Based on the work of Chauvière, Pétillon, and Baumann, they contend that Solutrean organic technology exhibits a strong investment in organic points and other 'hunting-related' objects – the only notable exception perhaps being *compresseurs* (*idem*).[561] This pattern obviously *reproduces* the general hierarchy between 'domestic' and 'non-domestic' spheres of lithic production. In the Badegoulian, to the contrary, the organic technological domain attests to an economic 'equilibrium' between 'domestic' and 'hunting' armature (*idem*). The authors take these findings as evidence of the validity and generality of the organisational relationships they have isolated. This part of the argument simply confirms what has been said earlier, namely that knowledge corroboration is pragmatic and the mode of inquiry holistic and 'hyper-relational.'

To strengthen this general systemic reconstruction, Ducasse and colleagues (2016) have recently integrated evidence on personal ornaments and other 'artistic' domains of material culture from both the Developed Solutrean and the Badegoulian; this evidence is thought to reproduce and thus to confirm the division. This again brings to light the 'dispersive' nature of inquiry and corroboration. It is once more the *proliferation* of fact, through the enumeration of even more contextual evidence which is regarded as helping secure scientific 'approvability.' The approach is 'dispersive' because its strength is to include a broad latitude of available data without presuming from the start that some data are more important than others; the same methodological symmetry holds for the domains of reality which have been included in the analysis – none are regarded as privileged, but instead viewed to point equally to the same 'super-structure' or 'macro-context.' The combined evidence for Pepper's contextualism is thus overwhelming; its structural categories greatly clarify what the authors have done and why they have done it.

5.1.3 *« Approche techno-economique » and group mobility*

Following the discussion in the previous section, it is instructive to take stock of the so-called French 'techno-economic approach' more generally (e.g., Perlès 1980, 1991b; Pigeot 1983; Geneste 1985, 1991 [2010]: 429-431; Jaubert 1993; Cretin 1996; Geneste and Jaubert 1999; Thiébaut 2006: Chapitre II; Renard 2010). This approach is already contextualistic in terms of its basic premises and orientations: it is primarily interested in the interplay between – that is, the 'co-fashioning' of – technology and economy. A key assumption is that *technological* and *economic rationalities* are largely co-extensive.[562] Techno-economic inquiry is typically concerned with the *economic implications* of vary-

[560] This 'theory of cognitive criticism' is probably a combination of what Pepper (1942: 272-278) identifies as the 'contextualistic' principle of a *verified hypothesis* and *qualitative confirmation* (see Chapter 2). The insights from the original training context are used to 'inductively' develop a number of hypotheses which are then explored in the added contexts ('direct verification'); the 'qualitative confirmation' theory, on the other hand, simply states that all elements, 'strands,' and/or 'references' take up the qualities of their context, which means that a multiplication of recurring structures can be regarded as indicative for the fact that these somehow take up the 'quality' of their overarching context ('super-context'). One therefore confirms what one asserts if and only if one retraces particular structural features of the whole in its parts, whereby wholes and parts are dynamically defined.

[561] *Compresseurs* are bone objects with often marginal traces of utilisation that are difficult to decipher (Patou-Mathis et al. 2002). It is interesting, however, that a possible role of these items in applying pressure for lithic retouch has regularly been invoked. Needless to say, a 'synergetic' relationship with practices of shaping foliates in the Solutrean would further strengthen the argument presented by Renard and Ducasse. It would directly tie these pieces to 'hunting-related' domains of lithic technicity and further detach them from strictly 'domestic' spheres of production and use.

[562] It is noteworthy that the mobilisation of essentially hybrid terms such as 'techno-economic' or 'techno-economy' to describe the project of lithic economic inquiry is largely restricted to the Francophone world. In Anglophone research, by contrast, scholars typically speak of 'lithic economy,' 'economy,' and/or 'economics.' While technology and economy fuse terminologically into each other in the first case, they are typically kept separate in the latter. This observation alone signals that largely distinct conceptions about the nature and status of economy are in place. It also indicates that in the Anglophone world economic aspects of lithic technology are really approached from the perspective of *economics*, a specialised academic field with specialised theoretical and methodological resources but mainly concerned with the present day. In addition, and I will return to this point below, economy in Anglophone research is often seen as a 'glue' that aids the understanding of how technology interfaces with its natural exterior (see Chapter 4). In France, the 'fusion' of technical and economic aspects is thought to illuminate how technology is stitched to its sociocultural substrate and how techno-economy is therefore always socially embedded.

ing technological make-ups.[563] Lithic economy, a term that is in fact rarely used, is therefore studied from the perspective of technical wholes rather than from the viewpoint of generalisable economic principles or laws. The idea, again, is that both domains of reality – technology and economy – 'interpenetrate' each other and therefore *inscribe themselves* onto each other's structure (cf. Perlès 1991a: 9). The technical 'interface' is thought to resonate both with its economic neighbour and with the societal whole and thereby picks up key characteristics of both. This inherently 'contextualistic' trope furnishes the central research mandate for French techno-economic studies.

Techno-economic inquiry in the French tradition effectively begins with Marie-Louise Inizan's *Nouvelle étude d'industries lithiques du Capsien* (1976), in which the author coined the interpretive concept of *« économie de débitage »* ('blank production economy') (see also Inizan 1980) – a concept that is still widely used today. Lithic approaches that draw on this concept set out to investigate the economic dimension of varying blank production systems (*débitage*). The guiding motivation, consistent with what has already been said, is to theorise and examine the precise economic implications and effects of organising lithic reduction in a number of different ways. Again, the 'structure' (*structure*) and 'operation' (*fonctionnement*) of a given technical system – i.e., the 'infrastructural' features of the targeted lithic technology – are viewed as informative of the system's economic status and purpose; in other words, the 'texture' of technology is used to infer a special axis of its 'function' (*fonction*): its *« fonction économique »* ('economic function'). The interaction between the two is regarded as providing critical insights into the 'economic quality' of various technical systems.

A central line of techno-economic investigation is to evaluate the differential capacity of lithic technological systems to support blank 'normalisation' or 'standardisation,' the 'diversification' of blanks, tools, and/or raw materials, and whether and in what way they require 'technical investment,' 'anticipation' and/or collective 'planning' (*planification*)[564]. While a lot of research has traditionally been dedicated to better understanding the interaction of knapping concepts and tactics with different raw material qualities and formats (e.g., Pigeot 1987; Meignen 1988; Geneste 1989; Perlès 1991b; Cretin 1996, 2000),[565] recent approaches have increasingly paid attention to 'inter-technological' trade-offs (e.g., Soriano 2000; Soressi 2002; Faivre 2008; Brenet and Folgado 2009; Brenet et al. 2014); that is, how different economic needs can be satisfied by employing a number of distinct technical solutions that complement and/or support each other economically.[566] The contextualistic inclination of this type of research is evident. Various technical 'micro-contexts' in the form of particular technological systems (e.g., various Levallois concepts, Discoid, Quina, and/or varying bifacial technologies) are related in such a way that their larger economic 'macro-context' becomes apparent; thus, the configu-

[563] Methodologically, this direction of inference and argumentation is explicitly laid out in 'Fig. 1' of Renard and Ducasse (2015).

[564] The notion of *planification*, which is regularly invoked when French scholars address the problem of economy (e.g., Bon 2009: 252; Langlais 2010: 301), carries a strong social connotation; it again signals that the 'techno-economic' approach is based on the conception that technology, sociality, and economy are mutually *embedded* into each other. This conception brings French techno-economic inquiry close to 'substantivist' views in economic anthropology (e.g., Polanyi 2001 [1944]; Dalton 1961, 1969), where economy is theorised as an expression or derivate of sociocultural organisation (and not the other way around!). Although the term *planification* is still best translated as 'planning,' its meaning is historically informed and refers to a top-down form of *collective planning*. The term was used originally to designate types of economic planning in which regulation, control, and coordination by higher-order (i.e. state) institutions played a cardinal role (cf. Quinet 1990). Economic planning understood in this way transcends the level of individual action and potentially even precedes the awareness of individual actors; strictly speaking, *planification* signifies a deeply sedimented form of patterned economic organisation which is negotiated on the highest society-level. It is therefore inconsistent with 'methodological individualism' and 'atomistic' reasoning (see Block and Somers 1984 for some of the reasons).

[565] The early work of Nicole Pigeot (1987) is an example of inquiry focussing on the economic interplay between raw material quality, knapping skill (technological variability), tool functionality, and the use of an excavated habitation space. Her results of the combined analysis of these various factors indicate that in the Magdalenian of Etiolles U5 high-skilled production of high-quality blades occurred around the central hearth area, whereas other flint-knapping areas probably result from the activities of less-skilled knappers who primarily produced expedient products and tools for immediate domestic consumption. Therefore, different economic needs may be satisfied by different people and different technical competences can be used to examine intra-group divisions of labour.

[566] A good example for this type of inquiry is the doctoral research of Sylvain Soriano (2000) introduced in Chapters 1 and 3. The central point of this study was to identify the changing logic of interaction between flake-production systems (*débitage*) and bifacial shaping systems (*façonnage*) across the Lower-to-Middle Palaeolithic boundary. Soriano shows that the 'status' and 'role' of both 'micro-contexts' of lithic production change as a function of their interrelationship through time. In the case of Gouzeaucourt level G, he is able to demonstrate that the present *débitage* systems of 'Clactonian' affinity are largely *stationary* technologies and thus supply the material for immediate domestic consumption at the sites (diversification of functional potential in terms of distinct blanks). This contrasts with the present *façonnage* systems which exhibit evidence for considerable resharpening and off-site production (suggested by the under-representation of tranchet- and volume-construction products) and is hence interpreted as a highly flexible but 'mobile' technology (dynamic and synergetic implementation of techno-functional-units/UTFs). The conclusion is that *débitage* and *façonnage* system complement each other in their 'function,' suggesting a differential use of space including technical anticipation and the spatiotemporal fragmentation of economic needs.

ration of this 'macro-context' is thought to yield a basic explanation for why particular 'micro-contexts' make their appearance.[567]

Perlès' *Économie de la matière première et économie du débitage* (1980) marks a turning point in the techno-economic discourse. Starting from the raw material question, Perlès argues that the concept of an *« économie de débitage »* merely describes a particular economic strategy – one that solves the problem of producing a toolkit diversified enough to satisfy all functional needs by means of a differential organisation of knapping. She contrasts this strategy with an alternative one, which she baptises *« économies de la matière première »* ('raw material economies'). The latter achieves toolkit diversification not by means of differentiated knapping modalities, but by differential raw material selection, acquisition, and exploitation (cf. Cretin 1996: Fig. 4; **Fig. 37**). The basic contention is that toolkit differentiation can be realised in a number of different ways (Perlès 1991b: 36f.); although the effective result – a diversified toolkit – may be broadly similar, each solution has different economic consequences and may offer distinct economic affordances (cf. Perlès 1987, 1991b, 1992). These diverse technical solutions and their consequences can in turn be charted by examining the 'texture' and 'quality' of different *chaîne opératoires* and their articulation (or lack thereof) with varying raw material substrates.

According to Perlès (1991b: 37-40), a knapper can generally decide whether she/he wants to base her/his toolkit on a set of 'undifferentiated' blanks or on a range of 'differentiated' blanks.[568] In the first case, *chaîne opératoires* tend to be structurally fairly 'simple' (*ibid.*: 38), giving the impression of a rather 'opportunistic' reduction strategy. In this scena-rio, toolkit diversification is typically achieved through a combination of blank selection and secondary modification, which together determine the morphology and function of the resulting lithic tools. Retouch in this scenario is *not fully determined* by the available blank-types; instead, it remains the primary operation for transforming blanks into the desired tools and thus to ensuring diversity in toolkit morpho-functionality. This scenario describes a *confectioning solution*.[569]

In the second case, if the knapper opts for basing her/his toolkit on a 'differentiated' pool of blanks, she/he has two contraposing options (Perlès 1991b: 38). She/he can either adopt an 'integrated' production system characterised by a single and typically rather 'complex' *chaîne opératoire* (*idem*), or can adopt a 'segregated' production system propelled by several disjunct *chaîne opératoires* of varying complexities (*ibid.*: 39).[570] In the former case, core reduction is generally 'intense' and thus typically 'ramified,' so that different blanks are available at different positions/stages in the reduction sequence. In the latter case, by contrast, blank differentiation tends to be a function of different reduction systems, whereby varying 'inter-active' and 'synergetic' relationships between these co-occurring *chaîne opératoires* are of course possible. The important point, however, is that toolkit diversification is not primarily a question of secondary modification (retouching), but instead becomes an issue of varying 'finalities' of lithic reduction methods; different methods may provide different blanks destined for different tool functions. Therefore, concordance (*« adéquation »*) between blank-types and tool-types is generally fostered, often developing into a key dimension of the 'technical logic' of the respective contexts. The implication is that the 'confection' stage (*« confection »*) of the *chaîne opératoire* is no longer decisive in terms of imposing the required final morpho-functionalities; secondary modification is thus often less invasive and strives to enhance the 'natural' morpho-functionalities of

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[567] An important implication of this type of reasoning is that the 'structure' of the 'macro-context' itself, that is, the general diversity of available or present technical sub-systems and their inter-relationality, emerges as an indicator of economic functioning. For example, Middle Palaeolithic contexts of lithic technicity stand out by hosting a great diversity of distinct technological systems with differential blank-production potentials and tool-kit implications; Upper Palaeolithic contexts of lithic technicity, by contrast, appear to be characterised by a much narrower set of co-occurring technological micro-contexts (mostly laminar in character). From a 'contextualistic' standpoint, this difference alone has far-reaching implications for the nature of economic needs and their mode of satisfaction in the two timeframes.

[568] Although Perlès (1980) was the historically influential piece, I have decided to use the updated and slightly more comprehensive version here (Perlès 1991b); the 'contextualistic' inclination of the inquiry is the same; in terms of the general strategy of analysis and the main points put forward, it does not matter much which version of Perlès' model is used.

[569] The term 'confectioning solution' derives from the French word *« confection »* ('confection'/'secondary modification') which designates the stage of tool manufacturing in the *chaîne opératoire*.

[570] The perhaps most influential application of the ideal-typical distinction between 'integrated' and 'segregated'/'disjunct' lithic production systems has been provided by Bon (2000, 2002, 2010). He discriminates between an 'integrated' techno-economic system of the Protoaurgnacian and the 'disjunct' production of blades and bladelets in the Early Aurginacian. Since Bon (2002) interprets the former as preceding the latter, he essentially offers a *chronological account* of Perlès generalised scheme of techno-economic organisation within the grander scheme of the evolution of the Aurignacian in Southwestern France.

blanks rather than authoring entirely new ones.[571] As a result, the 'status' and 'role' of secondary modification itself tends to be fundamentally different. Technical systems based on the production of a diversified range of blanks to support toolkit diversification thus typically engender *flaking solutions*.

This distinction between 'integrated' and 'segregated' production systems has far-reaching implications for the economic management of the available raw material substrates (Perlès 1991b: 40f.). 'Integrated' and fairly 'complex' production systems that furnish highly differentiated blank repertoires typically rely on sophisticated knapping strategies (multiple re-organisation of reduction patterns and/or core volumes, high investment in preparatory procedures, etc.) and/or a high degree of technical 'anticipation' (e.g., structured and well-planned provisioning of high-quality raw materials), whereas 'segregated' production systems yield a much greater potential to make differential but productive use of varying raw materials.

Ideal-typically,[572] the general design of 'integrated' systems should buffer them against the effects of local variation in the quality and availability of raw material substrates.[573] 'Segregated' systems, in contrast, are not effected by such variation to the same extent; they are typically capable of embracing the diversity and locally shifting quality of raw material spectra and exploiting them to their benefit. Determination of the nature of an 'integrated' production system is therefore based purely upon the enchainment of technical actions, that is, the choices that knappers, consciously or unconsciously, make in the course of the knapping process. 'Integrated' lithic production thus usually pairs with what Perlès calls an ideal-typical *« économie de débitage »* ('blank-production economy'). In comparison, 'segregated' production systems are primarily governed by technical choices that pertain to the selection, acquisition, or management of distinct lithic raw materials – 'segregated' lithic production is thus typically associated with what Perlès refers to as an ideal-typical *« économie de la matière première »* ('raw material economy').

These categories are interpretive aids to navigate a complex technological reality and as Perlès (1991b: 41f.) readily admits are rarely encountered in their 'pure' state. Rather, they are typically observed in 'mixed' or 'hybrid' forms. Having said this, the key point is that different reduction structures are re-cast in economic terms, by evaluating different technical options and 'intra-technological' relationships bound to these structures. Technological 'design,' for example, is considered a question of

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571 Since 'tool' is clearly understood in maximally inclusive terms here (the category of 'tool' is itself a context-dependent category and may or may not be defined by the presence of secondary modification), this may also imply that secondary modification ceases to be a necessary means to satisfy functional needs at all. In other words, maximally economic 'flaking solutions' (see *supra*) would lead to an almost perfect concordance between blanks and tools and therefore result in a toolkit consisting primarily of un-retouched pieces. Hence, the economic corollaries of varying technical 'textures' not only have qualitative implications for the composition of lithic assemblages, but make a *quantitative* difference as well. We may wonder, for example, whether retouch-rich assemblages generally signal 'confection solutions.' In addition, we may expect that 'flaking solutions' re-negotiate the 'role' and 'status' of retouching altogether. Instead of being a means of tool individualisation, retouch may be used primarily to re-sharpen tools and/or to imbue lithic pieces with a particular culturally-mediated 'style;' retouch may also be used to differentiate between tools used for immediate 'domestic' consumption and tools that are carried around in the landscape and require elevated levels of functional 'versatility' and/or 'longevity' – a differentiation that has obvious consequences for import-export dynamics, the fragmentation of blank pools, and the mobility of different tools. The predicated logic of reasoning is undoubtedly 'contextualistic' since none of these techno-economic dimensions can be determined in isolation, that is to say, 'absolutely' or 'once and forever.'

572 We are indeed dealing with a classic case of 'ideal-typical' reasoning here. 'Ideal-types' are to be distinguished from 'real-types' grounded in ordinary or 'average' empirical reality (the latter is typically important in 'formism') (e.g., Hillmann 1994: 348). 'Ideal-types' are always *constructed* with some interpretive purpose in mind and are consequently often purely theoretical, rational, and/or logical constructions; they regularly 'overdraw' key aspects of reality in order to emphasise their relevance (a key difference to 'real-types'). True 'ideal-types' are not just theoretical concepts that give a name to varying interpretations of the empirical evidence but also play a crucial role in the method of science itself – they bring forth a proper 'method of ideal-types' which tends to be 'hermeneutic' in character (cf. e.g., Weber 1904, 1997; Gerhardt 2001). The method consists of carefully constructing a spectrum of 'ideal-types' to characterise, arrange, order, and/or differentiate specific areas of (social) reality; quite often, the aim is to determine the relationships between different 'ideal-types' and to analyse how these are manifested (if at all) in empirical reality. 'Ideal-types,' in other words, are typically constructed either to capture the 'quality' of targeted contexts or aid the understanding of their 'texture.' The 'method of ideal-types' is a methodological cornerstone primarily of the humanities and social sciences (cf. Gerhardt 2001). For an explicit discussion of the role of 'ideal-types' in French archaeology, see Boissinot (2011: 280).

573 This general technological design may include a strong investment in setting-up highly specific core architectures before primary reduction begins; such a procedure not only reduces the risk of failure to produce the desired range of blanks but also introduces a distinction between blanks that arise during production and those that arise during extensive core pre-shaping (again, this is a technical affordance that can be exploited to sustain toolkit diversification). 'Ramified' production system are often interlinked with particular mobility strategies since the advancement of the reduction chain yields products of different formats and sizes so that the availability of these products must be 'timed.' Similar mobility-implications also play a role for technical investment relating to the installation of 'fail-safe' core architectures (cores that are 'over-prepared'): in this case, it is likely that the pre-shaped cores themselves travel in geographic space rather than their products (this tendency is obviously inversed in 'segregated' production systems) – 'integrated' production thus often (although not always) leads to a spatiotemporal fragmentation of the technical process.

operational and *decisional hierarchies*, insofar as it is reflected in the 'structure' and 'operation' of lithic reduction systems. In general, the 'status' and 'function' of particular technical practices such as the application of lithic retouch are examined through the prism of the wider technical context in which they appear.

All of this attests to a dynamic and 'embedded' mode of classification and interpretation characteristic of a contextualistic approach to lithic data. This approach gives voice to the intuition that everything is influenced by everything else and coevally influences everything else; nothing, except for the context itself, is fixed. Again, the general strategy is to expose the 'infrastructure' of lithic technology (e.g., various reduction systems sharing the same technical context) and to determine the 'grammatical' relationships that exist between the notable parts of this 'infrastructure' in order to infer the corresponding 'finality' or 'function' (*fonction*) of the technical context. This approach is economic insofar as it seeks to illuminate the opportunities and constraints tied to different types of technicity (i.e., technical contexts). Altogether, Perlès' techno-economic approach thus exemplifies some of the key aspects of Pepper's contextualistic world theory; since her work has opened up an entirely new angle of inquiry, its conceptual and historical significance to the French tradition cannot be overstated:

> "The important point which I wish to stress here is that the articulation of the method of knapping with the tools and plain vestiges enables one not only to establish general rules of management: which morphological classes of blanks can be rediscovered in certain classes of tools; but also to recognise the priority or the priorities underlying these rules. One may therefore pass over from the diversity of knapping methods to the techno-economic diversity of lithic systems." (Pelegrin 2011: 146; my translation [the original French quote is provided in **Appendix Q.13**])

Pelegrin's map of Upper Palaeolithic laminar technology

Pelegrin's *Sur les débitages laminaires du Paléolithique supérieur* (2011), alluded to in quote above, galvanises a similar logic of reasoning: the paper provides a recent extensive survey of Upper Palaeolithic blade technology, proposing a four-part classification scheme based on previous research. The goal of this classification of lithic laminar systems in the Upper Palaeolithic is to organise technological variability in an economically meaningful way. Pelegrin distinguishes between at least four general types – types 'A,' 'B,' 'C,' and 'D' – of laminar techno-economic functioning (*ibid*.: 146; **Fig. 38**). The logic of distinguishing these four types again showcases that techno-economic research in France amounts to nothing less than interrelating 'technical rationality' and 'economic rationality;' the economic purpose or 'function' of lithic systems is therefore generally as 'situated' as their technical organisation.

Pelegrin's (2011: 146) 'type A' is characterised by a single dominant method of laminar reduction; this method can be adapted to various different raw materials and is oriented towards the production of a single generalised blank-type.[574] The method brings forth a technical distinction between 'primary' and 'secondary' products: while reduction is generally geared towards the production of the former, the latter typically arise during procedures of core initialisation, preparation, and/or maintenance. Only the 'primary' products are preferentially transformed into a single dominant tool-class or a limited set of such dominant tool-classes. The by-products of this 'primary' production – the 'secondary' products – consequently furnish the 'raw material' for the rest of the toolkit. This technical orientation towards a single generalised blank-type, however, must not lead to a dominance of the same blank type in the blank repertoire. To the contrary, quite often and rather ironically, heightened economic investment in the products of 'primary intention' results in an over-abundance of 'secondary'

[574] The emphasis here is on 'orientation.' The system does not, of course, exclusively furnish the blank-type it strives for. As already specified above, the 'orientation' of a system is its 'function,' 'directedness,' or 'purposefulness' and thus a system-level feature; it is evaluated by relating the 'structure,' 'operation' (*fonctionnement*), and 'function' (*fonction*) of a lithic technical system and theorising how 'texture' informs 'quality.' Strictly speaking, the 'orientation' of a lithic system comes into view only when its 'quality' has been understood, since only then can the internal diversity – the 'infrastructure' – of a lithic system be interpreted in light of its 'operation.' This, in turn, enables an assessment of the relative contribution of different 'infrastructural' elements to the overall 'function' of the system. To speak of the 'orientation' of a lithic system is to speak of nothing more than this matrix of inter-relationality.

products.[575] The Châtelperronian (Pelegrin 1995; Roussel 2011) and the Lower Salpetrian (Boccaccio 2005) are given as prime examples for this type of laminar reduction.

Pelegrin's (2011: 146) second variant, 'type B,' is also defined by a single constant method of reduction, but the produced blanks are even more rigidly defined. These blanks are almost exclusively fashioned and are thus typically numerically overrepresented in an assemblage. Whereas 'type A' yields 'normalised' blanks of a particular type, 'type B' supports highly 'standardised' blanks, characterised by isomorphic affinity. These blanks are not just broadly similar in shape but appear to be almost identical in outline; size differences can be attributed mainly to the timing of blank extraction (temporal position) within the reduction sequence. The result is a 'universal' blank-type which is used to manufacture all required tool-types.[576] This configuration has two consequences.

First, lithic reduction depends on well-defined core architectures that can be stabilised throughout the reduction process (e.g., by means of 'auto-preparation'),[577] which is often achieved through the installation of easily maintainable core volumes (e.g., by a relatively high investment into the early stages of the *chaîne opératoire*).

Secondly, criteria of blank selection become much more 'subtle;' they often concern the dimensionality of blanks or refer to blank features which are the result of varying reduction positions (e.g., thickness, curvature, platform configuration or relative twist).[578] According to Pelegrin (*idem*), the prototypical example for this variant of laminar production is the Upper Magdalenian of the Paris Basin (Bodu 1994).

Pelegrin's (2011: 146) 'type C' also supports a single method of laminar reduction, but this time the production is oriented towards high quantities of dissimilar blanks. The only affinity that exists between these blanks is that they share a similar structural organisation; they differ in shape, size, and other technical qualities. This type of resemblance is called 'homomorphism' (*idem*). 'Homomorphic' production is thus an instance in which continued reduction keeps the structural organisation of blanks constant but yields blanks of different techno-functional details. This strategy appears to be a compromise between 'type A' and 'type B' reduction and the author stresses the possibility that 'homomorphism' might indeed be an emergent result of executing 'type B' reduction systems in particular ways, rather than a preserved feature of the blanks themselves. In any case, differences in the geometric outline of blanks and their technical qualities constitute privileged loci of differentiation of the toolkit in this laminar system. Furthermore, 'homomorphism' of blanks is often a function of temporally well-structured reduction sequences, for instance, when distinct series of blank removal generate structure-preserving but morpho-geometrically distinct blank matrices. This type of laminar reduction can easily support 'mixed' strategies of blank selection and tool manufacturing. Pelegrin's example for a 'type C' system of laminar reduction is the Lower Aurignacian from the Bergeracois (Le Brun-Ricalens 1993).

Pelegrin's (*ibid.*: 147) fourth and last variant of laminar reduction, 'type D,' is less rigid and hosts a multiplicity of reduction methods. What is kept constant here is primarily the mode of setting up and initialising the core matrix, whereas the actual method of reduction may change as lithic knapping progresses. In Pelegrin's own terms (*idem*), the resultant production is 'heteromorphic' since each

[575] The reason is that 'primary' products must fulfil certain quite demanding techno-morphological criteria and thus require extensive and regular preparatory interference. This produces a large amount of 'secondary' lithic material – a situation that may even lead to a quantitative over-representation of the latter. This is another reason that the 'techno-economic' approach is generally sceptical about the informational value of un-calibrated lithic quantification.

[576] This would account for a prototypical example of an 'integrated' production that obtains toolkit diversification primarily by confectioning blanks of a similar morpho-technical character (*sensu* Perlès 1980, 1991b).

[577] For instance, bi-directionally alternating laminar reduction with overlapping removals, if executed well, can constitute such a strategy of 'auto-preparation.' 'Auto-preparation' is nothing less than a form of 'embedded' preparation in which the gesture of knapping is not different from 'primary' production; in other words, 'auto-preparation' uses 'primary' removals to constantly rejuvenate the required surface convexities. If executed proficiently, 'auto-preparation' thus allows for exceptionally long and un-interrupted lithic reduction sequences.

[578] A potentially prominent selection criterion may be the 'marginality' of blank origin on the reduction surface. The key consideration concerns the effects of surface convexity on the morphological and technical character of the retrieved blanks. The logic is 'contextualistic.' Blanks can be interrelated on a reduction surface so that they form a 'geography' (or 'topology') of reduction. Similar technical gestures may then have different effects on the details of lithic products depending on where these products have been detached. This is largely due to the effect of increasing convexities at the margins of the reduction surface: the more 'marginal' the product has been knapped, the more twisted, off-axis, and generally asymmetrical in cross-section and longitudinal view it becomes. Yet, different volume-configurations of cores have different effects on different reduction localities; it follows that these effects and the difference-making aspects of technology in terms of blank-choice can only be determined by 'contextualistic' analysis, by examining the articulation of reduction position, core architecture, convexity management, knapping techniques, and so forth.

method furnishes a series of characteristic blank-types or blank-spectra which serve to effectuate well-delineated tool-types. Cores that are the product of 'type D' reduction systems therefore typically feature fairly 'complex' reduction histories which are difficult to decipher. An alternative way to implement 'type D' is to 'outsource' the diversity of reduction modalities and to apply different methods to different cores, for instance as a function of the initial volumetric structure of the exploited raw materials.[579] The main difference between the two technical options seems to be that the first strives to 'fix' the starting conditions of volumetric exploitation by technical means, while the second regards material starting conditions as determinative for technical means. The two versions of 'type D' laminar reduction systems further imply differential 'anticipation' of economic needs and the required technical investment.[580] Pelegrin presents the evolved French Gravettian of the Corbiac-type (Pelegrin 2006a) as an example of the first version of 'type D' lithic laminar reduction.

Altogether, Pelegrin's (2011) classification of laminar Upper Palaeolithic technologies is a classic example of a contextualistic reading of the available lithic evidence. The interpretive focus is clearly placed on 'intra-technological' relations and interpretations critically dependent on the larger technical context. For Pelegrin, the key to understanding lithic techno-economies is the interaction between the methods of *débitage*, the resulting variability of blanks, and the organisation of the toolkit (including the 'status' of specific tool-types in relation to the available blanks). Almost all of the interpretive concepts summoned to characterise the laminar systems are context-specific. Moreover, the total classification only makes sense when each laminar variant is regarded as a 'micro-context' within the larger context of Western European Upper Palaeolithic laminar technicity ('macro-context'); the identified differences between the systems are difference-makers only in this larger context.[581]

With Pepper, we can conclude that Pelegrin's four different laminar variants display a radically different 'quality' due to the differential articulation of the three mentioned technical domains (i.e. methods of core reduction, resultant blanks, and tools), which then simply describe the 'infrastructural' building blocks of the identified technological variants. Their specific interlocking is thus re-cast as the 'texture' of the laminar systems in question. As a result, the laminar reduction 'types' themselves are rendered higher-level classifications based on the organisational logic of distinct relational entities:[582]

> "[The technical system] results from the functional relations between the different constituent parts which can be considered as sub-systems. The functioning ['operation'] can be defined not by the 'rules of internal relations' governing the lithic production alone, but also by taking into account the latter's finality, which means its function – two concepts which are complementary and integrated [...]. A lithic production is thus simultaneously organised by its relationships with other sub-sets of the technical system, by its finality (to make tools is the most evident), and by its means (material and intellectual)." (Valentin 1995: 24; my translation [the original French quote is provided in **Appendix Q.14**]).

Delagnes and Rendu's approach to Middle Palaeolithic techno-mobility

A final example exposing the general contextualistic propensity of French techno-economic analysis is provided by Delagnes and Rendu's oft-cited paper *Shifts in Neandertal mobility, technology and subsistence strategies in western France* (2011). Their case allows us to address the issue of mobility and the fragmentation of *chaîne opératoires* in geographic space – two interrelated topics that have already been mentioned and that have been central to the French 'techno-economic approach' since its inception (e.g., Geneste 1985, 1988, 1991 [2010]: 427-429; Texier et al. 1998; Moncel 2003; Delagnes 2010; Bachellerie et al. 2011; Moncel and Deaujard 2012; Thiébaut 2013).[583]

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579 This strategy would conform to a 'segregated' production system trending towards a proper 'raw material economy' (*sensu* Perlès 1980, 1991b).

580 Whether this second version really represents a sub-type or rather a fifth variant of laminar reduction is largely kept open.

581 For example, the categories used to describe the 'texture' of laminar systems may have been very different if laminarity in the Levantine Upper Palaeolithic or the Indian Upper Palaeolithic had been targets of analysis and classification.

582 This point is important because it shows that technological classification is not just 'typology in disguise' as some critics argue.

583 These themes were partly foreshadowed by the influential paper *Des buts, problèmes et limites de l'archéologie paléolithique* (1972) co-authored by François Bordes, Jean-Philippe Rigaud, and Denise de Sonneville-Bordes. This paper is an interesting

Delagnes and Rendu (2011) attempt to relate Middle Palaeolithic technological functioning to mobility and subsistence, drawing on a vast corpus of lithic and faunal data from Western France. Their approach once again exemplifies the already outlined divide between 'analytic' and 'synthetic' modes of marshalling lithic evidence. They explicitly reject the idea that relevant techno-economic information on mobility and subsistence can be extracted by studying the aggregation and/or combination of discrete traits and/or attributes of individual lithic artefacts (*ibid*.: 1772f.). Techno-economic functioning – for them the key *par excellence* to reconstructing the interaction between lithic technology, mobility, and subsistence – must be examined on the level of 'technical systems.' This reiteration is important since it helps affirm that, contrary to first impressions, their approach is not at all rooted in 'Binfordian' theory and its distinction between 'logistic' and 'residential' mobility. While the authors are, generally speaking, inspired by some of the relevant concepts – a point I will return to below – their interpretative approach to the lithic data is fundamentally different.

Figure 39 exhibits the general framework of their reasoning. The guiding idea is that different lithic technological contexts that co-occur between OIS 7 and OIS 3 define well-delineated techno-economic systems which reflect varying ways of using the landscape and exploiting the animal environment. Delagnes and Rendu assume

> "[...] that a long reduction sequence duration combined with low blank versatility and a limited potential for tool maintenance or recycling suggest a low transportability of the whole production, while shorter reduction sequences associated with high blank versatility and/or a high potential for tool maintenance would be diagnostic of a higher transportability." (Delagnes and Rendu 2011: 1772f.)

They add that their approach

> "[...] considers not only tool reduction, maintenance and recycling, criteria commonly used for assessing tool transportability, but also the duration, complexity and flexibility of the reduction sequences. Considering the whole reduction sequence rather than simply the end-products, it provides basic clues for understanding how the structure of the chaînes opératoires relates to specific mobility patterns. A similar dynamic approach related to meat acquisition strategies is considered here and combined with the technological record, resulting in a systemic reconstitution of Neandertal economies." (*idem*)

In a manner consistent with the French approaches discussed above, the authors explore which behaviours, activities, and functions varying technological 'infrastructures' – the 'textures' of lithic systems – *enable* or *block*. The important point is that lithic technology is not only conceptualised as a 'problem-solver,' but at the same time emerges as an equally important 'problem-generator.' The underlying conception is that Neanderthals (and other hominins for that matter) were necessarily – and before anything else – thrown into 'pre-furnished' technical worlds; they first had to deal with and make use of what these worlds provided them.[584] Some of these 'default' technical repertoires, for example, provide means that are better suited for travelling long distances or for tracking down particular prey species, while others may be more flexible in coping with changing raw material situations. The important insight is that there is a fundamental *trade-off* between different aspects of techno-economic performance and that each technologically-mediated opportunity also has its drawbacks.

Delagnes and Rendu (2011: 1772, Fig. 5) emphasise three key sources of techno-economic trade-offs that help to make sense of technological performance and the interaction of lithic technology with mobility and subsistence. These are (i) the 'duration' and/or 'depth' of the lithic flaking and/or

historical document and showcases some of the enduring effects of the Binford-Bordes debate on French Palaeolithic archaeology.

584 We will return to this central notion in the second part of the chapter in more detail. It can already be said, however, that the concept of 'pre-furnished' technical worlds implies a criticism of *tabula rasa* ideas of human social and material existence. The contention is that hominins lived a fundamentally socially- and materially-mediated life and hominin biology therefore does not have logical priority. Hominins are always socially and materially predefined, just as they are biologically predefined – there is, in other words, a *technological apriori* that needs to be taken into account. This view has a number of implications which I cannot draw out here. Importantly, the world into which hominins are born is not conceptualised as an empty room – capable of adjusting to any external situation in an 'optimal' manner – but is instead regarded as a partially invested, decorated, and furnished room (cf. e.g., Thévenot 2001). With Heidegger (2006 [1927]) we can say that lithic technology was always *ready-to-hand* [*Zuhanden*] rather than constantly re-invented from scratch to face new challenges. In the language of 'contextualism,' this 'pre-furnished' room constitutes the wider historical context of hominin technicity. We can say that the nature of 'pre-furnishing' likely differs between such contexts (as a function of 'novelty' and 'change'); 'pre-furnishing' in this sense can be defined as a product of the inherent 'spread' of a relevant 'macro-context,' so that key 'references' of the whole are carried through its parts and thereby connect them in time and space.

shaping sequences; (ii) the 'versatility' of the produced lithic blanks; and (iii) the technology-specific capabilities of lithic 'tool maintenance.'[585] It is generally expected that distinct technical systems will differ in their performance across these economic domains; it is in fact anticipated that divergent techno-economic configurations will be characterised by an unequal *distribution* of economic performance between the three domains. Again, the main point, conforming to contextualistic logic, is the 'situated' cross-configuration of these domains – their basic 'inter-relativity.' None of the three domains can be taken in isolation. Rather, all of them must be examined together – in their trade-off structure – to indicate system-level principles of economic organisation.

With Pepper we can say that the three domains act as sub-contexts (parts) of a larger economic whole, whose lithic technological corollaries must be determined empirically.[586] That the interrelationship between these domains – the 'texture' of the larger economic context – is expected to differ across varying contexts of technicity predicates the contextualistic categories of 'novelty' and 'change,' carrying through the principle of radical context-dependency and the root metaphor of 'situationality.' The work of Delagnes and Rendu furnishes a number of examples which help to illustrate this contextualistic condition of techno-economic inquiry. Their description and eventual comparison of Quina, Discoid, Levallois, and MTA technical systems in terms of the three economic domains exemplify this condition.

Quina reduction systems are described as 'volume-consuming' and as generally yielding a small range of rather 'thick' and often 'naturally backed' or at least 'quasi-backed' flake-blanks (Delagnes and Rendu 2011: 1777f.). These blanks are typically much wider than they are long. Blanks of this type – 'Quina-blanks' – are highly 'versatile' and, due to their rich 'raw material reservoir,' have the potential to be curated and re-sharpened over considerable timespans (*idem*). The lithic tools supported by this *débitage* system consequently afford long 'use-lifes' and intricate 'object biographies.' Because of its relatively 'simple' volumetric core structure, Quina technology requires only 'low-medium' degrees of technical investment, yet promotes 'long-term' tool maintenance, plenty of opportunities for raw material recycling, and elevated levels of technical 'ramification' (*idem*). In the authors' own words:

> "[I]n the Quina system, the flake is potentially multi-purpose since it can be exploited as a retouched or non-retouched tool, as well as alternately or successively as a core, following an order and priority that vary according to needs. In this case, recycling is not a casual practice, but a principle that determines the entire reduction sequence. The low elaboration of the flaking process is balanced by a high tool curation rate." (Delagnes and Rendu 2011: 1777)

Discoid reduction systems, by contrast, tend to afford much 'shorter' cycles of tool-use, tool re-organisation, and/or raw material re-cycling (Delagnes and Rendu 2011: 1778). Discoid technology authors more 'differentiated' blank-repertoires (one can distinguish four blank-types: 'pseudo-Levallois' points, triangular flakes, elongated *débordant* flakes and relatively wide flakes). These blanks are less 'massive' in character and their potential role as raw material reservoir is clearly reduced; that is to say, intrinsic blank-volumes are much more quickly depleted (*idem*). In return, Discoid methods can be executed rather 'reliably' in all sorts of raw material contexts and factors which are typically constraining, such as natural raw material formatting and/or quality, tend to be of marginal importance: Discoid systems perform equally well under different raw material conditions.

Levallois reduction systems require 'heightened' technical investment since a specific core architecture must be installed (hierarchy of two opposing asymmetric surfaces/hemispheres, etc.) before

[585] Many of the interpretive categories that Delagnes and Rendu (2011) mobilise in their paper – e.g., 'versatility,' 'curation,' 'portability,' 'flexibility,' etc. – are of course inspired by the Anglophone type-literature in the wake of Peter Bleed, Steven Kuhn, Robert Kelly, Lewis Binford, and others. However, this convergence – as I will detail below – is rather superficial and the way in which the authors bring these concepts to bear on the lithic evidence is inconsistent with Anglophone research. One should recall here that the mobilisation and application of specific concepts is only part of that which defines scientific approaches; more important is often how concepts are implemented and how they actually interact with data. This is precisely where the difference can be found here as well (see *infra*).

[586] Strictly speaking, this means that scholars must interrelate at least two part-whole complexes: first, part-whole articulations that characterise economic functioning are delineated; secondly, part-whole articulations that characterise the lithic technological system and that have significance for the economic system are explored. Analysis of the relationship between these two systems provides information on how the two are imbricated into each other; this last step amounts to a higher-level examination, where the two systems are re-cast as parts of their own, so that their systemic articulation within a larger and unifying whole can be determined. When French scholars talk about 'techno-economic' systems, they essentially talk about this construct of a larger and unifying whole (above described as 'macro-context').

primary production can even begin (Delagnes and Rendu 2011: 1773f.). In order to counterbalance the technical investment required (e.g., extensive preparatory procedures) and to reduce the risk of failure, Levallois systems typically have relatively 'strict' raw material requirements; they at least perform differently under varying raw material conditions. Levallois technology therefore usually presupposes higher degrees of 'planification' and techno-economic 'anticipation' – although these factors of course depend on the precise method or modality of Levallois reduction employed (*idem*).

As a result of the crucial importance of core initialisation and maintenance stages of the *chaîne opératoire*, Levallois systems tend to be 'fragmented' in geographic space and give rise to critical import-export dynamics (e.g., of pre-shaped cores and/or blanks of 'primary intention'). 'Preferential' or 'recurrent' blank-products (especially those stemming from bidirectional-recurrent Levallois systems) provide a maximisation of cutting-edge, even (or especially) without being retouched (*idem*); conversely, the typical 'by-products' of Levallois reduction (e.g., backed or quasi-backed *débordant* elements and other shaping products) lend themselves to use 'on the spot' for immediate and relatively 'expedient' domestic consumption (*idem*). Particularly large or 'massive' initialisation-products may even be exploited as core matrices to spawn independent production chains 'on-flake' (*ibid*.: Fig. 2).

All of these features foster an internal structural division between relatively 'mobile' and rather 'stationary' Levallois products. Moreover, the general organisation of Levallois technology affords the 'optimisation' of patterns of blank-tool convergence (*« adéquation »*). The result is a highly 'differentiated' spectrum of comparatively 'specialised' blanks, whose economic versatility remains rather 'limited.' Nevertheless, some Levallois production methods – e.g., selected 'recurrent' and 'laminar' modes of volumetric exploitation – yield blanks with an 'intermediate' potential for 'tool maintenance' (cf. Delagnes 2010).[587] It is this particular configuration of opportunities and constraints that defines the economic signature of technical systems we call 'Levallois.'

The MTA (*Moustérien de tradition acheuléenne*), finally, combines one or more of the described *débitage* systems with a specific mode of bifacial production (*façonnage*) (Delagnes and Rendu 2011: 1774-1777); this production typically yields so-called cordiform 'MTA bifaces,' which clearly exhibit elevated levels of mobility as shown by the spatial 'fragmentation' of their production, resharpening, and/or re-cycling (cf. Soressi and Hays 2003; Claud 2008). In the MTA, a relatively 'high' degree of 'technical investment' – attested to by the construction of the respective bifacial volumes (*façonnage*) and the maintenance of their morpho-functionality – is thus correlated with a generally 'high' potential for 'tool maintenance' (Delagnes and Rendu 2011: 1778f.). Depending on the associated *débitage* system(s), this economic signature can be variously enhanced and/or supplemented – *débitage* systems may either 'complement' or 'synergise' with the existing bifacial production. The result is a highly 'flexible' super-system that buffers against mobility stress and enables a variable division of activities in space. The technical architecture of the MTA thus tends to be fairly 'complex' and this complexity should be reproduced by the general patterning of behaviour documented within this context.

The line of reasoning presented thus far encapsulates a 'user-centred' approach to lithic technology: technical systems are conceptualised as self-regulated complexes of economic trade-offs which allow their users to interact with the environment in particular ways.[588] The important point is that these self-regulatory trade-off systems are used to define the economic performance characteristics of the technical systems in question. 'Economic performance' is therefore understood not simply in terms of specific lithic artefact properties and/or their 'absolute' instrumentality, but instead as a function of the systemic interaction between the 'structure,' 'operation' (*fonctionnement*), and 'function' (*fonction*) of a technical whole. This technical whole does not simply exist 'passively' in the world, 'reacting' to the economic needs imposed by external conditions (e.g., environmental, demographic), but *actively* shapes the convergence of hominins and their exteriorities.[589] Hominin-environment interactions

[587] Delagnes and Rendu (2011: 1773) discuss Levallois methods and non-Levallois laminar methods in tandem because they are systematically associated with one another – a fact that I have omitted in the present reconstruction.
[588] It is no coincidence that the term 'trade-off' is rarely used in the French literature; instead, scholars tend to invoke the notion of *« échange »* in order to characterise the respective relationships among the parts of a technical whole. This again signals that 'trade-offs' are really analysed in a 'synthetic' manner – as a result of particular part-whole dynamics – and that economic trade-offs are simply regarded as a special type of inter-relationality typifying the 'texture' of a whole.
[589] This conception assumes two things: first, that technology has some sort of *agency* that established a bi-directional hominin-technology dialogue, and secondly, that hominins will be 'smart' enough to quickly discover the potentials and drawbacks of a given technological system (see *infra*).

are regarded as *technologically mediated*.[590] Lithic technology is essentially seen as an artificial 'user-interface' which, if operated by experts, can be customised in a number of ways to solve a number of different problems; however, because the systems themselves tend to be rather 'complex,' a portion of the issues to be solved is always home-made, that is, derives from the self-created constraints of particular user-interfaces.[591]

The 'pro-active' dimension of technological problem-solving can be illuminated by the various 'opportunities' provided by the interplay between technical 'texture' and 'quality.' These 'opportunities' may be characterised as *technological affordances*,[592] defined as features, aspects, or sub-structures of a wider technological system that 'invite' users to take advantage of them to reach certain goals under certain circumstances. In other words, technical 'affordances' help theorise which part of a technical 'texture' is good to accomplish *x* and thus to satisfy the need *y* if required. The notion of 'affordance' is thereby always a relational construct: its epistemic task is to sort, arrange, and signify other relations. It thereby opens the gates to a 'soft' ecology approach to lithic technology and is perfectly consistent with contextualism's central tenets:[593]

> "[…] The groups that favored the Levallois débitage method, or those that manufactured Quina scrapers or bifaces, would have been constrained by their technical traditions. In response to possible shortages of local, high quality raw materials in sufficient quantities (anticipated or not), they would have carried with them the minimal equipment necessary for short expeditions and seasonal movements. Because their knapping method was more dependent on the quality and dimensions of available raw material volumes, these groups opted to transport part of their necessary equipment. At the other end of the spectrum, the groups who used the Discoid *sensu stricto* method were less dependent on the quality and dimensions of available raw materials, and thus did not encumber themselves with such equipment when they moved across long distances. The flexibility of this débitage method thus freed these groups from the technical constraints imposed by the raw materials available to them." (Thiébaut 2013: 15; original italics)

The next step in the analysis is to specify the relationship between the documented lithic systems and the corresponding subsistence practices. The goal here is two-fold: on the one hand, the technological findings are to be calibrated against the implications of the faunal record; on the other hand, the subsistence-implications of the technological conclusions are to be tested against the available evidence. Again, this strategy conforms to a combination of 'direct verification' and 'qualitative confirmation' – modes of knowledge corroboration proper to contextualism.[594]

The authors relate the structure of the technical systems to the structure of the associated faunal assemblages to derive specific mobility profiles (Delagnes and Rendu 2011: 1772f.); these are intended to capture the interaction between the former and the latter. Mobility is thus re-cast as a not directly observable parameter of past reality that must be inferred from two directions: from the technology-specific potential to support 'increased' or 'decreased' mobility, and from prey-specific ethologies that call for these types of mobility and require specific hunting tactics. The authors thus seek to identify a mobility system (including activity and site organisation) that illuminates why and how prey mobilities – mapped on a spectrum from 'mobile' to 'stationary' – are regularly associated with particular technology-specific mobility potentials. As an auxiliary factor to help calibrate the respective technical 'affordances' against the relevant animal behaviours, a distinction is made between relatively

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590 This moment of 'mediation' dispels overly 'mechanistic' conceptualisation since it undermines the idea of a direct 'contact zone' between lithic technology and environmental make-up. The rejection, explicit or not, of 'mechanistic' explanations that emphasise 'final' or 'ultimate' causes is at least symptomatic of a 'contextualistic' stance.

591 This is the 'curse' of technicity to which we will return in the next part of the chapter.

592 'Affordances' are *possibilities of action* that do not arise from the intrinsic motivations and/or needs of the actors alone (Gibson 1977, 1979; cf. Withagen et al. 2012). The notion thereby links approaches that emphasise the 'activity' of material culture ('agentivity,' 'potentiality,' 'materiality,' etc.) to those that stress the importance of human motivation and choice; it paves the way for a *user-centred* approach to technology (Gaver 2001; Hutchby 2001), which can be contrasted to 'actor-centred' or 'environment-centred' approaches. The following statement exemplifies a key aspect of an 'affordance-based' approach to technology: "[i]n contrast to recent sociological emphases on the social shaping of technology, [I] propose[] and illustrate[] a way of analysing the technological shaping of sociality […] [I] argue[] for a recognition of the constraining, as well as enabling, materiality of artefacts" (Hutchby 2001: 441). Although French *chaîne opératoire* approaches do not share all of these respective positions, some of the mentioned views and inclinations are implicitly embraced.

593 For an illuminating discussion of the role of 'affordances' in *« actions outilées »* ('tool-mediated action') and the critical distinction between 'natural' affordances – grounded in the biology and physiology of organisms – and 'artificial' affordances – anchored in human-endowed technical worlds – see Sigaut (2012: 118-122).

594 See Chapter 2 for details or refer to Pepper (1942: 272-278).

'solitary' and relatively 'gregarious' species.[595] The examination of the associated faunal spectra establishes part of the wider context of lithic technology (its 'macro-context'), which, in turn, guides the analysis of technological performance under varying animal circumstances.[596] It follows that the assessment of the differential capacity of lithic technology – its intrinsic 'pros' and 'cons' – to follow, intercept, and/or chase down particular animals requires serious evaluation of the ways in which the two 'micro-contexts' – 'animal' and 'technical' – *co-produce* each other.

Drawing on Pepper, we can say that a successful 'fusion' of the technical and animal 'micro-context' provides an explanation for why the two exist side-by-side. Only evidence for a shared super-structural 'quality' of the two 'micro-contexts' can illuminate why they can be regarded as 'micro-contexts' of the same 'macro-context' in the first place. To demonstrate that the two 'micro-contexts' condition each other consequently implies the elimination of all blocked 'strands,' which would have rendered their cohesiveness rather unintelligible. By relating the economic implications of the lithic context to the technological implications of the animal context, the authors show that the resulting super-context is 'workable' and advances our understanding of past reality; this approach is multi-directional and resonates with contextualism's proper theory of cognitive criticism.

Delagnes and Rendu (2011: 1773-1778) identify four distinct mobility systems which they organise in two groups of two (**Fig. 40**). Levallois-laminar and MTA technical systems are interpreted to promote 'non-selective' hunting strategies, while Quina and Discoid-denticulate systems are considered to encourage more 'selective' hunting strategies.

Levallois technology is shown to be typically associated with assemblages yielding a wide variety of 'non-migratory' prey species; this likely indicates 'low-medium' mobility and that hominin movement was probably more strongly dictated by raw material requirements than by animal behaviour (Delagnes and Rendu 2011: 1774, Fig. 3). The MTA is interpreted as a sort of leapfrogging system, where hominin groups alternated between larger 'multi-purpose' campsites (involving high-investment installations such as campfires) which have produced highly variable faunal assemblages (some of which indicate that even 'solitary' animals were occasionally targeted) (*ibid.*: 1777). The distinction between 'stationary' *débitage* systems and a 'highly mobile' *façonnage* system in the same context is thought to be consistent with the implied 'intermediate' level of mobility.

In contrast, Quina technologies seem to be regularly associated with a 'monospecific' fauna, in which reindeer is the dominant prey (Delagnes and Rendu 2011: 1777f.). Here, selective hunting meets a 'gregarious' and fairly migratory species whose seasonal movements are largely predictable. The fact that Quina-bearing sites represent a mixture of true campsites and task-specific satellite-sites is seen as further indication that the corresponding mode of operating in the landscape was based on 'high' levels of mobility: hominins are depicted as 'residential' reindeer-followers who established 'logistical' camps around one or more seasonal basecamps (*ibid.*: Fig. 4). The presented arguments for liking Discoid-denticulate systems and their target prey mobilities are not much different. Discoid-denticulate systems are typically associated with faunal assemblages dominated by bison and horse, two seasonally migrating taxa. This is regarded to reflect a selective hunting strategy which presupposes elevated levels of mobility. The corresponding settlement profile is consistent with this evidence, also pointing to an interlinked system of campsites and more task-specific sites (*ibid.*: 1778). The reconstructed 'high-mobility' pattern is thus broadly similar to that reconstructed for Quina systems. Both systems are consequently interpreted as largely equivalent solutions to similar economic problems. The resultant character and chronological positioning of the four techno-economic macro-

[595] Why is this categorisation not 'dualistic'? Two answers can be given: first, the categories represent 'ideal-types' which are formulated for heuristic and methodological reasons, not to trace the ontological structure of reality (see *supra*); secondly, with Pepper one can state that the categories aim to capture the 'qualities' of their 'micro-contexts,' which are then translated into 'strands' (and perhaps even 'references') to analyse their interrelationship in their resulting new 'macro-context;' 'ideal-typical' categories are hence nothing more than interpretive aids to determine the role of 'micro-contexts' in their 'macro-context' and to understand how 'they tangle into one another' (or do not) as 'strands.' The results do not need to be affirmative. 'Disorder' is an important category in 'contextualism' and 'strands' may be incompatible; as long as local 'disorder' explains global 'operationality,' this does not pose a problem.

[596] This reflects the fact, already alluded to above, that the 'affordance' structure of technical systems can only be evaluated in relation to its wider context of significance – in the present case: the animal context. The analysis is thus highly context-sensitive by definition.

systems are regarded to refute simple and uni-directional models of Neanderthal behavioural evolution in Western France between OIS 7 and OIS 3 (*ibid.*: 1789).[597]

All of this shows that Delagnes and Rendu's total account is clearly characterised by descriptive and explanatory 'thickness.'[598] The account is 'thick' because the boundaries between meticulous description and substantial interpretation are often blurred and the ordering of relationships turns out to be the authors' core business.[599] 'Thickness' is a contextualistic category and responds to the need to map the details of contexts and even super-contexts as comprehensively as possible; this, again, requires consideration of each context's 'texture'-'quality' dynamics, both in terms of 'novelty' and potential 'disorder.' A consequence of this contextualistic 'thickness' is the multi-directionality of inference, categorisation, and interpretation that characterises *Shifts*. The emphasis clearly lies on articulations, co-constitutions, inter-constraints, etc. – specific relationalities that must be identified, arranged, and assessed.[600] This is consistent with the idea of 'weak' determination and the consolidation of a multiplicity of potentially equally important factors to shape reality. The epistemological stance is hence anti-foundational, which again illustrates that contextualistic reasoning cannot accept the fixation of reality, not even a fixed structure of determination (e.g., a 'ladder of causation');[601] contextualistic realities tend to be *entangled* and *messy*. This conceptual orientation is made explicit by the authors themselves:

> "[...] The picture that emerges from our data is more relevant to a complex and multicausal explanation of the diversity observed in the archaeological record than to a single explanation, whether cultural, functional, chronological or environmental." (Delagnes and Rendu 2011: 1779)

Another observation is important: the positioning of any of the four technical systems in Delagnes and Rendu's economic triangle *depends entirely on the positioning of all other technical systems within it*.[602] The signification of system-specific trade-offs, in other words, is a comparative assessment and therefore always *relative* to the wider 'context of comparison.'[603] None of the three identified sources of economic variability can be described 'absolutely' – this fact is directly reflected in the relativist terminology applied (e.g., 'high,' 'low,' 'increased,' 'decreased,' 'elevated'/'heightened,' 'reduced,' etc.). This not only confirms that lithic systems are conceptualised as sub-systems ('micro-systems') which are examined internally and then compared to other sub-systems to determine the relevance of the discovered 'infrastructural' features, but also highlights again that everything remains context-dependent – i.e., nothing can be fixed before a context has been analysed. This pattern of thought is highly characteristic of French lithic research in general – it is predicated upon Leroi-Gourhan's *« technologie comparée »* (cf. Leroi-Gourhan 1949; de Beaune 2011; Soulier 2015: 25f.) and was later taken up by approaches in the wake of *« Technologie préhistoire »* (cf. Tixier et al. 1980; Audouze et al. 2018), the mother of lithic technological research in France.

A similar perspective is reflected in what has become the standard reading of the Mousterian techno-economic architecture of Western Europe (e.g., Bourguignon et al. 2006; Meignen et al. 2009; Dawson et al. 2012). The result is a cross-tabulation, in which the economic characteristics and trade-offs of different technical systems are generalised (**Fig. 41**).[604] This table is inherently comparative: it

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[597] The contention here is that a 'multi-linear' evolutionary scenario is much more likely given the chronological juxtaposition of Quina and Discoid-denticulate systems at the end of the chronological sequence (MIS 4-3). In addition, the authors explicitly ponder the question of whether Quina and Discoid-denticulate systems are to be regarded as two *culturally distinct* responses to very similar economic needs (Delanges and Rendu 2011: 1780). A linear or gradual evolutionary scenario is also problematic because the MTA is intercalated between the Quina and Discoid-denticulate complexes and it is not evident how the resulting sequence is illuminated by such a scenario (*idem*).

[598] See Chapter 2: **Box 8**.

[599] That interpretation, analysis, and description are somewhat blurred is signalled by the fact that lithic, faunal, and settlement data are presented and interrelated in a single paragraph for each techno-economic system.

[600] This inclination is in itself characteristic of 'contextualistic' inquiry. It is expressed in the fact that Delagnes and Rendu quasi-symmetrically relate the structure of lithic assemblages to the structure of settlement organisation and faunal assemblages. It is also notable that the starting point of this analysis is largely arbitrary and one therefore typically starts from wherever the evidence is richest (in other words: the fact that the authors embark on the analysis from the perspective of lithic technology is no argument for the general explanatory primacy of lithic technology).

[601] From a 'contextualistic' perspective, even 'determination' is confronted with 'novelty' and is thus potentially context-dependent.

[602] Even the addition of a single technical system would change the larger context of technologies and thus potentially the signification of the relative features that define this larger context.

[603] In *Shifts*, this wider 'context of comparison' is simply the wider context of OIS7-3 Middle Palaeolithic technicity.

[604] This cross-tabulation can be interpreted as a specification of the structure of economic 'affordances' provided by each technical system.

juxtaposes 'investment in core shaping and/or maintenance,' 'degree of predetermination of desired endproducts,' 'degree of normalisation of desired endproducts,' 'potential for blank/tool resharpening,' 'degree of ramification,' and 'blank productivity' of various technical systems. Taken together, the relative weight of these features, derived from the 'infrastructural' organisation of the respective technical wholes, is thought to define to the economic 'qualities' of the latter.

These 'qualities' are *relative* in a dual sense: each systemic feature is determined by its relationship to all other features of the same system, but the specific quality of each feature also depends on the quality of all other features of the same category that exist within the same wider context of technicity (in the present case: the 'Mousterian' of South-Western France). This pattern of thought clearly reiterates what has already been found, namely that each technical system is typically identified as a context of its own ('micro-context'), but also participates in the broader technical context of its period/epoch ('macro-context'). To this effect, the tabulated economic features of the listed Mousterian technologies are clearly context-sensitive. They are 'objective' insofar as each systemic configuration of features is consistent with the system's placement in the context of all other systems – the relative placement of each system, in other words, removes all interpretive obstacles and thus 'works.'[605]

5.1.4 *What's in a type? Morpho-types, techno-types, and 'technological typologies'*

Another field in which basic contextualistic assumptions feed into French lithic research is typology, which is a contested arena. The term conceals substantial variability in how types are constructed and interpreted. The main issue, as we have already seen in Chapter 2, concerns the role and function of classification and typology in knowledge-formation. Not all typology is the same in this respect. A crucial issue is that typological reasoning in the French tradition appears to be largely 'non-taxonomic,' extremely dynamic, and highly flexible, and thus conflicts with the 'formistic' interpretation of types which prevails in most Anglophone lithic research. French scholars have come to reject the 'catholicity' of types, including the idea that typology represents a viable means of directly mapping intra- or inter-assemblage variability.[606] The reasons are manifold and partly historical, partly epistemological – yet, most of them are a consequence of the opposition drawn between 'typology' and 'technology' (cf. Otte 1991).

The 'typology'/'technology' distinction reiterates the 'synthetic' proclivity of French lithic research: 'typology' carves out discrete parts in the world, whereas 'technology' concerns the structure of wholes. The tension between 'typology' and 'technology,' characteristic of the wider French lithic discourse (e.g., Boëda 1991: 38-40; Forestier 1993: Fig. 16, 1998; Bourguignon 1997; Lenoir 2008; Valentin 2008b), therefore reflects the ever-present struggle to come to terms with part-whole dynamics in lithic research. The implication is that 'typology' can never be the final answer to technological questions (cf. Boëda 1991: 38); 'technology' is always *more than typology* – accordingly, it cannot be reduced to a mere question of types.

The rejection of typology as the central method of lithic inquiry is inextricably bound to the 'technological revolution' incited by André Leroi-Gourhan and Jacques Tixier between 1970 and 1990 in Paris (Texier and Meignen 2011; Audouze et al. 2018). A key objective of the time was to overcome the interpretive impasse created by 'La méthode Bordes.' Before the 'technological turnover,' there were essentially two contesting lithic approaches, both built on a 'Theory of Types.' The first was grounded in classic 'Bordian' type-lists (Bordes 1950, 1961a, 1961b; Sonneville-Bordes and Perrot 1954, 1955, 1956a, 1956b; Sonneville-Bordes 1960), the second in the 'analytic' methodology of Georges Laplace (1966a, 1966b, 1968, 1972). While the Bordian approach relied on a *« typologie morphologique »* ('morphology-based typology'), Laplace's approach was based on a *« typologie analytique »* ('analytic/trait-based typology') (cf. Lippé 2012: 170; Demars 2011).[607] However, Laplace's

[605] This again takes up the 'soft ecology' inclination of French lithic research. The 'quality' of each 'micro-context' is controlled by the 'qualities' of its immediate surroundings (other 'micro-contexts'). Metaphorically, one may therefore say that the resulting relative economic positioning of each 'micro-context' corresponds to its 'economic niche' in a wider context of technicity.

[606] This does not preclude the use of typology as a 'quick-and-dirty' means to characterise and compare lithic assemblages; typology thereby acts as an initial 'proxy,' but the results require further empirical examination and corroboration.

[607] A strict opposition between Bordes' *« typologie morphologique »* and Laplace's *« typologie analytique »* is only partly adequate since Bordian typology is not exclusively grounded in the morphological aspects of lithic artefacts, but also took into account some of their technical characteristics. Arguably, Bordes' typology was grounded in a 'synthetic' appreciation of artefact-

explicitly 'atomistic' and attribute-based approach to lithic typology – an example of 'taxonomic' reasoning as I have defined it in the previous chapter – was quickly marginalised by the Bordes and hence disappeared from the epistemic core of the French tradition (Bon 2009: 84-88; Lippé 2010; Plutniak and Tarantino 2016).[608] Tixier's (1976; 1980) forceful critique of the quantitative presupposition that had dominated most of the 'Bordian era' simply amplified this effect (cf. Perlès 2016), removing all seeds of 'taxonomic' or otherwise strongly 'typological' reasoning from the French lithic research enterprise (e.g., Perlès 1987, Boëda 1994). 'Typology' would now serve 'technology,' and not the other way around (cf. Geneste 1985: 171, 249-251, esp. Fig. 72).

The result is a *pragmatic* treatment of types. Their methodological role in French technological research is restricted to casting light on the contours of varying *chaîne opératoires*. 'Typology' is used to enable the analysis of relationships among lithic types and thus to illuminate some 'infrastructural' features of lithic technology. Typology, in other words, has become a tool used to investigate the 'texture' of technical systems rather than to characterise their 'quality.' Typically, typology either aids in charting the 'structure' (*structure*) or the 'function' (*fonction*) of a technical system (*sensu* Sigaut 1991), but rarely captures aspects of them both; typology is generally regarded as only poorly equipped to address the problem of systemic 'operation' (*fonctionnement*). It is typically seen as capable of describing merely a part of the systemic articulation which French lithic experts seek to unveil.

The idea, again, is that different 'textures' may support different lithic types and *particular types may therefore only be useful for understanding particular technical systems*. Different types may also elucidate different levels of technological organisation and types must thus always be calibrated against their whole. This 'resonating' linkage between the types that are mobilised and the wholes which the types are supposed to illuminate is characteristic of the use of typology in French technological research. It is a classic expression of the 'inseparability' tenet permeating contextualistic thought,[609] motivating a somewhat 'dialogical-dialectical' mode of typology-making.[610] It is therefore not surprising that types are regularly formed under 'hermeneutic' and 'dialogical' conditions of analysis. Types are not simply inferred; their legitimacy must be defended by argument and interpretive rationality.[611]

From this perspective, the transition from the 'typological era' (Bordes) to the 'technological era' (Tixier) can be said to correspond to a fundamental shift in the role and status of typologisation in lithic research. The transition has considerably weakened the 'semantic' role of types and fortified their 'syntactic' role in lithic inquiry. That the Bordian typological system is still widely used reflects a concern with precise and consistent terminology (e.g., Brézillon 1968) – the aspiration of scholars to use the same expressions and even the *same words*. The distinction between 'words' and 'language' is significant here. 'Words' fix a certain meaning, but some words are polyvalent insofar as their meaning depends on the sentence-context; speaking a 'language' implies knowledge of the rules that connect words and sentences in meaningful ways (grammar, syntax, narrative style, etc.), knowledge of the various semantic connotations, and the ability to render each utterance intelligible in its context. This is exactly the difference between 'typology' and 'technology' in French lithic analysis: 'typology' provides the words and sometimes parts of the sentences, while 'technology' constitutes the language in which they make sense (**Fig. 42**). 'Types,' in a similar vein as words, enable the pre-organisation of the lithic evidence and present a means of easy communication. Their role is 'syntactic' in this sense. But in order to elucidate aspects of technological organisation, types always require further contextual interpretation.[612]

wholes, while Laplace's approach was strictly 'analytic' and as such mainly concerned with building up types in 'bottom-up' fashion, via the detection of patterned trait-associations.

608 Instead, Laplace became influential in both Italy and Spain – Laplacian thought was literally exiled to other countries.

609 See the description of 'contextualism' in Chapter 2.

610 See Chapters 2 and 3 for the significance of this mode of analysis in lithic research guided by 'synthetic' world theories.

611 The implication is that 'Bordian' typology primarily serves a *descriptive* purpose (e.g., Le Brun-Ricalens1993: 130f.), so it logically precedes *technological interpretation*.

612 Guillaume Boccaccio (2005: 40), for example, explicitly contends that 'technology permits the understanding of the morphogenesis of lithic types, while typology facilitates the comprehension of certain technological choices.' This illustrates that the cross-calibration – or *contextualisation* – of 'typology' and 'technology' is really what promises to deliver comprehensive lithic knowledge.

The contextualistic orientation of typological practice in the French tradition is perhaps best reflected by the *plurality* of lithic type-concepts that are put forward.[613] Classic 'Bordian' tool-types are thereby merely one way to employ typological reasoning, perhaps a rather marginal one. They are complemented by many other types, many of which are much more interpretive; these other types serve different analytic purposes and typically radicalise the aspect of context-dependency. This typological 'context-dependency' can be discussed from three different perspectives.

First, 'Bordian' tool types may constitute the 'macro-context' of typologisation. The idea then is to look for technical, technological, and/or techno-functional distinctions within a given 'Bordian' type, in order to further divide it into potentially meaningful sub-categories – e.g., relative to the functional potential of a cutting edge, the mode of manufacturing, and the volumetric structure or type of the original blank (e.g., Bonilauri 2010; Nicoud 2011: Chapitre 3.5; Weyer 2016). This practice establishes new 'micro-contexts' which can be related in turn to other 'micro-contexts' within the same technical system. The strategy is 'dispersive' and the aim is the *proliferation* of situated facts, so that the 'texture' of lithic technology comes into clearer focus. Instead of sub-dividing 'Bordian' categories, scholars may also aggregate types into larger, more generic types.[614] The aim is the same: to link the constructed types to other 'infrastructural' features of the technical system in order to determine its internal organisation and regulatory principles.

Similarly, other features of the *chaîne opératoire* may be defined as a 'macro-context' of typologisation; for instance, researchers may devise lithic types in relation to distinct stages of reduction – i.e., how many types are associated with a given stage and how they are characterised (cf. Boëda 1988) – or relative to different blank-matrices (e.g., Bourguignon 1997; Soriano 2000). Typology then depends on the construction of other subordinate typolo -gies, and types which are considered technologically meaningful are often found to be the product of the relationship between two or more basic types (e.g., blank-type, tool-type). The qualities and features relevant to grouping particular lithic artefacts together thereby depend entirely on their technical context (cf. e.g., Chevrier 2012: 154-160; Carmignani 2017: esp. Figure 13, 23f.; **Fig. 43**).[615] Typology thus requires the specification of a context, which is typically defined as a function of the 'quality' and 'texture' of the encasing *chaîne opératoire*.

This strategy again reveals the radical 'dispersive' potential of French technological research since types may be multiplied endlessly, leading to an ever-increasing proliferation of fact. It follows that the construction of types cannot itself constitute the ultimate goal. Types are always *means*: enabling features of inquiry which themselves say very little. A type is useful not because it embodies a statistically significant difference in the world, but because it allows scholars to make 'infrastructural' connections that are otherwise overlooked. Typology is consequently nothing more than a device to find consistent webs of intra-technological relations and to remove all interfering obstacles of interpretation. Types are thus constructed and mobilised in a manner consistent with the mode of knowledge corroboration proper to contextualism.

Secondly, assemblages, or the wider technical sphere of a given period or epoch (i.e. Mousterian, Aurignacian, Western European Upper Palaeolithic, etc.), may delineate the 'macro-context' of typologisation. The objective here is to give structure to highly variable entities and to identify their constituting lithic 'micro-contexts.' In contrast to the foregoing variant of typology-making, the target is no longer lithic artefacts, but higher-level entities such as 'technical systems.' We may in fact say that the talk about different 'lithic technologies' in the French literature has its origin in this variant of typological reasoning. The respective 'technologies' or 'technical systems' are the 'texture'-giving substructures of assemblages or periods/epochs. Pelegrin's (2011) four-part classification of Upper Pal-

[613] It is likely that it is precisely this plurality of type-concepts, all of which serve a distinct epistemological function (see *infra*), that has caused so much irritation and misunderstanding in the Anglophone world. The charge of 'over-formalisation' prominently put forward by Bar-Yosef and Van Peer (2009) and the positive responses in the commentary section of their *Current Anthropology* paper only confirm this fact and show that the issue hit a nerve. In fact, it seems rather common-sense among many Anglophone lithic scholars to believe that 'technology' is merely some obscure sort of 'neo-typology' and thus 'over-formalises' the available evidence to this effect (e.g., Tostevin 2011b: 352, 359-362, 2012: 94-97; Monnier and Missal 2014: 62). This assessment is ironic given the apparent 'contextualistic' architecture of French lithic typologies including the fact that 'types' essentially help to unearth technical relationships and thus ensure that technological analysis works (see *infra*).

[614] Scholars may of course also aggregate types into macro-types and then subdivide them again based on some of the same features mentioned above.

[615] Cf. Chevrier (2012: 175-262, 304-377 433-534, 582-669) for a detailed application of 'techno-type'-based classification of African and Levantine Acheulean bifaces.

aeolithic laminar reduction technologies in Western Europe is an example of this mode of typology-making. More generally speaking, this meta-perspective on types also motivates scrutiny of the possibly changing 'status' of typology in varying technical 'macro-contexts' (e.g., Valentin 2011: 47). It should be obvious that this inclination is deeply contextualistic since the role of typologisation itself is suspected to change relative to the 'quality' of different contexts. Even the utility of typology in knowledge-formation is thus thought to be mutable, that is, context-dependent.[616]

Thirdly, specific production systems may be identified as 'macro-contexts' of typologisation; the aim is then typically to find lithic types that are 'diagnostic' of the respective systems. Their recognition, consequently, depends on the 'texture' and 'quality' of the technical system of which they are a part, which are is often referred to together as the 'finalities' of the system (e.g., Valentin 1995: 25f.). Specifically shaped (i.e. convexity, twistedness, laminarity, etc.) and prepared (i.e., directionality, types of negatives, etc.) crested pieces might be regarded as such 'techno-types.' Techno-types are thus types that have been constructed with reference to their technological role and implication – they are *pars pro toto*.[617] As such, they are distinct from 'morpho-types' which are primarily defined by their morphological and shape-related attributes. Again, it is typically the interaction between 'techno-types' and 'morpho-types' which defines a particular lithic technology.

Taken together, these three perspectives on context-dependent typologisation illustrate that 'typology' in the French tradition depends on a *global* assessment of the technical context under consideration; in the case of a lithic assemblage, 'typology-making' cannot therefore be separated from the *technological reading* (*« lecture »*) of the assemblage-totality (cf. Geneste et al. 1997). As such, typologisation is a 'multi-stranded' endeavour since various different types must be marshalled in order to determine the structure-giving relations making up lithic technologies. The lithic types that French scholars construct and analyse thereby reflect the general conception that technical systems are complex and multidimensional entities (e.g., Forestier 1993: Fig. 1; Ducasse 2012: 151), which is largely at odds with the 'analytic' definitions of types that predominate in Anglophone lithic research.[618]

Generally speaking, the 'technological approach' (*sensu* Tixier et al. 1980; Pigeot 1983; Perlès 1987; Pelegrin et al. 1988; Boëda 1994; Pelegrin 1995; Inizan et al. 1999 [1995]) sharply distinguishes between 'Bordian' types – largely restricted to tools, cores, and some special blanks – and 'technological typology' in the wake of Tixier (2012 [1978]: 135f.). Whereas the former groups together lithic objects that share crucial aspects of their 'artefactuality,' the latter groups together objects that occupy a similar place or play a similar role in their *chaîne opératoire*. This is why 'technological typology' may be informed and/or solidified by experimental knapping (e.g., Roche and Tixier 1982; Binder and Pelegrin 1983; Boëda and Pelegrin 1983, 1985; Texier 1984; Geneste and Maury 1997). 'Bordian' and other classic typologies, by contrast, they tend to be indifferent to experimental knapping insights and typically don't benefit from them. This difference represents another locus where French lithic typologies display their contextual constitution; if the construction of types can be easily and productively informed by general insights into the functioning of lithic reduction, it exhibits a critical 'openness' and contextual sensitivity.[619]

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[616] Boris Valentin (2011: 47), for example, invokes the possibility that the difficulty of typologically organising pre-Upper Palaeolithic, especially Mousterian, lithic assemblages is rooted in the technological nature of these complexes; different technological contexts, in other words, may have different *typological consequences*. The fact that Upper Palaeolithic technologies support well-differentiated and recognisably distinct 'types' can then be seen as a result of their distinct techno-economic architecture. Types, then, become also much more susceptible to reflecting regional variation (e.g., Klaric 2007). See also the discussion by Slimak (2006) on the status of burins in Middle Palaeolithic assemblages.

[617] See for example Crassard's (2007: 143-151) reconstitution of the 'Wash'a' *débitage* system of laminar production in Southern Yemen.

[618] 'Analytic' definitions of types, for example, stress that types are clusters of attributes (e.g., McPherron 1994: 42). Even the conventional 'analytic' distinction between 'monothetic' (types as clusters of objects) and 'polythetic' (types as clusters of attributes) typologies (cf. Adams and Adams 1991: 226) does not fully apply to the kind of typologising we regularly observe in French lithic analysis.

[619] This 'openness' of typologisation for experimental knapping insights is another reason why experimental knapping has traditionally occupied such a central place in French lithic research. It not only provides general knowledge about the process of knapping, but also has a 'difference-making' potential for how types are constructed and interpreted. 'Technological typology,' more often than not, is a typology calibrated against knowledge derived from experimental knapping; this last aspect indicates that typology-making often depends on an experimentally derived *prejudice-structure of knowledge* – on 'pre-knowledge' from another domain of practice. This general configuration carries a 'hermeneutic' undertone since technologically meaningful types can be constructed if, and only if, lithic artefacts are interpreted against the background (*horizon*) of subjective and inter-subjective knapping experience. This 'hermeneutic' inclination is a strong indication for the 'contextualistic' nature of typology in the French tradition (see Chapter 2 for the link between 'contextualism' and 'hermeneutics').

It is therefore the constant tension between classic typology and 'technological typology' – i.e., the interplay or incompatibility between the two – that turns out to be productive in French lithic research (cf. Pessesse 2002; Lenoir 2008). An example is the concept of 'D/discoid' which can either have a strictly 'typological' or a strictly 'technological' meaning; 'discoid' is typically decapitalised in the first case and capitalised in the second case ('Discoid') to signify this important difference (Boëda 1995a). Discoid cores in the 'Bordian' sense are morphologically defined, as cores that have a 'discoidal' shape. As such, they do not always attest to the presence of the 'Discoid' method. The occurrence of 'Discoid' cores can only be evidenced by demonstrating the presence of a 'Discoid' technical system; 'Discoid' technology, as a consequence, is not reliably proxied by the mere presence of 'discoid' cores – especially if this presence has an anecdotal character – but requires scholars to convincingly show that 'discoid' cores are a systemic/regular feature of the assemblage and co-occur with the four main characteristic blank-types of 'Discoid' *débitage* systems (Boëda 1993, 1995a; Mourre 2003; Deschamps 2017: 35).[620] It is in this sense that 'discoid' cores can be said to designate polyvalent words, whereas 'Discoid' cores bespeak of the language of 'Discoid' technology.[621]

A second example is provided by the polyvalent category of 'Levallois points.' Boëda (2013) and others have suggested that, in order to do justice to important differences in their technological signification, one must at least distinguish between two types of 'Levallois points.' The former (*ibid.*: 132-138) generally discriminates between *« typo-pointes Levallois »* ('Levallois type-points') and *« pseudo-typo-pointes Levallois »* ('Levallois pseudo-type-points'). These types are interpreted to reflect 'two intentions tied to different production objectives' (*ibid.*: 132). 'Levallois type-points' are typically produced from properly installed Levallois cores (i.e., two asymmetric hemispheres, etc.) and tend to occupy the distal part of a preferential Levallois blank-production series. 'Levallois pseudo-type-points,' by contrast, can be manufactured from different production systems and typically derive from the outermost perimeter of two-hemispheric core architectures via 'recurrent' (non-hierarchical) reduction modalities (cf. Slimak 2003: 58f.). They are typically a product of 'Discoid' (Discoid *sensu stricto*) and 'Discoid-like' (Discoid *sensu lato*) technologies (cf. Deschamps 2014: Fig. 125).[622] Quite often, this technological difference is reflected in blank-axialities (axis of detachment) and the type and degree of proximal investment/preparation. The signification of these differing qualities, however, can only be recognised if the 'technical logic' of the lithic technologies that host them is compared.[623] The distinction conjures a contextualistic logic.

As a third example, it is instructive to examine the contested category of burins. Burins have been interpreted as either tools or bladelet-cores – they represent a lithic category where typology-technology relations are constantly re-negotiated (e.g., Perlès 1977, 1982; Ducasse and Langlais 2008; Chehmana 2009). The burin discourse in the French scene clearly shows that burin 'types' are not semantic categories *per se* – but, typically for contextualism, their potential status as semantic categories is also not categorically denied. The implication is that the signification of various burin 'types' must be demonstrated empirically rather than categorically predicated. Generally, burins are thus not understood as a homogenous technological category. Although all burins of course share some overarching features, different burin-types may have served distinct functional and/or technological needs. According to most researchers, the only way to determine their status is to analyse how different burin types *interact* with the assemblage-totality (cf. Le Brun-Ricalens and Brou 2003; Pesesse and Michel 2006; Le Brun-Ricalens et al. 2006; Chehmana et al. 2007; **Fig. 44**). Burins, in other words, must always be contextualised with other artefacts of their assemblage-context in order to decide whether they served primarily as tools or as core-matrices (cf. Pesesse 2002). It follows that the interpretation

[620] The disagreement between Tostevin (2000, 2012) and Boëda (1991, 1993, 1995a, 1995b) on the interpretation of 'Discoid'/'discoid' technology in the Micoquian of Kulna cave can be reconstructed by reference to this difference. Tostevin (2012) constantly refers to 'discoidal shape' in his analysis while shape is not at all the main concern in the technological definition provided by Boëda (1995a). We may say that Tostevin speaks about 'discoid' while Boëda implies 'Discoid.'
[621] See also Bourguignon and Turq (2003) for an exemplary case of analysing the interplay between tool typology and Discoid technology.
[622] For a discussion of the difference between 'Discoid' technology *sensu lato* and 'Discoid' technology *sensu stricto*, see e.g., Mourre (2003: 9-11) and Deschamps (2014: 86, Fig. 30).
[623] The typological category of 'Levallois' (*sensu* Bordes 1961a/b) is generally approached with a certain dose of caution; for example, 'Levallois blades' may have a different 'technological' signification depending on whether they occur in 'recurrent' Levallois systems with a laminar tendency or in 'non-Levallois' systems of laminar production (cf. Révillion 1993). A detailed analysis of the relationship between the 'typology' and 'technology' of Levallois blades based on technological refits of the Middle Palaeolithic assemblages of Seclin and Saint-Germain-des-Vaux is provided by Révillion (1994).

of burin typology critically depends on technological organisation – the 'function' (fonction) of a burin-type thus corresponds to its relative place within the 'structure' (*structure*) and 'operation' (*fonctionnement*) of its technical context.[624] A burin-type is simply conceived of as a node within a wider technical 'infrastructure.'

The burin discussion shows that types are rarely 'reified' or 'essentialised' and must always prove their epistemic utility;[625] types are primarily methodological operators that help to dismantle technical 'textures' and to reach out to technical 'qualities.' Types are not innocent, but highly mutable to this effect. The goal of technological analysis is generally to find those types that help to surmount the encountered interpretive obstacles – that is, to identify ways of typologisation which illuminate as *many other co-present lithic artefacts as possible*. To show that a burin-type signifies, *pars pro toto*, bladelet-production rather than tool-use, one would therefore need to show that the respective type helps to understand the presence of other lithic types in the same technical context – for example, that presumably bladelet-producing burins are associated with fitting bladelets (i.e., bladelets of a matching morpho-technical character) and the respective by-products (i.e., matching preparatory elements)[626] and that all of them, including the burins themselves, are non-anecdotal elements of their context (cf. Ploux and Soriano 2003: esp. Fig. 6).[627] It must be said, however, that even the non-satisfaction of one of these preconditions may not be enough to reject the core-hypothesis since scholars may be capable to providing a satisfactory contextual explanation for this non-satisfaction (e.g., Faivre 2012).[628]

All of this demonstrates that a lithic 'morpho-type' is not automatically co-extensive with a lithic 'techno-type.' Typology is a relational practice and cannot be successful if attributes and 'traits' of artefacts are cut-off from their contexts and marshalled exclusively 'bottom-up' – 'technological typologies,' the primary target of French typologisation, hence generally enshrine *situated* categories. This only confirms that the role of typology in French lithic research is to support contextualistic analysis and is often contextualistic itself.

The interpretive primacy of technical contexts also permeates more recent work on lithic technology in France. Scholars now often devise morphometric sub-types – for example within the category of laminar blanks – in order to relate these types to different 'micro-contexts' of technical systems (e.g., Langlais 2010: Figure 141, 145; Mevel 2017: Figure 116, 155). In other words: they assess the morphometric space of exploitable blanks based on the types of core-matrices encountered in an assemblage and use these expectations to explore the structure of metric data within the same category of blanks. The morphometric sub-types are thus dependent of knowledge on the nature of *morphometric constraints* imposed by a particular type of core-reduction system (e.g., Pigeot 1991: Fig. 4).[629] It should be noted that these authors tend to speak of 'classes' rather than types, a habit that probably reflects the sedimented belief that types carve out reality in a more conclusive manner than classes do.[630] The point, however, is that both 'typologisation' and 'classification' are highly dynamic practices

[624] This implies that typology is often not an independent operation in French lithic analysis but fundamentally depends on technological inquiry and its fruits of knowledge; this situation marks a signature difference to 'formism' where typology typically constitutes an *independent* operation.
[625] *Contra* Tostevin (2011b: 359), Shott (2003: 100, 2010), and Shea (2013a: 154, 2014, 2017a).
[626] To show that the present bladelets or a sub-set of them is most parsimoniously explained by the presence of certain burins typically involves a negative argument about other potential sources of bladelet-production. This argument is relational since it situates burins relative to other potential and actual core-matrices. Where a particular blank-group originates from is therefore always a *relative* question.
[627] A typical 'mechanistic' objection is that the status of burins can only be determined by conducting use-wear analysis, echoing the 'mechanistic' intuition that similar types often result from different causal processes. This critique, however, misses the mark because the kinds of types devised and criticised in 'contextualism' have been constructed and secured contextually. Their 'truth' is evaluated from *within* and therefore does not depend on external validation. The burin-core debate that has been waging for years in Palaeolithic archaeology is thus nothing more than a symptom of the ongoing clash between 'mechanistic' and 'contextualistic' modes of reasoning.
[628] The ability to explain why something is significant even though it is not frequently or systematically present in a lithic assemblage is a 'trademark' of 'contextualistic' modes of inquiry; it reflects the 'contextualistic' credo that nothing can be denied and nothing can be presupposed other than that nothing is presupposable (see Chapter 2).
[629] Valentin (1995: 27) explicitly notes: "[t]his approach demands a faithful reconstruction of the objectives assigned to the *chaîne opératoire* as well as a detailed appreciation of the circumstances of its realisation ("*the space of the possible*"). When these circumstances are properly appreciated [and understood], the prehistorian is able to evaluate whether this or that modality is the necessary answer in a given situation (when "the possible space is closed" [Pelegrin 1995]) or if it is merely one of the anticipated solutions from a set of possible options. This is a difficult assessment, which necessarily requires a global understanding of the *chaîne opératoire* [....]." (my translation; original italics [for the original French quote, see **Appendix Q.14**]).
[630] But compare the discussion of the relationship between typology and classification offered by Perlès (1988: 1080): "[i]n any archaeological ensemble, there are pieces (combinations of attributes) or attributes (manufacturing techniques, shapes, raw

and necessarily anchored in co-constitutive technical relations. Their orientation is blazingly contextualistic in Pepper's sense.

5.2 **Tropes of organicism in French practice**

5.2.1 ***Boëda's notion of « Levallois récurrente »***

Éric Boëda's work on the various methods and modalities of Levallois technology probably represents the most organicistic strategy in the French scene to understand lithic technology on the assemblage-level.[631] This approach is laid out comprehensively in Boëda's (1986) influential doctoral dissertation, later published as a monograph under the title *Le Concept Levallois: variabilité des méthodes* (1994). Several other key papers about the same topic were published between these two landmarks, all of which explore the tension between the 'unity' and 'internal variability' of Levallois technology (e.g., Boëda 1988, 1990, 1991, 1993); they embody an approach that systematically distinguishes between 'technique,' 'method' and 'conception' in order to illuminate Levallois diversity (Boëda 1988: 185).[632] Conceptually, the approach treats 'diversity' as the flipside of 'unity' – an interpretive preoccupation characteristic for organicism.[633] Higher-level unity is thought to condition lower-level diversity – the two are viewed as being mutually dependent.[634] Accordingly, Levallois 'modalities' are defined as lower-level technical variations, not violating the principles (and general technical rules) of a given Levallois 'method.' All of the different levels of variability are specified in 'volumetric' terms (Boëda 1994).

This meticulous analysis of the 'Levallois phenomenon' culminates in the seminal portrayal of Levallois as a 'facial' or 'surface-extracting' technology – a kind of technology that is regarded to be fundamentally opposed to 'volume-extracting' technologies (cf. Boëda 1990, 1988: Figs. 18.9-18.10).[635] According to Boëda (*idem*), the difference between these two types is rooted in their technical 'structure.' As it will become clear from the following exposition of Boëda's characterisation of 'recurrent' Levallois systems based on the lithic material from Biache Saint-Vaast, presented in detail in *Analyse technologique du débitage du niveau IIA* (1988), 'structure' has not the same implications here as in 'contextualism.' Instead, 'structure' is interpreted in organicistic terms, as 'organic structure' achieved through a specific 'organic process' that can be defined by its 'progressive' and 'ideal' categories.[636]

Boëda's approach to Levallois technology and the identification of 'recurrent' methods in particular is guided by two key assertions: (i) each Levallois 'method' is conceptually discrete (i.e., bespeaks of a distinct *schéma opératoire*); and (ii) each 'method' is characterised by a specific spatio-temporal organisation of its corresponding *chaînes opératoires* (i.e., it makes room for a *chaîne directeur*). Although his approach is generally based on a classic 'technological reading' (*lecture*) of the assemblage-totality, including the detailed examination of *schémas diacritiques*, and the 'virtual' reconstruction of technical artefact-interrelationships ('mental refitting') (Boëda 1988: 186; see previous part of the chapter), the way in which these two assertions are defended suggests that the analysis is governed by an organicistic logic.

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materials, etc.) considered characteristic of the whole [...]. It is for clearly pointing out differences (or similarities) that the prehistorian elaborates a typology, or utilises an already existing typology. When developing a typology, based on groups of pieces (complex combinations of attributes), one necessarily performs a hierarchisation of features [...]. A typology is therefore very different from a classification since each piece could, strictly speaking, belong to several types [...]. But it is characteristic of a typology to bring to light those features which make it possible to solve specific archaeological problems [...]. In principle, a typology should be designed relative to the problem posed (which dictates the choice of relevant characteristics), and several typologies can be applied to the same whole to solve different problems. [...] Whatever may be our interest, a classification will always express a real structure within the studied material since it is based on its intrinsic properties. This is one of the differences with a typology where one instead chooses to privilege certain features, and to rank them according to the problem posed." (my translation [the original French quote is provided in **Appendix Q.15**]; cf. Valentin 1995: 2, footnote 2)

[631] As we will see in this part of the chapter, 'organicistic' reasoning turns out to be correlated with a specific temporal perspectives, it typically operates on higher-levels of analysis (see *infra*).

[632] For a good summary of this approach, see Chevrier (2012: 139-141).

[633] 'Unity' is interpreted as 'integrity' – specifying the *external* relatedness of the Levallois phenomenon – and 'diversity' is simply interpreted as the 'structure' of the integrated whole – specifying the *internal* relatedness of the whole's parts. This conception is, first, 'synthetic' since it concerns the question of how parts are bound together by significant wholes and, secondly, 'organicistic' since the identification/determination of 'significant' wholes is part of the basic epistemic task the analyst has to complete (cf. Chapter 2).

[634] We will return to this 'organicistic' key *topos* at a later stage in this chapter.

[635] These 'volume-extracting' technologies are typical for the Western European Upper Palaeoltihic, where they find their climax in developed prismatic blade technologies (Boëda 1990, 1994).

[636] See Chapter 2, and esp. Chapter 2: **Box 9**.

An organicistic orientation is already indicated by the strong emphasis on the idea of the 'operational scheme' (*schéma opératoire*) and the outlined temporal structure of 'recurrent' Levallois technologies.[637] The notion of the 'operational scheme' not only entails an emergent conception of technology – technical systems are viewed as 'more-than-compositional' (Boëda 1988: 185) – but also embodies an 'ideal' category itself, somewhat detached from the 'progressive' categories detectable via the 'stigmas' preserved on the given lithic artefacts (cf. *ibid.*: 185f.).[638] The 'progressive' categories, those that delineate the space of description and thus a 'significant' whole, are found in the spatiotemporal structure of Levallois reduction. In particular, the strategy is to find a 'structure' that is capable to integrate the 'progressive' categories, clearing the view for the 'ideal' whole. Even though both spatial (i.e., volumetric, geographic/topological) and temporal dimensions of technological organisation are considered, the crucial point is that it is primarily the temporal 'structure' of reduction which gives meaning to the observed spatial articulations of lithic artefacts and artefact-groups. Temporality is thus conceived as a *superordinate* category[639] – a presupposition that is germane to organicistic modes of reasoning (cf. Pepper 1942: 308-310).

The organicistic logic of Boëda's technological reconstruction becomes especially evident when we retrace the spatiotemporal structure of 'recurrent' Levallois and examine how this 'structure' is empirically established. The first aspect to note is that the 'recurrent' method of Levallois – subdividable into two modalities (uni- and bidirectional) – is characterised by a specific order of well-separated technical 'stages,' each of which is defined by a specific articulation of artefacts and technical gestures/operations (**Fig. 45**). Each 'stage,' in other words, forms a sub-set of the material and non-material ingredients that together form the technical system we call 'recurrent' Levallois – these 'stages' are part of the 'progressive' categories of the latter. This general character of reconstructing technology reveals that the 'synthetic' constitution of a technical whole (part-whole interweaving) is interpreted *temporally*, which, in turn, illustrates that the variability and heterogeneity of a lithic assemblage is primarily resolved by shedding light on the integration of the assemblage-parts (primarily lithic artefacts) by a temporally extended process of volumetric reduction of high technical specificity. This process is shown to make sense, that is, to *resolve* the initially observed heterogeneity. It is in this sense that we can speak of an 'organic process' which is initially 'concealed.'

It is 'concealed' because the process is not immediately given or obvious in 'phenomenal' reality – that is, the 'reality' of physically scattered artefacts; it only becomes apparent through a careful re-organisation of the lithic 'fragments' into qualitative units of time (i.e., reduction stages), so that the process of passing through the latter in the correct direction can be shown to *integrate*, that is, 'unify', all initial fragments in a single 'organic whole.'[640] The system Boëda calls Levallois 'recurrent' is nothing less than such a unified 'organic whole,' which accordingly comes into view only through an under-

[637] 'Scheme' is not an innocent concept. *Schéma* is for example a key term in Piaget's theory of developmental psychology and there are obvious conceptual affinities between the former and the notion of the 'operational scheme' (*schéma opératoire*) in French lithic analysis (cf. Schlanger 1994). A 'schema,' for Piaget, is a cluster of concepts used to represent the world, i.e., objects, scenarios, sequences of events, or relations. Piaget (1952, 1964 [1959]) famously distinguished between *behavioural* schemata (organised patterns of behaviour guiding the representation and manipulation of objects and experience), *symbolic* schemata (internal mental images and/or other systems of codification to represent and organise experience), and *operational* schemata (internalised mental patterns to deal with an operationalise problems). All of these strands are somewhat relevant for the reconstruction and interpretation of technological *schémas opératoires*. The concept gives voice to the idea that practice, representation, and cognition are deeply enmeshed in human technicity (cf. Pigeot 2011; see Boëda 1997: 12 for an explicit citation of Piaget's work). The important point is that Piaget's *developmental* theory is 'organicistic' in many regards – a circumstance that is perhaps best reflected in the fact that the 'becoming' of the human individual (its 'genesis') is thought to be achieved through a succession of distinct developmental 'stages.'

[638] The term 'stigma,' regularly used by Boëda himself, has – as already outlined in Chapter 3 – relationalistic implications. In addition, however, it signals the 'fragmentariness' of artefactual information insofar as lithic artefacts convey merely *traces* of the technical systems in which they originally participated. In the context of Boëda's (1988) reconstruction of the 'recurrent' Levallois method, this can be taken as preliminary indication that artefacts are primarily understood as 'fragments of experience' – thereby confirming the 'organicistic' orientation of his approach.

[639] Time, in other words, is considered to be the supreme/superior 'structure-giving' force in nature.

[640] The centrality of a technical system's temporal 'structure' – what in 'contextualism' would be referred to as the temporal 'spread' of a technical 'texture' – makes it necessary to invoke qualitatively discrete elements that enable the analysis of a technical whole's unfolding in time; one can therefore not content that the introduction of 'reduction stages' is a deliberate interpretive decision here, fully under control of the analyst. Rather, we have to acknowledge that the introduction of 'stages' or 'steps' is *required* to render the offered account conceptually consequential as well as consistent. The resulting 'staging' of the lithic technological architecture can therefore not rejected by simply appealing to some selected facts; its rejection necessitates the rejection of 'organicism' altogether. The controversy between advocates of 'discrete' and 'continuous' reduction in lithic studies (see e.g., Baumler 1987, 1988; Baumler and Speth 1993; Dibble 1995a; Henry 1995; Shott 2010, 2017; and Shott et al. 2011 for a general defence of 'continuous' reduction scenarios) is thus likely to be the symptom of a more basic clash between 'organicists' and 'non-organicists' (especially 'formists' and 'mechanists'). We will return to this point in Chapter 6.

standing of the underlying 'organic process' that determines its coherence and 'technical reality' (*réalité technique*). This 'organic process' exhibits subtle but significant differences when we compare 'uni-' and 'bidirectional' systems of 'recurrent' Levallois technology. Importantly, the emerging gap between *Appearance and Reality* is distinctive to organicism.

The basic strategy is to order the assemblage into 'significant' technical 'structures' and 'sub-structures' and to show that all initially encountered 'fragments of experience' – lithic artefacts – can thereby be *resolved* into their respective technical wholes; the 'structures' and temporal 'sub-structures' constructed are shown to be 'significant' due to their ability to *enable* this process of resolving.[641] This is demonstrated by illustrating that only with the help of the respective 'sub-structures' it becomes possible to render their corresponding 'structures' temporally *coherent*.[642] The two following aspects are important to consider in this regard.

First, technical wholes ('technical systems') are conceptualised as 'determinative' forces, which is another way of saying that the taken approach is 'integrative;' it is 'integrative' because, on the assemblage-level, 'relevant' lithic artefact variability needs to be separated from 'irrelevant' variability – the specification of a 'significant' whole entails the definitive specification of artefacts belonging to the whole and artefacts not belonging to it. A single 'organic process' is then shown to explain why this must be the case; this process is 'directed' and 'teleological' insofar as it serves to satisfy one single 'ideal' – the *schéma opératoire*. The resulting explanation is 'economic' since it saves all initial 'fragments of reality' without any loss and thereby reveals their 'unification' through various temporally extended yet 'significant' wholes (*sensu* Pepper 1942: 306f.).[643] This also implies that all lithic artefacts allocated to a 'significant' organic whole are shown to *imply* the whole, whereas the whole can be considered to *transcend* its fragments – this is the delicate balance between 'implicitness' and 'transcendence' that is typical for organicistic inquiry (*ibid*.: 304f.).

Second, the general strategy of analysis clearly exposes that knowledge claims are secured by demonstrating that each identified technical 'structure' can be *coherently* described by bringing to bear its 'sub-structures' and a specific 'organic process' that authors and organises them (*sensu* Pepper 1942: 283).[644] The initially observed 'conflicts,' 'counteractions,' or 'contradictions' between the 'fragments of reality' (i.e., the lithic artefacts) are shown to dissipate in this way because the whole turns out to be *temporally coherent* with the totality of its parts, despite the material heterogeneity of the latter.[645] This is the classic interpretation of knowledge corroboration in organicism – it confirms the presence of a 'coherentist' account of cognitive 'veracity,' stressing internal technological intelligibility.[646]

Boëda (1988) accordingly seeks to *minimise* all inconsistencies, contradictions, and explanatory gaps on the assemblage-level, while at the same time maximising the cognitive economy of his account; epistemic virtues such as interpretive 'elegancy' and explanatory 'simplicity' are thus interpreted through the lens of organicism, as the ability to provide a 'progressive' technical process that is 'or-

[641] See the exposition of the proper 'organicistic' theory of cognitive criticism in Chapter 2.
[642] Boëda (1988) thereby acknowledges that lithic artefacts deposited together (lithic assemblages) do not necessarily belong together technologically. Thus, to identify those lithic objects which belong together and to separate them from all other objects emerges as a key task. In 'organicistic' terms, one can understand this as re-casting the lithic assemblage as a problematic whole, whose 'organicity' can only be verified by showing that all of its artefacts can be resolved in 'significant' sub-wholes (i.e., particular technical systems) without any loss. This is the 'organicistic' interpretation of the technical 'infrastructure' of a lithic assemblage. The same reasoning can also be used to evaluate whether or not assemblages are *technologically coherent* and hence whether or not they are likely to be mixed or not. This is why 'organicism' motivates an entirely different type of 'source criticism' than 'mechanistic' which typically relies on 'formation theory' – a type of 'source criticism' that favours an 'internalistic' perspective and may be built exclusively on technological data.
[643] Boëda (1988: 213) explicitly names 'conceptual unification' as a goal of his analysis.
[644] Already Cresswell (1976: 6), one of the founder figures of French *technologie culturelle*, has noted: "[t]echnical chaîne opératoires have two essential characteristics: *internal coherence* and an organic relationship with the social structure." (my translation; emphasis added [for the original French quote, see **Appendix Q.16**]; cf. Cresswell 1983). For the concept of 'technical coherence' (*cohérence technique*), see e.g. Nicoud (2011: 68).
[645] This is another way of saying that inconsistency and heterogeneity turn out to be rather 'illusionary' since they only persist if one approaches lithic technology as a 'static' and strictly 'synchronic' entity, *not* extended and somehow 'distributed' in time. A truly 'dynamic' account, by contrast, is capable – and 'organicism' interprets 'dynamism' primarily in temporal terms – to show that the respective heterogeneity vanishes if the temporal configuration of 'distributed-ness' and 'interconnectedness' are taken seriously into consideration. In Bergson's (1907, 1922) classic formulation, this trail of reasoning entailed a basic epistemological critique on human knowing, which was regarded to regularly fall prey to the phenomenological illusion that worldly objects are somehow 'static' and thus temporally fixable entities. It follows that the 'real' *temporal existence* of phenomena is generally difficult, if not impossible, to observe directly.
[646] See Chapter 2 and Pepper (1942: 308-314).

ganic' and realises its inherent 'ideal.'[647] It is no surprise then that Boëda's argumentation is multidirectional, often rather intricate, and generally 'dialectic' – the account is 'coordinative' to this effect (i.e., it coordinates all lithic 'fragments of reality'). However, it has to be noted that this 'complexity' is not so much a property of the offered explanation itself (which is in fact fairly 'simple'), but rather an essential characteristic of the nexus of argumentation and embedded interpretation that is required to develop, present, and secure it.

The effective *coordination* of all original lithic artefacts, interpreted as 'fragments of reality,' via the postulation of relevant technical 'structures' and their 'progressive' categories – lithic reduction 'stages' – is the organicistic corollary of the 'contextualistic' 4D-puzzle. But puzzle-solving is understood as a reversed, directed process of organic growth. Each 'stage' of reduction is a logical consequence of its preceding 'stage' and coevally determines the 'stage' that follows. We can say that each 'stage' implies its past and is 'pregnant of its future' – a credo highly characteristic of organicistic thought. In the case the lithic assemblage of Biache Saint-Vaast IIA, the coordinative maximisation of explanatory economy leads Boëda (1988: 186) to identify *multiple* technical wholes exhibiting patterns of inversed technical growth that are *specific* to them (reduction schemes 'A' to 'E'). The proposition that these technical wholes correspond to distinct 'concepts,' 'methods,' and/or knapping 'modalities' is hence a largely unavoidable result of the taken approach.[648] The 'discreteness' of the 'stages' themselves follows from the fact that their order is *not* arbitrary or interchangeable since each 'stage' has determinative significance – the totality of 'stages' is technically *enchained* (*enchaînement technique*) (cf. *ibid*.: 1987).[649]

The point is not that a fundamental re-organisation of lithic reduction – e.g., successively employing different knapping strategies to a single core – is generally impossible, but that the costs would be unreasonably high. This leads to the conclusion that economic knapping behaviour would typically consist in the avoidance of knapping-pattern alternations – an insight that, ironically, is often opposed by 'mechanists' by calling upon *Homo oeconomicus*.[650] The entire point of setting-up a specific volumetric core-architecture is to achieve its corresponding knapping 'ideal' through a specified set of 'progressive' operations; especially in the case of Levallois technology, where initial preparatory investment is generally high, it is therefore unlikely that the reduction strategy will experience major changes during core reduction.[651] In addition, if core re-organisation was a regular aspect of technological organisation at Biache, it can be expected to show itself after inter-artefact coherency is established.[652]

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[647] Apart from the notion of the 'operational scheme' (*schéma opératoire*), another conceptual locus where the 'progressive' and 'ideal' categories meet is predicated by the idea of a 'knapping plan' (*projet de taille*) which is thought to connect the former with the latter (Boëda 1988: 185).

[648] This fact is probably responsible for the basic conflict between Boëda's (1988) and Dibble's (1995a) accounts of the lithic technology from Biache Saint-Vaast level IIA (see *infra;* cf. Chapters 1 and 3).

[649] 'Organic' lithic reduction leads to *technical entrapment*. It implies that specific lithic reduction trajectories open a space of technical options becoming more and more constrained as reduction proceeds, especially when initial technical investment was high (e.g., relatively cost-intensive early (preparatory) phases of a *chaîne opératoire*). Because of the specific technical consequences of each trajectory, only a number of knapping solutions lead to acceptable knapping results, others punish the knapper (e.g., by an increased risk of knapping errors, etc.) (cf. Pigeot 1991: Fig. 4). To change the logic inherent to a given reduction trajectory, for example foreshadowed by a specific core set-up, often requires to re-set the entire core- and reduction-architecture, a procedure that typically depends on renewed preparatory investment and is often non-economic (especially in terms of raw material consumption). Lithic reduction is *path-dependent* to this effect (cf. Boëda 188: 210). Boëda (1988: 210) himself maintains: "[…] [t]hey [the knappers of Biache Saint-Vaast level IIA] were, as it seems, prisoners of the limitations inherent to the volumetric conception of the Levallois core, which fixes a specific function for each of the two [reduction] surfaces." (*ibid*.: 191f. [for the original French quote, see **Appendix Q.17**]).

[650] It can in fact be concluded that the 'organicistic' interpretation of the *Homo oeconomicus* underlines that 'economic' reduction behaviour is only possible if the interlink between the 'progressive' and 'ideal' categories of different knapping concepts is respected; the 'economic' potential of a knapping concept lies precisely in its capacity to fulfil its 'ideal.' If the chain of 'progressive' categories is thus interrupted, a part of the knapping investment has been wasted – this can be viewed as 'un-economic.' The clash between 'mechanism' and 'organicism' consists thus in a fundamental disagreement on how to measure and objectify 'economic-ness' – the former typically assesses economy in terms of 'absolute' and 'external' categories, while the latter examines it in terms of 'relative' and 'internal' categories.

[651] There is of course still the possibility that reduction patterns change because of some *unforeseen events*. Such events may be unrepairable knapping accidents that destroy the required volumetric structure, so that lithic reduction cannot continue as anticipated, or the depletion of the raw material matrix of a core. In the latter case, it becomes opportune and hence economic to extract as much further material as possible, no matter how.

[652] If inter-artefact coherency can be established without postulating a change in core management, one has little reason to invoke such a change. Again, this logic reflects the 'organicistic' interpretation of the simplicity principle: *Okham's Razor* suggests to minimise the number of reduction strategies that feature in a given explanation (cf. Sober 1988, 2015). *Okham's Razor* is thereby interpreted 'synthetically' and thus diverges from the *Razor* that is typically invoked in 'formism' or 'mechanism.' In fact what 'simplicity' *means* is simply contested among these theories.

To illustrate the main points outlined so far, it is useful to examine Boëda's reconstruction of uni- and bidirectional *« Levallois récurrente »* in more detail, especially how distinct 'stages' of reduction are identified and characterised. In general, *three discrete stages of débitage* are pinpointed, all of which are defined by a specific articulation of groups of blanks and core configurations (Boëda 1988: 186-196). The basic strategy is to understand the *consequences* of particular flake removals for the configuration of the corresponding cores and, conversely, the *consequences* of particular core configurations for the structure of the corresponding flakes. The aim is to coordinate these consequences in such a way that extracted flakes explain particular core configurations and the core configurations explain particular flakes (e.g., *ibid.*: 198). Flakes and cores are considered to be potentially *complementary* 'micro-structures' which participate in effective 'meso-structures' (reduction 'stages') whose temporal enchainment gives birth to technological 'macro-structures' (technical systems) (*ibid.*: Fig. 18.7; **Appendix III.5: Fig III.6**). The structure-giving features are different in all of the three cases.

The relevant 'stigmas' on flakes are physical outline, spatiotemporal structure of dorsally preserved scars (i.e., scar-geography, scar-directionality, scar-chronology), angulations (i.e. profile, cross-section, dorsal convexities, etc.), and the direction of detachment (Boëda 1988: 187). Based on these and other features, it becomes possible, given one has formed a general understanding of the architecture of the cores from which these flakes most likely stem, to infer to effects of their removal on the convexity of the core-surface from which they have been extracted. These effects regulate future flake-removals, and so forth. Relevant core 'stigmas' are represented by the physical outlines of fully preserved flake-negatives, the spatiotemporal structure of flake-negatives on the reduction surface (i.e., scar-geography, scar-directionality, scar-chronology), and the general configuration of surface-convexities (*idem*). Based on these and other features, it is possible to retrodict how the preceding flake-removals must have looked like and to anticipate how the next removal(s) would look like (*ibid.*: 199-201) – the latter is basically a function of the nature of extraction-convexities on the core surface created through past removals (cf. *ibid.*: Fig. 18.2, 18.8-18.10).

The distinction between 'determining' flakes (*prédéterminé*) and 'determined' flakes (*prédéterminants*) (Boëda 1988: 185) is a direct consequence of this logic of reasoning and enshrines the methodological impetus to assess flakes in light of cores and cores in light of flakes (*ibid.*: 198; cf. Boëda 1986: 181-252).[653] Each artefact is viewed to conserve traces of past technical operations and to be pregnant with future operations (cf. Boëda 1982).

With Pepper we can make sense of this in the following way: each single lithic artefact is identified as a 'fragment' of its technical reality (*réalité technique*) with a specific 'nexus' of *technical potentiality*. This nexus is determined by a fragment's 'stigmas' (see *supra*) and delineates the possible technical connections that the fragment may have maintained with other lithic fragments. A technical 'nexus' thus constitutes a field of potential relations with other lithic artefacts. We can say, then, that Boëda compares the 'nexuses' of flakes with the 'nexuses' of cores in order to determine their meeting point(s).[654] These meeting points are ways in which the lithic 'fragments' may complete themselves (*sensu* Pepper 1942: 291f.), by merging together with other fragments to form a larger technical 'structure.'[655] If there are no plausible meeting points, the fragments can be said to be 'irrelevant' for each other's integration.

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[653] Cf. "[…] The study of cores must have priority. The core is the most important vector of information to determine the utilised concept of knapping, especially because it bears the stigmas of the employed methods or techniques. The analysis of predetermined and predetermining flakes is secondary: it is from this study that the method or methods employed by the knapper will be definitively determined. This methodological articulation between nucleus and flakes must evidently take into account the informational capacities provided by the artefacts of an archaeological site." (Boëda 1988: 1985; my translation; for the original French quote, see **Appendix Q.17**). Even though Boëda insists on the analytical priority of cores here, this priority is essentially born out of interpretive convenience; cores and flakes are methodologically equals, but because cores typically preserve more information (each core usually corresponds to a number of flakes) they constrain the possible meeting points of 'nexuses' stronger than single flakes do. However, in order to know which cores belong together (i.e., form the fragments of a single reduction method/system), one already needs to have inspected all flakes in the same assemblage. The entry point of inquiry is thus generally arbitrary and a matter of convenience, rather than theory. This should not be surprising since argumentation and inference tend to be 'dialogical' and 'multi-directed' in 'organicism.'

[654] If there are multiple meeting points of the involved 'nexuses,' the criterion of total *coherency* decides which of the meeting points is most likely to be relevant in the current technical context. The question, then, is simply which of the meeting points positively articulates with the other so far determined meeting points of 'nexuses' in the organic whole. It is to this effect that the whole is of primordial importance in securing 'organicistic' knowledge.

[655] The 'nexus' of a fragment thereby simply drives home the 'organicist's' conception that the whole has always been *implicit* in its parts, but at the same time necessarily *transcends* it (see *supra*). Each lithic fragment is 'stigmatised' by its *chaîne opératoire* to this effect (cf. Pepper 1942: 304).

This conception clarifies how 'mental refitting' is interpreted in organicism: as *the coordination of 'nexuses' with the goal to integrate all lithic fragments in such a way that overall technical coherence is reached*.[656] 'Mental refitting' is thus simply the name for a procedure that seeks to determine the technical meeting points (if any) of various lithic artefacts sharing a 'significant' technical context (i.e., assemblage, technical system, etc.) (cf. Boëda 1988: 198). Accordingly, artefacts are complementary from a technical point of view when their 'nexuses' meet. This way of 'matching' lithic artefacts and to determine which belong together and which not is clearly reflected in Boëda's Fig. 18.16 and Fig. 18.17, in which particular articulations of Levallois core and flake structures (i.e., their mutual implicatedness) are theorised (**Appendix III.5: Fig. III.7, III.8**; cf. **Fig. 6A** in Chapter 3).

The identification of 'uni-' and 'bidirectional' reduction methods as distinct variants of 'recurrent' Levallois reflects this organicistic orientation. A key difference between the two is that the unidirectional 'method' requires constant monitoring and regular re-preparation of the distal core-convexities, which otherwise deplete as a function of the general organisation of lithic reduction; the bidirectional 'method,' by contrast, through the alternating removal of a series of flakes from opposing platforms introduces a self-preparatory procedure ('auto-preparation'), which ensures that distal core-convexities do not deplete as quickly. Alternating bidirectional exploitation of the core-surface convexities, in other words, provides a means to manage/control these convexities. This difference in core management has subtle but significant consequences for the nature of the corresponding flakes. The bidirectional, self-preparatory 'method' enables the extraction of slightly more elongated flakes (Boëda 1988: 201f.) because the guiding ridges of bidirectional reduction create a less-pronounced, that is, 'smoother' distal core-angulation which permits controlled 'feathering' (*ibid.*: 187).[657] In addition, bidirectional cores have two distal parts that both serve as striking platforms of their own – they are thus automatically monitored and prepared (*ibid.*: 201).[658]

This articulation of bidirectional core-reduction and elongated flakes is confirmed by the metric data. Levallois flakes with a bidirectional scar-pattern are generally more elongated than flakes with unidirectional scar-patterns. Importantly, metric differences between relevant flake-categories are interpreted as a consequence of distinct reduction methods (Boëda 1988*:* 202-207), and not the other way around; metric differences *within* these flake-categories, conversely, are regarded to reflect raw material size reduction generated by increasing reduction depth.[659]

Since the resulting account delivers a coherent picture of the two methods, each of which is characterised by three logically-dependent reduction 'stages' – the first stage is 'preparatory,' the second stage reflects 'primary production' of maximally-sized Levallois products, and the third stage represents 'final extraction' of size-reduced Levallois products before raw material exhaustion – Boëda concludes that there is no empirical reason to assume a mixture of Levallois reduction strategies –

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[656] By coordinating flake and core 'nexuses,' it becomes not only possible to recognise their co-constitution, but also to determine a flake's precise *location of removal* as well as its *date of removal*, which in tandem allow an assessment of the flake's *temporal positioning* and *technical function* in their *chaîne opératoire*. It is along these lines that a distinction between 'preparatory' and 'non-preparatory' flakes can be made. In 'organicism,' *knapping intentions* are thus interpreted through the lens of 'nexuses' and their global structure.

[657] Bidirectional Levallois 'recurrent,' however, also has some technical disadvantages. According to Boëda's (1988: 191) reconstruction, when core size diminishes this method (*Schéma B*) is much more likely to yield extremely flat extraction-surfaces – the central surface convexities of the 'active' core hemisphere are more likely to exhaust at the end of a core's biography. This explains why *Schéma B* cores are sometimes exploited along their lateral edges at the end of their use-life, generating strongly oblique detachments (*ibid.*: Fig. 18.8). What is thematised here again is the double-edged nature of technical systems: techno-economic effectiveness (*efficacité*) may be counterbalanced by technical entrapment; technology is 'boon' and 'bane' at once. We will come back to this figure of thought at the end of this chapter.

[658] Another consequence is a structural *asymmetry* between aligned and opposed scars on the dorsal face of bidirectional Levallois flakes (Boëda 1988: 201).

[659] The fact that 'size' is interpreted as a consequence of reduction method and the corresponding articulation of lithic fragments constitutes the primary reason why Dibble (1995a) and Boëda (1988) come to contradictory conclusions about Biache Saint-Vaast level IIA. For Dibble (1995a), 'size' is a parameter fixed to dimensional time, which means that reduction depth can directly be proxied with its help – 'size,' in other words, is interpreted through the lens of the 'field of locations,' a structural category proper to 'mechanism.' For Boëda (1988), however, 'size' is a *technology-mediated* parameter of lithic artefacts and thus contributes to an artefact's 'nexus,' just like any other artefact-feature. The main point for Boëda is that 'size' is a highly polysemic category since it may not only be shaped by the relative positioning of an artefact in its corresponding *chaîne opératoire*, but may also be determined by the artefact's location of detachment (e.g., products of initial centripetal preparation may be smaller than 'primary products' even though the former precede the latter in the operational sequence). From Boëda's perspective, a central weakness of Dibble's account is therefore that this possibility is not accounted for, that is, it is not explicitly tested as a competing hypothesis [it has to be emphasised here that the hypothesis of 'size' being a product of a lithic artefact's origin from the corresponding surface of reduction does itself not depend on a particular world theory chosen; each world theory must be able to somehow examine it].

each 'method' yields a specific set of 'progressive' categories furnishing a unique body of differentiated Levallois products. Lithic reduction is 'recurrent' because the second and the third 'stage,' *grosso modo*, generate a large number of non-hierarchised Levallois-products (all of the flakes are 'determining' (*prédéterminé*) and 'determined' (*prédéterminants*) at the same time) (Boëda 1988: 202). Levallois 'recurrent' differs in this regard from other Levallois 'methods' (cf. Boëda 1991, 1994).

It can be concluded that time acts as the primary *integrator* and its 'structuring' effects (i.e., the 'developmental stages' of lithic technology) help to organise the lithic facts; the analysis of Boëda's pattern of reasoning has shown that as soon as the 'correct' temporal structure of the targeted *chaîne opératoire* has been identified, the lithic facts, so to speak, "organise themselves" (*sensu* Pepper 1942: 291). The main strategy to secure corroborative truth is to ensure the coherence of assertive statements as they pertain to a technical process defined by its duration (*durée*). The handling of a core-matrix is pictured as an 'organic' yet determinative process which, once established, appears to be largely irreversible and path-dependent. Lithic technology is thereby defined by the 'progressive' categories it enacts; these, in turn, are specified by the 'ideal' categories to which they trend (i.e., the chain of 'reduction stages' serves the 'knapping project' and thereby fulfils the *schéma opératoire*). All of this leads to the conception that the 'temporal structure' of lithic technology is *technology-specific*; technological time itself is regarded to be 'qualitative.' It follows that different technical phenomena may navigate through time in a different manner and possibly at different speeds.[660]

Having said this, the key preoccupation of Boëda's account is the problematic status of excavated artefactual realities (i.e., the scatteredness of lithic assemblages). The 'essence' of lithic technology is not directly given and even regarded to be 'obscured' in this format of experience; human experience is viewed to merely grasp the fragments of lithic technology and these fragments themselves – the lithic artefacts – can thus not be trusted for they 'conceal' the true unity of 'organic' technical processes that propel lithic technology. This account is thus clearly organicistic on all levels of inquiry.

5.2.2 *« Paléohistoire », multiple temporalities, and the conflict of becoming*

« Paléohistoire » provides another glimpse into persisting tropes of organicistic thought in the French scene (cf. e.g., Audouze and Valentin 2010).[661] *« Paléohistoire »* is the attempt to connect different temporal scales – 'nano-' or 'micro-historical' (i.e., short-time occupations, knapping events), 'meso-historical' (i.e., social structures, sociotechnical norms and values), and 'macro-' or 'hyper-historical' ('civilisations,' periods, epochs) (*sensu* Valentin 2015) – in order to provide an integrated picture of long-term societal evolution (e.g., Pigeot 2004; Valentin 2005, 2008a, 2015; Bon 2009, 2010).[662] The

[660] The conceptualisation of time is of the essence and distinguishes 'organicism' from its 'integrative' sister 'mechanism.' If different technical phenomena travel through time in a different way, this implies that *time affects different technical phenomena differently*. Therefore, *technological time* cannot be measured by 'fixed' or *a priori* variables. In different technical systems, different variables may in fact turn out to be temporally sensitive (i.e., 'time-indicative') – the identification of 'temporal variables' is thus part of the empirical work that an 'organicist' has to do. This is exactly where Boëda (1988) and Dibble (1995a) disagree. Dibble's critique of Boëda's interpretation of the Biache Saint-Vaast IIA assemblage is based on an 'objectivist' account of time, according to which the relative chronology of reduction can securely be estimated by a fixed set of variables – a view that Boëda would clearly reject. For Boëda, time is to be measured differently when different 'organic' processes are at work.

[661] *« Paléohistoire »* is the name of a recently established umbrella-approach representing the crystallisation of various strands of theorising in the French scene since the late 1990s. It hosts two or three major branches of inquiry: first, what can be called *« Paléohistoire » sensu stricto* – based on the pioneering work of Jean-Pierre Fagnard (1988), Nicole Pigeot (2004), and Boris Valentin (2005, 2008a, 2015) – and, secondly, what may be termed *« Paléotechnologie »* in the wake of Éric Boëda (1991, 2005, 2013) and others (see **Appendix III.4** for more details). While the latter will be portrayed in the next section, the former can be subdivided into two sub-strands of inquiry. The first, building on the work of the 'Late' Leroi-Gourhan (1972, 1983a, 1984), Beatrice Schmider (1971, 1982, 1988; cf. Schmider and Roblin-Jouve 2008), Catherine Farizy (1990), Jean-Pierre Fagnard (1984, 1988) and others, foregrounds the sociological dimension of long-term population histories (see esp. Leroi-Gourhan et al. 1976); this approach, recently further elaborated by the work of Boris Valentin (2008a, 2015) and François Bon (2009, 2015), stands on the shoulders of French *« Sociologie préhistorique »*. The second sub-strand, mainly represented by the work of Grégor Marchand (2014, 2015), foregrounds dynamic human-environment interactions in writing the long-term history of past societies.

[662] The overarching ambition is to consolidate divergent strands of French 'palethnological' thought (cf. Valentin 2008a: 27, 33f., 2015). Valentin (2008a: 28-32) re-casts this problem as an issue of divergent time scales and their specific temporality of observation. He argues that Leroi-Gourhan's original *« Palethnologie »* carves out reality on a broadly 'microhistorical' scale – the relevant rhythms are tangible, they are often bodily and unfold in seconds, hours, and maybe days (lithic knapping, making fire, inhabiting a camp, etc.); *« Paléohistoire »*, by contrast, carves out reality on a 'macrohistorical' scale – its millennium-scale rhythms are less tangible and their significance is thus different. The dialectical movement between the 'micro' and the 'macro' and how they are temporally imbricated and/or enfolded into one another that is of primary interest for 'palaeo-historians.' The theoretical corpus on which this conception draws – sometimes consciously, sometimes unconsciously – is vast and includes

key concern is to understand the *interconnectedness* of the various scales of observation which are available to prehistorians – all of these scales are regarded to bear a distinct *temporal significance* (Olive 2005; Olive and Pigeot 2006; Bodu et al. 2006: 723f.; Valentin 2008a: 18, 21; Audouze 2010). The target of such research are the specific 'historical trajectories' of past societies, thought to signify the *genesis* or 'becoming' of societies in the *longue durée* (Bon 2009, 2015; Valentin 2011). Inquiry thereby focuses on how the targeted societies navigate the depths of time and how they handle duration (*durée*) (Valentin 2008a: 21; Perlès 1998, 2013).

Typically, research under the umbrella of *« Paléohistoire »* pays special attention to the 'dialectics' between continuity and discontinuity in the palaeo-archaeological records (e.g., Fagnard 1988: 125; Coudret and Fagnard 1997; Bodu and Valentin 1997; Valentin 2006; Jaubert et al. 2014).[663] Continuity and change are regarded to be a function of different, at times counteracting temporalities and their interrelationships.[664] Social evolution is conceptualised as a 'concealed' yet organic process, which in its temporal progression resolves any remaining 'conflicts' among its parts to come into view as an integrated whole. This reading of the evidence can build on traditional subdivisions of Palaeolithic periods such as the Magdalenian comprising 'Lower,' 'Middle,' and 'Upper' phases, re-casting these phases as 'stages' of organic social evolution (e.g., Valentin 2008, Langlais 2010).[665] *« Paléohistoire »* generally foregrounds the 'active' making of society as an interdependent and temporally 'structured' process.[666] The approach is tied to a basic reconsideration of the nature of time and bound to an ongoing, although often tacit, re-definition of Palaeolithic archaeology itself – as a discipline that offers a unique perspective on processes of the distant past that *take time* (cf. Perlès 1998: 17; **Fig. 46**). With Bergson – and following this line of reasoning further – one can maintain that no other discipline has direct access to this *duration* (*durée*) of human social evolution.[667]

The organicistic conception of 'stage'-mediated, path-dependent evolution, already encountered in the previous section, is directly reflected in one of the key tenets of *« Paléohistoire »*: the 'branching/dendritic paradigm' (*« paradigme buissonnant »*) (Valentin 2015: 183, 2011: 108).[668] This 'paradigm' stresses the contingent nature of societal trajectories, that is, that there exists a *plurality* of pathways even though social evolution is directed and largely irreversible. Each societal whole – although coming into view only in its duration – is defined by a specific exchange between culture and nature – or between 'man and matter' (*sensu* Mauss 2006 [1929/1930]; Leroi-Gourhan 1936a) – and hence by both its natural habitat and a set of traditions, technical norms, and values proper to it. A societal whole, accordingly, is characterised by its particular geographic place and its inner sociotech-

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thinkers such as Fernand Braudel, Henri Bergson, Gaston Bachelard, Marc Bloch, Carlo Ginzburg, François Furet, and Claude Lévi-Straus – to name but a few.

663 Langlais (2010: 271), for example, explicitly speaks of 'dialectic' relationships in order to explain social evolution in the Magdalenian.

664 Continuity and change are understood as the result of 'thesis-antithesis' configurations that may or may not bring forth a new 'synthesis.' The key point is that this 'synthesis' can never be guaranteed – a circumstance that gives voice to organicism's 'progressive' structural categories of 'conflict' and 'contradiction' (*sensu* Pepper 1942: 292-297).

665 The ambition of *« Paléohistoire »*, following Boris Valentin (2006, 2008a: 30, 2015: 180), is to give meaning to the succession of these phases, i.e., to imbue them with a 'palaeo-historical' *sense* (*« sens »*) (cf. Bon 2009: 25). Valentin's (2011: 121, 2015: 182) vision of *« Hyperhistoire »* ('hyper-history') and the associated insistence to move beyond 'chronometric' practice and the tendency to write mere "compilatory histories" (Valentin 2008a: 30) reflect this emerging attitude. Establishing a 'palaeo-historical' *sense* ultimately means to identify the 'progressive' categories of a sociohistorical whole and to analyse their contribution to the fulfilment of the whole's 'ideal' categories. *« Paléohistoire »* is 'genetic' in this sense – it consists of 'putting chronology into perspective' (*ibid.*: 28-34). This 'palaeo-historical' ambition draws explicitly on the work of François Furet (1975), who sought to overcome purely descriptive history-making and to bring what he called 'problem-history' to the forefront of inquiry (cf. Audouze and Valentin 2010: 35). *« Paléohistoire » sensu stricto* – in the wake of Valentin and others – therefore seeks continuity with French *structural history*. A key point is that this orientation reinforces the general 'interpretive' stance (in the sense of *Verstehen*) of French Palaeolithic archaeology.

666 This 'structural' preoccupation of *« Paléohistoire »* is already anticipated by Valentin (2015: 177f.) who speaks of *« Ethnographie structurale »* ('structural ethnography') in order to characterise the 'palaeo-historical' endeavour of tying up divergent temporalities of observation.

667 According to Bergson (1907, 1922), only *duration* enables a realistic, 'dynamic' account of existence and may thus counterbalance the overly 'static' and 'presentist' representations of the world to which human minds are drawn. When French prehistorians speak of their ambition to develop a 'dynamic' account of human social evolution, they typically draw on this general conception (a conception not only held by Bergson of course).

668 The *« paradigme buissonnant »* may be interpreted as a subtle re-surfacing of the Bordian 'phyla model' of lithic industrial evolution (Bordes 1961c, 1963, 1968). However, Bordes framed his 'dendritic' conception of lithic evolution in broadly phylogenetic terms, while Valentin's concept is defined in strictly historical and, if you will, broadly 'epi-phylogenetic' terms (cf. Valentin 2011: 108). In addition, the former is based on lithic techno-typology whereas the latter is firmly anchored in the 'technological approach.' Nonetheless, the usage of a similar terminology may signal that the 'diachronic turn' tied to *« Paléohistoire »* entails a forceful return to the 'big narratives' of the founding-figures of French prehistory including the Bordes.

nical constitution. These two poles are thought to 'resonate' with one another, unleashing the historical dynamics that inaugurate distinct evolutionary trajectories.[669]

This conception relocates 'particularism' from spatiotemporal contexts to entire historical pathways (e.g., Valentin 2011: 122; Marchand 2014: 427).[670] But the idea is *not* that these pathways are strongly predetermined. The determinative significance of 'phases' and 'stages' can only be *diagnosed* (and thus 'retrodicted'), but can never exactly be predicted.[671] The reason is that the whole exercises determinative primacy, not its parts, which means that the parts alone cannot tell us which role they play in the whole. 'Organic' evolution is viewed as a long-term management of contingency that in retrospect *makes sense*. This directly reflects how organicism interprets 'integrativity' – as the *universality of developmental patterns realised in a multitude of different ways*.[672] Therefore, the developmental patterns themselves may be anticipated, but not what creates them. This is precisely what is implicated by Valentin's notion of the *« paradigme buissonnant »*. It corresponds to a concept of evolutionary determination that is fundamentally opposed to 'mechanistic' readings where the cause-and-effect chain generally proceeds in *upward* direction ('bottom-up').[673]

Valentin's *« paradigme buissonnant »* ('branching/'dendritic paradigm') ultimately entails the conception that different societies, through their unequal development, travel through time in a different way.[674] It is only through mapping their particular temporal journeys, then, that one can come to an understanding of the various isolated facts which they leave behind. Each sociohistorical trajectory can be said to describe a specific temporal journey, unifying the disparate factual remains attached to it (i.e., site-locus, site organisation, settlement pattern, social networks). This temporal journey of a societal formation represents a 'concealed' organic process, whose various 'fragments of experience' can be observed and studied archaeologically. The integration of these facts, however, is only possible if one acknowledges their place in the temporal process. The palaeo-archaeological facts are interpreted as 'appearances' and the object-specific temporal trajectories as the *longue durée* 'realities' that save and explain them. This, in turn, requires the recognition of the respective 'nexuses' and their meeting points – a mode of reasoning that, *grosso modo*, confirms the organicistic underpinnings of *« Paléohistoire »*.

Reconstructing societal evolution in this manner relies on a general understanding of societies as temporal organisms, whose 'modes of existence' author particular 'modes of becoming' (historical ontogenies).[675] Since the latter are object-specific, each societal organism largely *self-determines* its long-term history – societies, as temporally extended 'structures,' represent *self-regulatory* entities.[676] This aspect is crucial because the 'tempo' and 'mode' of social evolution consequently depend on the

[669] This 'resonating' interface between nature and culture typically leads to the acceptance of 'feedback loops' and other 'counteractive' effects. An example is Marchand's (2014: 111) insistence on the role of *« rétroaction »* ('retroaction') in past human-environment interactions.

[670] 'Organicism' re-interprets the 'contextualistic' categories of 'novelty' and 'change' in terms of the temporally extended 'organic' wholes it reconstructs. This gives way to the recognition of the inherent *alterity* (or 'otherness') of individual sociotechnical trajectories (see next section in this part of the chapter). The regulative role of 'otherness' – in contrast to 'sameness' – is for example reflected in Marchand's (2014: 427) notion of the *« insondable altérité »* ('immersurable alterity') of past sociohistorical configurations. Such conceptions embody an implicit critique of 'Neo-Darwinian' research agendas which often stress 'progress,' 'modernity,' 'inevitability,' and the 'unity of history' (cf. e.g., Valentin 2011: 5, 21).

[671] 'Organicism' is generally *non-prescriptive*. As Pepper (1942: 296) notes: "[...] [organicists] do not prescribe the path of knowledge. Nor do they believe they are prescribing anything at all; they are merely pointing out what actually goes on among the facts of the world. Their argument is through and through illustrative."

[672] The credo is that time remains poorly understood as a single temporal arrow but rather consists of multiple 'focused' temporal arrows. The claim that time itself is *heterogeneous*, suspiciously Bergsonian in orientation, is then no conceptual stretch anymore. The idea of temporal heterogeneity is of course difficult to reconcile with 'mechanistic' theories of time, which tend to 'objectify' the latter – time is typically viewed as a structure-giving feature of the world, rather than being 'structured' itself.

[673] 'Organicistic' approaches such as *« Paléohistoire »* extend the 'contextualistic' notion of *historicity* – i.e., the necessary 'situatedness' of a 'historical act' – to the *longue durée* and re-cast it as a feature of extended sociohistorical trajectories. In this way, historicity comes into view as a consequence of building up a temporally extended whole by striding through temporally enchained contexts of action (what in 'contextualism' would be seen as the 'spread' of a context). In 'organicism,' historicity in therefore means that different 'situated' contexts grow out of each other and thereby form a whole that is both 'organic' and 'situated.' The guiding metaphor is life-theoretical – society is understood as a 'living organicism' that is born, growths, and ultimately dies. All of this reflects the 'organicistic' root-metaphor of the 'living being' (see Chapter 2; cf. Pepper 1942: 280).

[674] Cf. Testart (2012: Fig. 29).

[675] Note that notions such as 'mode of being' or 'mode of existence' are deeply buried in French intellectual history and have recently re-surfaced, for example in the work of Bruno Latour (1991 [1992], 1994, 2011, 2012 [2013]) and Isabelle Stengers (1988, 2003 [1997]). Similar ideas, although applied to aesthetics and technology, have already been developed by Étienne Souriau (2009 [1943]) and Gilbert Simondon (1958) at the turn to the second half of the last century. Especially the latter constitutes an important historical source of terms/concepts – e.g., *« réalité technique »* ('technical reality') – that freely circulate in the French lithic scene (cf. Leroi-Gourhan 1993 [1964/1965]; Boëda 1993, 1997).

[676] See Chapter 2: esp. **Box 9** for the signification for self-regulatory principles of explanation in 'organicism.'

society in question, on its existence in the *durée*. All societies emerge, rise, consolidate themselves, experience crises, and are ultimately wiped from reality, but they are regarded to set the note and to be *their own rhythm-givers*. The same holds true for their 'significant' parts, for the *genesis* of societies is viewed to be complicated by 'conflict' and counteractive forces – societal becoming is nothing less than an ongoing attempt to overcome the two (Pepper 1942: 290). For similar reasons, both wholes and parts are considered *autonomous* and 'active' in their own right;[677] it is only when the 'ideal' of society (and thus the overall integration of parts) is reached that there can be no difference between the whole and its parts anymore. All of this leads to the *pluralisation of time*, to the delineation of distinct *temporalities* tied to different phenomena and/or domains of reality – a signature disposition of organicistic thought:

> "[...] But there is a double problem here: firstly, neither the time scale nor the nature of time are the same depending on whether we observe climatic changes (cyclical), plant evolution (linear and very slow), the evolution of faunas (also linear but much faster) ... There is not a time of prehistory, which is relevant for all phenomena studied, let alone for human phenomena. Secondly, the causes of change are also not the same: neither the variations of the Earth's orbit, which are at the origin of the climatic cycles, nor the laws of sexual reproduction, at the origin of the transformations of biological species, can claim to explain the "evolution of bifaces" or the transition from an economy of predation to an economy of production. There is therefore an autonomous area of inquiry, that of the "cultural time," of its nature and its rhythms." (Perlès 1998: 17f.; my translation; original emphasis [for the original French quote, see **Appendix Q.18**])

Perlès' symptomatic statement suggests that different aspects of reality (what organicists would identify as 'significant' wholes) are powered by different 'organic' processes and therefore engender their own temporalities (cf. e.g., Audouze and Valentin 2010: 34f.; Rocca 2013: 28 for a similar argument); they may even obey to *different rules of development* altogether. This idea is already outlined in the *œuvre* of the 'Early' Leroi-Gourhan, culminating in the latter's account of technology-language coevolution in *Le geste et al parole* (1993 [1964/1965]). Leroi-Gourhan, too, proclaimed that human technicity has its own 'mode of existence' and is subjected to domain-specific laws and regularities of development (*ibid.*: 147).[678] This domain-specific temporal behaviour was captured by his notion of the *« tendance »* ('technical tendency'), which he opposed to the *« faits techniques »* ('technical facts') (Leroi-Gourhan 1943/1954; cf. Audouze 2002: 283; Stiegler 2009 [1994]: 69). The relationship between the two is that between a 'concealed' but directed organic process and its isolated 'fragments of experience.' This reiterates the organicistic conception that there is always unity to be found in diversity – i.e., that the unity of technology is made possible by the diversity of technical facts.[679] We will return to this point in the next section.

What is perhaps most important in the current problem context is that Leroi-Gourhan (1964/1965), based on these considerations, developed a general account of evolution, in which evolution was diagnosed to be governed by a plurality of distinct 'cycles' and 'epicycles' of becoming. This argument on the 'cyclicity' of time has been very influential and, at least tacitly, underpins the periodisation of the Western European Upper Palaeolithic in terms of its temporal sequence of great 'civilisations' (*civilisations*)[680] – i.e., 'Lower' vs. 'Upper Perigordian,' or the succession of 'Aurignacian,' 'Gravettian,' Solutrean,' and 'Magdalenian' (Leroi-Gourhan et al. 1976; cf. Bon 2009; Debout et al. 2012) – including their internal sub-division, typically into 'archaic'/'initial'/'proto-,' 'developed,' and 'final'/'epi-' phases respectively (e.g., Valentin and Pigeot 2000; Bon 2006, 2010; Langlais 2010, Klaric 2013). All of these different 'civilisatory trajectories' are formed by the relationships between the tem-

[677] The notions of 'object-specific' and 'object-inherent' *activity* [*Eigenaktivität*] can be considered a typical result of refining the structural categories of 'organicism.'

[678] Cf. "[...] Technoeconomic determinism is a reality whose effect upon the life of societies is deep enough to bring into existence *structural laws to govern the material world as firmly as moral laws govern the behavior of individuals toward themselves and their follow beings*. We may recognize that thought has as much reality as the material world, we may even assert that the latter owes its being to the effects of the former, but the fact remains that thought is reflected in organized matter. It is the organization of matter that, in various ways, directly shapes all aspects of human life." (Leroi-Gourhan 1993 [1964/1965]: 147, emphasis added)

[679] The difficulty to think of the world in its 'wholeness' [*Ganzheit*] while coevally acknowledging its diversity and 'multiplicity' [*Vielheit*] is a classic problem of 'organicistic' thought and can be traced back to the philosophies of Leipniz and Spinoza.

[680] 'Civilisation' is a key notion since it underscores the 'pro-active' dimensions of society-making. Society is seen as the product of a 'civilising process' (*sensu* Elias [1939] 1969) whose proper temporality is the *longue durée*. The concept of 'civilisation' will be discussed in detail below.

poral pathways of their 'significant' parts, by how these parts interact, possibly interfere or overlap with one another, or even fuse. In *Le geste et la parole*, Leroi-Gourhan explicitly introduces the idea that 'technological time,' at a certain point in human evolution, becomes critically detached from 'cultural time' which is largely defined by the rhythms of art-making (cf. Bidet 2007). The 'epicycles' that govern the latter are argued to be distinct from the 'epicycles' that propel the evolution of lithic technology.

The general conception of 'offset' trajectories of change, corresponding to different domains of reality or kinds of archaeological objects, has recently been re-invigorated by various French scholars. Naudinot and colleagues (2017b), for example, have called attention to the fact that at the far edges of North-Western Europe processes of 'Azilisation' – i.e., the gradual and persistent transition from the Final Madgalenian and Hamburgian to the latest glacial and early post-glacial human societies (Azilian/*Federmesser*) – have produced a marked 'time lag' between technical and symbolic developments. They present evidence suggesting that technical developments were much faster and have set the tone, whereas the evolution of 'artistic' expressions clearly lagged behind; the authors highlight that this *decoupling* of distinct material trajectories is of critical importance if we wish to understand the coalescence of what is called the 'Azilian' phenomenon (*idem*; cf. Valentin 2008a). In an earlier paper, it is even alluded that the lithic developments leading to the Azilian likely have to be explained in terms of general 'technical tendencies,' rather than being the product of regional peculiarities (including eco-climatic factors) (cf. Naudinot et al. 2017a). Different material trajectories may thus signify different aspects of past realities; it is their 'individuation' and temporal differentiation which is important to recognise and examine – otherwise, it remains impossible to understand whether similar 'appearances' have different significations in different evolutionary contexts.[681]

A second example is the work of Teyssandier (2003, 2007) and Bon (2002, 2010, 2015) on the evolution of Aurignacian societies in Western and Central-East Europe. These authors have proposed that the emergence of the 'Aurignacian package' cannot properly described by a 'revolutionary' scenario, but rather conforms to a gradual and step-wise process, in the course of which several distinct material trajectories of change meet at different points in time (Teyssandier 2007; Bon 2010).[682] The key concept is *arrhythmicity*. Historical processes of varying scales and temporalities are regarded to operate asynchronously (Bon 2015: 11; cf. Discamps et al. 2014), cumulating developmental potential to perhaps merge into something new over time (cf. Audouze and Valentin 2010: 41-43).[683] This account renders the Aurignacian the product of 'organic' social evolution, its organic structure is explained by invoking a number of developmental 'stages,' reflecting the temporal coalescence of the 'effective' material parts (i.e., lithic technology, organic technology, hunting strategies, settlement organisation, ornamentation practice, art-making, etc.) (e.g., Teyssandier et al. 2010). The 'coalescence' of these parts is thought to be a consequence of each part's own 'logic of change' – it consists in the *coordination* of the 'nexuses of change' which are proper to each part of the larger whole.

This coordination of 'nexuses' is seen to entail 'struggle' and the fragments thus often persist in basic 'conflict' to one another – the integration of all parts, therefore, can only succeed in *duration* (i.e., as a function of the full sequence of Aurignacian development). This is why social evolution has to be heterogeneous, partly asynchronic, and multi-temporal. The impossibility of integration at one given point in time turns out to be the *precondition* for a successful integration at a later point in time.[684]

This organicistic logic, namely that understanding 'conflict' is a necessary prerequisite for comprehending evolutionary 'integration,' issues a research mandate largely opposed to correlational epistemologies. Boris Valentin (2008a: 41) is quite explicit about this orientation. After reviewing the general epistemological situation of Palaeolithic archaeology, he advises its practitioners to pay primary attention not to similarities and vivid correlations, but to developmental discrepancies, inconsisten-

[681] The differentiation of time and the study of distinct temporal 'structures' is therefore an indispensable 'organicistic' instrument for assessing the 'equifinality' of 'appearances' and parts of larger temporal wholes.
[682] The evolution of the Aurignacian in Western Europe is explicitly pictured as a 'determined' and 'irreversible' process (Bon 2015: 11, 13) – two cornerstones of an 'organicistic' interpretation of social evolution.
[683] 'Arrhythmic' evolutionary scenarios have also been proposed by Langlais (2010: 283) in order to understand the development of lithic technology during the Magdalenian at the foothills of the Pyrenees.
[684] Cf. "[The] nexuses reach out from fragments like tentacles and encounter contradictions for the fragments. The progress of integration is not smooth and continuous, but is a buffeting of fragment against fragment, producing conflict and contradiction which is only resolved in an integration. The nexus of a fragment leads it inevitably into conflict and contradiction with other fragments." (Pepper 1942: 292)

cies, and contradictions – to what he denominates *« décalages »* ('mismatches'). These are often overlooked because researchers are trained to search for 'matches,' yet their interpretive significance cannot be overrated.[685] This view comes in various degrees of radicality but it is usually tied to an explicit critique of the 'heteronomic' assessment of temporally unified contexts in terms of causalities and/or first-movers (*idem*; Marchand 2014: 111, 151).[686]

A third example is provided by Perlès' recent essay on the nature of archaeological time, entitled *Tempi of Change: When Soloists don't play Together. Arrhythmia in 'Continuous' Change* (2013). This paper examines the ornamental and lithic evidence from Franchthi cave (Greece) in order to assess how the two domains of material culture change throughout the archaeological sequence. Perlès concludes that the two develop in fundamentally different ways and ultimately exhibit divergent 'rhythms' of change; she even contends that their respective 'modes of change,' although clearly authoring separate 'focused' arrows of time, can hardly be 'objectified:'

> "If several tempi of change can be identified in single technical production[s] such as stone tools and weapons, others again if one introduces symbolic productions such as ornaments, how many different rhythms of change should we expect when whole societies are considered? In particular, why would societal transformations necessary follow a ternary temporality, just as we have – according to Occidental thought – a past, present, and future, and just as we tend – still in Occidental thought – to divide time into Early, Middle, and Late?" (Perlès 2013: 297)

The second part of the title – *When Soloists don't play Together* – reassures us of the general autonomy of different material agencies but also introduces an illuminating metaphor – that of 'music' or 'music-making.' Why is this metaphor illuminating? First, because it is invoked to convey how distinct object-categories handle time and, secondly, because music is a prototypical example of an 'organic' phenomenon.

'Pure' music is organic in a fundamental sense: it requires *composition*, *creativity*, and *coordination*, especially when multiple voices and/or instruments take part in its making; pure music is also processually 'organic': its quality is bound to its temporal unfolding, most participating voices and/or instruments unequally contribute to this quality, and it is typically divided in determining 'scores,' whose structure and nature cannot be changed without changing the quality of the musical whole. Furthermore, a piece of music has certain 'synthetic' qualities such as 'melody,' 'pitch,' 'tonality,' and 'rhythm' (cf. Scruton 1997: 1-79) which follow from the rules of the piece (Arewa 2014), but these qualities generally differ from the individual qualities of the instruments and voices that have engendered them. Music is therefore both 'synthetic' – it is 'more than the sum of its parts'[687] – and inherently *temporal* – it can only be appreciated in its duration.

The music metaphor intuitively calls attention to concepts of 'orchestration' and 'multivocality' – to the dialectics between 'coordination,' 'tension,' and 'suspense' – which only in combination and over time give rise to a complex musical whole.[688] Music is organised sound brought into existence by combining and connecting tones in a distinct order (e.g., Levinson 1980: 6);[689] 'melody' is a result of

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[685] The key point, although not fully developed, may even be that conflicting and contradicting evidence must be regarded the *status quo* rather than the exception; to acknowledge this pristine fact, however, would of course imply a fundamental shift in the focus of inquiry. Away from the search for 'matches' towards the careful documentation of cases of unsuccessful correlation.

[686] 'Heteronomy,' in contrast to autonomy, is the conception that phenomena are 'other-directed,' or 'shaped' and 'controlled' by forces/agents external to these phenomena; 'heteronomy' denotes the belief that a phenomenon's behaviour must be governed by something independent of the phenomenon. This principles implies the repudiation of 'self-determination' and 'self-directed' behaviour as features of explanation – both popular categories of 'organicism.'

[687] Surprisingly, the 'synthetic' quality of music is rarely addressed by theories of music. For an exception to this tendency, see Scruton (1997: 19-79, 2007) and Davies (2001: 47-71).

[688] Take the example of an orchestra, in which different instruments and musicians contribute to the final musical product. This 'musical whole' is not merely the sum of its parts but is literally *created* through the 'orchestration' of all of its parts, a process that already presupposes the whole. Moreover, each configuration of instrument and musician is different and each group of instruments contributes something else; this 'something else,' however, must accord with the musical potential of each instrument, for example with how the latter is able to build up, change, and maintain 'melody' and 'rhythm' and how this, in turn, chimes/resonates with the rest of the assemblage of instrument-musician hybrids. The resulting organic interaction therefore depends on the 'musical reality' of *each* of the participating hybrids. Needless to say, in reality the situation is typically even more complicated: there are, for instance, different 'roles' in an orchestra (e.g., groups of players, soloists, and a conductor). Clearly, this *inherent complexity* is another facet lending itself to 'organicistic' reconstructions. In order to make his point, the 'organicist' would ask: how can we unify the heterogeneities among the parts in an extended process of orchestral music-making?

[689] This definition of music focalises 'structural' aspects – a full-fledged definition of music, which is not the main concern here, would also need to take into account the 'intentional,' 'historical,' and 'cultural' dimensions of the same (e.g., Davies 2012).

the precise succession of tones and intercalated pauses within a fixed timeframe, from the 'chord' of tones of different pitch-levels (scales) 'polyphony' arises, and the relationships among the tones themselves define the 'harmonics' of a musical piece. To speak in organicistic terms, the 'tones' represent the 'fragments' which in isolation make little sense but through their *order* and *location* drive forth the temporally extended musical whole. Drawing on the music metaphor, 'organic' evolution can be analysed in terms of 'rhythm,' 'multivocality,' 'harmonics,' and global 'melody.' Perlès' paper (2013) on the long-term evolution of material culture at Franchthi addresses at least the first three aspects while paying special attention to 'multi-vocal' developments – as indicated by the title-phrase.

To conceive of technical evolution as a 'music-like' phenomenon[690] implies to regard it as an internally structured process operating according to an 'internal logic.' This construal establishes a conceptual triad to shed light on long-term developments in the sociotechnical domain – it makes room for analysing organic evolution as the interplay between the 'inherent rhythm' [*Eigenrhythmik*], the 'logic of development' [*Entwicklungslogik*], and the 'inherent dynamic' [*Eigendynamik*] of a given historical trajectory (including its sub-trajectories). The nature of a temporal phenomenon becomes a question of its *genesis*, that is, how its parts 'individualise' the whole over time.[691] The identification of technical evolution as 'music-like' generally implies to consider the technical sphere as temporally 'alive.' Musical metaphors simply draw attention to the fact that sociotechnical developments may be better understood if the wholes that frame these developments are recognised as distinct quasi 'living beings:'

> "Slow or fast, calm or bumped, the possibly changing rhythm of this prehistoric history remains to be measured much more finely, and the circumstances of its eventual upheavals deserve closer explications. This is what the palaeohistorical ambition aims for when it is firmly supported by palethnology." (Valentin 2008a: 28f.; also cited in Bon 2009: 185; my translation [the original French quote is provided in **Appendix Q.19**]).

Apart from Perlès (2013), musical reasoning is clearly reflected in the recent work of Langlais et al. (2012, 2016). These authors mobilise musicological terminology in order to analyse the long-term development of lithic technology in the southwestern fringes of France; they invoke two concepts – 'metronome' and 'syncopation' – to help interpreting the dynamics of sociotechnical evolution in the Magdalenian. The concept of the 'metronome' serves to characterise the 'role' of lithic technology in the evolution of the Magdalenian as a whole. It is argued that particular elements of lithic tool-kits can be used to measure the 'tempo' and 'mode' of Magdalenian social evolution (Langlais et al. 2016). The term 'metronome' thereby indicates that long-term developments in the lithic domain – especially those pertaining to systems of lithic weaponry – are structured into object-specific time intervals, intercalated in such a way that they generate a highly diagnostic rhythmicity.[692] The evolution of lithic technology is thereby thought to 'set the tone' because its directed 'mutation' creates new 'opportunity niches' (*sensu* Arthur 2009: 174-176) and the requirement to adapt other domains of society to them[693] – particular aspects of lithic technology – as *pars pro toto* – are considered to catalyse the whole of

Music, to this effect, is 'more-than-just-structural' – a point that Levinson (1980: 6) has insisted on and that is generally consistent with a 'synthetic' view of music.

[690] It is possible that the music-like character of long-term technical developments represents a special case of 'cyclic' evolution (cf. Perlès 1998: 18). Taken some of the evidence presented below, one may legitimately ask whether *musicality* can be considered to capture part of the 'organic' domain-specificity of technical evolution.

[691] The 'individualisation' of a whole can be understood as its ontogeny, a process during which the whole develops its key features and qualities and comes into view as something *different*. The 'becoming' of a whole, in other words, emerges as a key condition of differentiating wholes in 'organicism.' Differences between wholes are the result of divergent developmental trajectories. Synchronic comparison, therefore, remains necessarily partial and inconclusive. Analysing and comparing the discrete 'shapes' and 'traits' of lithic artefacts would be an instance of such practice; it is therefore unsurprising that 'organicists' typically see little merit in such an undertaking.

[692] See e.g., Valentin et al. (2004) for a similar reconstruction.

[693] The guiding concept is 'internal adaptation,' taking up the core intuition of society as a system. The general rationale can be illustrated by the example of the relationship between lithic domains and subsistence/hunting domains. The idea is simple: if lithic technology changes, it creates new opportunities to hunt animals – perhaps to hunt different animals, perhaps to hunt the same animals in novel ways. Lithic changes may also render long-hold practices untenable because they can no longer be 'supported' by the available lithic technologies. But this conflict must be discovered and the tension experienced. It nonetheless implies that some changes in the lithic domain will cause a re-organisation of the hunting domain – to ensure compatibility and/or to maximise synergies between the two. Synergetic co-evolution can for example be proposed to explain somewhat parallel developments in the domains of lithic weaponry and organic implements (e.g., Langlais et al. 2012: 146). However, in order to know what is adapting to what and why, one generally needs to know the timing, tempo, and mode of changes in each domain. The evolutionary scenario is 'organicistic' since it emphasises transformational necessity (evolutionary 'directedness'), contradiction and conflict among domains, and the gradual and sometimes delayed integration of these domains.

societal evolution. The latter is consequently often 'irregular,' 'unsteady,' and not fully predictable, even though sociotechnical evolution is generally pictured as a determinate process (cf. Langlais 2007, 2010).

The concept of 'syncopation' is more intricate. A 'syncope' is a musical figure conveying a rhythmic design which breaks with the prevailing schemes of accentuation, deliberately creating 'tension' and the potential for novelty. Processes of 'syncopation' can hence be described as tacit but irreversible transitions within a larger composition. Langlais employs the term to designate ongoing or sudden shifts in the 'rhythm' of lithic development as they unfold in time; 'syncopation' is effectively used to identify and describe 'stage'-transitions in the larger evolutionary scheme of Magdalenian societies of southwestern France (Langlais et al. 2012: 146). The notion of 'syncopation' thus encapsulates a classic organicistic pattern of reasoning: it seeks to coevally capture the *gradual* and *saltatory* character of evolutionary transitions (cf. Perlès 1998: 21). For organicists this attempt is not paradoxical – to the contrary, it is regarded to do justice to the fact that each transition must necessarily be built-up but also brings qualitative novelty. In this way, 'organic' evolution brings forth stage-like but interconnected temporal structures. Each novel stage of lithic development issues a new musical 'score,' yet all 'scores' remain part of the same evolutionary composition. This attempt to think continuity and change together – as two aspects of the same process – is typical for organicism, in which 'unification' is generally reached by keeping the delicate balance between the 'progressive' and the 'ideal.'[694]

The conceptualisation of continuity and change as complementary characteristics of temporal wholes is common-place in the French specialist literature. It is, for example, reflected in the popular phrase 'unity and diversity' (*unité et diversité*), often found in titles and headings of lithic studies (e.g., Slimak 1998/1999; Bon 2000; Klaric 2003; Marchand and Tresset 2005; Teyssandier 2006; Bon et al. 2006; Forestier et al. 2010; Bachellerie 2011; Bereiziat 2011; Tomasso et al. 2014). The slogan has almost assumed a signature status;[695] it expresses an insight that only organicistic thought has come to embrace in its radicality: the fact that 'conflict' presupposes higher-level unity and the possibility of 'unity' presupposes disintegration and scatteredness. Organicism recognises the basic contradictoriness of 'unity' and 'diversity,' but maintains that their contradictory nature is a result of a 'static' perception of world affairs (e.g., Copleston 1994 [1974]: 181, 186). If we acknowledge time as a structure-giving force, conflicting elements of reality can be integrated as time goes by.

A 'dynamic' view of time, therefore, removes the difficulty and puts 'diversity' and 'unity' as co-constitutive features of reality into perspective. 'Unity' is granted by an interconnected and temporally coherent 'organic structure,' diversity is sustained by the incompatibility of most of its 'fragments of experience.' Organicistic analysis demonstrates that the latter are 'fragmented' merely in experience and in reality turn out to be singularities of their past and multiplicities[696] of their future.

With Bergson (1934: 185), we can say that each 'fragment' and each configuration of 'fragments' is a testimony of the entirety of its past, yet also entails the full potential of its future development.[697] This not only delivers a basic critique of 'presentism'[698] – that is, the attempt to derive general principles and/or laws of reality from an observation of the present – but also clarifies the signification of evolutionary mechanisms in organicism. An evolutionary mechanism is what explains the observed temporal organisation of fragments in light of the totality of their 'nexuses,' so that the past, present, and future of each fragment can come into view as *one*. When Valentin (2008a: 27, 33f., 2015) insists on the specification of historical mechanisms to explain long-term societal developments (cf. Audouze

[694] To regard continuity and change as two sides of the same coin may easily result in 'punctuated equilibrium' models of evolution; it cannot overemphasised, however, that the types of 'punctuated equilibria' that 'organicism' typically advocates tend to differ from the 'punctuated equilibrium' models of evolutionary biology. The main reason is that 'static-ness' – as emphasised for example in Eldredge and Gould's (1972) seminal paper on the issue – cannot be foregrounded in 'organicism' since the theory is basically motivated by a fundamental critique of 'static' perception.

[695] Complementary phrasings are 'unity in diversity' or 'diversity in unity.'

[696] The concept of 'multiplicity' calls attention to the fact that each 'fragment' embodies multiple developmental potentials. This potentiality is not fully determined, yet different 'fragments' yield different potentials. 'Potentiality' is a concept proper to 'organicism' and delineates the *space of possible developments*. It is notoriously difficult to analyse and typically requires a general understanding of the behaviour of certain types of 'fragments' and the constraining effects of specific fragment-context.

[697] Bergson's (1907, 1922, 1934: 185) contention is that reality is 'becoming' and that everything necessarily exists in duration (*durée*). The past always persists in the present and the present is always carried over into the future (cf. Copleston 1994 [1974]: 182, footnote 1).

[698] The critique on 'presentism' primarily targets research agenda's that trust in 'uniformitarianism' and base their interpretations on comparative frames of reference, constructed in the here and now – two strategies that are regularly combined in 'formism' and especially in 'mechanism.'

and Valentin 2010), he thus simply means to lay bare an initially 'concealed' organic process which coherently accounts for the global organisation of fragments. This call to mechanisms should therefore not be confused with the 'mechanistic' perseverance on causally-specific principles of explanation.[699]

This organicistic conception of evolutionary determination is explicitly laid out in Valentin's *Jalons pour une paléohistoire des derniers chasseurs* (2008a), the founding document of *« Paléohistoire »*. According to Valentin (*ibid.*: 13f.), if one wishes to comprehend a 'palaeo-historical' trajectory and why the associated social systems change in the way they do, one has to study *« préfigurations »* ('pre-configurations'/'anticipatory capacities'). The idea here is that each system state – each developmental 'stage' – of a sociohistorical trajectory is *preconfigured* through its preceding stage and *configures* its succeeding stage.[700] This can be understood as a process of *systemic inheritance* – each system state inherits something from its past and passes on something in order to have a say on its future. This conception counters *tabula rasa* views on human history and maintains that each system state is defined by a particular set of material, social, and cognitive resources that are a function of its temporal position in the 'palaeo-historical chain' (*sensu* Valentin 2011: 80).

Each system state, picking up a conception already encountered in the last part of this chapter, enters reality 'pre-furnished.' As we have seen, the mode of 'furnishing' proper to long-term trajectories is *self-furnishing*. The concept specifies what evolutionary *self-determination* amounts to in organicism. Since each system state is already pre-configured, its future development is constrained by the nature of the configuration. The study of *« préfigurations »* is thus nothing but the study of how an evolving social system pre-furnishes itself through time – with specific objects, practices, norms, concepts, and needs.[701] In the words of Audouze and Valentin (2010: 35), each evolving system embodies the "concretisation of a system of values," reflected in a repertoire of *« manières de faire »* ('ways of doing things') and *« manières de voir »* ('ways of seeing things').[702] The becoming of a 'palaeo-historical' trajectory, in other words, corresponds to the crystallisation of societal resources specific to this trajectory. This is why different societal pathways inescapably inaugurate an *« insondable altérité »* ('immersurable alterity') (Marchand 2014: 427) – an alterity that can only be illuminated if the trajectories are studied from the *inside*. This basic alterity is another reason why 'universalist' and/or 'externalist' analysis is met with great scepticism:

> "[...] During the Late Glacial period between 18,000 and 14,000 calBP, the archeological record of several different aspects of hunter-gatherer activities attest to an internal evolution between the Middle and Upper phases of the Magdalenian in the South-west of France. Throughout these four millennia, rapid changes are perceptible in hunting weaponry, which may be tied to the syncopation of techno-economic choices outlined above. Dynamic technical solutions, evident in these various forms of hunting weaponry, highlight the significant technological creativity and innovation inherent in these objects vital to hunter-gather groups. Understanding of the forces driving these changing trajectories still remains limited and can only be further advanced by integrating non-environmental factors such as personal ornamentation, mobiliary and parietal art, or funerary practices, all of which were undoubtedly instrumental to these hunter-gatherer groups [...]." (Langlais et al. 2012: 146)

How a social system reacts to changing external conditions is then not only a matter of the external conditions themselves, but becomes a question of how the system can *cope* with these conditions. Whether and how particular external conditions can be dealt with depends on the resources and types of pre-configurations the system has inherited. Together, they specify the capacity of the system to modulate and, if necessary, re-organise its internal relations (cf. Marchand 2014: 13, 2017: 9). From this perspective, external conditions *as such* become secondary since their effects greatly depend on the available societal furniture – on what Bon (2009: 243) calls the 'bark of the social tree'; the latter is 'primary' because it constitutes a historical *a priori*. Human-environment interactions consequently

[699] With Pepper, we can say that the insistence on certain determinative principles both in 'mechanism' and 'organicism' is the result of their shared 'integrative' commitment. The fact that this affinity turns out to be deceptive is the consequence of divergent concepts of 'truth' and 'assertibility' adopted by both theories.
[700] The distinction between *preconfiguring* and *configured* is the conceptual equivalence of the distinction between *determining* and *predetermined* flakes discussed in the previous section – the two differ merely with respect to scale of the 'organic' wholes they seek to illuminate.
[701] This 'self-furnishment' is not necessarily 'linear' and 'cumulative,' specific practices and concepts may also be discarded, abandoned, and/or lost/forgotten. Logically, however, what can be forgotten must first be 'furnished.'
[702] For the distinction between *« manières de faire »* and *« manières de voir »*, see esp. Pelegrin (1995: 35f.). For the distinction between *« vouloir faire »* ('volition-to-do') and *« savoir-faire »* ('know-how'), see e.g. Ploux and Karlin (2014).

come into view as fundamentally *mediated* by larger sociohistorical trajectories. Not every society will react to the same external conditions in a similar fashion (Langlais 2010: 14) – a fact that is considered to generally undermine the ability of scholars to predict such reactions.[703] Adaptation, in this view, is a question of 'organic evolution' rather than 'cultural ecology' (e.g., Bon 2009: 265, 324).

This perspective entails a 'not-everything-goes' proposition of social change. The basic contention is that organic evolution *decreases* the ecological plasticity of societies – not every solution to an externally-defined problem is feasible or possible; the 'space of response,' in other words, is predefined by the nature of each evolutionary 'stage' and the entire evolutionary trajectory.[704] Although the respective concepts are hardly used by French practitioners, we may conclude that different social formations are considered to be differentially *resilient against* or *vulnerable to* different external transformations.[705] Additionally, different sociohistorical trajectories are expected to create their own, sometimes contingent *internal* problems (captured by the structural categories of 'conflict' and 'contradiction'). Again, evolving societies are not only pictured as problem-solvers, but equally emerge as *problem-generators* – many of the internal conflicts, inconsistencies, and difficulties an evolving society has to deal with and solve may be *self-generated*. In general, this view combines well with *technology-push* conceptions (*sensu* Freeman 1994)[706] of sociotechnical evolution. It redirects the explanatory focus to the *internalities* of past societies and their *longue durée* trajectories.

The emphasis of internally evolving 'palaeo-historical' trajectories has somewhat inversed the allocation of relative 'passiveness' and 'activeness;' societies, as a function of their 'organic' long-term development, are now regarded to represent the primary pole of activity – they are pictured as 'ever-moving,' self-organising entities imbued with creativity and a certain degree of 'animacy' – whereas environmental conditions, even though capable to enact certain obstacles, appear to be relatively passive contributors to societal developments (see esp. Bon 2009: 243 [introductory quote of this chapter; cf. **Appendix Q.5**]). This not only introduces yet another level of potential tension and 'conflict,' but shows that change and transformation are really viewed as the *modus operandi* of 'societal existence.' Societies change constantly of *their own accord* – transformation and alteration are regarded as an essential part of the nature of society. This again confirms the 'inherent activity' [*Eigenaktivität*] of sociotechnical realities, past or present. The corresponding mode of 'being alive' is often captured by the mobilisation of two complementary concepts: *technical invention* and *mutation*. Typically, these two concepts target the self-organisational capacities of varying 'technical milieus' (*milieus techniques*) (*sensu* Leroi-Gourhan 1943/1945; Gille 1978).

Already the 'Early' Leroi-Gourhan – in *Évolution et techniques* (1943/1945) – has insisted on the fact that each society harbours its proper 'technical milieu' equipped with the ability of deliberate expansion (cf. Audouze 2002: 285). 'Technical milieus' are defined by continuity with themselves and

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703 As discussed in Chapter 2, 'organicism' and 'mechanism' do not see eye to eye in the question of 'prediction.' Although both believe in relatively *strong determinacy*, they have come to reject each other's interpretation of the latter. Whereas 'mechanism' departs from assumptions of 'simplicity,' 'universality,' and 'uniformity,' 'organicism' commits itself to the analysis of determination in terms of 'complexity,' 'particularity' and 'heterogeneity.' Despite the occasional mobilisation of similar terms, both modes of cognition therefore conceptualise determination in vastly different ways – a fact that has important consequences for assessing the role of 'prediction' in lithic research.

704 The idea of a 'space of possible responses' can be clarified with the concept of *« bricolage »* ('bricolage') (Lévi-Strauss (1966 [1962]: 19). 'Bricolage' is a praxis-oriented concept which maintains that problem-solving in traditional societies can only poorly be understood by invoking the metaphor of the 'engineer.' According to this popular conception, problem-solving is a process of independent design – problem-solution designs are typically developed from scratch and seek to be optimally efficient. 'Bricolage' is an alternative strategy according to which problem-solving is most likely to be successful when it actively builds on the pre-existing cognitive and material resources of a society. These can then be recombined or further developed in such a way that the respective problem can be overcome.

705 Valentin (2008a: 19f.) explicitly draws attention to Lévi-Strauss' (1966 [1962]: 233f.) dichotomy between 'hot' and 'cold' societies. These two types of society differ in how they relate to their own historicity. 'Cold' societies try to conceal internal entropy and disorder in order to prevent change (often by means of equating historical time with mythical time). 'Hot' societies, by contrast, *cultivate* entropy and encourage change (which typically produces inequality). The distinction draws attention to the interlinkage between a society's 'deep structure' and its temporal development. We can say that the two society-types are differentially *resilient* against/*vulnerable* for changes in their external environment(s).

706 The rivalling position favours a 'demand-pull' conception of technological change, according to which technical changes primarily occur when external conditions necessitate such changes. Although both 'technology-push' and 'demand-pull' conceptions are somewhat 'mechanistic' in their basic logic (they are based on the 'push-and-pull' metaphor), the former is often reflected in practical applications under the banner of 'organicism' while the latter is typically favoured in 'mechanistic' approaches. If one speaks of 'technology-push' in the context of 'organicism,' one should of course not interpret *push* in overly 'mechanistic' terms; 'organicistic' *push* is always also a question of *creativity* and *ingenuity*. We will return to this crucial point below.

temporal coherence (Leroi-Gourhan 1973 [1945]: 344).[707] This notion of the 'technical milieu' – which often makes its appearance in disguise of terms such as *« sous-système technique »* ('technical sub-system') or *« realité technique »* ('technical reality') – remains highly influential in French lithic research (e.g., Pelegrin 2004), conveying its basic organicistic orientation. Based on Leroi-Gourhan's foundational writings, one can assert that the inherent 'animacy' of the 'technical milieu' is a function of its *inner drive* to achieve internal technical coherence. This, in turn, is another way of saying that technical integration is typically achieved through ensuring *compatibility* between various techniques and technological sub-domains (cf. Leroi-Gourhan 1973 [1945]: 39f.) – such compatibility can be technological, functional, and/or conceptual. Even though the 'Early' Leroi-Gourhan did not pay particular attention to aspects of social compatibility (Latour and Lemonnier 1994: 12-16), the main point is clear: societies cannot simply be forced by external circumstances to adopt particular technical solutions. We might say that a 'technical milieu' can only bring forth *what it can creatively envision and what it is ready for*.[708]

This conception of society as an irreducible evolutionary agent in its own right – as a 'protagonist' of social evolution – is already encapsulated in the idea of *« civilisation »* (*sensu* Leroi-Gourhan 1936; Leroi-Gourhan et al. 1976),[709] which for many, especially Upper Palaeolithic, researchers has become an important surrogate for the concept of 'culture' (e.g., Taborin 1993, 1994; Bon 2009, 2010: 117; cf. Wisniewski 2003: 9-11).[710] In point of fact, the term 'civilisation' embodies an organicistic critique of contextually or otherwise narrowly defined concepts of culture; it expresses the organicistic dissatisfaction with an overly 'static' construal of the latter. While the classic idea of 'culture' places strong emphasis on fixed regulations and carries a 'destinatory' connotation, *« civilisation »* emphasises the *processual* and *ever-developing* nature of culture (cf. Braudel 1949; Mauss 2006 [1929/1930]).[711]

The employment of 'civilisation' is thus also an attempt to sidestep 'emphatic' or 'idiographic' understandings of culture, which are both considered to neglect the most basic, that is, everyday aspects of culture-in-the-making.[712] *« Civilisation »*, by contrast, depicts social becoming as an *effort* and puts the *life-practical building blocks* of society (*praxis*, *techné*) centre stage. By freeing human actors from the shackles of their inevitable cultural destiny, the concept of 'civilisation' brings into focus that societies are capable of forging their own future.[713] 'Civilisations' unfold in the *longue durée* and accumulate means to pro-actively *relate* to their environments, rather than merely buffering themselves against them (Ramírez Galicia 2016: 12, footnote 11; cf. Bon 2015: 11f.). The process of civilisation is hence a 'creative' process in which aspects of the environment (*milieu naturel*) are gradually integrated into the cultural repertoire of a society (e.g., via specific ways of working natural materials, depict-

[707] Cf. "[...] An essential property of the milieu technique is its coherence and continuity, resulting from the permanent relationship of each element with the totality of other elements and from their perpetual interactions [...] Covariations [therefore] constantly occur [...]" (Audouze 2002: 285).
[708] This conception takes up Margaret Miller's famous statement "[...] a culture takes in what it is ready for [...]" (1997: 243), resulting from her research on cultural contact and exchange in the ancient Mediterranean.
[709] For a basic exposition of the concept of 'civilisation,' see esp. Elias (1969 [1939]) and Febvre (1988).
[710] *Contra* Straus (2002b: 1, 2005: 12).
[711] For helpful summaries of the idea of the 'civilising process,' see Hahn (2013: 26) and Law (2015: 278-280).
[712] 'Emphatic' and 'idiographic' conceptions of culture foreground 'art,' 'music,' and 'architecture' as key features of cultural architectonics (cf. Geyer 2010). They are often criticised to be 'eurocentric' since the core of their culture definition is based on what Europeans had long regarded as 'high culture' [*Hochkultur*]. Having said this, 'idiographic' understandings of culture often play a key role in general narratives of human evolution; Robert Kelly (2016), for example, has recently renewed this inclination. In his *The Fifth Beginning: What Six Million Years of Human History Can Tell Us about Our Future*, he distinguishes between the biological beginnings of humanity, which he associates with the dawn of stone technology (Chapter 3), and the cultural beginnings of humanity, which he identifies with the emergence of 'beads and stories' (Chapter 4). His account (*ibid.*: 36) attests to an 'idiographic' definition of culture which is inconsistent with the more inclusive conception of 'civilisation' instigated by basic *techniques* such as stone knapping.
[713] Tim Ingold (2016 (1983): 62) has paraphrased this history-making capacity of human society in the following way: "[h]istory [...] does not just happen, it is *made* through the intentional activity of conscious purposive subjects – by people [...] as historical agents, we act from within, as participants in our own creation: Collectively, 'man makes himself'. And although every individual agent has a transitory existence (as each of us, unconscious of the event, must make his entry and his exit), the history that we make, and that is made in us, transcends the bounds of our particular experience. It is [...] nothing other than the process of *social life*. Moreover, this process cannot apprehended as an accumulated series of discrete, empirical events. Our subjective life is not contained within events but is conducted through them: It is a continuous, creative movement, like a task that is never complete." (original emphasis)

ing animals, modifying natural spaces such as rocks and caves, etc.). Natural environments thereby come into view as 'last' movers, rather than 'first movers.'[714]

'Technical invention,' as an antonym to Neo-Darwinian 'adaptation,' simply takes up what Leroi-Gourhan described as 'the capacity of the technical milieu to expand deliberately' (see *supra*). A 'technical invention' is the adoption of a technical novelty that can be integrated into an inherited 'technical milieu' – it spotlights the self-generative potentiality of the latter (cf. de Beaune 2008, 2012). The emphasis of 'invention' as a function of the creative potential proper to each technical context resonates with the ambition of French lithic experts to 're-humanise' the Palaeolithic past, to bring more clearly into focus the anthropological dimensions of technicity (e.g., Tixier 1980; Perlès 1991a; Inizian et al. 1999 [1995]).[715] Radically put, the concept of 'technical invention' adds an element of *serendipity* to the character of human evolution – 'inventions' can be interpreted as the product of unanticipated events or processes proving future utility.[716] A 'technical invention' in this sense can only be retrodicted – that is, diagnosed in retrospect – but hardly be predicted in all of its details.[717] Conceptually, it balances the determinative nature of the past and the creative potential of the present in light of a coming future, which is highly characteristic of organicistic thought. Clearly, the overall configuration of reasoning reflects a conception of evolution that is more Bergsonian than Darwinian.

For Bergson (1907), 'invention' is a key term, reflecting the capacity of evolutionary processes to break out of their developmental necessities. In *Évolution créatrice*, he defends a conception of becoming explicitly opposed to Darwin's (1859) evolution by means of natural selection. He highlights the centrality of *creativity* both in natural and human evolution – a fact that is reflected in his conception of the *« élan vital »* and his definition of *Homo faber* (Copleston 1994 [1974]: 198; Hussain, forthcoming). For Bergson, most importantly, human technicity is therefore primarily defined by technical creativity, opening up an almost inexhaustible space of combinatory possibilities[718] - it follows that 'the universe is not made, but is being made continually' (Bergson 1907: 255). The basic argument, later further elaborated by many other thinkers, is that technical objects (artefacts), in contrast to natural objects, are always *created* and *invented*, that is, they always contain a human gesture (Schick 2018).[719]

Bergson's critique on Darwin is reiterated by Bernard Stiegler (1994), one of the most influential voices of French technological thought today. Stiegler (2005) argues that selection in the technical world operates via 'adoption' rather than Darwinian adaptation (cf. Moore 2013: 18, 24f.). 'Adoption' is internally-directed and consists in the process of changing and/or adding technical means to an already pre-existing technical domain; it creates an evolving 'technical world' and thus a new logic of existence – what Stiegler identifies as the basic *technological condition* of humanity. 'Adoption,' ac-

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[714] This rejection of the role of the environment as 'first mover' gives way to the repudiation of 'mechanistic' theories of social evolution altogether. Yet, it also leads to a refusal of 'formistic' theories that explain observed patterns by means of invoking the environment as a 'subsistent' category.

[715] This 're-humanisation' of the Palaeolithic past is for example reflected in the fact that *« Paléohistoire »* scholars have recently begun to convey time in *human generations* (e.g., Valentin 2008a: 11-14, 2011: 3; Marchand 2014: 14). This manoeuvre signals that society-making is understood as an *active* 'civilising process,' as the cumulated efforts of human individuals organised in generations. These generations are linked – that is, 'enchained' – via long-term historical trajectories.

[716] This conception of 'technical inventions' as creative and sometimes spontaneous discoveries which only later turn out to be beneficial or otherwise functional is typically not shared by Anglophone experts, especially not by those working under the 'mechanistic' paradigm. An example is the faithful rejection of 'technical inventions' as evolutionary driving forces by Kuhn and Clark (2014). Apart from rejecting the concept altogether, the only alternative seems to discuss 'technical inventions' in the context of 'demand-pull' models of technological change (see *supra*), according to which invention is virtually forced upon a given technical context since external factors render it inevitable: "[...] In general, technological innovation is most likely under conditions where risk is high because that is where people have the most to gain from effort invested in new technologies." (Kelly 2013: 122; cf. Fitzhugh 2001)

[717] This difficulty to predict a 'technical invention' is also a consequence of the possibility that different technical domains and sub-domains, as a function of their domain-specifity, may engender different *rates of innovation*, perhaps even different *logics of discovery*. Valentin (2011: 31) anticipates this problem: "[...] [the] general division of the Later Palaeolithic only imperfectly accounts for the documented regional and historical variations, and especially for transitions operating with different rhythms not only in varying regions but also relative to different *fields of invention*" (my translation; emphasis added [the original French quote is provided in **Appendix Q.20**]). This quote clearly shows that particular 'inventions' are thought to emerge at the intersection between 'man' and 'matter,' by recognising the particularities of them both – human ingenuity and creativity meets specific matter-potentials. The resulting interactive scenario which unfolds in the *longue durée* substantiates the view that the basic research orientation is 'organicistic' here.

[718] In all of his works, Bergson insists on an important element of *human freedom* (cf. Copleston 1994 [1974]: 187f.), but this freedom is not regarded to be unconstrained since it is enfolded in duration and can only persist through temporal continuity.

[719] Sigaut (2012) also draws attention to the importance of 'invention' in understanding human tool-use. He maintains that the human tool is never simply an organic adaptation, but always represents an *irreducible* and *original creation* and as such an 'invention' in the literal sense (*ibid.*: 18).

cording to Stiegler (2004b: 15), enables humans to constantly *re-invent themselves* on evolutionary time scales; 'adoption' and 'invention' are key processes of a fundamental 'techno-logical' mode of existence.

Bon (2009: 337), citing Maurice Godelier, ushers in a similar critique by emphasising the common bond between human life, technological production, and technical innovation, crucial for understanding the 'social morphology' (*sensu* Durkheim 1894)[720] of past societies:

> "[H]umans are not only beings who adapt, they are beings who invent themselves. Humans are beings who are incapable of living in a society without providing or receiving from their birth the capacity to produce this society in order to live." (Godelier 2007: 189; my translation [the original French quote is provided in **Appendix Q.21**])

The concept of technical 'mutations' (*mutation*), regularly found in French lithic literature,[721] expresses a similar logic. Perhaps even stronger than technical inventions, however, 'mutations' call attention to *auto-poeitic* processes of societal change.[722] The ancient Greek notion of *poeisis* implies an 'activity through which something is brought into existence which did not exist before.' The term 'mutation' indicates such an activity; it accounts for the *poeitic* capacities of organic processes of becoming to self-stipulate change; organic development is *auto-poeitic* in this sense. The notion of 'mutation' can hence be understood as the organicistic interpretation of the structural category of 'novelty,' originally proper to 'contextualism.' The added ingredient is the specific organicistic interpretation of time. 'Mutations' balance continuity and change. We realise this point when considering what initially appears to be the paradox of mutations.

This paradox consists of the fact that mutations themselves are generally difficult to predict – no single mutation is *per se* necessary to happen at a given moment in time – but entire organic systems are bound to mutate with relative certainty; we can thus say that although we are incapable to precisely anticipate when and how a system mutates, we are not surprised that it mutates at all. In addition, even though mutations may introduce something entirely new, these mutations always depend on what was there before. Put differently, there must be a pre-existing *something* that mutates – a 'substrate of mutation':

> "[...] What drives these observable changes [connected to the Madgalenian-Azilian transition] in material culture? How did this [Azilian] mutation operate on the Magdalenian substrate? [...] The precise connections between, on the one hand, climatic and ecological upheavals of the Late Glacial, and, on the other hand, other substantial mutations in the domain of symbols and techniques, naturally sit at the heart of all debates [...]."(Marchand 2017: 9; my translation [the original French quote is provided in **Appendix Q. 7**]).

Hence, 'mutations' appear to be paradoxical only when time is reduced to static simultaneity. They presuppose duration and temporal interconnectedness; they bind together past, present, and future and justify the discontinuity of continuously structured temporal wholes. Furthermore, 'mutations' echo the organicistic conception of determination insofar as they are always preconfigured by their preceding substrate and remain strongly determined by the temporal growth-patterns of their organic wholes. In theory, we should thus be able, for example, to determine the *rate* of mutation of specific wholes with a good amount of certainty[723] – thus, determination is clearly defined 'synthetically.' The fact that the frequency and perhaps even the nature of mutations may depend on the organic whole in which the respective mutations occur simply reiterates the organicistic preoccupation with the object-specifity of distinct objects of reality. Technical 'mutations,' in a similar way as 'inventions,' thus typi-

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720 Inquiry in the tradition of *« Paléohistoire »* is strongly influenced by the work of ethnologist Alain Testart (1982, 2005, 2012), who is regularly cited by Bon, Marchand, and Valentin. Testart builds a conceptual bridge to traditional French sociology in the wake of Durkheim and others. This tradition often considers society as a *quasi-living superorganism* – as a developing organic whole that is more than the combination of its parts. Testart's role cannot be underestimated since it was probably him who brought 'social evolution' to the agenda of French anthropology and, more recently, Palaeolithic archaeology. He was one of the last great thinkers in the tradition of comparative *« Sociologie générale »*. In a similar way as *« Ethnologie générale »* in the wake of Leroi-Gourhan has influenced the development of *« Palethnologie »*, Testart arguably played an important, although perhaps not yet fully developed role in the emerging strand of *« Sociologie préhistorique »* (cf. Bon, in the future).

721 The term 'mutation' is for example mobilised by Bodu and Valentin (1997), Marchand (1999a), Valentin et al. (2004), Teyssandier (2007), Naudinot (2010), Langlais (2010), Pesesse (2010), and Bon (2015) – to name but a few.

722 *Autopoeisis* is the ability of a living or quasi-living system to re-create itself. For a comprehensive definition and application of the concept, see e.g. Varela et al. (1974). For its role in the general theory of 'social evolution,' see esp. Luhmann (1984, 1990).

723 From an 'organicistic' point of view, a relatively constant *rate* of mutation – always an emergent property of the whole – gives rise to a particular 'rhythm' of change. The notion of 'mutation' is therefore logically linked to the concept of developmental rhythms – an idea characteristic of the French tradition as we have seen.

cally emerge as a product of 'civilising processes.' Because organicism detects various degrees of 'animacy' in the phenomena it investigates, mutations are not confined to specific domains of reality, let alone to the realm of biology. 'Mutatability' is re-cast as a universal feature of evolving wholes, but the nature of mutation is considered to greatly differ among different kinds of wholes. The concept of technical 'mutation' (*mutation*) reflects the constitutive organicistic tension between regularity and particularity.

5.2.3 ***« Approche techno-génétique », technical lineages, and radical anthropology***

The third window into organicism has recently been opened by the 'techno-genetic' paradigm, developed by a small group of scholars around Éric Boëda (1997, 2005, 2013) in Paris-Nanterre (e.g., Soriano 2000, 2001; Forestier 2010; Nicoud 2011; Chevrier 2012). This paradigm is based on what has been termed the 'techno-genetic approach' (*approche techno-génétique*). This approach seeks to fill the void of classic *chaîne opératoire* analysis – to understand the 'finality' (*fonction*) of tools[724] – and to place both tools and the systems of their production into long-term processes of 'organic' lithic evolution. The emergence of the techno-genetic paradigm can be understood, on the one hand, as a reaction to Tixier's deliberate neglect of functionality, especially in the domain of lithic tool technology,[725] and, on the other hand, as a re-appraisal of the 'Early' Leroi-Gourhan's 'technological vitalism' (*sensu* Delitz 2015), including the latter's interest in the gestural and morpho-functional aspects of tool-utilisation (cf. Leroi-Gourhan 1968).[726]

As a result, the focus of techno-genetic research lies, often exclusively, on technical objects themselves rather than on past societies. This clearly separates the 'techno-genetic approach' from *« Paléohistoire » sensu stricto* – the latter departs from the 'Late' Leroi-Gourhan and his 'palethnological' legacy, whereas the former takes inspiration in the Leroi-Gourhan of *Évolution et techniques*. Since the techno-genetic endeavour is mainly pre-occupied with the evolution of lithic technology *per se*, we may speak of *« Technohistoire »* ('Technohistory') or *« Paléotechnologie »* ('Palaeotechnology') depending on the emphasis of inquiry.[727]

The techno-genetic approach entails a number of conceptual and methodological reorientations in how lithic technology is to be studied. The perhaps most important change in perspective concerns the conception of lithic tools themselves (cf. Boëda 1997: Chapitre 8, 2013: 45-53). Tools are no longer regarded to be the mere output of technical systems – i.e., the products of the 'confection' phase of the *chaîne opératoire* – but are taken into consideration as *systemic entities* in their own right (Chevrier 2012: 147).[728] They come into view either as technical 'micro-systems' or as 'sub-systems' of larger lithic production structures (cf. Lepot 1992/1993: Planche 87).[729] Tixier's 'anarchism' in terms of technological finalities has thereby motivated, first, the study of interactions between tool-systems and lithic production systems (Boëda 1991, 2005: 59-61, 2013: 35) and, second, the re-examination of the structure and morpho-functionality of tool-systems themselves. The latter has given rise to what is known as the 'techno-functional approach' (*approche techno-fonctionelles*) (Lepot 1992/1993; Boëda 1997, 2001; Bourguignon 1997; Soriano 2000; Soressi 2002; Pagli 2009; Lourdeau 2010; Bonilauri

[724] For the distinction between 'structure' (*structure*), 'operation' (*fonctionnement*), and 'function' (*fonction*) (*sensu* Sigaut 1991), see the previous part of this chapter.
[725] Cf. esp. Tixier (2012 [1978]: 33).
[726] Leroi-Gourhan's interest in tool-mediated 'modes of action' has given rise to an entire strand of research – commonly grouped under labels such as *gestural anthropology* or *« Technologie »*. This trajectory of sociotechnical thought leads from Mauss over Leroi-Gourhan to Haudricourt (1987) and Sigaut (1991, 2012), converging with some noticeable branches of sociology which investigate the status of sociotechnical systems (Rabardel 1995). The legacies of all of these thinkers have, to various degrees, shaped the techno-genetic paradigm – its motivations, methods, and goals.
[727] Techno-genetic reasoning represents a more definitive departure from 'contextualism' than *« Paléohistoire »*. While the latter embraces the multiplicity of developmental agents and trajectories shaping societal evolution, the former regards it as self-sufficient to address technological evolution *sui generis*. This has led to a shift in emphasis and research interest away from the ambition to write a proper 'palaeo-history of societies' towards the vision of writing 'palaeohistories of knapped stones.' This conceptual shift is for example notably reflected in the subtitle of Boëda's most recent book, *Techno-logique & Technologie. Une Paléohistoire des objets lithiques tranchants* (2013) – a key document of the 'techno-genetic' project.
[728] The recognition of the lithic 'tool' as a systemic entity automatically re-directs analytical attention to the problematic relationship between 'artefacts' and a 'tools' (e.g., Chevrier 2012: 135-138; see *infra*). Tools are generally regarded to be 'more-than-just-artefacts,' mirroring the 'synthetic' re-definition of the tool concept in this branch of French lithic research.
[729] The domain of lithic tools is considered to delineate yet another 'compartment' within the wider technical system – representing another building block of the *« système technicien »*, to speak with Jacques Ellul (1977). [For an explicit citation of the latter, see Chevrier (2012: 98)].

2010; Koehler 2011; Bodin 2011; Nicoud 2011; Chevrier 2012: 148f.; Rocca 2013; Leroyer 2016; Weyer 2016).[730]

Techno-functional inquiry is regarded to complement, and sometimes substitute, the functional and typological analysis of lithic tools (e.g., Boëda 2001; Soriano 2005; Boëda et al. 2015).[731] A tool is seen as a *technical microcosm* to be studied in its technological 'structure' (*structure*), 'operation' (*fonctionnement*), and 'function' (*fonction*) (*sensu* Sigaut 1991; cf. Boëda 1991, 1997: 30f., 2005: 47, 2013: 60f.)[732] – just like any other technical entity. Pivotally, the material 'appearances' of tools – which have largely been the target of analysis prior to the dawn of techno-functional inquiry – are viewed to 'conceal' much of a tool's 'structural,' 'operational,' and 'functional' complexity – an organisational complexity which is regarded to be crucial to decipher (Boëda 1997: 36, 110; Forestier 2010; Chevrier 2012: 12, 87, 99, 146).

The techno-genetic paradigm utilises the insights gained from techno-functional analysis to place varying tool-systems into their broader evolutionary context (Boëda 1997, 2013). This evolutionary context is identified with long-term technical trajectories regarded to reflect the organic 'becoming' of lithic objects *sui generis* (Boëda 2005). Accordingly, the primary evolutionary context of lithic objects comes into view as an extended temporal whole, perceptible only in the *durée* ('duration'). The key concept is the 'technical lineage' (*« lignée technique »*).[733] Each 'technical lineage' encases a particular chain of technical developments, in which a technical object passes through a succession of technical 'stages' (**Fig. 47**).

The basic idea – although often spelled out rather vaguely – seems to be that 'technical lineages' host a multitude of different and temporally dispersed technical objects sharing a basic set of relevant techno-functional principles (cf. Boëda 2013: 49f.).[734] Thus, the conception appears to be that 'technical lineages' organise aspects of the observable 'structural' and 'operational' variability of lithic objects to the point that the *genesis* (the 'becoming-concrete') of a 'functional' schematic becomes discernible – a schematic that ultimately unifies all the different objects.[735] The dynamic evolution of aspects of 'structure' (*structure*) and 'operation' (*fonctionnement*) is thus rendered intelligible by illuminating their role in the emergence of a relatively stable and well-defined 'function' (*fonction*). The implication is that the ultimate finalities (*fonctions*) of lithic objects – whether they are tool-systems or even larger technical systems – can only be assessed if the corresponding 'technical lineage' is identified and analysed. Techno-genetic reasoning is 'synthetic' in this sense – technical objects can only be understood if placed into their 'significant' evolutionary wholes, that is, into their respective 'technical lineages' (*« lignées techniques »*).

With Pepper, we can clarify the organicistic status of this style of reasoning. To this end, it is useful to distinguish between 'primary' and 'secondary' technical contexts: 'secondary' technical con-

[730] An alternative label for the same research enterprise is 'techno-morpho-functional' inquiry (*étude techno-morpho-fonctionelle*).
[731] See e.g. Soriano (2000: 6-8) for a summary of what is seen as the core difficulty of lithic use-wear analysis and why it is regarded to be of limited value in pre-Upper Palaeolithic contexts of technicity. See also Lepot (1992/1993: 134), Jaubert (1999: 57f.), and Boëda (1997: 107, 2005: 48, 2013: 29): "[…] [t]he arguments are to be derived from the coherence of the technical system by means of the techno-functional approach and not by means of traceological analysis which merely confirms the presence of hafting, without informing us of its specificities." (Boëda 2013: 229; my translation [the original French quote is provided in **Appendix Q.22**]).
[732] The differentiation between 'structure,' 'operation,' and 'function' broadly corresponds to Rabardel's (1995) distinction between 'artefact', 'scheme of utilisation,' and 'instrument' on which Boëda (2013: 50-55) and his students draw (e.g., Soriano 2000: 119, 134).
[733] The concept of the 'technical lineage' has been proposed by Simondon (1958) and further developed by Deforge (1985). See also Tinland (1977), Stiegler (2004a), and Guchet (2008). For a summary of its core meaning and a discussion of its role in Palaeolithic research, see Chevrier (2012: 100f., 111-113).
[734] The notion of the 'technical lineage' embodies the 'organicistic' preoccupation with the tension between unity and diversity. In Palaeolithic research, the concept is typically defined as a *structural family-resemblance* – different objects of the same family of lithic structures are analysed in their becoming (cf. Chevrier 2012: 157). The 'technical lineage' is thereby the *unifier* and the aim is to show that at least a part of the natural diversity of technical objects can be resolved by invoking the concept (see next footnote).
[735] We may say that the identification of a basic functional scheme through the analysis of 'technical lineages' plays a somewhat similar role as, say, the identification of the *schéma opératoire* in the analysis of lithic assemblages. Moreover, the examination of the latter typically provides critical clues about the former. The spatiotemporal organisation of lithic assemblages and situated technical systems simply represent a 'stigma' of the 'technical lineage' they are a product of. In the same sense as *chaînes opératoires* specify the status of each lithic artefact in a given lithic assemblage, 'technical lineages' specify the status of each *chaîne opératoire* in its attendant evolutionary chain. We may say that the 'ontogeny' of a lithic technical system is informative about its relative 'phylogenetic' position. However, this assertion does not imply that 'technical ontogeny recapitulates techno-functional phylogeny,' but merely underscores the fact that each technical system is a result of its past and points to its future.

texts are lithic assemblages, technical systems, tool-systems, and/or a combination of them all; 'primary' technical contexts are the 'technical lineages' in which the 'secondary' technical contexts make their appearance. One can then say, first, that the 'primary' context *dynamises* the associated 'secondary' contexts on the temporal plane and, secondly, that the totality of 'secondary' contexts defines the set of 'progressive' categories individualising the 'primary' context, which therefore embodies the 'ideal' categories of the total temporal whole.

The evolution of lithic objects, in this view, is determined by the 'dialectical' movement between the 'primary' context and its 'secondary' contexts and consists in the 'progressive' movement towards the 'ideal.' The divergent character of the 'secondary' contexts make clear that lithic evolution is a 'staged' process and that evolutionary time can be differentiated only qualitatively, not quantitatively.[736] The organic process that 'progressively' leads to the 'primary' context is initially 'concealed' since what is given in experience are only isolated 'secondary' contexts. The 'secondary' contexts come thereby into view as 'fragments of reality' and their succession, although initially 'concealed,' turns out to be directed and irreversible. All 'contradictions' and/or 'conflicts' between the 'secondary' contexts are resolved by unifying them through their 'primary' context.

The resulting research mandate seeks to identify 'primary' contexts and to determine which 'secondary' contexts *belong to them*. The overall goal of lithic inquiry is thus to detect the nature of the organic process that arranges the 'secondary' contexts in time and gives shape to the 'progressive' categories that lead to the 'ideal.' It remains an empirical question to specify which evolutionary mechanisms, principles of development, and/or phylogenetic laws can be said to underpin this organic process. This endeavour typically comes down to determining the *logic of change* between the developmental stages and to assess whether or not this logic changes through time (that is, whether other stage-transitions in the same whole conform to the same logic). Conceptually, interpretations juxtapose the evolutionary fact of 'techno-genesis' (*« techno-genèse »*) with the 'techno-logic' (*« techno-logique »*)[737] of lithic development (cf. Boëda 2013: 87f.). It should be clear that this strategy generally predisposes techno-genetic inquiry to spawn *qualitative* accounts of lithic evolution – it is simply unclear how one would study the 'logic of change' in purely quantitative terms.

As already indicated before, organicistic conceptions of evolution are by no means new in the French scene but have already played an important role in the 'ancestral' and 'formative' periods of Palaeolithic research. Garbiel de Mortillet, Pierre Teilhard de Chardin, and the 'Early' André Leroi-Gourhan, for example, remain exemplary cases of theorising the grand scheme of technical evolution, while Henri Breuil can be mentioned as a model case of interpreting the development of Palaeolithic art from an organicistic perspective. Mortillet coined the term 'palaeoethnology' (*« paléoethnologie »*) – not to be confused with the *« Palethnologie »* developed by the 'Later' Leroi-Gourhan and his team – to denote an integrated 'new science of prehistoric man'[738] and subdivided the Palaeolithic period into several 'ages' – from the Acheulean to the Tourassian (today's Azilian). These 'ages' were considered 'stages' of a directed evolutionary sequence. For Mortillet, as subsequently for Leroi-Gourhan, the Palaeolithic constitutes an indisputable part of human history (cf. Junghans 2014 [1987]: 47) – an important window into *« histoire générale »* ('general history') or what Marc Bloch later termed *« histoire totale »*.

Mortillet's long-term history was already a history of alternating 'civilisations' (*ibid.*: 54). Yet, the basic organicistic idea, namely that human history can only be understood as a continuous but

[736] The fact that time, if one resists its 'spatialisation,' can only be differentiated qualitatively was also a main conclusion of Bergson's *Évolution créatrice* (1907; cf. Copleston 1994 [1974]: 186). With Pepper, we can add that the 'spatialisation' of time results in the conception of a 'field of temporal location' typically tied to an 'objectivist' account of time stressing its homogeneity. This account corresponds to the classic 'mechanistic' reading of time and thus signifies an important locus of divergence between 'mechanism' and 'organicism.'

[737] 'Techno-logic' (*« techno-logique »*) is a difficult concept and regularly, I believe, confused with other affiliated terms. The term for example needs to be distinguished from the notion of 'technical logic' (*« logique technique »*) which seems to be a category of 'contextualism.' This 'technical logic' captures the organisational, that is, 'infrastructural' logic of technical contexts, i.e., technical systems, periods, or sub-periods. 'Techno-logic,' by contrast, appears to target the structural organisation of an organic temporal whole, conveying especially the nature of the various 'stage-transitions' that can be observed as the whole unfolds. Both concepts therefore pinpoint relational configurations of 'significant' wholes: 'technical logic' pictures the relational configuration of contexts – the wholes of 'contextualism' – and 'techno-logic' portrays the relational configuration of organic structures – the wholes of 'organicism.' The concept of 'techno-logic,' proper to an organicistic interpretation of technological evolution, thereby reproduces the indubitable *topos* of 'unity in diversity' – it expresses the belief that different developmental stages can be unified through a common principle of becoming.

[738] Cf. Junghans (2014 [1987]: 53f.).

creative movement of 'man' and 'matter' giving rise to successive stages of lithic development, was perhaps carried to the extreme in the writings of Teilhard de Chardin (1955, 1956; cf. Schiwy 2006).[739]

It was the 'Early' Leroi-Gourhan, however, who set the lasting agenda for French techno-organic reasoning.[740] His distinction between *« faits »* ('facts') and *« tendance »* ('tendency') – already alluded to in the last section – holds the key for understanding the recent return to the roots of lithic organicism in the French scene (cf. Boëda 2013: 23). For Leroi-Gourhan, *« fait »* was a means of expressing that the same global tendencies of technical development can be tangibly instantiated in a number of different ways; each society typically supports its unique instantiation(s) of technicity. This conception was considered to offer a solution to the undeniable fact that there is much technical variability even though technical evolution appears to be directed.[741] Arguably, Leroi-Gourhan never fully abandoned the distinction between 'facts' and 'tendency' but relocated his attention in the course of his career. While the 'Early' Leroi-Gourhan of *Évolution et techniques* was preoccupied with the grand narratives and, as a consequence, focussed on the 'tendencies' of technical evolution, the 'Later' Leroi-Gourhan, branded by the Pincevent experience, prioritised studying the situated facts (*« faits »*) of particular sociocultural contexts.[742]

From this perspective, the tension between 'facts' and 'tendency' motivates a distinction between 'evolution' and 'history' (cf. Boëda 2013: 231). 'History' becomes a category proper to distinct evolutionary 'stages'; it can be taken to describe those aspects of lithic technical variability which are unnecessary for effectuating the transition to the next 'stage.' History, if you will, is then the creative variation of a necessary theme. 'Evolution,' for this reason, comes into view as a process that transcends historical contingency and is 'transcultural' in a fundamental sense (*ibid.*: 23, 223-236). The distinction between historical and evolutionary factors therefore turns out to be an empirical precondition for techno-genetic reconstructions. Methodologically, the characterisation of a 'technical lineage' – which presupposes the identification of the latter's effective evolutionary features – should therefore enable the discrimination between cultural and non-cultural variation in the associated lithic technologies (*ibid.*: 146, 167).[743] This interpretive dichotomy between 'history' and 'evolution' seems to be another important discriminator between the 'techno-genetic approach' and *« Paléohistoire » sensu stricto*, which does not discriminate between these two concepts.

For techno-genetic approaches, history and evolution represent different games that are played with different rules on different temporal scales. If *« Paléohistoire »* can be described as a practice of 'hyper-history' (cf. Valentin 2011), 'techno-genesis' (*« techno-genèse »*) would be concerned with 'hyper-evolution.' Strictly speaking, the latter's main concern lies not with the *longue durée*, but with the *très longue durée*. What it shares with *« Paléohistoire »*, however, is the 'dendritic paradigm.' Yet, this is also where it voices some quiet critique on Leroi-Gourhan. Techno-genetic research is based on the recognition that there is not only a single global technical 'tendency' but instead multiple local 'tendencies.' The reasons for this are manifold: for one thing, each 'lineage' develops in its proper 'natural milieu'; for another thing, contingent developments and random factors (including rare events) at an early stage of a 'lineage' may have irreversible and *direction-giving* effects on the evolutionary trajectory of the 'lineage' as a whole – technical lineages are *path-dependent* to this effect. Because a given lineage can be called 'cultural' only in this twofold sense – or, alternatively, because it differs from other 'lineages'[744] – techno-genetic accounts tend to be techno-deterministic. The space of cultural variation is preconfigured by larger technical trajectories, some of which may leave little leeway for lithic cultural variation:

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[739] Boëda (2013: footnote 20 [35]) explicitly invokes Teilhard de Chardin as an ideational forefather.

[740] The key role of Leroi-Gourhan is also acknowledged by Boëda (2013: 28).

[741] Leroi-Gourhan's 'tendency' (*tendance*) represents an appropriation of Bergson's « *élan vital* » (cf. Gazagnadou 2008: 46). For the many 'Bergsonisms' in the work of Leroi-Gourhan, see Schlanger (2004, 2015). For the role of the concept in lithic techno-genetic research, see esp. Boëda (2013: 35, 223).

[742] From this perspective, Leroi-Gourhan's *Le geste et la parole* (1964/1965) amounts a transitory work. The passage from the 'Early' to the 'Late' Leroi-Gourhan may in fact correspond to a research-historical transition from an initial 'organicistic' orientation of inquiry towards a full-blown 'contextualistic' inclination. In retrospect, we can say that this 'Late-contextualistic' Leroi-Gourhan was born in Pincevent. Clearly, however, more historical groundwork is needed to confirm this affirmation.

[743] *Contra* 'mechanism,' the contention here is that the discrimination between 'functional' and 'non-functional' factors in relation to a given temporal present is always short-sighted. 'Non-functional' factors can only be identified if the evolutionary function of effectuating change in a given direction has already been excluded.

[744] The plurality of possible technical 'lineages' delivers only an indirect argument for the 'cultural load' of these lineages. This problem, however, is openly acknowledged and has motivated the discussion of technical convergence in an 'organicistic' context of inquiry (cf. Boëda 2005).

> "[…] [I]n the case of 'Type Pyramidal E2,' several methods permit to produce uniquely blades or, contrarily, a mixed technique may deliver triangular blade removals including Levallois points. In the case of the [D]iscoid as of the pyramidal, however, the direction of detachments has no value in differentiating the methods. In the case of the [D]iscoid, it is effectively necessary to change the direction of removal in order to proceed from a first exploitable volume to a second one; in the case of the pyramidal, it is necessary to obtain detachments from the same direction. In opposition to what we will see for the Levallois core and certain Upper Palaeolithic cores, changing or uniform directionalities represent more a structural necessity than the expression of a cultural character." (Boëda 2013: 146; my translation [the original French quote is provided in **Appendix Q.22**])

Another reason for the plurality of technical trajectories is that technical 'tendencies' – Boëda's *« lignées »* – may be *object-specific* (Boëda 1997, 2005, 2013). This potential object-specificity of technical trajectories marks the input of a second key source of techno-genetic thought – French philosophy of technology and its cybernetic heritage. Boëda (2005, 2013) and his students (e.g., Nicoud 2011; Chevrier 2012; Rocca 2013) specifically draw on the work of Gilbert Simondon, one of the most influential technologists of 20th century France. His central text is *Du mode d'existence des objets techniques* (1958). This work, which is foremost *technological* and only secondarily anthropological (Barthélémy 2015), suggests that technical evolution can only be properly understood by examining the genesis of technical objects – their 'becoming' (Simondon 1958: 19f.); Simondon considers the evolution of technology to be guided by *structural laws proper to the technical domain*. Accordingly, technical objects possess a specific 'mode of existence' (cf. Boëda 2013: 28, 88; Nicoud 2013: 51). Technology is viewed as a 'quasi-living' force capable of self-regulation and evolutionary self-determination. How this general capacity is realised, however, always depends on the technical object in question:

> "Technique, just like magic or religion, is a way of being in the world. Th[e] cultural evaluation of technical reality entails the investigation of the technical nature of an object, rethinking the object from the perspective of its technicality and reconsidering the technical object as structurally coupled with the human, itself becoming. This notion of coupling necessarily implies a co-evolution of human[s] and technique[s], the latter being governed by 'laws of evolution.'" (Boëda 2013: 28; my translation [the original French quote is provided in **Appendix Q.22**])

Following Simondon (1958, 2014), a technical lineage fulfils the functional potential of a technical object as the object passes through time, typically by increasing the latter's internal 'inclusiveness' and/or 'organicity' in such a way that the object's functionality is optimised – each systemic element then implies any other element and only all elements together ensure the total functionality of the object (cf. Simondon 1958: 50-55). The functional potential that is thereby carried through by a technical lineage is called 'technical essence' (Simondon 1958: 41f.). This 'technical essence' describes the 'ideal' of a technical lineage in light of its 'progressive' categories (see *supra*); it corresponds to the already introduced notion of a 'functional schematic' holding a technical lineage together in time. The continuous re-adjustment between a 'technical essence' and the lineage that lives up to this essence generates the 'laws of evolution' proper to the lineage.

Boëda (1997, 2013: 40) adopts Simondon's (1958: 19-22) ideal-typical distinction between 'abstract' technical objects (*« objets abstraits »*) and 'concrete' technical objects (*« objets concrèts »*) to develop a new perspective on how lithic technology evolves. Discriminating between the two establishes a spectrum of developmental stages from the relative starting point of a technical lineage to its relative endpoint (*ibid.*: 23-49, 61-64). This spectrum is thought to deliver a universally-valid scheme of technical development which, in turn, can be used to assess the relative position of lithic objects in their evolutionary chain(s).[745]

'Abstract' stages describe a condition in which the contribution of each technical part (if any) to the overall functionality of the technical whole is *independent* of other parts – 'abstract' technical stages harbour compartementalised systemic entities. 'Concrete' stages, by contrast, can be characterised by a condition in which the parts are *interdependent* and *only in concert* produce the functionality of the whole – the contribution of each part has become inseparable from the contribution of all other

[745] Again, it has to be emphasised that 'universality' is only granted to the general progression from more 'abstract' to more 'concrete.' Which stages are taken, which are perhaps skipped, and how the stages are precisely instantiated, is an empirical question and potentially differs between various object-matters. We may thus more properly speak of a *general developmental frame of reference* rather than a universal scheme (cf. Chevrier 2012: 103f.).

parts. In this second case, the parts can be said to form an integrated 'organic whole' while in the first case their 'being-one' ('one-ness') is implicated but not (yet) realised. In order to identify a technical lineage and by means of this lineage explain all objects found in it, one needs to show that the actual (ideally: observed) temporal enchainment of objects can be rendered intelligible as a succession of ever more 'concrete' systemic entities.

Simondon (1958, 1964, 1989) names this passage from the relatively 'abstract' to the relatively 'concrete' a process of *concretisation* or *individuation*. One can speak of 'individuation' because evolving objects, by becoming more and more 'concrete,' literally *find to themselves* – to their 'technical essence.' Technical evolution comes into view as a process of self-identification and, perhaps more importantly, *self-adaptation* (Simondon 1958: 50-55).[746] Technical objects, if you will, transition from a state of inner 'schizophrenia' to a state of internal indifference (cf. Boëda 2013: 40).[747] To overcome the schizophrenic state of organisation means to realise the technical 'ideal.' Again, technical evolution is regarded to be inherently *creative* because its organic processes have to resolve the *tension* [*Spannung*] between the parts of a (yet) 'un-concrete' whole (cf. Schick 2013: 153).[748] Creativity, then, is defined as the evolutionary fact of resolving technical 'conflict,' which presupposes developmental potentiality rather than predetermination.

The categories of 'abstract' and 'concrete' are logical refinements of the 'ideal' category of the 'organic structural whole': 'concrete-ness' refers to completely realised 'organicity,' whereas 'abstract-ness' specifies the exact opposite – a state of 'in-organicity.' The two notions are purely theoretical; they open a space of developmental potential to proceed from 'abstract' to 'concrete' wholes. The latter state is rarely reached in reality because achieving the 'ideal' would imply eternity and the end of evolution (cf. **Appendix II.2**). Even though the realisation of the 'ideal' is somewhat paradoxical, it does offer an explanation for why technical lineages may collapse *sui generis*: fully realised organicity typically implies *evolutionary inflexibility* since the re-organisation of parts, without sacrificing key functionalities, becomes practically impossible. The inability of an 'ideal' system to adapt to novel circumstances therefore *enables* a new technical lineage to emerge (cf. Boëda 2013: esp. 230-236). This is the organicistic interpretation of lineage extinction and/or succession. This perspective underlines 'cyclicity' (sub-cycles, cycles, epi-cycles) as a key feature of technical evolution.

The focus on categories implied by the 'ideal' leaves the 'progressive' categories of technical evolution largely undefined. According to organicism, this should be seen as an advantage since it is consistent with the idea that wholes set the evolutionary tone and parts are instantiated by the necessity to realise them. The 'progressive' categories are therefore whole-specific and have to be determined empirically. This is where typology comes into play. 'Effective' types – typically identified with what has been coined *techno-functional types* – are considered to instantiate the 'progressive' categories of their wholes. The role of typology is to facilitate the detection of technical objects that belong to a given technical lineage and to somehow encapsulate the arguments for attributing the respective objects to the lineage. The result is a sharp distinction between 'effective' and 'ineffective' lithic types – the former help to chart technical lineages, the latter only cloud the view for them.[749] Based on the aforemen-

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[746] Simondon (1958) sometimes also invokes terms such as *auto-correlation* or *self-convergence* because 'individuation'/ 'concretisation' amounts to a 'structural' and 'operational' match between the parts of a whole that ensures the latter's global functionality.

[747] The tendency of technology *to adapt its parts to itself* provides a general evolutionary mechanism to explain technical becoming (Boëda 2013: 40). The concept of 'self-adaptation' thereby implies a new interest in *synergetic relations* – a key *topos* of French technological research in general. The interpretive manoeuvre in techno-genetic research is to re-direct the attention to *system-internal synergies* instead of mainly concentrating on the complementarities between distinct yet co-occurring technical systems (i.e., between *débitage* and *façonnage* systems). An important consequence is that Darwinian adaptation becomes a secondary phenomenon at best.

[748] Conversely, if there is no tension or structural conflict, the evolutionary 'impulse' is dramatically reduced. At the extreme, there is no evolution at all because there is no 'abstract-ness' left. This implies that full-blown organicity – the 'ideal' – may mark the end of evolution and typically ushers in a state of developmental stasis or collapse. The 'saturation' of an evolutionary lineage – its complete 'concretisation' – is therefore likely to be the beginning of the end of this lineage. It is in this sense that 'organicists' may speak of the natural 'death' of technical linages.

[749] The distinction between 'effective' and 'ineffective' lithic types is a consequence of the inherent 'integrativity' of 'organicistic' explanation. Since 'organicism' presupposes a relatively high degree of worldly order and because determination is considered to be 'focused,' some facts turn out to be irrelevant and can even be thrown into the 'unreal.' This general inclination engenders a core difference to 'contextualistic' practices of lithic typology. As shown in the last part of this chapter, 'contextualism' tends to pluralise typology in order to capture different levels of typological organisation; these levels of typological variability are later related to one another in order to clear the view for the verticalities and horizontalities of technical 'infrastructure' – the strategy is inclusive and 'dispersive.' In 'organicism,' by contrast, some typologies – those which fail to help illuminate their temporal wholes – are simply discarded. They are identified as 'deceptions of appearance.' This basic difference explains why lithic 'organ-

tioned, it becomes then clear that 'effective' types must take into consideration the 'structure' of lithic technical objects, rather than their form (cf. Forestier 2000: 544).[750]

The classificatory systems developed by proponents of the techno-genetic approach reflect this realisation (cf. e.g., Soriano 2000; Forestier 2010; Chevrier 2012; Boëda and Hou 2011; Nicoud 2011, 2013; Rocca 2013; Nicoud et al. 2016; Chevrier et al. 2017). Classifications are guided by the objective to identify different part-configurations and the relationships between the lithic parts and their technical whole. We can distinguish between two complementary approaches to characterise these 'technical structures' and to examine the associated processes of systemic integration: the first is centred on the analysis of *tool structure* (Boëda 2013: 54f.), the second on the evaluation of *structures of volumetric core exploitation* (*ibid*.: 89-97). The general interpretive categories developed by these two angles of investigation furnish the principal resources to devise the 'progressive' categories required to chart the evolution of lithic systems from their 'abstract' to 'concrete' states. The fact that these categories appear to be case-sensitive – especially that they fundamentally differ when reduction-systems and tool-systems are compared (cf. *ibid*.: 28, 88) – underscores the organicistic pre-occupation with object-specificities.[751]

The first strand of techno-functional inquiry, taking into account the evolutionary becoming of tool-systems, is based on the identification of *techno-functional units*, or *UTFs* (*Unités techno-fonctionnelles*) in French (cf. Boëda 1997: 107, 2001, 2013: 39, 54f.; Soriano 2000: 123f.). The methodological and interpretive resources to analyse UTFs (henceforth 'UTF-analysis') have been developed collaboratively, even though Michel Lepot's (1992/1993) *théorie artisanale de l'outil* ('non-industrial theory of lithic tool production') was a key contribution. Lepot (*idem*) developed a basic toolkit to characterise the functional parts of lithic tools in order to compare their organisational structure (cf. Boëda 1997: 107-109; **Fig. 48**). The examination of a tool-system's UTF-structure is generally based on the morpho-technical character of the modified and non-modified edges, their chronological and topological relationships, and their contribution to the total functional design of the system (cf. Pagli 2009; Bonilauri 2010; Forestier 2010; Donnart 2010; Lourdeau 2010; Bodin 2011; Chevrier 2012).

In contrast to traditional wear studies, UTF-analysis pays primary attention to the *potentialities* of tool-use rather than empirically attested tool functions (if any); it explores the functional 'efficacy' (*efficacité*) of making tools in particular ways (cf. Lepot 1992/1993: 119). The basic idea is that not every edge configuration can serve every possible tool-function (e.g., Lepot 1992/1993: 26-88, Planche 4-23; Soriano 2000: 119-135, Annexe 2 [411-416]). Specific tool-functions impose specific functional requirements on the tool-edges supporting them. One can therefore study the 'functional morphology' of tool-edges in order to isolate aspects of the original 'functional intention' motivating their creation. The general conception is that 'a tool exists only in action' (*sensu* Leroi-Gourhan 1964/1965, 1968) and is always adapted to a specific tool-aided gesture (cf. Boëda 2013: 46).[752] Moreover, a tool-system's past (process of manufacture) can be said to have led to its present (current state of structural organisation), only to point to the tool's future (possible usage). There is thus an inseparable link between the

icists' tend to be much more hostile against 'Bordian' and other classic types than 'contextualists' (cf. e.g. the recurrent critique on 'typology' by Boëda). The key difference to 'mechanistic' typologies has to do with the 'synthetic' nature of types in 'organicism.' In opposition to 'mechanism,' in which lithic types are also treated 'integratively,' 'organicistic' types are rendered 'effective' through the specificity of their relationship with organic wholes, their epistemic 'effectiveness' only *indirectly* relies on other types/parts.

[750] The reliance on structure-based types is perhaps the main reason why lithic 'organicists' do not come to grips with 'formists,' who base their types on patterns of part-driven forms, often paying exclusive attention to shape-based artefact attributes.

[751] The fact that the progression from more 'abstract' to more 'concrete' developmental stages is regarded to instantiate itself in a myriad of different ways generally reveals how 'organicism' interprets the 'operationalisation' of general theory. If Simondon (1958) provides a general theory of technical becoming, Boëda (1997, 2005, 2013) is concerned with how the categories of this theory (relative 'abstract-ness' vs. relative 'concrete-ness') are to be interpreted in different lithic domains. This application of general theoretical categories to object-specific, empirically explorable domains conforms to the 'operationalisation' of these categories. This may indicate a fundamental difference between 'organicism' and 'mechanism' since the former – as we have seen – seeks to translate general categories into object-specific categories whereas the latter typically translates general categories into quantifiable and testable categories (these are object-specific only insofar as the tested features and feature-constellations must of course be measurable). 'Operationalisation' is therefore unequally interpreted, reminding us of the strong conceptual tension between 'organicism' and 'mechanism.'

[752] The insight that tools are crystallisations of human gestures, again, refers back to Haudricourt (1987) who maintained that tools can be defined as *adaptations to human gestures* (« L'outil est adapté au geste et non inversement »; cit. Haudricourt 1987: 158). For a similar contention, see Leroi-Gourhan (1968).

production, structure, and function of a lithic tool – a link that can be explored and studied (cf. Nicoud 2013: 45).

The functional potential of lithic tools may be analysed on two levels. First, each edge configuration generates its own 'nexus' of possible instrumentalisations (if any). Second, each tool-system as a whole also creates its 'nexus' of possible instrumentalisations (if any), but this 'nexus' is determined by the meeting point(s) (if any) of all or some of the 'nexuses' of its effective functional parts. Differentiating between these two levels motivates to distinguish between 'tools' (*outils*) and 'artefacts' (*artefacts*) for the two may not be identical (e.g., Chevrier 2012: 135-138).[753]

Although the distinction between 'artefacts' and 'tools' is often confused, the basic idea seems to be that the former should be regarded as material placeholders for the latter and, depending on the tool-system in question, may accommodate either a single 'tool' or multiple 'tools.' In the latter case, each artefact-edge with functional potential may constitute a 'tool' of its own – the artefact itself then represents a 'pluri-tool' (*sensu* Boëda 2013: 63-64, Fig. 16, 19, 20; cf. Chevrier 2012: 265-275; **Fig. 49**). Alternatively, all artefact-edges with functional potential are integrated into a single 'tool' – we may then speak of 'mono-tools,' 'true tools,' or proper 'artefact-tool identities' (cf. Boëda 2013: 63-64, Fig. 17, 18; Nicoud 2013: 48f., Fig. 3B; **Fig. 50**).[754] This strategy is clearly organicistic. The resultant categories serve to delineate relatively 'abstract' from relatively 'concrete' tool-states: 'pluri-tools' are defined as non-organic entities – the functional 'nexuses' of all relevant artefact-edges are difficult to coordinate; 'true tools,' by contrast, are defined as highly inclusive entities whose functional parts have been successfully coordinated – they embody a functional equilibrium of the 'nexuses' of their parts.

The routinely employed distinction between the 'transformative' part of a tool-system (*partie transformative/coupe de CT*), its 'prehensive' part (*partie préhensive/coupe de CP*), and its 'transmissive' part (*partie transmettrice/coupe de CR*) (Boëda 1997: 107-110, 2013: 54-55, Fig. 11; cf. Chevrier 2012: 147; **Fig. 51**)[755] hence establishes a classification of tool-areas based on the coordination (and/or non-coordination) of the 'nexuses' of all relevant technical elements, especially the edges, of the system in question. This classification takes into account that not every potential tool-edge, whether modified or unmodified, necessarily serves as a 'cutting-edge' in the tool-system. Different edge-treatments may signal the differential *status* of artefact-edges and the artefact-parts they belong to.

The tripartite differentiation between CTs, CPs, and CRs thus aims to illuminate the 'function' (*fonction*) of varying tool-parts in bringing forth the 'structure' (*structure*) and 'operation' (*fonctionnement*) of a tool-whole. CTs signify the 'active' tool-parts (proper cutting-edges), the areas where the tool is designed to come into direct physical contact with the worked material; CPs denominate the 'passive' tool-parts ('false' cutting-edges) which primarily serve to received and/or absorb the energy of utilisation – 'passive' parts may also define the ergonomic qualities and the grip characteristics of the tool-system; CRs, finally, facilitate the flow and transformation of energy between the 'active' and 'passive' tool-parts – their role is 'mediative.' Each tool-system may harbour multiple UTFs of each type

[753] The distinction between 'artefacts' and 'tools'/'instruments' is also propagated by Rabardel's (1995) theory of tool-use.

[754] Nicoud's (2011, 2013) doctoral research on the evolution of bifacial technology in the Western European Acheulean can be cited as an example for the identification of 'integrated' and 'disintegrated' schemes of tool construction. Nicoud (2011: esp. Fig. 126) distinguishes between three types of bifacial configuration: (i) 'false bifaces' which turn out to be bifacially exploited core-matrices (*galets à enlèvements bifaciaux*), (ii) 'bifacial blanks' which serve as tool-matrices for future modification (*pièces bifaciales supports d'outil(s)*), and (iii) 'true bifaces' which represent the only truely integrated bifacial tools (*pièces bifaciales-outil*) (cf. Nicoud 2013: 45-51, Fig. 3). Two aspects of this scheme are of particular importance: first, the author shows that some artefacts only 'appear to be' bifaces, but after close inspection turn out to be bifacially-worked cores – they represent an 'ineffective' category which has to be (at least partly) explained away; secondly, the distinction between 'bifacial blanks' and 'true bifaces' is based on an analysis of artefact-tool relations from the perspective of the latter's becoming (sequencing of the manufacturing process). The difference between the two is that in case ii the construction of the bifacial volume is independent of (and in fact precedes) the construction of active tool-edges, whereas in case iii both are formatively intertwined. While the generated bifacial volume of ii – literally a 'bifacial-blank' – may support a number of different tool-edges, the construction of the volume in iii anticipates the global tool-functionality. The former hence represents a 'disintegrated' tool-system, the latter an 'integrated' one. Noteworthy is especially that technical 'integration' and 'disintegration' are conceptualised in *temporal* terms and that the determinative effects of creating either the artefact or the tool(s) are considered. 'Bifacial blanks' simply represent an object category in which the 'nexus' of the artefact is not coordinated with the 'nexus' of its future tool-edges – the artefact determines its 'tool-ness' rather loosely. 'True bifaces,' by comparison, exhibit a high level of coordination between the 'nexus' of the artefact and the 'nexus' of the future tool(s) – the construction of the artefacts determines the future tool-state fairly well. Nicoud's approach demonstrates that interpretive categories are based on a consideration of how past, present, and future interpenetrate each other in within a given technical object.

[755] Lepot (1992/1993) originally proposed a slightly different terminology. He (*ibid.* : 123) differentiated between *« contact transformatif » (CT)* ('transformative part'), *« contact préhensif de l'outil » (CP)* ('prehensive part'), and *« contact réceptif de l'énergie » (CR)* ('transmissive part').

(not all types need to be represented though) and each type may be instantiated in a number of different ways.[756]

The point is that the intentional modification of an edge cannot – *by default* – be taken to imply its 'active' role as primary cutting-edge. Similar types of modification may contribute differently to the 'operation' of dissimilar tool-system; their function may vary due to disparate structural tool-configurations (cf. Chevrier 2012: 135f.), reflecting the classic organicistic interpretation of 'equifinality' – that similar forms or partial configurations may be instantiated by varying structural wholes (**Fig. 52**).

The determination of the functional techno-morphology of potential tool edges and non-tool edges relies on the meticulous description of retouch types (i.e., marginal, scalariform, denticulated), edge morphologies and cross-sections, relationships between the intersecting surfaces creating the edges (i.e., plano-convexity, semi-convexity, biconvexity, etc.), and the angulation of edges, including the characterisation of edge outline and 'route' (**Fig. 53**). In general, the assessment relies on a *lecture* of the present micro- and macro-detachments and their technical, spatial, and chronological relationships. This approach is firmly rooted in the core principles of *chaîne opératoire* analysis (cf. Lepot 1992/1993: 26-88; Bourguignon 1997; Soriano 2000; Nicoud 2011; Rocca 2013), including the reconstruction and evaluation of *schémas diacritiques* (cf. Soriano 2000: 119-135, Annexe 2 [411-416]).[757] Analogously to studying the 'technological morphology' of lithic artefacts (*sensu* Tixier 2012 [1978]: 125-132), the goal is to establish the 'functional morphology' of lithic tools and tool-systems (cf. Boëda and Hou 2011).

This 'functional morphology' not only seeks to convey the functional potential of particular edge-configurations, but also takes into account how these edges are *situated* in the tool-system, for instance whether they possess an opposing 'non-active' edge shaped in a different manner, exhibiting a natural/artificial back or not.[758] Ultimately, all of these relational aspects serve as 'fragments' of a functional tool-reality – they need to be resolved in their systemic totality. Each 'fragment' is compared to its appendant 'fragments' in order to evaluate whether or not the respective 'nexuses' meet – the presence of certain tool-functionalities can thus be reconstructed as a successful meeting of 'nexuses.' Moreover, the resulting configurations of positively resonating 'nexuses' of tool-parts provide a baseline for isolating the *ergonomic* and *energetic affordances* a tool-system provides.[759] The totality of these functional affordances, in turn, can be interpreted to reflect *how tool-systems are adapted to their utilisation*. The functional potentiality of tools and tool-systems is thereby thought to imply a crystallised human gesture.[760]

In this way, the relative 'integration' or 'disintegration' of various UTFs and their 'functional pregnancy' can be taken as a measure for the relative 'abstract-ness' or 'concrete-ness' of lithic tool-systems. This, in turn, allows researchers to discuss whether the functional potential of particular tool structures has been exhausted or whether there is potential for refinement and optimising change (e.g., Nicoud 2011: 400-403, esp. fig. 131; Chevrier 2012: 725-733; Rocca 2013: Chapitre XIII; Moncel et al. 2016a, 2016b, 2016c; **Fig. 54, 55**). The identified tool-structures – interpreted as a *functional present* – are therefore used to *project* their possible further-developed instantiations into the future.

[756] The lack of a major UTF-type may be taken as positive evidence. An example is the apparent lack of an *UTF de CP* ('prehensive part') which may signal that a tool-system was originally hafted, that is, has been part of a more complex super-system involving organic elements (cf. Boëda 2013: 73-75). Again, the lack of a particular UTF-type is seen to change the configuration of 'nexuses' and, as a consequence, to disclose the *potentiality* for hafting. One may even argue that in order to respect the system's global 'operation' (*fonctionnement*), one has to infer that the tool-system *was*, in fact, hafted. This would be an argument from necessity which depends in its validity entirely on the global articulation of the 'effective' tool-parts.

[757] For a discussion of *chaîne opératoire* analysis and its key operations, see the last part of this chapter.

[758] This holistic interpretation of edge-configurations provides new meaning to long-standing lithic tool concepts such as a 'knife.' It may also shed new light on the question of whether or not particular tool-edges can be said to be more versatile or more specialised than others. While some edges, as we have seen, may be not functional at all (i.e., due to their extreme biconvexity), some may be 'razor-like' (i.e., due to their relatively flat plano-convexity) and some may be 'saw-like' (i.e., due to their denticulated step retouch). These and other differences pave the ground for new ways of classifying tools and their parts. This mode of classification highlights 'integration' and the contribution of features to the 'organic' functioning of their whole(s).

[759] For an explanation and discussion of the concept of 'technical affordances,' see the last part of this chapter.

[760] It should be emphasised that the interpretation of functional potentialities is generally *independent* from the question of whether or not these potentialities have actually been *realised* by past users or not. UTF-analysis does not necessarily assume that these past users have *always* exploited the full functional potential of their tools. It typically does assume, however, that the functional potential of tools is *inseparable from how tools had to be conceptualised* before they were created. Strictly speaking, not even this assumption is necessary since particular tool-manufacturing decisions may lead to unanticipated functional potentials which may drive the long-term evolution of these tools yet not always impact their actual utilisation at a given point in time.

Insights on the potentials for refinement and optimising change helps to connect particular tool-instantiations with other tools succeeding them in time. If no absolute chronology is available, tool-structures can be ordered in such a way that maximally parsimonious – that is, *coherent* – technical trajectories are retrievable;[761] this provides an indirect measure of the relative chronology of different tool-instantiations belonging to the same technical trajectory.[762]

The second strand of techno-functional inquiry, addressing the issue of the functional integration of lithic blank production structures in technical evolution, examines the differential treatment of core-matrices in order to assess the relative 'organicity' of core-reduction processes (cf. Boëda 1997: 30f., 2013: 89-97). Analogous to the techno-functional analysis of tool-systems, the strategy is to identify 'significant' core-parts and to investigate their changing functional role. In general, the 'significant' parts of core-reduction systems not only consist of the physical components of exploited core-volumes, but may also comprise non-lithic aspects such as knapping techniques and utilised knapping supports (i.e., striking tools). For the present purpose, however, it is sufficient to concentrate on aspects of the exploited core-volume itself.

Boëda (1997: 30f., 2013: 89-97) distinguishes between 'additive' structures (*structures additionelles*) and 'integrated' structures (*structures integrées*) of lithic reduction. The basic question is whether an exploited volume is used globally, in which case the entire volume is rendered functional, or whether the volume is only used partially, in which case at least one portion of the core-matrix has limited functionality in the reduction process.[763] The concept of the *« volume utile »* ('utilised volume') reflects this logic of reasoning: the 'utilised volume' may be identical with the core-matrix or it may qualify only a proportion of it.[764]

The concept of the *« volume utile »* may be understood rather narrowly or more inclusively. In the first case, the 'utilised volume' is defined by the configuration of the reduction surface and its capacity to yield particular blanks. In the second case, the 'utilised volume' not only specifies the potential volume of primary production, but also includes those parts of the core-matrix that facilitate this production – these parts may be constructed and maintained or not.[765] Core features such as striking platform(s), core flank(s), and/or core back(s) may then be identified as potentially functional or 'effective' elements of reduction systems.

The logic is similar as in UTF-analysis: some of these elements and parts may play an 'active' role during volumetric reduction, others a more 'passive' or 'regulatory' one. When all of these parts

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[761] This indirect arrangement of tool-systems in time presupposes the 'synthetic' understanding of a 'functional schematic' (or 'technical essence') which is carried through by the respective technical lineage. Tool-structures which are not included must be shown to realise another 'functional schematic.'

[762] The approach is 'integrative' because the specification of relevant lithic objects is part of the interpretive task. Disentangling synchronic technological contexts to extract meaningful diachronic trajectories emerges as a central undertaking in techno-genetic inquiry. Sampling, therefore, is typically highly selective and rarely takes all lithic objects in an assemblage-context into account. *What needs to be studied in its entirety is not the lithic assemblage itself but the technical lineage*. As a consequence, everything that doesn't belong to the targeted lineage(s) needs to be (at least temporally) explained away. Even sampling strategies, for this reason, cannot be separated from world theory commitments, and it is not surprise that UTF-driven analysis is often based on sample sizes that 'mechanism' and especially 'formism' would regard as insufficient.

[763] This concept can also be applied to tool-system. Tools may then be analysed in order to determine whether the entire tool-volume is 'functional' or whether some parts remain 'non-functional' in some specified sense. The conception of the 'pluri-tool' (see *supra*), for example, often implies an 'additive' tool-structure (cf. Chevrier 2012: 158) – tool-edges are simply *added* to an artefact-matrix and can theoretically be removed at any time without unmaking the entiry tool-system.

[764] Boëda's (2013: 41) notion of *hypertélie* ('hyperdevelopment'/'overdevelopment') can be interpreted as the tendency of 'organic' technical evolution to remove unnecessary or redundant elements; reducing *hypertélie* (*sensu* Simondon 1958: 50f.) thus opens another pathway towards 'concretisation.' According to Boëda, the trend to abolish *hypertélie* in technical evolution leads to the well-known phenomenon of *miniaturisation*, both in lithic core and blank domains. This lithic 'miniaturisation' is nothing else than the gradual elimination of 'non-used' parts of the volume ('non-utilised volume') and a more tight spatial/volumetric integration of the remaining parts, which ultimately results in increased levels of lithic specialisation.

[765] The inspiration for distinguishing between 'additive' and 'integrated' reduction structures probably derives from the classic Boëdian dichotomy between 'facial'/'surface-exploiting' and 'volumetric'/'volume-exploiting' technologies – ideal-typically identified with Levallois reduction and volumetric blade production of Upper Palaeolithic type respectively (cf. Boëda 1990). Classic Levallois reduction systems offer a welcome example to illustrate what is at stake when one applies the distinction between 'utilised' and 'non-utilised'/'residual' volume-parts in lithic technological analysis. In the case of the classic tortoise-like Levallois core, the constructed hierarchy between the two distinct hemispheres (often asymmetric) creates one part which is 'active' – that is, serves as the volume-matrix to retrieve Levallois blanks during primary production – whereas the other opposing part remains 'passive' – its role is limited to indirect convexity-regulation. However, by serving as the basis for re-preparing the perimeter and controlling the striking platform etc., the surface also has an in undeniable role to play in the reduction system as a whole. Even though this role is not 'active' in the sense that the volume is used for blank extraction or something similar, it has a well-defined system-level function – *it helps to bring forth the desired blanks*. This clarification is important if we wish to apply Boëda's (2013: 89-97) interpretive categories: if one defines the idea of the 'utilised volume' too narrowly, the Levallois core appears to be only partially used; if one defines the concept more inclusively, however, the Levallois core comes into view as a globally used volume-body.

are integrated – that is, only in concert ensure the overall efficacity (*efficacité*) of the reduction process – and the entire volume can be utilised, one faces a relatively 'integrated' reduction structure. Otherwise, one has identified a lithic reduction structure situated more towards the 'additive' end of the spectrum of possible structures. Again, each element is considered a 'fragment' of a larger technical reality and it is through the analysis of each fragment's potentiality of integration (defined by its 'nexus') that the relative 'organicity' of core-reduction structures can be determined. 'Additive' structures tend to be 'abstract' because the synergetic potential of the parts has not been realised yet. Conversely, 'integrated' structures tend to be 'concrete' for the opposite reasons.

A complete integration of core reduction processes, however, also requires temporal coherence. Boëda (2013: 90-92) introduces the distinction between 'homotetic' and 'non-homotetic' core reduction to address this issue. 'Homotetic' core reduction (*caractère homotétique*) is when the reduction structure, once installed, can be kept constant during the entirety of the reduction process. 'Non-homotetic' core reduction (*caractère non homotétique*), by contrast, is when the reduction structure has to be re-created or altered at least once during the reduction process. Consequently, lithic reduction can only develop high levels of inclusivity when a 'homotetic' character is assumed since it is only then that the temporal organisation of reduction is 'harmonised' or 'synchronised' with its spatial organisation.[766]

Boëda's (2013: 100-174, esp. Fig. 97) six-tiered evolutionary scheme, identifying a general developmental progression from 'Type A' to 'Type F' reduction structures, attempts to order core exploitation systems according to these criteria. The scheme epitomises classic organicistic reasoning and presents a single technical trajectory thought to incrementally strive towards the 'organic' ideal of core reduction (see esp. *ibid.*: 147, 151-174).[767] 'Organicity' is thereby simply the measure for the *relative technical coherence* between the structural key features of different core exploitation systems outlined above.

All of this clearly demonstrates that the techno-genetic paradigm is powered by the structural categories of organicism and its particular logic of 'world making.' This infusion of techno-genetic thought with life-oriented metaphors and concepts is not least reflected in a prevailing pre-occupation of the lithic discourse with *« mémoire oubliée »* ('lost memory') (e.g., Lepot 1992/1993: 28; Bonilauri 2010) and *« altérité technique »* ('technical otherness') (e.g. Chevrier 2012: 11, 87; Weyer 2016: 23)[768], terms which prominently feature in many techno-genetic accounts and play an key role in Boëda's *Techno-logique & Technologie* (2013). The two conceptions can be interpreted as a refinement of basic organicistic categories – i.e., heterogeneity, subjectivity, object-specificity, and alterity – revealing some of the larger implications of approaching lithic technology form an organicistic perspective. Both concepts are best understood in tandem (*ibid.*: 42) – as a product of the specific, yet often tacit, anthropological agenda of techno-genetic investigations.

The techno-genetic approach arguably conveys a radical anthropological impetus. Its techno-deterministic orientation paves the ground for a *radical anthropology of technology*. Although this assertion initially sounds paradoxical, it turns out to be the logical consequence of how humans and lithic technologies are conceptualised. The core idea of techno-genetic reasoning is that technology, in

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[766] The cardinal example of 'homotetic' reduction with elevated levels of 'organicity' is Upper Magdalenian blade production of the Paris Basin. The often large blade-cores are carefully and extensively prepared, so that their initial appearance mimics a bifacially worked piece with biconvex outline. These 'pre-cores' are then exploited bidirectionally, by using a rather redundant flaking algorithm, alternating serial blade-removals from both striking platforms. The result is the potential to quickly exploit almost the entire volume of the cores. The main reason for discarding cores is not their 'non-functionality,' but rather their incapacity to produce blanks of particular sizes – the residual cores are simply too small to fulfil certain blank-requirements. The fact that the cores are not fully exploited is therefore not the result of structural constraints but instead reflects particular human selection preferences. The main point, however, is that the core structure, including exploitation strategies, can be kept fairly constant during the entire reduction process, once it has been installed by extensive preparation. Moreover, almost all structural features of the reduction process support each other in their functionality. For example, tangential soft hammer percussion yields *en éperon* prepared blanks smoothly extending down the exploitation surface while keeping the central surface convexities rather intact. Additionally, alternating series of blade-removals from two directions introduce an element of 'auto-preparation:' they balance the amount of material removed from both sites and thereby *auto-regulate* the structure of the primary extraction-convexities. The dynamics of the system hence establish self-organisational principles – principles which are also considered characteristic for living and quasi-living systems. Because many technical elements work together in these and similar ways, the total reduction system can be said to be relatively 'organic.'

[767] According to Boëda (2013: esp. Fig. 97), 'Type A' to 'D' represent relatively 'abstract' reduction structures, while 'Type E' and 'F' exhibit relatively 'concrete' reduction structures.

[768] See esp. the research project *L'altérité technico-culturelle du continent asiatique durant la préhistoire: peuplement et changement culturel* (2010-2013) sponsored by the *French National Research Agency* (ANR) and directed by Hubert Forestier and Éric Boëda.

contrast to proper living systems, constitutes a *semi-autonomous* life-form (cf. Chevrier 2012: 100). The reason is of course that although technology is capable of self-determining its direction of development,[769] it always needs to be created, reproduced, and/or maintained – it thus generally depends on hominins and their societies to survive. Hominins, however, are also not in full control. Following the 'Early' Leroi-Gourhan and others, it has to be admitted that these hominins, before anything else, live in an 'internal milieu,' part of which is the 'technical milieu,' and only secondarily, through mediation, come into contact with their external (natural/non-technical) milieus (Boëda 2013: 223). As a consequence, they can only survive by being receptive to the requirements of their technical surroundings and by consulting the latter's possibilities.

The resultant conflict between hominins and their technologies creates both leeway and constraints for technical evolution – both agencies, although very different in nature, have to be coordinated. Arguably, this is precisely the scenario that is implied when proponents of the techno-genetic approach insist on *human-technology co-evolution* (cf. Boëda 2005: 47, 2013: 22-23, 42). This emphasis on the 'co' entails a methodological *symmetrisation* of human and technological domains, recasting *Homo faber* as *Homo coordinans* (*sensu* Schick 2018).[770]

The specificity of human life, in this view, consists of the fact that it is irreducibly bound to self-created technical worlds.[771] Humans, as a consequence, cannot escape but have to *deal* with this world and to *coordinate* their actions with it – different technical worlds thereby imply different possibilities of coordination.[772] Thus, the human comes into view as a being fundamentally defined by its *technological condition* – a situation that Bernard Stiegler (1994 [2009]: 201f., 2003) has characterised as the distinctive 'pharmacological condition' of humanity.[773]

The organicistic logic of this account is pervasive. First, a distinction is drawn between two 'modes of existence' – one anthropological, the other technological – only to reveal that there is developmental 'conflict' between them. Secondly, it is shown that the conflict can be resolved by finding a new synthesis between the two. In order to make the synthesis happen, thirdly, the two conflicting parties have to converge their developmental potentials in order to establish a new stable state of relative *symbiosis*. This new stable state, realising one or more meeting points of the appendant 'nexuses,' inevitably forces both parties to change. The conclusion is that change must be understood as an organic co-evolutionary process.

If organic co-evolutionary processes are realised by long-term technical trajectories, these trajectories convey human-technology configuration which are specific to them. They can be interpreted as a distant voice of past humans *and* past technologies. Techno-genetic approaches therefore typically define themselves in direct opposition to any kind of sociocultural reductionism.[774] The critique is primarily voiced against lithic 'contextualism' which tends to re-cast each historically situated context as a

[769] Audouze (2013: 18), for example, explicitly speaks about technological 'vitality' to describe the quasi-autonomy of lithic technology.

[770] As indicated by the preceding sentence, this 'symmetrisation' can only be methodological since humans and technologies exhibit different 'mode of existence.' They legislate over their respective other in very different ways and potentially at different temporal scales. The involved 'power-relations' are thus asymmetrical, but it remains difficult to say who is actually 'in the driver's seat.'

[771] The subtle but important difference between 'contextualistic' and 'organicistic' readings of the evolutionary significance of human-created worlds is notable here. The former typically emphasise the inextricable *enmeshment* of humans and their worlds, crystallising in the conception of the Maussian *l'homme total* (see also **Appendix II.3**), whereas the latter tend to underscore the ontological *difference* between humans and their artificial material worlds. From an 'organicistic' perspective, human-created technical worlds may accordingly acquire a status as *semi-independent forces* in human evolution.

[772] Because this technical world evolves, whether humans want it or not, it provides a *resonating resistance* to human action, creating existential 'conflict' and thus also the potential for solving it. Each such solution therefore implies coordination and development, sometimes even creativity and innovation (see *supra*).

[773] According to Stiegler (1994, 2004a), living in a technical world is a double-edged affair: on the one hand, technology is an enabling force and allows us to do certain things; this is what we normally refer to as the inherent instrumentality and potentiality of technology. On the other hand, however, technology also constrains and/or channels human action and narrows down the available options; this is the inevitable techno-deterministic dimension of human technical existence. Stiegler captures this duality with his notion *pharmakon*. Technics, in his view, are always both 'cure' and 'poison' at the same time, both humanity's potential salvation and its doom and ruin (Stiegler 2010). The technological nature of human existence thus simultaneously frees and condemns. For Stiegler (2009 [1994]: 201-202, 2006: 115), this 'pharmacological condition' is the *sine qua non* of what it means to be human.

[774] In France, there are currently some efforts underway to re-establish 'anthropology' as a separate discipline with its own subject-matter (e.g., Piette 2010, 2011). These efforts are bound to the recognition that the 'anthropological' cannot properly come into view if it is reduced to the 'social' or 'cultural.' In general, this endeavour seeks to define a new (and somewhat radical) anthropology, in which anthropological and not merely sociological or 'culturological' questions can be investigated – the goal is to free anthropology from 'the tyranny of sociology and ethnology' (Piette 2017). This approach also stresses the critical *object-specificity* of anthropological research (Piette 2016).

singularity. Having said this, the critique may also apply to some branches of *« Paléohistoire » sensu stricto* where social evolution is volitionally foregrounded (e.g., Bon 2009, 2015). Taken together, we may conclude that the techno-genetic endeavour seeks to establish a proper *techno-logical anthropology of the deep past* – an anthropology where *technology* has a crucial say.

The notions of *« mémoire oubliée »* ('lost memory') and *« altérité technique »* ('technical otherness') bespeak of this anthropological significance of technical lineages. The first concept – *« mémoire oubliée »* – focalises the non-material dimension of co-forged trajectories – the fact that they are the product of specific forms of mind-matter interaction, *as such* storing a particular sociotechnical memory.[775] Since most technical lineages went extinct long ago and have no connection to the present, the memory that they record is 'lost' and cannot be retrieved from the technical inscriptions of the modern world anymore (Boëda 2013: 226-230).[776] The second concept – *« altérité technique »* – is both a consequence and a precondition of the first (*ibid*.: *42*); it reflects the conviction that the specific coordinative accomplishments [*Koordinationsleistungen*] that have incrementally given shape to a technical lineage are to be interpreted as a convergence of mind and matter never achieved in this particular manner again in human evolution. The particular technicality that 'fossil' lineages convey therefore expresses an irreducible anthropological 'otherness' – it provides evidence for *alternative humanities* to have existed in the deep past.

The study of long-term technical trajectories in the Palaeolithic is hence also the study of how we *could have been*. It opens the gates for a fundamental inquiry into *human life* itself, with the intent to re-map its inherent developmental potentiality.[777] In general, it is therefore not surprising that techno-genetic research has paid much attention to disconnected geographic areas (e.g., Boëda and Hou 2004; Li et al. 2009; Forestier 2010; Forestier et al. 2010; Boëda and Hou 2011; Boëda et al. 2013a, 2013b, 2014, 2015; Nicoud et al. 2016; Wei et al. 2017; Chevrier et al. 2017). The aim is to identify and characterise local evolutionary trajectories and to compare them on a global scale (e.g., Chevrier 2012; Moncel et al. 2016a, 2016b, 2016c; Weyer 2016). The focus lies on 'technical alterity' in its chronological and geographic dimensions. This focus, *grosso modo*, issues the antithesis to research agendas seeking to uncover *behavioural modernity* in space and time – agendas that are predominantly pursued by Anglophone scholarship. Techno-genetic analysis is interested in technical 'otherness' and its implications, not in the question of 'modernity.'

To conclude, the techno-genetic paradigm is built on concepts and ideas which are predominantly organicistic. These concepts not only feed into general theories of evolution, but have left a deep mark on the concrete methodologies devised to understand the 'structure' of lithic technology themselves. This notion of 'structure' differs from the signification of the same term in 'contextualism': it serves a much greater purpose – namely, to reconstruct technical lineages – and is primarily analysed

[775] Boëda (2013: 223f.) draws on Stiegler's (1998, 2004a, 2009 [1994]: 234-236) notion of *« épiphylogénèse »* ('epi-phylogenesis') to clarify the nature of 'lost' sociotechnical memory. This memory is primarily 'material,' but is cultivated and created by processes of 'epi-phylo-genesis.' The latter describes, as Stiegler points out himself, a fusion of Leroi-Gourhan's (1964/1965) concept of 'exteriorisation' and Bergson's (1896: xi) idea that 'memory' forms the natural point of intersection between mind and matter (cf. Copleston 1994 [1974]: 190). The core idea is rather simple: the long-term co-evolution of humans and technologies nurtures specific bodies of practical and theoretical knowledge in need of being stored outside of biological organisims, that is, 'epigenetically.' Technology itself is a suitable extra-somatic carrier information because of its longevity and its consequential ability to bridge past, present, and future. For Bergson (1896: 294), memory is formed in duration and generally yields "a synthesis of the past and the present in view of the future." Such a synthesis can only be provided by 'technical lineages,' which thereby come into view as products of 'epi-phylo-genetic' evolution. The *« mémoire épiphylogénètique »* ('epi-phylo-genetic memory') embodies by varying such lineages is different from Halbwachs' (1925, 1950) *« mémoire sociale »* ('social memory'). It primarily concerns inscriptions of practical, cognitive, and technical significance. These are thought to precede the social and symbolic inscriptions of the *« mémoire sociale »*. The externalised memory of technical lineages sheds light on the becoming of general constellations of *« manières de faire »* ('ways of doing'), *« manières de voir »* ('ways of seeing'), and *« manières de vivre »* ('ways of living') (*sensu* Stiegler 2009 [1994]: 145; cf. Boëda 2013: 226-230).

[776] Because the modern world is a product of its own lineage-ecology, extinct – that is, 'fossil' – lineages and the knowledge they convey cannot be illuminated by drawing on the present. This trail of reasoning implies another forceful critique on universalistic accounts basing their explanatory principles on observations in the present. In the context of lithic research, a prime target of this critique is 'Middle Range' theorising, practiced both by lithic 'formists' and 'mechanists,' as well as 'uniformitarian' reasoning, mainly advocated by 'mechanists.'

[777] The fact that different 'technical lineages' are thought to realise differential facets of the human evolutionary potential shows that 'plasticity' and 'elasticity' are granted only on hyper-evolutionary timescales. Plasticity, for example, consists not in the ability to adapt to particular environmental circumstances as optimal as possible, but rather in the capacity to accumulate a myriad of different sociotechnical outfits to live in a generally difficult world in a myriad of different ways. Human plasticity, in this view, can only properly be studied if divergent long-term trajectories of human-technology co-evolution are compared. Put differently, within a given technical lineage plasticity is often critically reduced, yet the juxtaposition of different technical lineages reveals that human technicity, on a general level, turns out to be highly plastic indeed.

to determine the relative 'organicity' and self-regulatory capacity of different technical entities. Techno-genetic research has thereby adopted a view of technical evolution that foregrounds internal 'organic' development and integration – a view inspired by life-theoretical currents of technological and cybernetic thought in France. Some of the respective ideas have led to a basic reconsideration of the nature of lithic technology and its role in early human evolution.

An important result of this reconsideration has been the re-cultivation of the classic concept of the *Homo faber* ('technical man'), placing renewed emphasis on the primacy of human technicity and the difficult becoming of coupled 'anthropo-technical systems.'[778] This accentuation of the *Homo faber* is tied to a vision of human evolution inspired more by Bergson than Darwin.[779] After all, it was Bergson who initially coined the concept of the *Homo faber* and it is – perhaps unsurprisingly then – Bergson who is cited at the very beginning of Boëda's latest book (2013):

> "[…] If we could stray ourselves from all pride, if to define our species we would strictly adhere to what history and prehistory present to us as the constant characteristic of man and intelligence, we would perhaps not say *Homo sapiens*, but *Homo faber* instead." (Bergson 1959 [1907]: 613; cited by Boëda [2013: introductory citation] and original emphasis; my translation [the original French quote is given in **Appendix Q.22**])

[778] See Hussain (2018) for a more detailed discussion on the role of the *Homo faber* in French lithic research, including the significance of 'technicity' as a concept.
[779] For Bergson's critique on Darwinian evolution, see e.g. Miquel (2007).