A view to a kill : investigating Middle Palaeolithic subsistence using a optimal foraging perspective

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9 Conclusion

Using the archaeological record to gain insight in the "knowledge-intensity" of foraging strategies remains a difficult undertaking. However, this study has shown that it is helpful to adopt theories from behavioural ecology, as an aid in the interpretation of archaeological bone assemblages. Using ecological theory as a framework when interpreting clues about past foraging behaviour has yielded more plausible interpretations on why certain species were exploited, while others were left untouched. This type of research is therefore a valuable addition to the study of Pleistocene subsistence strategies. By improving behavioural ecological models we can create a basis from which the radically changing ideas surrounding the evolution of foraging strategies and their implications for the evolution of hominin life-histories, group size, intelligence, and the like. can be evaluated.

The application of OFT models still needs to be improved though. Refining the variables used in the model may improve its "fit" to the archaeological data. In order to gain insight in the decisions made during Neanderthal foraging activities it seems most important to refine our prey ranking. Estimating the added value of animal fur may further clarify why brown bear was hunted while giant deer was not. This is also the case for a more difficult variable, namely prestige value of foraging products. With regard to the knowledge intensity of foraging strategies, reconstructing the handling cost of the available prey seems productive. More refined understanding of the anti-predator behaviours of prey species may clarify whether species that were difficult to hunt were avoided or whether they were regularly exploited for example.

However, by reconstructing the handling cost, even using the simplest of variables we gained some insight in the "knowledge-intensity" of Neanderthal foraging. This analysis has therefore added depth to current zooarchaeological studies that have provided a very high-quality baseline by proving *that* Neanderthals indeed hunted at certain archaeological sites. Now we can also interpret *why* they avoided specific species and focussed on others.

For instance, we can convincingly argue that during interglacial circumstances, a focus on large and solitary species was adopted. This suggests that caloric value was a very important consideration in Neanderthal foraging strategies, as the diet breadth model predicts. We can also see that the handling cost of herd animals resulted in a low ranking and that these species were thus not exploited. Moreover we know that even in interglacial conditions, while hunting in small groups, some animals were still killed regularly. Brown bear, even nowadays considered dangerous prey for hunters with firearms was routinely hunted at both sites for example.

In contrast we can also explain why specialised hunting of ungulates was adopted in "mammoth-steppic" environments. When the environment becomes more open as in the upper levels of Biache-Saint-Vaast, dangerous species like bear are dropped from the set of exploited species, and herd animals become more important. In a full-fledged mammoth steppe, hunting of herd animals becomes even more important and the large, solitary species are probably not exploited at all. In these environments, Neanderthals were able to increase their group size and were able to drive herds of species into an ambush. This suggests that Neanderthals were able to very well coordinate their action in order to deal with hunting animals living in large herds.

In the future this kind of analysis has to be drastically refined. Some recommendations as to how we can go about this have already been made in the previous sections. Moreover, the interpretations that we arrive at using this kind of analysis have to be tested against future excavated sites, such as the rich assemblage very recently excavated at Neumark Nord in Germany. This can help to overcome problems of equifinality of different hypotheses.

The scenarios developed here and to be tested are quite simple. First, Neanderthals invested in simple versatile technology, but they were able to dispatchprime-aged individuals of species much larger than themselves. The upper boundary of species that they considered prey is much higher than would be expected for a predator, which usually does not regularly hunt species much more than twice its size. This shows that Neanderthals must have successfully applied refined strategies, using knowledge of the landscape and the animal species to ambush and kill these dangerous species of prey.

Second, Neanderthal population densities varied with the amount of animal biomass that was available in the landscape, like in modern hunter/gatherers. They may have been more severely affected by drops in available biomass, because of their high energetic needs and may have been forced to abandon territories that modern humans could colonize. Another factor that may have influenced Neanderthals' ability to successfully exploit landscapes is the character of the landscape. Because of the close-encounter character of Neanderthal hunting strategies, the possibilities in the landscape to prepare ambushes may have made up a significant part of animals handling costs. Moreover, their population density will have been significantly lower than that of modern humans hunter/gatherers would have been. This had consequences for their group size and social structure. It is proposed that adjustments to group size and social structure may have been an important way to deal with fluctuations in available biomass. This is thought to have important repercussions for the focus of their hunting activities. They seemingly preferred solitary prey in more closed environments. This suggests that hunting behaviour in Neanderthals was a collective enterprise. From this, it follows that a well-developed system of food distribution must have been in place. Had this not been the case, solitary foraging strategies like we see in hyenas would have been more profitable for many individuals.

Evidence for "mass-collecting" of cervids and smaller ungulates is mostly derived from the last glacial. This is caused in part by taphonomic factors. We simply know more sites from this period than from preceding times. On the other hand, this is also thought to be related to changes in the ecological structure of the environment. The rich mammoth-steppe environment will have allowed for Neanderthals to exploit the landscape in larger groups and this will have enabled more refined hunting tactics, like animal drives and ambushes, making large groups of herbivores available for exploitation.

Finally, the changes in the ecological structure of the environment during MIS 3 may have had severe consequences for the viability of the Neanderthal's way of life. They needed to realise very high return rates and because of the added costs of locomotion, their foraging radii will have been smaller than those of anatomically modern humans. When changes in the available biomass were combined with a change in the predator guild (like the appearance of modern humans) this may have put Neanderthals under severe stress, ultimately leading to their demise.