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## Chapter 28

# Social Intimacy, Artefact Visibility and Acculturation Models of Neanderthal–Modern Human Interaction

Gilbert B. Tostevin

The dispersal of anatomically modern humans into Eurasia and their encounters with biologically archaic populations such as the Neanderthals is one of the most fascinating questions in palaeoanthropology and was a central theme of the conference ‘Rethinking the Human Revolution’. Within this topic, the most hotly debated issue has been the Neanderthal Acculturation Hypothesis as applied to western Europe, in which intrusive Aurignacian populations of modern humans are argued to have been responsible for Neanderthal populations changing their material culture behaviour from one typed archaeologically as the Mousterian of Acheulean Tradition to one typed as the Châtelperronian (Mellars 1989; 1993). Through a series of critiques and rebuttals (d’Errico *et al.* 1998; Mellars 1999; 2005; Zilhão & d’Errico 1999; 2003; d’Errico 2003; Conard & Bolus 2003; Bordes 2003; Gravina *et al.* 2005; Zilhão & Trinkaus present volume), the arguments and chronological data have been greatly clarified for both the independent evolution of the Châtelperronian and the Bow Wave Model (Mellars 1999; 2005), a long-distance version of the Acculturation Hypothesis. Yet the current discussion has been substantially hindered by a lack of concern for how anthropological theory can inform our understanding of potential culture contact for both Neanderthal and modern human populations. This chapter attempts to address this issue.

Both ethnography and historical archaeology have provided examples from which anthropologists have modelled culture contact processes (Wiessner 1983; Lightfoot & Martinez 1995; Fagan 1997; Lesick *et al.* 2002). Yet this perspective is mostly ignored in the debate’s almost exclusive focus on the chronostratigraphic *possibility* of the Aurignacian affecting the Châtelperronian in a particular region as a result of the Aurignacian *preceding* the Châtelperronian in that region. While such questions must be pursued and recent work in this area has been extremely productive

(Bordes 2003; Zilhão & d’Errico 1999; 2003; Conard & Bolus 2003), a wealth of ethnographic and historic examples of culture contact demonstrate cultural processes which undermine the current chronostratigraphic arguments used to assess the Bow Wave Model. For instance, d’Errico and colleagues (1998, S11–12) argue that differences in the techniques of manufacturing bone tools and personal ornaments in Châtelperronian and Aurignacian contexts disprove any technological diffusion from Aurignacian to Châtelperronian artisans in neighbouring sites or regions. This data does indeed argue against the diffusion of *techniques* but does not refute the long recognized phenomenon of *stimulus diffusion*, the spread of the idea of an object, rather than the specific techniques of its manufacture (Kroeber 1940). While Mellars has also neglected to utilize the anthropological concept of stimulus diffusion in his ‘impossible coincidence’ argument (2005), his citation of ethnographic examples of long distance contact (Mellars 2005, 21–2; Mulvaney 1976; Murdock 1960) clearly shows that he recognizes that such contact can be as much an impetus to culture change as face to face interaction. This is an integral part of the stimulus diffusion concept defined by Kroeber. The ethnographic examples Kroeber uses to illustrate the concept demonstrate that instances of stimulus diffusion tend to occur as a result of either greater cultural distance (i.e. resistance to change or incomplete knowledge) or greater geographical distance between the affected and affecting societies when compared to instances of full diffusion. It is known that hunter-gatherers can be affected by material culture diffusing as far as 1200km away from the source of the behaviour (Mulvaney 1976, map 3). In such a case, Neanderthals in the Dordogne could be affected by modern human populations in the Lower Danube even though only individual Neanderthals in the Lower Danube would be in direct contact with the moderns. Thus, although unacknowledged to date, the

stimulus diffusion concept is at the heart of the Bow Wave Model as presented by Mellars (1999; 2005).

Given the centrality of stimulus diffusion to the Bow Wave Model, it is insufficient to demonstrate (e.g. Gravina *et al.* 2005) or refute (Bordes 2003) interstratification of Châtelperronian and Aurignacian occupations in the same site or even region in order to support or refute the Bow Wave Model (but see Zilhão & d'Errico 1999, 45–7). Instead, one must be able to differentiate the results of independent innovation from diffusion as well as diffusion from stimulus diffusion in material culture behaviour associated with Neanderthals and modern humans in order to test this model. Movement in this direction has, unfortunately, been slow and the repercussions of this lag in the development of method and theory are clearly seen in the debate. With this in mind, the present chapter attempts to bridge this method and theory gap by presenting a new middle-range theory for studying the material evidence of social contact, or what may be called social intimacy. This new theoretical perspective is combined with a modification of Tostevin's previous methodology for quantifying the comparison of flintknapping behaviours at the assemblage level (2000a,b,c; 2003a,b; in press; Tostevin & Škrdla 2006). This combination of theory and method is thus designed to evaluate three-way assemblage comparisons suitable to investigating acculturation hypotheses, rather than pair-wise assemblage comparisons for the purpose of testing for ancestor-descendent relationships. The workings of this new method and theory are demonstrated against one of the possible acculturation scenarios of the Bow Wave Model within the Middle Danube region during OIS 3.

### A middle-range theory for measuring social intimacy

The interaction between Neanderthals and anatomically modern humans must be treated as the accumulation of numerous culture contact events if this interaction is to be studied with any degree of theoretical sophistication. As such, we must base our understanding of this interaction on the recognition of contact events as arenas of social processes. The Late Pleistocene was a period in which potentially quite different social environments came into contact, the environments in which individuals were enculturated into how to lead their lives within a group. This enculturation, extending from birth to death, includes how the individual learns and gains proficiency in a wealth of behaviours, such as the formation of social relationships with kin and non-kin, the social uses of material culture, methods for exploiting a landscape's resources, the body techniques and operational se-

quences for material culture production (*sensu* Lemonnier 1992), and the articulation between technological choices and the organization of the society's tasks on the landscape (Nelson 1991). While this conception of enculturation agrees with Herskovits (1948, 41) in presuming that more enculturation occurs earlier than later in life, this definition differs from Herskovits's earlier use of the term in emphasizing the continuity of learning processes exhibited by non-human as well as human primate societies. In this sense, the enculturating environment discussed here is more akin to Donald's (1991; 1998) use of the term, as well as Boesch & Tomasello's (1998) and Kelly's (1995, 153–6) discussions of social learning from role models.

From recent ethnographic and ethnohistoric examples of culture contact, it is clear that such events are arenas for the interplay of numerous social as well as biological processes (Wiessner 1983; Lightfoot & Martinez 1995; Lightfoot *et al.* 1998; Van Kirk 1983; Merrell 1999; White 1991; Fix 1999; Cook 1998). Yet these different processes are contingent upon the social proximity of the actors involved (Wobst 1977; Carr 1995a) and Palaeolithic archaeologists have yet to use this fact to our advantage in understanding how close archaics and moderns got to each other during their contact events. This chapter is an attempt to apply the needed anthropological theory to the study of Pleistocene culture contact, albeit in a brief form; please refer to Tostevin (in press), however, for the more developed middle-range theory addressing these issues.

Drawing on the ethnoarchaeological work of Wiessner (1982; 1983; 1984) and Lee & DeVore (1976) among the !Kung San, the process of culture contact between hunter-gatherers can be understood to vary between events in which individuals have little exposure to each others' residential space, with meetings occurring at the edge of their respective ranges, to events in which marriage partners are exchanged and previously 'foreign' individuals become fixtures in each others' residential lives (Fig. 28.1). Wiessner's work (1983) suggests that bow shot range is the likely distance for contact between unfamiliar individuals. As individuals become more familiar or *socially intimate* with each other (i.e. willing to engage in social interaction rather than aggressive territorial exclusion), interaction begins to take place within residential camps, where many individuals of diverse ages, and particularly children, are exposed to the stranger. This represents the access of the stranger to what Stanner (1965; Peterson 1986) terms the forager's *estate*, the core of her/his range. When socially distant individuals become familiar enough with each other to affect how they and their offspring learn about the



Contact along the pathways  
(socially distant)

Contact in residential sites  
(socially intimate)

**Figure 28.1.** *Spectrum of locations and social intimacy involved with culture contact among foragers. (Copyrighted photographs provided courtesy of AnthroPhoto.com.)*

world, their respective enculturating environments have begun to overlap. This overlap is the temporal, geographic, and social space in which *acculturation* occurs, defined here as the process of learning from a socially distant individual. *Social distance* itself may be defined at various levels of intimacy, frequency of interaction, and form of interaction depending upon the question but may be taken here as encapsulating individuals within the ‘intimate’, ‘effective’ and possibly the ‘extended’ networks discussed by Gamble (1999, 52–64; but see also Dunbar 2003; Hill & Dunbar 2003; Zhou *et al.* 2005; Dunbar present volume). The social distance concept need not relate to a particular land tenure or territoriality system, as it is clear that hunter-gatherers have a diversity of social openness and land ownership strategies (Eerkens 1999; Kelly 1995, 161–204; Peterson 1986; Dyson-Hudson & Smith 1978). Social distance is intentionally left widely defined and independent from a geographical definition for that reason. Regardless of the absolute size or land tenure of the social entities engaged in contact, acculturation of both parties is usually the norm, rather than the one-way street presumed by colonialist literature (Fagan 1997). Yet there is variation in the degree to which enculturating environments are affected by contact, with some cases evidencing almost no acculturation. The contact between the Greenland Norse and Dorset Inuit is a clear example where cultural resistance to change as well as distinct ecological niches prevented the acculturation of at least the Norse, resulting in this culturally conservative group going extinct (McGovern 1981; 1994). Thus we should expect that Pleistocene examples of con-

tact may evidence a range of effects, from significant to insignificant acculturation.

Where in this range of acculturation a particular case lies can be determined by an interesting relationship between where contact occurs and what can be learned between groups. Specifically, the differences in the location of contact, from unsocial encounters on the edge of a forager’s range to social intimacy in the residential heart of the forager’s encampment, result in differential amounts of exposure to information and behaviours of each group. Differential access to information thus produces the differential ability to learn and adopt from the other group (i.e. to be acculturated). This represents differential access to the enculturating environment. Thus, in a culture contact event between stone tool using hunter-gatherers, the amount of lithic technological knowledge learnable by each party depends upon where contact occurs relative to where lithic operational sequences are enacted.

Using the ethnoarchaeological work of Wobst (1977), Wiessner (1982; 1983; 1984) and Sinopoli (1991), the theoretical work of Gamble (1999, 82–7) and Ingold (1993), and particularly the middle-range theory of Christopher Carr’s unified theory of artefact design (1995a,b), the lithic core reduction sequence can be understood in two parts: 1) the sequence of behaviours which produced the blanks for use; and 2) the morphology of the retouched tools and utilized blanks of the curated mobile tool kit. From our understanding of the organization of lithic technology relative to the demands of optimal foraging theory (Nelson 1991), blank production, i.e. how nodules are shaped into cores and reduced into flakes or blanks,



occurs mostly at raw material sources and residential locations. Blank production occurs less frequently on *the pathways of the landscape* due to the inefficiency of transporting a heavy core when a lightweight flake or retouched tool could provide the necessary cutting edge (Kuhn 1994), adaptive reliability (Bleed 1986), and functional flexibility (Shott 1986; Nelson 1991) for most anticipated tasks. Instead, the curated tool kit carried into the landscape consists of the blanks selected from the pool of debitage products made at the raw material and residential locations that are subsequently retouched in anticipation of tasks on the landscape. Thus while blank production behaviours and initial tooling/hafting of the tool kit are enacted at raw material source and residential locations (and only there is the artefactual evidence of these behaviours deposited into the archaeological record), only the selected blanks made into retouched or hafted tools are transported onto the pathways of the landscape. As a result, only the morphology of this tool kit would be visible on a hunter-gatherer during contact events at the edge of the foraging range, where she or he might encounter a social stranger. Compared to an individual who is allowed to visit at a residential site where a diversity of visible behaviours are enacted (including tools made for use only at the residential site), the stranger met on the pathways of the landscape would only be exposed to and thus only be able to learn from the curated tools of the forager. Compare what artefacts and behaviours are visible in the two images of foragers at different contact locations in Figure 28.1. A visitor to a hunting stand or retooling site, on the other hand, would only be exposed to the mobile tool kit and perhaps the retouch behaviours used to rejuvenate the cutting edges.

This opposition of behaviours enacted on the landscape *versus* those enacted at residential & raw material sites is analogous to Gamble's elegantly elucidated distinction between an *encounter* and a *gathering* (1999, 68–71). The main difference between Gamble's concepts and those advanced here is the present model's specific predictions on what effect the difference in these types of locales has on the potential acculturation of lithic technology which might result from culture contact in each context. Much of this predictive power comes from the ethnographically-derived middle-range theory of Carr's (1995b) physical visibility hierarchy of artefact attributes, which has been independently tested against the ethnographic and prehistoric record (Clark 2001). The present paper's predictions for different acculturation potentials, however, are not based only upon the physical visibility of different types of stone artefacts found in each location (cores & debitage vs retouched

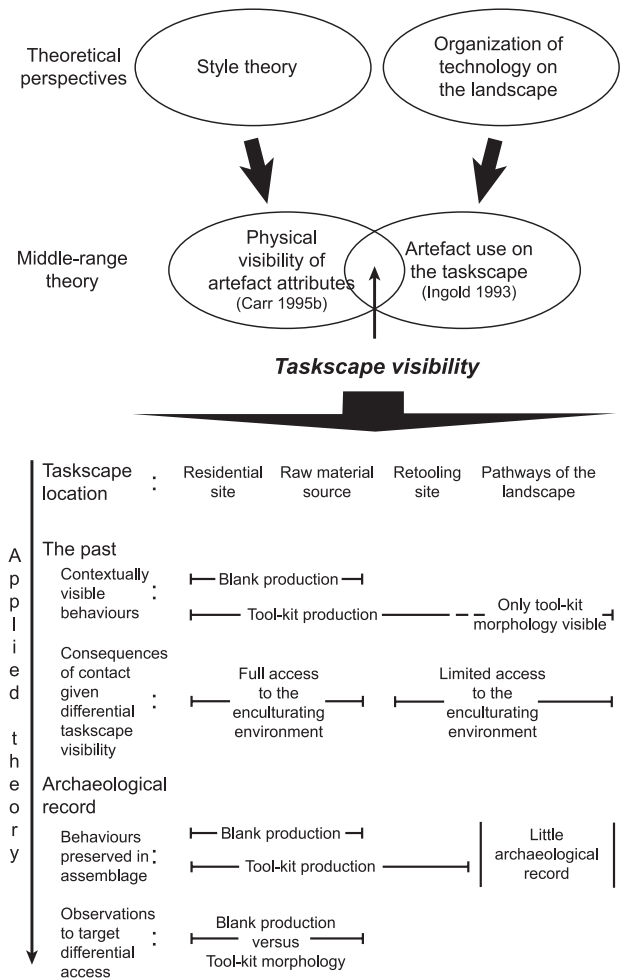
tools) but also upon the context of whether or not a social outsider has the opportunity *to witness the flintknapping behaviours* which produced a given tool in a specific locale.

Flintknapping is a technological performance which can only be effectively taught and learned by observation of the body movements, the handling of the core and percussor, and the flake by flake strategizing on how to exploit core volumes. For example, if the social context of the contact between two individuals from different enculturating environments remains less than intimate and the contact event occurs away from residential and/or raw material locations, the visiting individual has little chance to observe and thus learn the early phase of the lithic core reduction sequence, i.e. the blank production behaviours. Given the equifinality of multiple manufacturing sequences leading to the same tool form (Sackett 1982; 1990; Lemonnier 1992) — a well-recognized phenomenon in lithic technology (Marks & Kaufman 1983; Tixier 1984; Boëda 1995), it is fairly certain that the visitor has little chance of reconstructing and thus copying the exact blank production behaviours of the other, even if the visitor is an archaeologist with the useful, if perverse, desire to know how everything is made. Even the best knapper is unlikely to be able to replicate the whole core-reduction sequence from an item of the curated tool kit without the analysis of the debitage debris to use as inference. It is possible that a visitor could independently innovate some of the behaviours of blank production from examining a tool alone but it is unlikely that s/he would produce the *same debitage-wide central tendencies for all of the behaviours in the process*. Independent innovation or convergence of behaviours within blank production is thus always a possibility, but not a high probability. See Tostevin (in press) for a more detailed discussion of the evaluation of homoplasy *versus* homology in the context of western Eurasian *versus* global lithic variability.

In utilizing Carr's middle-range theory of artefact design, the context of the artefact's use is an important issue (Carr 1995b, 185). In the case of the present middle-range theory, this context is explicitly temporal ('were you there when the flintknapping happened?') as well as geographic ('were you in the right place to see it?'). This contextual approach to tasks enacted on the landscape has been pursued in detail by Ingold (1993) through his concept of the *taskscape*, a definition of landscape as experienced through the social activities and technical acts conducted at given places and times in the environment. Given how similar this view of the taskscape is to the above discussion of the visibility of flintknapping behaviours at particular places and times on the landscape, it is fitting to combine

Carr's and Ingold's terms to describe the context of when and where a technological act is learnable (from the operational sequence, to the finished object, to its social use) as its *taskscape visibility* (Fig. 28.2). By comparing the taskscape visibility of the two components of the lithic operational sequence, i.e. blank production and the mobile tool kit, it is possible to distinguish different degrees of contact between the knappers responsible for different archaeological assemblages. If contact has been intimate enough for periodic residential mixing of the groups, then the details of the blank production sequence could be copied between two groups. If contact has been less intimate, only the effective morphology of the tool kit could be copied (Table 28.1). This is in essence the difference between diffusion and stimulus diffusion, as defined over 60 years ago by Kroeber. The *taskscape visibility* concept thus provides the theoretical bridge to cover the gap identified above in the current evaluation of the Bow Wave Model.

This distinction between the taskscape visibilities of blank production and the curated tool kit is not a rigid determinant of the difference between diffusion and stimulus diffusion, but a guide to interpreting diachronic assemblage similarity through model expectations derived from the middle-range theory. Table 28.1 presents a model for understanding the results of culture contact through the effect of different degrees of social intimacy for material culture in general and lithic technology in particular. It should be noted that the likelihood of mating and gene flow between the societies in contact is correlated closely with the degree of social intimacy (Van Kirk 1983; Kelly 1995, 261–92; Fix 1999) and thus could be included in this model. As such modelling requires extensive justification, the integration of lithic attribute analysis into the dual inheritance modelling of Boyd & Richerson's (1985; 2005) cultural transmission theory is pursued elsewhere (see Tostevin in press).



**Figure 28.2.** Development of the middle-range theory for the analysis of culture contact scenarios among stone tool-using foragers.

**Table 28.1.** The results of culture contact modelled through the effect of different degrees of social intimacy.

Degree of social intimacy	Contact process resulting from intimacy	Material culture behaviours affected	Change in lithic technology
Low	Conservatism	The operational sequence and final product remain the same or become entirely novel.	Neither blank production nor tool-kit morphology is adopted as a result of little social intimacy or strong cultural resistance.
Low	Stimulus diffusion	The idea or morphology of the final product is only copied.	Only the tool-kit morphology is adopted, leading to equifinal blank production.
Moderate	Adaptive conservatism	The operational sequence is copied but the morphology of the final product remains unchanged.	Blank production is learned and replicated but the selected tool-kit morphology remains unchanged for reasons of tool function or social signalling.
Medium to high	Diffusion	The operational sequence, the final product, and the social context of use are copied.	Blank production as well as the tool-kit morphology are learned and replicated.

### Flintknapping choices and analytical domains

Given the fact that this approach is based on investigating whether or not archaics and moderns learned anything from each other during their contact events, the smallest units of analysis must be physical observations on artefacts which reflect learned behaviours related to how blanks are produced during flintknapping and how blanks are selected for retouch and incorporation into the mobile tool kit. As argued elsewhere (Tostevin 2003a), these individual flintknapping behaviours should be measured as central tendencies and dispersions within an assemblage, rather than as anecdotal refits or epistemologically dubious constructs of archaeologists, such as 'Levallois', 'desired end-products', and 'industrial types'. Using such a behavioural approach (Schiffer 1976; 1996), each assemblage is defined as the association of flintknapping behaviours enacted at that spot on the landscape within the given time range of the assemblage's palimpsest (see Tostevin & Škrdlá 2006 for the development of this argument). In other words, *each assemblage represents one enculturating environment* created by all of the hominins who have contributed material culture to its palimpsest. This definition is both epistemologically justifiable given Pleistocene site-formation processes and analytically appropriate for the application of the taskscape visibility concept.

For blank production, both free-hand knapping experiments and controlled experiments have identified specific choices a flintknapper must make in order to produce blanks for use. These choices can be understood as being made in temporal clusters during the process of flintknapping, with some clusters of choices being made on a flake by flake basis while others are made once or twice per core reduction. These clusters of knapping choices, represented by artefact measurements, have been termed *flintknapping domains* (Tostevin 2000c; 2003a,b) and serve to structure the analysis of learned flintknapping behaviours. While the definition of each variable's measurement is provided elsewhere (Tostevin 2000c; 2003b), the domains and their variables will be discussed here in order to illustrate how they can be used to evaluate similarities and dissimilarities between assemblages for the purposes of studying acculturation. These domains and variables are listed in the left-hand column of Table 28.2.

The flake-by-flake variables and their two domains have received the most direct research. From free-hand experiments (Whittaker 1994), we know that the knapper who struck off a flake consciously chose or unconsciously determined through her or his body performance how far into the platform to

strike (the platform thickness), the angle of the exterior platform at that spot, and whether or not to alter that angle with platform preparation beforehand. Together these three variables constitute the *platform maintenance domain* (see Table 28.2) as these choices are enacted together with the blow of the percussor. From controlled experiments into flake fracture mechanics, we know these variables to be independent choices of the knapper that together determine the mass of the resulting flake (Dibble & Whittaker 1981; Dibble & Pelcin 1995; Dibble 1997). From free-hand experiments, we also know that the knapper chooses where to strike the core relative to the morphology of the dorsal surface. From controlled experiments, it has been shown that the morphology of the dorsal surface contributes significantly to the shape of the resulting flake but independently from the platform variables' determination of flake mass (Pelcin 1997). Thus, the choice of where to strike relative to the dorsal morphology reflects the knapper's choices relating to the flake's shape. This choice of dorsal surface morphology is operationalized by Tostevin (2000c; 2003a,b) with five variables which individually and together constitute the flake shape. These five variables reflect the longitudinal extent of the surface (the length/width ratio of the flake), the vertical convexity of the mass to be removed (the width/thickness ratio of the flake), the number of dorsal ridges defining the convexity (the flake's cross-section type), the longitudinal shape of the surface (the flake's lateral edge type), and the curvature of the core surface (the flake's profile type). Each of these physical features of the dorsal surface of the core are visible cues available to the flintknapper to choose the shape of the flake before the removal. As each variable is in fact chosen simultaneously with the blow of the percussor, however, all five variables are combined within one temporal cluster, *the dorsal surface convexity domain*.

The clusters of decisions or domains which are made once or twice during a given core reduction have been subjected to far less quantification than the flake by flake decisions. They are in fact frequently represented by a typological approach to characterizing the whole core reduction, as in diagnostic *chaînes opératoires* such as *discoïde* or *Levallois préférentiel* (i.e. Boëda 1995), or unstandardized representations of refitting sequences (i.e. Valoch *et al.* 2000). Instead of typing the whole assemblage as one reduction type versus another or using each assemblage as an anecdote, the present approach (Tostevin 2000a,b,c; 2003a,b; in press; Tostevin & Škrdlá 2006) recognizes comparable choices within the strategic reduction of a core, both at the flake by flake level and at particu-

lar stages in a reduction (Tostevin 2005). Of the stage related choices, two temporal/functional clusters of choices are recognized here: the *core modification domain*, which includes the choice of orientation of the raw material as a core and specific methods of repairing and maintaining convexities, and *direction of core exploitation*, which includes the dominant directions of debitage removal during both the early and late stages of core exploitation. The latter domain is based on the analysis of debitage, not unrepresentative core morphologies at discard as stated in Marks's (2003) misreading of Tostevin (2003a). In fact, the analysis utilized for the *direction of core exploitation domain* not only corroborates existing refits such as those presented by Volkman (1983; 1989) and Škrdlá (2003a,b,c), counter to Marks's (2003) comments, but is comparable across sites regardless of the presence of refits (see Tostevin in press for a reply to Marks 2003).

The twelve variables within the four flintknapping domains described above represent the behaviour by behaviour approach to evaluating the degree of similarity and dissimilarity in blank production between assemblages. For blank production, the assemblage is composed of both complete debitage blanks (unretouched flakes) and the retouched tool kit. The retouched tool kit is included in, rather than excluded from, evaluating blank production since those pieces selected for retouch frequently represent the larger end of the variability actually created during blank production (Morrow 1996).

The analysis of the tool-kit morphology on the other hand includes only those pieces with retouch in the same assemblage as well as those traditionally labelled as such despite a lack of retouch, e.g. Levallois products. The characterization of an assemblage's tool kit constitutes its own domain of choices enacted during selection of blanks for inclusion into the tool kit. The variables used to characterize tool-kit choices reflect physical features of the tool shapes which are visible from a distance (Carr 1995b) and likely to affect the efficacy of the cutting edge. These variables thus include the elongation (length/width) and cross-sectional ratio (width/thickness) of the tools as well as the categorical attributes of the tool shape which have the most significant impact on the cutting edge itself, i.e. lateral edge type and profile type. The distal terminus type is perhaps the most relevant morphological variable for both its visibility and the suitability of a blank for particular functions. The last two of the seven variables used to characterize an assemblage's tool kit relate exclusively to the highly visible results of the application of retouch, with one variable accounting for unique retouch types (bifacial, carinated, etc.) and another account-

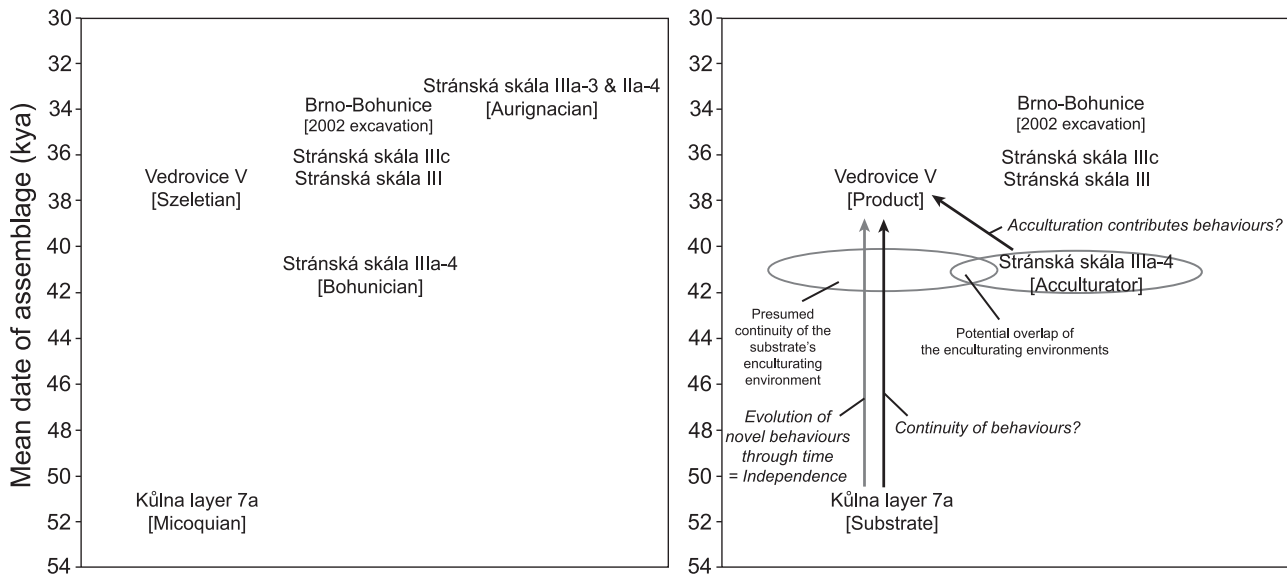
ing for a general emphasis on lateral edge retouch (indicated by a majority of Middle Palaeolithic tools) *versus* distal retouch (indicated by a majority of Upper Palaeolithic tool types).

In the case of both blank production and tool-kit morphology, individual variables are combined with others chosen at the same time in the production sequence by the assemblage's flintknappers. The simultaneity of the variables within a temporal cluster or analytical domain makes it advisable to scale the weight within each cluster when testing for the similarity and dissimilarity between two assemblages. These tests are conducted on a variable by variable basis, with *t*-tests and  $G^2$  likelihood ratio tests (approximating the chi-square distribution) for quantitative variables where appropriate, and with qualitative judgments for nominal variables. Significantly different variables are summed within domains and then divided by the number of variables within each domain in order to account for the simultaneity of the knappers choices within each domain. The maximum difference in blank production between two assemblages is thus the number of domains, 4.0, with only 1.0 for the maximum difference between two tool-kit morphologies. This scaling of the significance of each test by the number of tests within the analytical domain is also useful for removing the potential interaction among variables within each domain. Galton's Problem concerning the interdependence of variables (Thomas 1986, 448) is quite small in this case, however, as the statistical evaluations of the variables' interactions reveal miniscule levels of correlation (Tostevin in press).

### Comparability of assemblages

Assemblages from raw-material workshops and residential sites are preferable for this research compared to specialized hunting sites, retooling sites, or highly reduced assemblages due to raw material exhaustion (see Fig. 28.2). Specifically, in comparing the central tendencies of behaviours within two assemblages, it is important to gauge how comparable the two assemblages are in terms of which portions of the operational sequence, from acquisition of raw material to discard of the exhausted cores, they happened to capture. Equally, it is important not to compare the tool-kit morphologies of assemblages with vastly different degrees of retouch intensity. The methods used for evaluating the comparability of tool kits as well as blank production data are described in detail in Tostevin (in press). For the present purposes, the three assemblages examined in this chapter are comparable.





**Figure 28.3.** The Middle to Upper Palaeolithic transition in Moravia (Middle Danube Basin): a) the general chronostratigraphy of the transition; b) the Bohunician Acculturation Hypothesis.

### Acculturation scenarios in the Middle Danube

The archaeological record of OIS 3 in the Middle Danube has served as the basis for several acculturation hypotheses related to the Bow Wave Model, although none have received the attention of the western European hypotheses. This is sufficient reason to use the chronostratigraphy of the well excavated and dated sites of the northern half of the Middle Danube Basin, i.e. Moravia (Fig. 28.3a), for the experimental application of the middle-range theory and methodology developed above.

Karel Valoch (1990b, 123) has long argued that the Micoquian, as represented at 50/53 kya by the Neanderthal-made assemblage from Kůlna Cave Layer 7a (Valoch 1988; Rink *et al.* 1996), was present in the Middle Danube when hominins bearing an Aurignacian material culture intruded upon the region. According to his hypothesis, the Micoquian was transformed into the Szeletian through the acculturation resulting from this culture contact. Part of this scenario is supported by typological arguments for cultural continuity between the Micoquian and the Szeletian (Valoch 1990a; Neruda 2000; Allsworth-Jones 1986; 1989). As can be seen in Figure 28.3a, however, the problem with this hypothesis is that the earliest chronologically secure Aurignacian assemblages in the Middle Danube, Stránská skála IIa-4 and IIIa-3 (32,350±900 BP & 30,980±360 BP) are later than the dated Szeletian at Vedrovice V (39,500±1100 to 35,150±650 BP) and long after the first Bohunician assemblage in the region, Stránská skála IIIa-4 (41,300±3100–2200 BP)

(Svoboda *et al.* 1996; Svoboda 2003; Zilhão & d'Errico 1999, 39; 2003, 338; see Tostevin & Škrdl 2006 for comments on Willendorf II as well as Adams & Ringer 2004). Although further excavation may find an earlier example of an Aurignacian assemblage in the Middle Danube, the hypothesis is currently unlikely.

If the Szeletian is the result of interaction between the Micoquian and another enculturating environment, the Bohunician assemblage from Stránská skála IIIa-4 is a more likely candidate for an acculturator of Kůlna Cave Layer 7a for several reasons (Tostevin & Škrdl 2003). First, it appears before the Szeletian of Vedrovice V, unlike the Aurignacian (Fig. 28.3a). Second, typological comparisons (Valoch 1986; 1990b; Kozłowski 2000; 2004), refitting studies (Škrdl 1996; 2003a,b,c; Svoboda 2003; 2004), and finally attribute analyses (Tostevin 2000a,b,c; 2003a,b) have all suggested an intrusive origin of the technological choices which produced the assemblages archaeologists recognize as Bohunician in central Europe. A specific suite of blank production choices, labelled the 'Bohunician Behavioural Package' (Tostevin 2000a,b,c; 2003b), unites particular assemblages between the Levant and central and eastern Europe as well as distinguishes them from their predecessors in each region. These assemblages appear first in the Negev at 47 kya, at 45 kya in the Balkans (Kozłowski 2004), and 41 kya in the Middle Danube. The detailed lithic evidence for this diffusion event is presented elsewhere (Tostevin 2000c; 2003b; in press). It is important to note here, however, that the evidence is suggestive, although not demonstrative without a clear fossil association, of the spread of anatomically modern humans into Europe



via the Danube Corridor (Conard & Bolus 2003). As gene flow via mating networks is just as likely a process as population dispersion by competitive exclusion for the spread of the Bohunician Behavioural Package (Tostevin in press), this evidence interacts closely with many scholars' hypotheses relating to material culture and biological change in OIS 3 (e.g. papers by Stringer, Mellars, Bar-Yosef, Kozłowski, Svoboda, Van Peer & Vermeersch, and Zilhão & Trinkaus, present volume; but also Smith *et al.* 2002 and Zilhão & Trinkaus 2002). While the evidence for the Bohunician Behavioural Package is compatible with multiple views within the Neanderthal Acculturation Debate (including both Mellars 2006 and Zilhão 2006), it runs counter to Zilhão's (2006, 187–9) argument for a southern Polish antecedent for the Bohunician in the form of the stratified site of Piekary IIa (Sitlivy *et al.* 1999a; Valladas *et al.* 2003). The relevant assemblages from this site, as well as those from Księcia Józefa (Sitlivy *et al.* 1999b) are very small (only a few hundred artefacts per layer in most cases) and have only been published in a qualitative and categorical manner, analytically inappropriate for testing for cultural transmission. Until a larger data set is studied from southern Poland using analytically appropriate methods, a Levantine origin of the Bohunician Behavioural Package is still the most parsimonious interpretation of the Middle Danube data.

Potential culture contact in the Middle Danube between 41 and 30 kya is thus an intriguing question that must be tested against the archaeological record rather than assumed based on the chronostratigraphy. The most likely contact scenario is used here to illustrate the method and theory developed in the first half of this paper, although multiple scenarios are theoretically possible, particularly if the Upper Danube is involved as a source of west-to-east bow wave acculturation under the implications of the *Kulturpumpe* Model (Conard & Bolus 2003; Bolus & Conard 2001). This most likely scenario is the Bohunician Acculturation Hypothesis, given the Bohunician's intrusive origin, its appearance in the Middle Danube at least 2000 years before the Szeletian, and its contemporaneity with the Szeletian for roughly 6000 years before the appearance of the Aurignacian. This hypothesis posits that the enculturating environment of the Stránská skála IIIa-4 assemblage, at 41 kya the first marker of the Bohunician Behavioural Package in this region, overlapped sufficiently with the enculturating environment of 41 kya descendants of Kůlna Cave Layer 7a to acculturate these Micoquian descendants, resulting in the appearance of the Vedrovice V Szeletian assemblage between 39 and 35 kya (Fig. 28.3b).

### Simultaneous evaluation of the data's support for acculturation, continuity, and independence

The middle-range theory of taskscape visibility allows the quantitative evaluation of continuity in flintknapping behaviours in multiple forms, depending upon the chronostratigraphic and culture historical context of a region. To date, this has been demonstrated for the evaluation of diffusion versus independent innovation on an intra- and inter-regional basis using pair-wise comparisons of assemblages (Tostevin 2000a; 2003b; in press). The question of culture contact resulting in the overlap of enculturating environments, however, warrants adjusting the pair-wise methodology to three-way comparisons between assemblages. In the present case, therefore, the quantitative evaluation of a scenario hypothesizing the acculturation of a local by an intrusive enculturating environment takes the following form. Flintknapping variables are arranged to test the acculturation of one assemblage into a second due to the influence of a third. The earliest assemblage in the region is labelled the *substrate* and the identified technological choices by domain are listed in the second column from the left in Table 28.2. The next assemblage found chronologically on the landscape is labelled the *acculturator* and its technological choices by domain are listed in the far right column in Table 28.2. The last of the three assemblages is labelled the *product* and its technological data are placed between the substrate and the acculturator.

For each acculturation scenario, the archaeological data can be tested simultaneously for its support of three competing hypotheses. By testing each flintknapping behaviour for statistical difference between the substrate and the product, the archaeological record is tested for continuity between the substrate and the product. In cases in which the behaviour is statistically the same between all three assemblages, the behaviour is judged to support continuity under the null hypothesis of no acculturation (and the possibility of the acculturator taking on behavioural choices of the substrate). By testing each flintknapping behaviour for statistical difference between the product and the acculturator, the archaeological record is tested for its support for the adoption of behaviours from the acculturator by the product. Lastly, if the product's variables are statistically different from both the substrate and the acculturator, the data supports the uniqueness or independence of this assemblage. Within each domain, the total number of significant differences are summed and then divided by the number of steps within the domain in order to reflect the clustering of the behaviours as well as to maintain independent units of analysis. This structure is repeated for both

**Table 28.2.** Blank production behaviours in Vedrovice V as an acculturation of Kůlna Cave Layer 7a by Stránská skála IIIa Level 4 (statistical similarity based on t-test, G<sup>2</sup> statistic, or qualitative: ✕ = p < .05; → = p > .05).

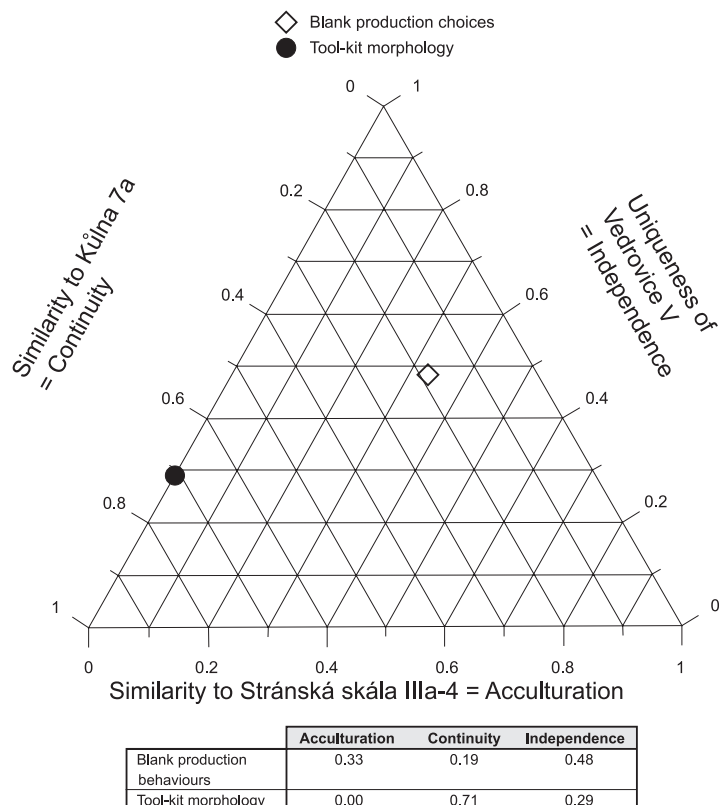
ANALYTICAL STEPS BY DOMAIN	SUBSTRATE Kůlna 7a Mean date, 51,500 BP		PRODUCT Vedrovice V Mean date, 37,475 BP		ACCULTURATOR Stránská skála IIIa-4 Mean date, 41,300 BP
Core modification domain					
Core orientation	Discoidal use of two surfaces, unifacial at end	✕	Preferential use of a longitudinal surface	←	Preferential use of a longitudinal surface
Core management	Secant surfaces exploited around the perimeter of the plane of intersection	✕	Lateral core tablets, orientation changes	✕	Débordants & side blade removals
Acculturated steps/Potential steps			1/2 = 0.5		
Independent steps/ Potential steps			1/2 = 0.5		
Continuity steps/ Potential steps			0/2 = 0.0		
Platform maintenance domain					
Platform treatment	Unprepared: 58% Prepared: 42%, <i>n</i> = 167	→	Unprepared: 61% Prepared: 39%, <i>n</i> = 380	←	Unprepared: 58% Prepared: 42%, <i>n</i> = 448
External platform angle (degrees)	mean: 83.8, s.d.: 14.8, <i>n</i> = 153	✕	mean: 89.0, s.d.: 17.4, <i>n</i> = 342	✕	mean: 85.2, s.d.: 15.3, <i>n</i> = 425
Platform thickness	mean: 9.08, s.d.: 4.63, <i>n</i> = 153	✕	mean: 5.01, s.d.: 3.64, <i>n</i> = 359	←	mean: 4.8, s.d.: 2.5, <i>n</i> = 433
Acculturated steps/Potential steps					
Independent steps/ Potential steps					
Continuity steps/ Potential steps					
Direction of core-exploitation domain					
Direction of early exploitation	Subcentripetal & Unidirectional	✕	Bidirectional & Unidirectional	✕	Bidirectional
Direction of late exploitation	Unidirectional & Crossed	✕	Unidirectional	←	Unidirectional
Acculturated steps/Potential steps			1/2 = 0.5		
Independent steps/ Potential steps			1/2 = 0.5		
Continuity steps/ Potential steps			0/2 = 0.0		
Dorsal surface convexity domain					
Longitudinal convexity: Length/Width Ratio	mean: 1.44, s.d.: 0.49, <i>n</i> = 273	→	mean: 1.47, s.d.: 0.57, <i>n</i> = 542	✕	mean: 1.71, s.d.: 0.67, <i>n</i> = 543
Shape of convexity: Lateral edges of blanks	Parallel: 54% Convergent: 23% Expanding: 20% Ovoid: 13% <i>n</i> = 198	✕	Parallel: 39% Convergent: 16% Expanding: 31% Ovoid: 14% <i>n</i> = 451	✕	Parallel: 49% Convergent: 24% Expanding: 18% Ovoid: 10% <i>n</i> = 514
Curvature of convexity: Profile of blanks	Straight: 64% Curved: 22% Twisted: 14% <i>n</i> = 225	→	Straight: 66% Curved: 15% Twisted: 19% <i>n</i> = 465	✕	Straight: 53% Curved: 29% Twisted: 18% <i>n</i> = 522
Lateral convexity: Cross-section of blanks	Triangular: 39% Trapezoidal: 54% Other: 7% <i>n</i> = 231	✕	Triangular: 52% Trapezoidal: 27% Other: 20% <i>n</i> = 493	✕	Triangular: 44% Trapezoidal: 51% Other: 5% <i>n</i> = 527
Vertical Convexity: Width/Thickness ratio	mean: 2.83, s.d.: 1.06, <i>n</i> = 273	✕	mean: 4.26, s.d.: 1.82, <i>n</i> = 542	✕	mean: 3.99, s.d.: 1.82, <i>n</i> = 543
Acculturated steps/Potential steps			0/5 = 0.0		
Independent steps/ Potential steps			3/5 = 0.6		
Continuity steps/ Potential steps			2/5 = 0.4		
Total measure of acculturation			1.33 out of 4.0 (33%)		
Total measure of independence			1.93 out of 4.0 (48%)		
Total measure of continuity			0.74 out of 4.0 (19%)		

**Table 28.3.** Tool-kit morphology in Vedrovice V evaluated as an acculturation of Kůlna Cave Layer 7a by Stránská skála IIIa Level 4 (statistical similarity based on t-test,  $G^2$  statistic, or qualitative:  $\times$  =  $p < .05$ ;  $\longrightarrow$  =  $p > .05$ ).

TOOL-KIT MORPHOLOGY	SUBSTRATE Kůlna 7a Mean date, 51,500 BP	PRODUCT Vedrovice V Mean date, 37,475 BP	ACCULTURATOR Stránská skála IIIa-4 Mean date, 41,300 BP
Laminarity	mean: 1.45, s.d.: 0.51, $n = 162$	mean: 1.51, s.d.: 0.52 $n = 115$	mean: 1.58, s.d.: 0.50, $n = 67$
Width/Thickness	mean: 2.84, s.d.: 1.12, $n = 162$	mean: 3.59, s.d.: 1.56, $n = 115$	mean: 4.28, s.d.: 2.14, $n = 67$
Lateral edges	Parallel: 55% Convergent: 7% Expanding: 23% Ovoid: 15% $n = 103$	Parallel: 31% Convergent: 12% Expanding: 46% Ovoid: 11% $n = 61$	Parallel: 39% Convergent: 31% Expanding: 16% Ovoid: 14% $n = 57$
Distal terminus	Blunt: 74% Pointed: 26% $n = 65$	Blunt: 81% Pointed: 19% $n = 36$	Blunt: 50% Pointed: 50% $n = 36$
Profile	Straight: 67% Curved: 20% Twisted: 13% $n = 126$	Straight: 64% Curved: 13% Twisted: 23% $n = 75$	Straight: 45% Curved: 32% Twisted: 23% $n = 62$
Unique types of retouch	Flat bifacial retouch	Flat bifacial retouch	Normal retouch
Tool types	Middle Palaeolithic tools dominate	Middle Palaeolithic tools dominate	Upper Palaeolithic tools dominate
Acculturated steps/Potential steps		0/7 = 0.00	
Independent steps/ Potential steps		2/7 = 0.29	
Continuity steps/ Potential steps		5/7 = 0.71	

the blank production behaviours and the tool-kit morphology. The summation of the support for continuity, acculturation, and independence are transformed to a percentage scale (out of 1.0) and may be graphed on a ternary diagram for evaluation.

While the overlap of enculturating environments usually produces a two-way process of acculturation as noted above, this methodology tests for the effects of acculturation in one direction at a time, in order to give credibility to the null hypothesis of no acculturation whatsoever. Thus, Figure 28.3b and Tables 28.2 and 28.3 evaluate the data according to the possibility of Stránská skála IIIa-4 being the only active agent in the three-assemblage scenario. The evaluation of whether or not the Stránská skála IIIa-4 assemblage itself was acculturated by the resident Micoquian when it entered the Middle Danube would have to be tested with Kůlna

**Figure 28.4.** Ternary diagram of the archaeological support for the acculturation, continuity, and independence of Vedrovice V as an Acculturation of Kůlna Cave Layer 7a by Stránská skála IIIa Level 4.

Cave Layer 7a as the acculturator, Stránská skála IIIa-4 as the product, and the most likely immediate predecessor of Stránská skála IIIa-4, i.e., Temnata Cave layer VI, trench TD-II (Ginter *et al.* 1996; Drobniewicz *et al.* 2000) in Bulgaria, as the substrate.

### Results of the application of the method and theory

Table 28.2 presents the data and analysis of the blank production behaviours for the hypothetical contact scenario in which a presumed 41 kya descendent of the 50/53 kya enculturating environment of Kůlna Cave Layer 7a, a Micoquian residential assemblage (Valoch 1988), overlapped the 41 kya enculturating environment of Stránská skála IIIa-4, the earliest of the Bohunician residential and raw material workshop assemblages (Svoboda 1987; 1991). This overlap is hypothesized to result in the acculturation of the Micoquian descendent, producing the blank production behaviours seen in the Szeletian open-air residential site of Vedrovice V between 39 and 35kya (Valoch 1984; 1993). This data demonstrates that three of the four analytical flintknapping domains of Vedrovice V evidence a flintknapping choice which is statistically distinct from the choice used in Kůlna Cave Layer 7a but which is statistically similar to, and thus might have been learned from, the choice used in Stránská skála IIIa-4. As these flintknapping domains are independent choices of the knapper, the fact that three of the four domains show similarities between the acculturator and the product make independent innovation of these flintknapping choices in the separate domains improbable. This is archaeological confirmation, therefore, of moderate social intimacy between the hominins responsible for these two assemblages. Conversely, only two of the four flintknapping domains of Vedrovice V show statistical similarity to the central tendencies enacted in the Kůlna Cave Layer 7a assemblage. This is data which contradicts the presumed cultural relationship between these two assemblages, a relationship estimated based primarily on retouch tool typology (Valoch 1990a; Neruda 2000). Overall, however, Table 28.2 demonstrates that almost half of the central tendencies enacted in Vedrovice V are statistically different, in all four domains, from both the Kůlna Cave Layer 7a and Stránská skála IIIa-4 assemblages. This suggests that the enculturating environment of the local population encountered by the intrusive Bohunician hominins at 41 kya had already changed significantly from the 50 kya Micoquian antecedents by adaptation or random drift. Alternatively, it is possible that the local enculturation environment was still close to the Micoquian antecedent upon contact with

the Bohunician but the contact produced a plethora of novel behavioural responses in blank production. Which possibility is more likely may be determined through the discovery of a Micoquian/Szeletian-like assemblage dating before 41 kya. In sum, however, the Table 28.2 results show little remaining relationship in the blank production between Vedrovice V and Kůlna Layer 7a while at the same time indicating some effect of Stránská skála IIIa-4 on Vedrovice V.

Table 28.3 presents the data and analysis of this acculturation scenario for the tool-kit morphologies of the three assemblages while Figure 28.4 presents the ternary diagram for both blank production and the tool-kit morphologies. What is striking from this figure is the marked contrast between the comparison of the tool-kit morphologies and the comparison of the blank production behaviours. The blank production behaviours of Vedrovice V evidence stronger independence (48 per cent) from both Kůlna Layer 7a and Stránská skála IIIa-4 than continuity (19 per cent), with support for acculturation of the behaviours constituting one third of the central tendencies (33 per cent). The tool-kit morphology comparison, however, shows the opposite pattern among the three competing hypotheses, with continuity constituting 71 per cent of the central tendency data, independence 19 per cent, and no support for any acculturation from Stránská skála IIIa-4. Given the contact processes predicted in advance from the possible outcomes of the blank production versus tool-kit distinction (Table 28.1), these three assemblages suggest that the Bohunician Acculturation Hypothesis appears most to resemble a case of *adaptive conservatism*.

Adaptive conservatism is the result of social contact of moderate intimacy in which the enculturating environments have overlapped enough to affect behaviours of low taskscape visibility, such as blank production enacted at residential and raw material sites, but high taskscape visibility behaviours such as tool-kit morphology remain unchanged by the contact. This may initially seem counter-intuitive but it does *not* mean that contact occurred at residential sites and not on the pathways of the landscape; increasing social intimacy in contact has to proceed from the pathways to residential sites. Instead, the data indicate that the two enculturating environments overlapped to the extent that some acculturation of blank production occurred but this acculturation did not change the foragers' selection criteria for what blanks and types of retouch to use to create the tool kit they needed to transport onto the pathways of the landscape. While the Vedrovice V knappers produced different blanks via core reduction than those produced in Kůlna Cave Layer 7a, the type of blank selected for retouch



from the pool of debitage, the types of retouch, and where to apply it were still very similar to the choices made in the Micoquian assemblage. Such continuity in tool-kit design can be the result of two processes which influence the choice of attributes for this type of visible artefact (Carr 1995b):

1. continuity in the landscape tasks for which the cutting edges were needed, i.e., the adaptive, utilitarian function of the tools (Kuhn 1994; Hughes 1998; Shea 1998; 2003; 2005); and
2. continuity in the social use of the tool morphology for active signalling of social display (Wobst 1977; Sackett 1990; Clark 2001).

Wiessner (1983) has demonstrated that arrowheads among the !Kung San bear emblematic, population-specific morphology which is emically considered more important than the potential differences in the efficacy of the cutting edges. Thus it is not far fetched to propose that Pleistocene foragers could evidence either assertive or emblematic conservatism in their tool kit for signalling purposes, although the time span between the Kůlna and Vedrovice assemblages might make the functional utility of the tool kit a more likely reason for the continuity.

The role of foliate points in the potential functional conservatism of the Vedrovice tool kit is interesting but not the determining factor. For while it has been argued that the foliate points of the Szeletian show an application of bifacial retouch similar to that of Micoquian handaxes (Neruda 2000), the similarity in bifacial retouch represents only one fifth of the signature of continuity between the two assemblages and thus is not solely responsible for this high value (71 per cent). This continuity value would still be large even if the newly excavated, foliate-bearing Bohunician assemblage from Brno-Bohunice (Škrdla & Tostevin 2005) had been used instead of Stránská skála IIIa-4 (Tostevin & Škrdla 2006). Given these results, future research needs to investigate how the relationship between the tool kit and other landscape adaptations (e.g. Kelly 1988; Stiner & Kuhn 1992) of the Vedrovice V hominins and the Neanderthals of Kůlna Cave Layer 7a might play into the conservatism of the tool-kit morphology in the Szeletian assemblage.

## Conclusions

Despite arguments to the contrary (Clark 1994), archaeological data are directly relevant to discovering evidence of social interaction between Pleistocene hominins, although not using a simplistic culture historical approach. What is required is to bring anthropological theory and ethnographic data to bear on the close relationship between hunter-gatherer social

intimacy and reproductive networks, the recognition of the spatial aspect of forager culture contact, and how, where, and when material culture behaviour is learned by the individual. Between the middle-range theory of taskscape visibility and the behaviour-based quantitative method for three-way comparisons of lithic assemblages (and not industrial types), it is thus possible to measure the likelihood of a given acculturation scenario, even one potentially involving stimulus diffusion, as in the Bow Wave Model (Mellars 1999; 2005). This involves simultaneously measuring the support of the archaeological record for the continuity, acculturation, and independence of a hypothetical product of culture contact. This paper presents an analysis of a Middle Danube version of the Bow Wave Model involving an intrusive Bohunician assemblage acculturating a local Neanderthal-made Micoquian into an assemblage recognized archaeologically as Szeletian. The results of this analysis indicate that the degree of similarity in blank production behaviours between the Stránská skála IIIa-4 and Vedrovice V assemblages (Table 28.2) suggests that a moderate degree of social intimacy and residential mixing existed between the hominins who produced these two assemblages. The selection criteria for blanks to be retouched into tools remains extremely faithful, however, between Kůlna Cave Layer 7a and Vedrovice V, most likely for reasons of tool efficacy or social signalling. The enculturating environment of Vedrovice V is, however, distinct in many ways from both Stránská skála IIIa-4 and Kůlna Cave Layer 7a, suggesting several possibilities for future research. Further, if in the future it is demonstrated that Vedrovice V or a closely related assemblage was indeed made by Neanderthals while Stránská skála IIIa-4 or another Bohunician assemblage was made by modern humans, the present study would support the view of socially intimate contact between these previously distant hominins.

## Acknowledgements

I would like to thank Greg Laden and Gilliane Monnier for their thoughtful comments on the ideas presented in this paper. I would also like to thank Jiří Svoboda, Ofer Bar-Yosef, and Karel Valoch for guiding me into the wealth of the Central European Palaeolithic.

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