Neanderthal demise due to many influences, including cultural changes: study

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As an ice age crept upon them thousands of years ago, Neanderthals and modern human ancestors expanded their territory ranges across Asia and Europe to adapt to the changing environment.

In the process, they encountered each other.

Although many anthropologists believe that modern humans ancestors "wiped out" Neanderthals, it's more likely that Neanderthals were integrated into the human gene pool thousands of years ago during the Upper Pleistocene era as cultural and climatic forces brought the two groups together, said Arizona State University Professor C. Michael Barton of the Center for Social Dynamics and Complexity and School of Human Evolution and Social Change.

"The traditional story in textbooks doesn't fit well with what we know about hunter-gatherers. For the most part, they don't like to go far from home. It's dangerous," Barton said.

Barton and Julien Riel-Salvatore of the University of Colorado Denver, present new research in the journal, *Advances in Complex Systems*, that the Neanderthals demise was due to a combination of influences, including cultural changes. The paper titled, Agents of Change: Modeling Biocultural Evolution in Upper Pleistocene Western Eurasia, appears online in January. It builds on work published last year in the journal Human Ecology and on recent genetic studies that show a Neanderthal contribution to the modern human genome.

"How a culture's working knowledge is passed on is as important as biological information for human evolution," Barton said. "There is a perception that biological evolution determines culture during the Pleistocene era and that cultural influences predominate afterwards (including today). The reality is that the two forces have been working together and they were as important 50,000 years ago as they are today."

The researchers used archaeological data to track cultural and socio-ecological changes in behavior in Western Eurasia during the past 120,000 years. As Neanderthals and early humans land-use patterns shifted during the last ice age, computer modeling showed that the two populations began to interact and mate, leading to the "extinction" of one of the groups due to hybridization, a well-recognized phenomenon in conservation biology. Neanderthals were limited to western Eurasia and usually it is the smaller population that becomes "extinct" in this way. Nevertheless, succeeding hybrid populations still carry genes from the regional group that disappeared, according to the researchers.

To address the possibility that the two groups would not have seen one another as potential mates, the researchers also examined the possible impacts of social barriers to mating in their models. They found that unless social taboos were nearly 100 percent effective, it would have not made any difference in outcomes over time as the gene pools mixed, Barton said.

"This is one of the first attempts to explicitly address the impact of various degrees of social avoidance on possible hybridization between the two groups," added Riel-Salvatore.

"Other than the fact that they disappeared, there is no evidence that Neanderthals were any less fit as hunter-gatherers of the late Pleistocene than any other human ancestor living at that time. It looks like they were as capable as anyone else," Barton said.

Barton and Riel-Salvatore studied the stone artifacts that were left behind by these ancient peoples to track the movement patterns among hunter-gatherers across western Eurasia during the Pleistocene era.

"Stone technology is completely different than the kind of technology we have today," Barton said. "But it can tell us important things about land use, how people organized themselves and how they moved to access resources to live."

These tools provide insight into Neanderthals' lives and gene sequencing tells the story of their legacy.

"Recent sequencing of ancient Neanderthal DNA indicates that Neanderthal genes make up from 1 to 4 percent of the genome of modern populations—especially those of European descent," Riel-Salvatore said. "While they disappeared as a distinctive form of humanity, they live on in our genes. What we do in this study is propose one model of how this could have happened and show that behavioral decisions were probably instrumental in this process."

The researchers suggest it's time to study variation and diversity among individuals rather than classify them into types or species.

"Neanderthals' legacy lives on in our biological genome and possibly in our cultural knowledge," Barton added. "There may have been may other populations like Neanderthals who were integrated into a global human species in the Late Pleistocene. We're the results."

Provided by Arizona State University

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