Technical data, typological data: a confrontation.

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Here, typological and technological data have been compared through several examples from the European and Anatolian Neolithic together with a discussion about the use of these analytic methods. Several cases of morphological and technical continuity are examined. The aim is to point out the benefits of both methods from the perspective of enlarging our anthropological knowledge of the Neolithic.

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The archaeologists, when faced with worked bone material, have at their disposal different tools of analysis and procedures of classification among which typology is the most important. Henriette Camps-Fabrer (1966) developed this method for the Neolithic. At that time, she attempted to distinguish various formal characteristics of bone tools on the basis of morphological criteria. By identifying the manufacturing techniques used to produce artifacts, authors such as Danielle Stordeur incorporated technical and functional elements within their classification of tool assemblages, bringing into question the purely typological approach (Stordeur 1982; 1985).

This French school has practiced for 40 years and today I would like to present a methodological idea concerning the way how combining the study of technical and typological analyses can make a contribution to our understanding of bone industries. Even though the question may appear trivial, it is not uninteresting to consider the synergy of the two methods from the standpoint of knowledge of traditions, innovations, and the transfer of practical knowledge in the hope of seeing new directions emerge in the way we handle this artifact class. Moreover, although this comparison has been ongoing over many years by people working with lithic material (Tixier et al. 1980; Tixier 1996), it has never been considered, to my knowledge, for bone industries. In order to illustrate this point, I have drawn on a few instructive case studies relating to European and Near Eastern Neolithic bone industries, from Syria to France.

Case study 1: continuity of techniques, discontinuity of morphology

Here we have two examples, which concentrate on northern Syria, Anatolia and the Balkans and illustrate a total separation between technical aspects of these assemblages and their morphological and stylistic aspects: hooks and spoons.

The technology of these two categories of objects does not vary or at least not very much on either side of the Bosphorus. As opposed to the Cardial spoons, whose shape is linked to the raw material they are made from (Camps-Fabrer et al. 1990, 146–147), the fabrication of the Anatolian and Balkan spoons, just like the fabrication of the hooks, emerges from a precise and exacting technology when it comes to the quality of the end product. It represents a form of sculpture, which consists of extracting a totally new and sophisticated shape from the original form. The latter is shaped little by little, first traced, then cut, scraped and dug out with a small stone tool (cutting edges, points and polisher tools) and a twine used as a tool (Figs. 1, 2).
On the other hand, the morphology, assembling and dimensions of these elements vary even more. In Turkey, all the dimensions and shapes found in diverse assemblages, co-exist at the same time at many different sites. Based on the stylistic expression of the elementary shapes, hook and spoon shapes cannot be categorised within one particular type although at the same time they can still be classified within broader families of objects (Fig. 3, 4). If the morphology and styles of these two categories of artifacts seem to develop very quickly in time and space, it is because a certain amount of formal decoration is allowed. For example the handles of the Anatolian spoons are decorated or finished with diverse anthropomorphic or zoomorphic patterns, in some cases the whole spoon representing an animal (Fig. 3: 9, 10). In the more recent Neolithic of Bulgaria, decoration can be found on hooks (Fig. 4: 1–3). The morphology of Bulgarian spoons, like the most recent ones from the Anatolian region (Pendik: Özdogan 1983, Fig. 6) tends on the contrary to be more standardized and belongs to one particular type (cf. typology of Nandris 1972). The Bulgarian hooks, true anthropomorphic sculptures, replace the Neolithic Anatolian hooks, which are totally lacking in decoration in general. During this stylistic development, the decoration put into the making of the Anatolian spoons has been shifted to the benefit of the European hooks. In the case of these two categories of artifacts, the drift in space and time was based on the decorative and stylistic repertory rather than on technology. The stylistic expression in all its diversity dominates, in spite of its common technical root.

Case study 2: discontinuity of techniques, partial continuity of morphology

Two new examples, which concentrate on Bulgaria and the rest of Neolithic Europe, illustrate the setting up of technical innovation and the adaptation of the morphologies to the newly applied techniques.

Two ways of fabricating rings co-exist for a while in Bulgaria. One of them, used in the majority of cases and probably the oldest of the two, uses the same technique, namely the sculpture of the
Fig. 3. Spoons from Anatolia and Bulgaria. 1–5 Kovacevo, Bulgaria; 6 Ilipinar (from Marinelli 1995); 7–10 Hacilar (from Mellaart 1970); 11 Pendik (from Özdogan 1983).

Fig. 4. Hooks from Anatolia and Bulgaria. 1–4 Kovacevo, Bulgaria; 5 Pendik (from Özdogan 1983); 6 Abu Hureyra (from Moore et al. 1975); 7 Halula (from Stordeur 1996); 8–11 Hacilar (from Mellaart 1970).
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Fig. 5. Ring manufacturing process, slowly formed by grinding around the perforation.  
1 diaphysis plate; 2 sawing the plate; 3 shaping the edges of the blank; 4 perforation; 5 shaping the blank;  
6 enlarging the perforation by scraping; 7 final shaping; 8–9 rings from Kovacevo, Bulgaria (Early Neolithic); 8 is an unfinished product.

material, characteristic of earlier Near Eastern industries. It aims to produce circular or rectangular  
rings, with variable diameters and thickness, also sometimes with some external prominant decorative  
elements. These volumetric variations are made possible by this technical process: the extraction of  
a ring from a length of a bone at least as thick as the thickness of the object (Fig. 5). The other  
technique, more rare and probably more recent, consists in cutting transverse slices of segments  
of long bones of corresponding dimensions. The cutting was carried out with twine (Fig. 6). The  
modules of the rings produced from this technique closely depend on the size of the bone and the  
species chosen. In spite of the greater morphometric constraints, because the thickness and  
internal diameter of the ring corresponds to the bone segment, the technique spread throughout  
all subsequent European cultures: Körös (Hungary: Makkay 1990), Cardial (Southern France and  
Spain: Sénépart 1984) and Linear Pottery (France: Sidéra 1989). The other technique grew much  
less common or was even abandoned. It still exists, for example, in the Körös culture (Makkay  
1990, Fig. 16).

The process of technical concept, which governs the realization of the two categories of rings, is  
fundamentally different. The first technique depends on the extraction of a “free” shape,  
independent of the raw material. The second one depends on the natural morphology of the bone  
and adapts itself to it. The fabricated ring is indeed constrained in its dimensions and its shape.  
No added external prominent decoration can be added to it. In the case of these two techno-  
types, the evolutionary choice does not rest on the stylistic and morphological variables, but  
rather on technical simplification.
The example of flat perforating tools produced on the metapodia of small ruminants is another illustration of partial continuity of morphology vs discontinuity of techniques. These tools, with their characteristic morphology, were widespread in Europe from the Early Neolithic of Bulgaria, to the more recent Neolithic in Greece but also along the Spanish and Sardinian coasts (Cardial), Continental Europe (Camps-Fabrèr et al. 1990; Christidou 1999; Sénépart 1984; Sidéra 1998; 2000b) (Fig. 7). They are still present in the later Neolithic period of Switzerland (Cortaillod: Murray 1977; Schibler 1981; Sidéra 2000a), of Italy (Lagozza: Maggi et al. 1997) and of France (Chasséen: Vaquer 1990) and the Chalcolithic of Bulgaria (Karanovo VI: Sidéra 1996). However, a thorough reading of the fabrication marks shows that they are produced using three distinctive manufacturing methods, which, by differentiating the cultural complexes in time and space, represent a significant amount
Fig. 8. Manufacturing processes for the flat perforating tool morpho-type. The first method uses abrasion only (example from Cuiry-lès-Chaudardes, Northern France, from Sidéra 1989). The second uses sawing first, then abrasion (example from Cuiry-lès-Chaudardes, Northern France, from Sidéra 2004). The third one uses abrasion first, then sawing (example from Muntillier, Switzerland, from Sidéra 2000a).
of cultural know-how: 1) manufacture using abrasion only (Poplin 1974); 2) manufacture by first sawing the metapodia in half and then abrading it (Sidéra 2004); 3) manufacture by first abrading and then by sawing (Murray 1977) (Fig. 8).

In the last two methods, abrasion has an impact and an intensity which has variable importance depending on the particular object. The tools used for fabricating these objects are also different depending on the methods used, since the first method limits itself to the use of a polishing tool. The second and third methods require the use of some sharp stones and polisher tools used in differing orders.

From a morphological point of view, there is nothing or at least very little to permit differentiation between the products of the three chaînes opératoires. Every front face includes some abraded areas spreading, more or less, from the shaft to the epiphysis and sinking deeply into the spongiosa (Fig. 8). On the other hand, the profiles have different shapes. Some, very narrow and regular, reflect the intensity of a large bi-facial abrasion. Some others, thicker and regular, display a large bi-facial abrasion but one which is still lighter than the first method. Finally, it is possible to find other objects where there is irregular, local abrasion. The cross-sections of these objects partly reflect the techniques used: For the first method: the cross-sections are rectangular from one end to the other; For the second method: the cross-sections are either rectangular or “crescent-shaped” depending on how the object develops in a lengthwise direction; For the third method: the cross-sections are either rectangular or rectangular and “crescent-shaped” depending on each individual object and the intensity and extent of the initial abrasion.

We are dealing here with a morpho-type (Fig. 7) resulting from different techniques and cultural skills (Fig. 8). Therefore, during the earliest Neolithic period use of the first two chaînes opératoires may be found within the same site (with a few variations that will not be mentioned, regarding the specimens from the Early Neolithic of Bulgaria). The second chaîne opératoire is mainly used in the Later Neolithic period of Bulgaria and Western Europe (the Southern Chasséen, as far as I know). It probably results from the morpho-type study that pre-existed in the former industries, but with a technical adaptation. The third method is specific to the Cortaillod sphere. It results from a local technical adaptation, seeking to produce a flat morpho-type but at the same time limiting the impact of flint, which is imported and rare in this area (Augereau 2000; Sidéra 2000a). With the exception of the Cortaillod bone industry, the flat morpho-type was previously present in all industries of the later Neolithic period where it was produced. It is probably reminiscent of most old industries, but with a technical drift. In the Cortaillod, it may have been acquired through contact with other contemporary cultures, such as the Lagozza or southern Chasséen. This would explain the uniqueness of the method used to produce it.

Case study 3: continuity of the techniques, continuity of morphology
Two new examples, the shoe-last shape in bone and stone, display a respect for shapes and techniques through the transfer of raw-material.

A sharp convex edge, a flat lower face, a convex even trapezoidal upper face and large divergent lateral edges define the morphological stereotype of a stone adze, called the shoe-last type which is typical of the complex of the Linear Pottery Culture. By the end of this culture in the Paris Basin, replicas of stone adzes are produced in bone (Sidéra 1989; 1995) (Fig. 9). This replica is not only morphological but also technical. The shapes of bone shoe-lasts, just like those from stone, are indeed produced from a flake made from a direct percussion and are
shaped by a covering abrasion. However, the debitage marks remain visible at the base of the artifacts. The flake scar from the percussion are not generally abraded (Fig. 9: 1, 2). This is a characteristic common to both stone and bone elements.

Where shoe-last shapes are concerned, skills and morphology are perfectly congruent. We are dealing with a tool, whether it be of stone or bone, loaded with a strong cultural and social significance closely connected with the consistency in techniques and morphology. Therefore, this example very definitely displays technical and morphological conditioning, so that a specific type of tool can survive, therefore assuring its identity and social functions. We have to add that the making of bone shoe-last shapes happen when the distribution networks are collapsing and when, in order to continue making it, it was necessary to change the raw-material. This type of object disappears at the same as the culture which created it.

**Fig. 9. Distribution of the bone shoe-last shape.** 1 stone, Trebur, Germany (from Driesch et al. 1992); 2 bone, Cuiry-lès-Chaudardes, Northern France.

**Conclusions**

The six examples chosen for discussion in reality show the evolutionary mechanism through time and space of the fabrication of different categories of artifacts, through morphological and technical transfers, which can be total, partial and at times separated. The examples of hooks, spoons and rings illustrate the principle of a technical concept common to a vast geographical area comprising the Near Eastern Neolithic and Balkans deriving from the same techno-complex. On the contrary, the morphological and stylistic characteristics of this production, which displays a great deal of variability, represent some other localized or regional identities. The shoe-last shapes are a good example of the accurate reproduction of shapes and techniques from one object to another. From this accuracy results one rarity: a strict type of object. The artifact survives through the change of material, from stone to bone and keeps its identity and social functions.

Through the morpho-type of the flat perforating tools, the technological approach makes sense because it permits, in definitive, to set in order their vast geo-chronological dispersion. The problems mentioned here are related to the origin of the techniques, their lasting ways and their drifts. Because we also face with a variability of the methods using to produce the same
type of artifacts, we can also put forward the origin of the adoption of the product. Thus this
double approach is an advantage to deal with the diffusion and origin of the cultural shifts. It
must be added that technical methods appear to a very good criterion for cultural differentiation.
Lastly the case study of the rings of Bulgaria shows more particularly the mechanisms of
replacement from one technique to another. Simplicity has played an important part in this case
and has dominated the morphological, stylistic and dimensional freedoms that the use of the
technique through sculpture permits. The stylistic expression disappears for the benefit of the
technical simplification. At the same time, this new adoption is one the characteristics which
expresses the freeing of the Bulgarian Neolithic from the already Early Near Eastern Neolithic
 techno-complex. It is also signs, including the flat perforating tools, of the birth of the European
 techno-complex.

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