Dynamics of Learning in Neanderthals and Modern Humans. Volume 2: Cognitive and Physical Properties

Takeru Akazawa, Naomichi Ogihara, Hiroki C. Tanabe, and Hideaki Terashima (eds.)
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This is the second of two volumes reporting the results of an inter-disciplinary conference held in Tokyo in November 2012. The conference was held by members of a five year research project (2010–2014) titled the "Replacement of Neanderthals by modern humans: testing evolutionary models of learning." This volume describes research from cognitive and neurological sciences which bears on the issue of the relationship between the two groups. The four co-editors begin with an introduction explaining the purpose of the research project. They are searching for innate differences in learning capacity between the two kinds of hominins, in order to explain why one disappeared and the other thrived. They stress that their authors are working within an inter-disciplinary research framework that incorporates new perspectives and methods.

This volume contains 26 papers in four sections. The first centers on cognitive and psychological perspectives on the learning process. Which cognitive and psychological functions helped to shape the fate of the two species? The second focuses on biology and genetics. The third is composed of papers giving a computerized reconstruction of fossil crania, and how this can help determine brain morphology. It involves a search for anatomical proof of differences in learning between Neanderthals and moderns. The fourth section includes papers using data from neuroscience, in order to describe the anatomical differences between the two kinds of hominins.

The first section contains seven papers dealing with cognitive and psychological perspectives on the learning process. In Chapter 2, Steven Mithen asks whether or not pigment use (red ochre) necessarily imply symbolic thought? He says not, in the absence of other lines of evidence. This is the case for Zilhão's sites in southern Spain, as well as for Pinnacle Point in South Africa. Mithen reiterates the view that the lack of lithic variation in the Middle Paleolithic reflects the small size of Neanderthal groups. A certain number of people are needed to transmit ideas and innovations, and this did not exist for Neanderthals. He concludes that Neanderthals had "emotionally rich but non-symbolic social activities" (page 14), but that something fundamental was lacking. On the other hand, modern humans had the capacity for cognitive fluidity, and expressed it in a wide range of material realms.

In Chapter 3, J. Ando reviews different kinds of learning—individual, imitative, and instructed learning. For him, Neanderthals learned by imitation, while moderns learned as individuals. Only moderns learned from a teacher or model. The author tested this idea with 20 students and 3 sets of puzzles. This was in order to test the quality of instruction, and the attentiveness of learners. In the initial phase, participants solved the first puzzle without any assistance (individual learning). In a second phase, they were allowed to observe and to imitate a model. In the third phase, a teacher explained how to solve the puzzle. Individual learning tended to be the most efficient, as the other two methods required time to observe and consult.

In Chapter 4, K. Omura described the ability to objectify conventional styles of problem solving. He used Bateson's model of learning in order to test the cumulative cultural evolution view of Michael Tomasello. It is composed of a series of stages from zero learning, through Learning I, Learning II, and finally Learning III. If there is one difference between Neanderthals and moderns, the author argues, it is in stage II learning (which involves individual or collaborative creation). Then he presents his own model, a combination of Bateson and Tomasello.

In Chapter 5, T. Kayama studies object making and object play among Baka pygmy children in southern Cameroon. Using Piaget's stages of learning, he argues that up to age 2, children express sensorimotor interactions, while around age 3, they start making objects. In Chapter 6, E. Yamagami studies resilience (or response to stress) in drawings made by Baka children. In Chapter 7, N. Takahashi et al. evaluate social learning through assigning tasks to measure trial and error, creativity, imitation, and other abilities. They see no relation between trial and error and imitation, and believe that being a social learner-explorer is most adaptive in a changing environment.

In Chapter 8, A. Mesoudi carries out a series of learning experiments which have applications to an archaeological context. Via a computer program, participants were asked to design a "virtual arrowhead" while working in groups of 5 to 6. Variables which could be adjusted were some of the same ones that archaeologists measure on lithics: height, weight, thickness, color, shape. Over a series of trials, one can improve the quality of an arrowhead. If the instructor manipulated key variables, then students could adapt their final product as they learned.

The second section involved physical traits ("Body science") and genetics. In Chapter 9, Y. Hoshino et al. record-

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ed an experienced knapper while the knapper produced Levallois pieces. This was done through collection of 3D motion data. In Chapter 10, I. Hagino and T. Yamuchi studied physical activity among pygmy children, using GPS to study where it occurred and its duration. In Chapter 11, the same two authors used measurements of height, weight, and body mass index to measure pygmy children as they grew up. In Chapter 12, R. Kunura analyzed single nucleotide polymorphisms (SNPs) to reconstruct the initial peopling of the Asia - Pacific region by modern humans.

The third section involved the computerized reconstruction of fossil crania as well as the study of overall brain morphology. In Chapter 13, E. Bruner examined the Neanderthal braincase, its role in thermoregulation, and how it may have operated. He points out that Neanderthal brains were generally pleisiomorphic, and that they might have limited learning when compared to their modern cousins. In Chapters 14 and 15, Y. Kobayashi and colleagues described macaque brains, their endocasts, and the location of sutures and major sulci.

In Chapter 16, N. Ogihara et al. describe a sliding landmark method for morphological analysis of modern Japanese neurocranial shape. A similar study was done by Y. Morita et al. (in Chapter 17) using CT scans and virtual models. This produced a reference database record for the three dimensional shape of the cranium. Similar studies of cranial shape and reconstruction were done in other chapters in this section. One study of special interest to paleoanthropologists was done by O. Kondo and his colleagues (Chapter 21). This involved a CT scan to produce a virtual endocast of Qafzeh 6. This was an attempt to compensate for postmortem taphonomic changes.

The final section is composed of five chapters using methods from neuroscience. Some of these were done in order to compare Neanderthal and modern brains using neuroimaging (Chapter 23) or to estimate cerebellar volume estimates for fossil hominins (Chapter 24). One tried to see how a sense of acceptance had a neurological signature (Chapter 25), while another tried to see if there was any trace of a motivation to learn (Chapter 27). One of the most unusual studies was that of N. Miura et al. who measured brain activity in test subjects while they looked at pictures of how to produce a Mousterian tool (Chapter 26). This brain activity occurred in the right cerebellum. Similar activity was observed in the left superior temporal gyrus while the same test subjects tried to learn how to pronounce Uzbek words.

As was the case in the first volume, this one is an eclectic mixture of methods and data analysis from a wide variety of social and natural sciences. The goal is to determine ways of measuring the differences between Neanderthals and modern humans. Both volumes begin with the assumption that there are clear differences between the two groups. But growing genetic evidence of hybridization makes us question how really different they were. Did they and the Denisovans, and possibly others, see themselves as that different from each? Chances are that their notion of difference was much less than what we infer today.