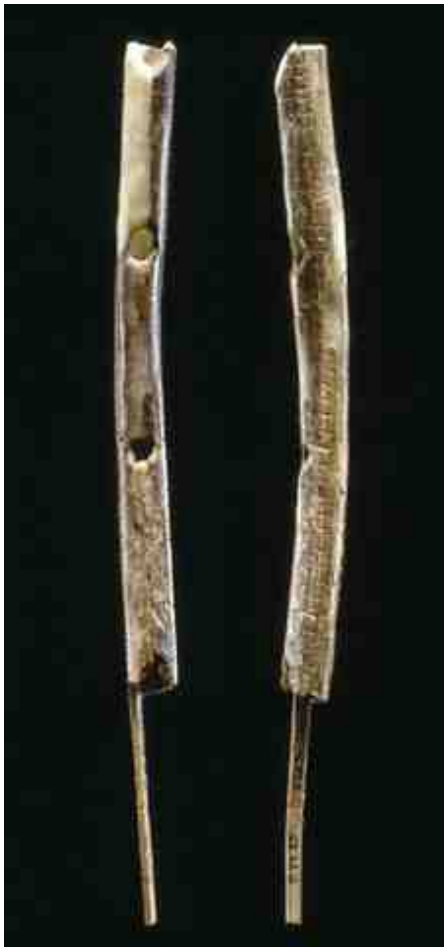
25 May 2012 Last updated at 11:03 GMT

Earliest music instruments found



One of the flutes has been fashioned from mammoth ivory

Researchers have identified what they say are the oldest-known musical instruments in the world.

The flutes, made from bird bone and mammoth ivory, come from a cave in southern Germany which contains early evidence for the occupation of Europe by modern humans - *Homo sapiens*.

Scientists used carbon dating to show that the flutes were between 42,000 and 43,000 years old.

The findings are described in the Journal of Human Evolution.

A team led by Prof Tom Higham at Oxford University dated animal bones in the same ground layers as the flutes at Geissenkloesterle Cave in Germany's Swabian Jura.

Prof Nick Conard, the Tuebingen University researcher who identified the previous record-holder for oldest instrument in 2009, was excavator at the site.

He said: "These results are consistent with a hypothesis we made several years ago that the Danube River was a key corridor for the movement of humans and technological innovations into central Europe between 40,000-45,000 years ago.

"Geissenkloesterle is one of several caves in the region that has produced important examples of personal ornaments, figurative art, mythical imagery and musical instruments."

Musical instruments may have been used in recreation or for religious ritual, experts say.

And some researchers have argued that music may have been one of a suite of behaviours displayed by our species which helped give them an edge over the Neanderthals - who went extinct in most parts of Europe 30,000 years ago.

Music could have played a role in the maintenance of larger social networks, which may have helped our species expand their territory at the expense of the more conservative Neanderthals.

The researchers say the dating evidence from Geissenkloesterle suggests that modern humans entered the Upper Danube region before an extremely cold climatic phase at around 39,000-40,000 years ago.

Previously, researchers had argued that modern humans initially migrated up the Danube immediately after this event.

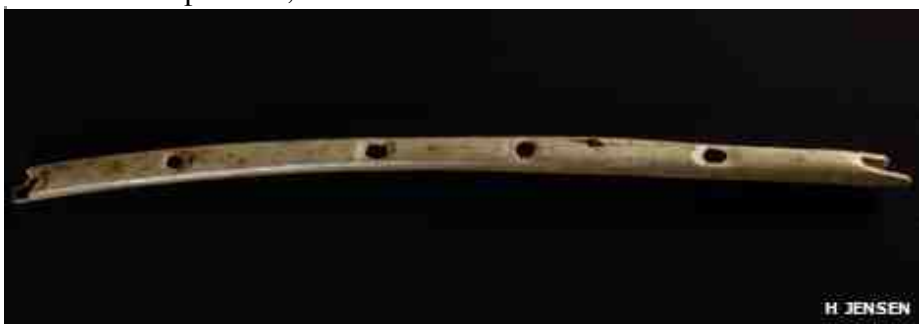
"Modern humans during [this] period were in central Europe at least 2,000-3,000 years before this climatic deterioration, when huge icebergs calved from ice sheets in the northern Atlantic and temperatures plummeted," said Prof Higham.

"The question is what effect this downturn might have had on the people in Europe at the time."

age last updated at 08:05 GMT, Thursday, 25 June 2009 09:05 UK

'Oldest musical instrument' found

By Pallab Ghosh
Science correspondent, BBC News



Scientists in Germany have published details of flutes dating back to the time that modern humans began colonising Europe, 35,000 years ago.

The flutes are the oldest musical instruments found to date.

The researchers say in the Journal Nature that music was widespread in pre-historic times.

Music, they suggest, may have been one of a suite of behaviours displayed by our own species which helped give them an edge over the Neanderthals.

The team from Tubingen University have published details of three flutes found in the Hohle Fels cavern in southwest Germany.

The cavern is already well known as a site for signs of early human efforts; in May, members of the same team unveiled a Hohle Fels find that could be the world's oldest Venus figure.

The most well-preserved of the flutes is made from a vulture's wing bone, measuring 20cm long with five finger holes and two "V"-shaped notches on one end of the instrument into which the researchers assume the player blew.

The archaeologists also found fragments of two other flutes carved from ivory that they believe was taken from the tusks of mammoths.

Creative origins

The find brings the total number of flutes discovered from this era to eight, four made from mammoth ivory and four made from bird bones.

According to Professor Nicholas Conard of Tubingen University, this suggests that the playing of music was common as far back as 40,000 years ago when modern humans spread across Europe.

"It's becoming increasingly clear that music was part of day-to-day life," he said.

"Music was used in many kinds of social contexts: possibly religious, possibly recreational - much like we use music today in many kinds of settings."

> **These flutes provide yet more evidence of the sophistication of the people that lived at that time**
>
> Professor Chris Stringer
> Natural History Museum

The researchers also suggest that not only was music widespread much earlier than previously thought, but so was humanity's creative spirit.

"The modern humans that came into our area already had a whole range of symbolic artifacts, figurative art, depictions of mythological creatures, many kinds of personal ornaments and also a well-developed musical tradition," Professor Conard explained.

The team argues that the emergence of art and culture so early might explain why early modern humans survived and Neanderthals, with whom they co-existed at the time, became extinct.

"Music could have contributed to the maintenance of larger social networks, and thereby perhaps have helped facilitate the demographic and territorial expansion of modern humans relative to culturally more conservative, and demographically more isolated Neanderthal

relative to a culturally more conservative and demographically more isolated Neanderthal populations," they wrote.

That is a view supported by Professor Chris Stringer, a human origins researcher at the Natural History Museum in London.

"These flutes provide yet more evidence of the sophistication of the people that lived at that time and the probable behavioural and cognitive gulf between them and Neanderthals," he said.

"I think the occurrence of these flutes and animal and human figurines about 40,000 years ago implies that the traditions that produced them must go back even further in the evolutionary history of modern humans - perhaps even into Africa more than 50,000 years ago.

"But that evidence has still to be discovered."

http://en.wikipedia.org/wiki/Divje_Babe_flute#.22Neanderthal_flute.22

Divje Babe flute

From Wikipedia, the free encyclopedia

Jump to: navigation, search

Divje Babe flute

Drawing of disputed flute by Bob Fink

Material	Bone
Created	Late Pleistocene (43100 ± 700 BP)
Discovered	1995 near Cerkno, Slovenia
Present location	National Museum of Slovenia, Ljubljana

The **Divje Babe flute** is a cave bear femur pierced by spaced holes that was found at the Divje Babe archeological park located near Cerkno in northwestern Slovenia. It has been suggested that it was made by Neanderthals, however according to Slovenian archeologist Brodar it was made by Cro-Magnon as an element of Central European Aurignacian[1]. Its hole spacing and alignment suggest it is most probable the world's oldest known musical instrument.[2] Alternative hypothesis notwithstanding[3][4][5], the artifact remains on prominent public display as a flute in the National Museum of Slovenia (Narodni Muzej Slovenije) in Ljubljana. The museum's visitor leaflet maintains that manufacture by Neanderthals "is reliably proven".[6]

Contents

Site and similar findings in Slovenia

Divje Babe is the oldest known archaeological site in Slovenia. The site is the location of a horizontal cave, 45 metres (148 ft) long and up to 15 metres (49 ft) wide. It is located 230m above the Idrijca River, near Cerkno, and is accessible to visitors. Researchers working at this site have uncovered more than 600 archaeological finds in at least ten levels, including 20 hearths[7] and the skeletal remains of cave bears, and have studied climate change during the pleistocene.[8] According to the museum, the presumed flute has been associated with the "end of the middle Pleistocene" and the time of Neanderthals, about 55,000 years ago.[6]

This is not the only such site in Slovenia. In the 1920s and 1930s, the archeologist Srečko Brodar discovered tens of bones with holes in another site, Potok Cave (Slovene: *Potočka zijalka*) in the Eastern Karavanke, but almost all of them were destroyed during Italian occupation of Ljubljana in World War II. The best known of them, still preserved, is a mandible of a cave bear with three holes in the mandibular canal.

Potok Cave, a cave in the Eastern Karavanke, where the remains of a human residence, dated to the Aurignacian (40,000 to 30,000 BP), including a flute bone, were found by Srečko Brodar in the 1920s and 1930s. This marks the beginning of Paleolithic research in Slovenia.[9]

Since World War II, specimens have also been found in Mokrica Cave (Slovene: *Mokriška jama*), Betal Rock Shelter (*Betalov spodmol*), and elsewhere. These bones are preserved today at the National History Museum of Slovenia in Ljubljana, the capital. According to the archeologist, who discovered many of them, Mitja Brodar, bones with holes were never found in the Western Europe, and they have been dated only to the end of the Mousterian and the beginning of the Aurignacian. Such bones were discovered also elsewhere in Central Europe, but in a much lower number, and it is unlikely that cave bears would make such holes only in Central Europe and only in a specific period. That these bones are still not recognised by international research community, Mitja Brodar attributes to the fact that most of the bones were found on the territory of France and the Paleolithic is still considered to be the French domain, although not a single bone with holes have been found there. The only one ever discovered *bone point with a hole* has been discovered in Potok Cave. According to Brodar, such holes are an element of Central European Aurignacian.[1] They have been ascribed to the

Cro-Magnon, modern human.[10] According to Brodar, the Divje Babe flute is a product of modern human as well, but this has been disputed by other Slovene scholars.[1]

"Neanderthal flute"

In 1995, Ivan Turk found an approximately 43,100 year-old[11] [12] juvenile cave bear femur at the Divje Babe site, near a Mousterian hearth. Because it has characteristics of a flute, he has called it the "Neanderthal flute".[7] Whether it is actually a flute created by Neanderthals is a subject of debate. It is broken at both ends, and has two complete holes and what may be the incomplete remains of one hole on each end, meaning that the bone may have had four or more holes before being damaged. The bone fragment is the diaphysis of the left femur of a one to two year-old cave bear, and is 113.6 mm long. The maximum diameters of the two complete holes are 9.7 and 9.0 mm. The distance between the centers of the holes is 35 mm.[13]

If the bone is a flute, it would be evidence of the existence of music 43,000 years ago.[14][15] Thus Ivan Turk has asserted that whether the holes are of "artificial" (made by man) or "natural" (punctures from a carnivore bite) origin is the "crucial question.",[7]

Divje Babe flute at National Museum of Slovenia

The bone has become a noted attraction in National Museum of Slovenia, publicized on official Slovenian websites[16] aired on TV with tunes played on a clay replica[17] and is a source of pride for the country. In the West, paintings were made, models constructed, and musicians such as Biology Professor and flautist Jelle Atema[18] have played them publicly.

French based, Italian taphonomist Francesco D'Errico (et al., 1998), Holderman and Serangeli (1999), as well as Chase and Nowell (1998, 552), hypothesized its carnivore origine.[19]

Hole spacing and alignment

The probability that four randomly placed holes would appear in-line in a recognizable musical scale is on the order of a few in several million, was shown in the analysis made in 2000 by Canadian musicologist Bob Fink.[20] Responding to the d'Enrico et al's carnivore-origin hypothesis, Turk (2005, 2006) pointed out that the features "common" between the carnivore-origin artifact and other chewed bones studied by D'Errico (see *hole shape* below) do not include the *line-up of the holes*.

There is also no evidence that the two holes could have been bitten at the same time. The tooth spans were checked by all taphonomists concerned to see if any animals could bite two or more such holes at once. No match could be found to any known animals. If a match had been

found, it could have been cited as *prima facie* evidence that the holes were animal-made. This was noted by Turk, et al., in his monograph, and was also noted from the opposing hypothesis holders Nowell and Chase in their *Current Anthropology* article in the August–October 1998 issue. "Holes in the specimen", wrote Nowell, et al., "were almost certainly made sequentially rather than simultaneously and that the distance between them has nothing to do with the distance between any two teeth in a wolf's jaw."[21]

Iain Morley, despite his holding the carnivore-origin hypothesis, in an additional observation to his November 2006 article observed that "(W)whilst the collections of cave bear bones examined by D'Errico et al. (1998), as well as those discussed by Turk et al. (2001), do show similar shaped and damaged holes...none of these occur in the diaphysis of a femur" (the thick part), as is found on the reputed flute (Morley 2006, 329).

Marcel Otte (director of the museum of Prehistoire, Universite de Liege, Belgium) pointed out in a *Current Anthropology* (April 2000) article, that there is a possible thumb-hole on the opposite side of the Divje Babe bone, which, making 5 holes, would perfectly fit a human hand.

Turk wrote in the Massachusetts Institute of Technology book *The Origins of Music*: "If this probability [of having lined-up holes looking like a flute] were greater (and of course it isn't), it is likely that there would have been more such finds, since...carnivores in cave dens were at least as active on bones, if not more so, than people in cave dwellings....".

Hole shape

D'Errico et al. made an analysis of the artifact in comparison to cave-bear bone accumulations where no hominid presence was known.[3] They published photos of several bones with holes in them which had more or less circular holes similar to those found in the artifact, but they did not have a single bone coming even close to the linear alignment of Turk's holes. Ignoring the probability of *line-up of the holes*, D'Errico et al.'s interpretation was that it was possible for the holes to have been made by animal, and they wrongfully concluded that of the available options this was the most likely (sic!). D'Errico insisted on ignoring the probability of line-up of the holes, and even after having analyzed the artifact firsthand, claimed that "the presence of two or possibly three perforations on the suggested flute cannot therefore be considered as evidence of human manufacture, as this is a common feature in the studied sample."[22]

Turk conducted laboratory experiments which pierced holes in fresh bear bones in the manner of carnivore punctures, and in every case, the bones split. Yet in the Divje Babe instance, the bone did not break, a fact not matching expectations of carnivore action, as Turk's results showed. Turk wrote, in his monograph and in his article in MIT's *Origins of Music* anthology, the bone shows no "counter-bites" that one would normally expect on the other side of the bone matching the immense pressure necessary for a bite to make the center holes.

Turk's 1997 monograph reported that the holes have similar diameters which would accommodate fingertips, and all are circular instead of oval (as carnivore bites often are). Furthermore, all are in the proper ratio of bore size to hole size found in most flutes, and the bone is the kind (femur) usually used for bone flutes.

An examination of the specimen using computed tomography was published in 2005 by Ivan Turk et al., in which he concluded that "the two partially preserved holes were formerly created

before the damage...or before the indisputable intervention of a carnivore."

The National Museum of Slovenia argues that this evidence has "finally refuted hypotheses that the bone was perforated because of a bear bite". The manufacture by Neanderthals "is reliably proven" and its significance in the understanding of their capabilities and the development of music and speech is secure.[6]

Bone marrow

The issue of how much bone marrow remains in the artifact is important, because the making of flutes from bone usually includes removing the marrow.

Turk, et al. (in the monograph *Mousterian Bone Flute*, p. 160) wrote that "the marrow cavity is basically cleaned of spongiose. The colour of the marrow cavity does not differ from the colour of the external surface of the bone. So we may conclude that the marrow cavity was already open at the time.... Otherwise, it would be a darker colour than the surface of the bone, as we know from coloured marrow cavities of whole limb bones."

April Nowell stated in an interview that "at Turk's invitation, [Nowell] and Chase went to Slovenia last year... They came away even more skeptical that the bear bone had ever emitted music. For one thing, both ends had clearly been gnawed away by something, perhaps a wolf, seeking greasy marrow. The holes could have simply been perforated in the process by pointed canine or carnassial teeth, and their roundness could be due to natural damage after the bone was abandoned. The presence of marrow suggests that no one had bothered to hollow out the bone as if to create an end-blown flute. Says Nowell, '[Turk's] willing to give it the benefit of the doubt, whereas we're not.' "[23]

Diatonic scale

Illustration of the diatonic flute by Bob Fink.
Bob Fink claimed in his essay[24] in 1997, that the bone's holes were "consistent with four notes of the diatonic scale" (do, re, mi, fa) based on the spacing of those four holes. The spacing of the holes on a modern diatonic flute (minor scale) are unique, and not evenly spaced. In essence, Fink said, they are like a simple fingerprint. The Divje Babe bone's holes matched those spacings very closely to a series of note-holes in a minor scale.

Nowell and Chase wrote in *Studies In Music Archaeology III* (presentations at a 2000 world conference on music archaeology), and saying in the media[23] as well, that the juvenile bear bone was too short to play those four holes in-tune to any diatonic series of tones and half-tones. (Fink had suggested there may have originally been a mouthpiece extension added to the bone before it was broken.)

[Nowell] along with archeologist Philip Chase, had serious doubts as soon as they saw photos of the bone on the Internet.... The Divje Babe bone bears some resemblance to the dozens of younger, uncontested bone flutes from European Upper Paleolithic [UP] sites. But, says Nowell, these obvious flutes are longer, have more holes, and exhibit telltale tool marks left from their manufacture. No such marks occur on the bear bone. Fink proposed that the spacing of the flute's holes matches music's standard diatonic scale. ...Nowell and Chase teamed with a

more musically inclined colleague to show that the bear bone would need to be twice its natural total length to conform to a diatonic scale.....[23]
In a 2011 article Matija Turk published the results of a collaboration with Ljuben Dimkaroski, an academic musician who had made replicas of the artefact. The authors argue that the instrument encompassed a range of two and a half octaves, which can be extended to three octaves by overblowing.[25] Dimkaroski created over 30 wooden and bone replicas of the flute and experimented with them. The replicas were made from femurs of juvenile brown bears provided by Hunters Association of Slovenia, but also calf, goat, pig, roe and red deer bones. In the end he concentrated on playing a replica made on a femur of a juvenile cave bear from Divje babe I, to come as close as possible to the dimensions of the original.

Science 5 January 2001:
Vol. 291 no. 5501 pp. 52-54
DOI: 10.1126/science.10.1126/SCIENCE.1056960

- Perspective

BIOLOGY AND MUSIC

The Music of Nature and the Nature of Music

1. Patricia M. Gray,
2. Bernie Krause,
3. Jelle Atema,
4. Roger Payne,
5. Carol Krumhansl and
6. Luis Baptista[HN27]*

1. *P. M. Gray is at National Musical Arts, National Academy of Sciences, Washington, DC 20016, USA.*
2. *B. Krause is at Wild Sanctuary Inc. J. Atema is at the Marine Biology Laboratory, Woods Hole, MA 02543, USA.*
3. *R. Payne is at Ocean Alliance, Lincoln, MA 01773, USA.*
4. *C. Krumhansl is in the Department of Psychology, Cornell University, Ithaca, NY 14853, USA.*
5. *L. Baptista was at the California Academy of Sciences, San Francisco, CA 99418, USA.*

Our world is filled with innumerable natural sounds, and from the earliest times humans have been intrigued and inspired by this “soundscape.” People who live close to nature perceive a wider range of sounds than those of us living in industrialized societies, who rely heavily on advances in sound technology. The sounds of whales in the ocean, for example, were first recorded in the 1940s, yet the Tlingit, Inuit, and other seafaring tribes have been hearing them through the hulls of their boats for millennia. Similarly, the ultralow frequency communications of elephants [HN1] have only just been recorded even though the Hutu and Tutsi tribes of central East Africa have incorporated these sounds into their songs and stories for centuries.

It is said that every known human culture has music. Music has been defined as patterns of sound varying in pitch and time produced for emotional, social, cultural, and cognitive purposes (1). Is music-making in humans defined by our genes? [HN2] Do other species show musical language and expression? If they do, what kinds of behavior invoke music-making in these animals? Is there evidence in the animal kingdom for the ability to create and recreate a

musical language with established musical sounds? How are musical sounds used to communicate within and between species? Do musical sounds in nature reveal a profound bond between all living things?

The Music of Nature

Whales. The undersea songs of humpback whales [HN3] are similar in structure to bird and human songs and prove that these marine mammals are inveterate composers. If songs can be defined as "any rhythmic repeated utterance, whether by a bird, a frog, an insect, a whale or a human being" (2), then humpback whale songs [HN4] are constructed according to laws that are strikingly similar to those adopted by human composers.

- • Singing humpbacks use rhythms similar to those in our own music, yet they could just as easily formulate free-form, arrhythmic sounds.
- • They use phrases of a similar length to ours—a few seconds—and create themes out of several phrases before singing the next theme. Their songs could easily "grow" organically without the need for repetition but, like human composers, these marine mammals prefer to reiterate their material.
- • Whale songs fall between the length of a modern ballad and that of a movement of a symphony. Perhaps they have chosen the same length of performance as we have because, with their large cerebral cortex, they have a similar attention span to humans.
- • Even though they are capable of singing over a range of at least seven octaves, humpbacks use musical intervals between their notes that are similar to or the same as the intervals in our scales.
- • Whales mix percussive or noisy elements in their songs with relatively pure tones, and do so in a ratio similar to that used by humans in Western symphonic music.
- • In some whale songs, the overall song structure is similar to human compositions: a statement of theme, a section in which it is elaborated, and then a return to a slightly modified version of the original theme (that is, the ABA form) [HN5].
- • The tone and timbre of many whale notes are similar to human musical sounds. With an infinitude of possible sounds to choose from, whales could easily prefer to make sounds that we would deem unpleasant (roars, stutters, grunts).
- • Most surprisingly, humpback songs contain repeating refrains that form rhymes. This suggests that whales use rhyme in the same way that we do: as a mnemonic device to help them remember complex material (2).

The fact that whale and human music have so much in common even though our evolutionary paths have not intersected for 60 million years, suggests that music may predate humans—that rather than being the inventors of music, we are latecomers to the musical scene.

Birds. Advances in audio technology allowed the late Luis Baptista [HN6] to draw fascinating parallels between bird song [HN7] and human music (3). For instance, when birds compose songs they often use the same rhythmic variations, pitch relationships, permutations, and combinations of notes as human composers. Thus, some bird songs resemble musical

compositions; for example, the canyon wren's [HN8] trill cascades down the musical scale like the opening of Chopin's “Revolutionary” Etude [HN9].

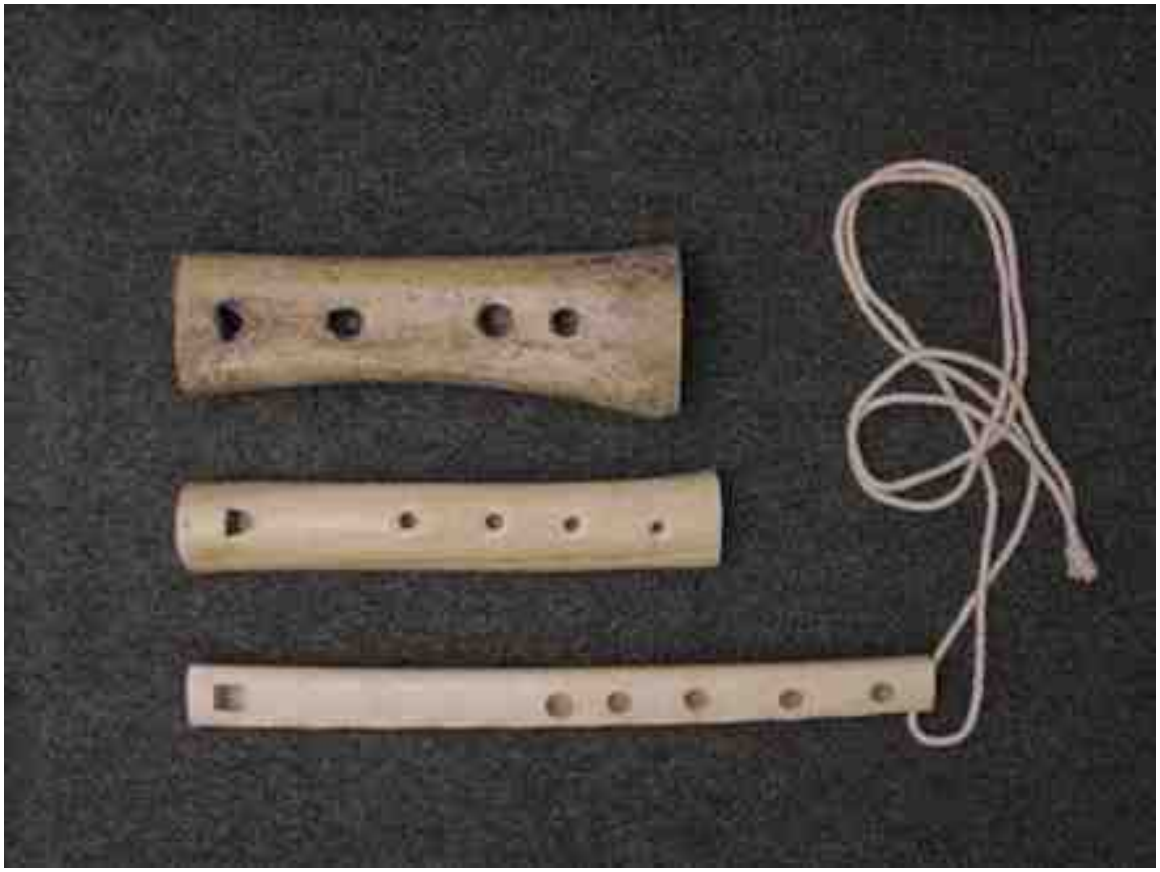
An examination of bird song reveals every elementary rhythmic effect found in human music (4). There are interval inversions, simple harmonic relations, and retention of melody with change of key [HN10]. Many birds regularly transpose motifs to different keys (5). Some birds pitch their songs to the same scale as Western music, one possible reason for human attraction to these sounds. For example, notes in the song of the wood thrush (*Catharus mustelina*) [HN11] are pitched such that they follow our musical scale very accurately (6). The interval between the first and second parts of the song of a ruby-crowned kinglet (*Regulus calendula*) [HN12] is often a full octave. The canyon wren sings in the chromatic scale (which divides the octave into 12 semitones) (7) and the hermit thrush (*Catharus guttatus*) [HN13] in the pentatonic scale (which consists of five different tones within the octave) [HN14] (8).

The simple melodic canon [HN15], a frequent device in human composition based on imitation, is reminiscent of the matched countersinging of many bird species. The Socorro mockingbird (*Mimodes graysoni*) [HN16] of Mexico sings a long series of short themes and its immediate neighbor will then respond to each theme with the identical theme (9). The Californian marsh wren (*Cistothorus palustris*) [HN17] may sing as many as 120 different themes in a fixed sequence. Each theme is matched by its neighbor in a leader-follower sequence (in music this is known as the call-response pattern) (10).

Not all bird sounds emanate from the vocal tract—some are produced with “instruments” such as special feather structures, others by the bird pounding on an object with a “preferred” resonance. Perhaps the most remarkable example of a bird using an instrument to produce sound is that of the palm cockatoo (*Probosciger aterrimus*) [HN18] of Northern Australia and New Guinea (11). Each male breaks a twig from a tree, then shapes it into a drumstick. The bird selects a hollow log with a preferred resonance and then, holding the stick with its foot, drums on the log as part of its courtship ritual.

Humans. Human music-making may vary dramatically between cultures, but the fact that it is found in all cultures suggests that there is a deep human need to create, perform, and listen to music.

It appears that our Cro-Magnon and Neanderthal ancestors [HN19] were as fond of music as we are. The discovery of prehistoric flutes [HN20] made of animal bone in France and Slovenia, ranging in age from 4000 to 53,000 years old, demonstrates that ancient civilizations devoted considerable time and skill to constructing complicated musical instruments (see the figure, below). Reconstructions of these prehistoric flutes suggest that they resemble today's recorders [HN21] (12). It is possible that these ancient instruments even had a sound-producing plug (a fipple), making them easier to play but more difficult to make. Remarkably, many different types of scales can be played on reconstructed prehistoric flutes, and the sounds are pure and haunting. Given the sophistication of these 50,000-year-old instruments, it is quite possible that humans have been making music for several hundred thousand years.



No bones about Neanderthal music.
Reconstructions of (**top**) a 53,000-year-old Neanderthal flute made of bear bone found in Slovenia (possibly recorder type), (**middle**) a 30,000-year-old French deer bone flute (most likely recorder type), and (**bottom**) a 4000-year-old French vulture bone flute (definitely recorder type).

“CREDIT: JELLE ATEMA”

The oral tradition of the Sami—the indigenous people of the northern Scandinavian Peninsula and the Kola Peninsula of present-day Russia—is contained in exclusively vocal songs called yoiks [HN22] (13). Yoiks—consisting of short repeated cycles of nonsense syllables without linguistic meaning—describe everyday life and always carry personal meaning for the yoiker. Although not described in words, the topic of a yoik may be a person, livelihood, an animal, a place, or an aspect of nature. It is believed that musical knowledge is acquired in part by the internalizing of frequently repeated patterns in a particular musical style, thereby enabling listeners to abstract recurring commonalities from the music that they hear (13). The ability to memorize and recognize musical patterns thereby creates learned oral traditions that are passed on to subsequent generations.

Musical Commonalities

The ability to memorize and recognize musical patterns is also central to whale and bird music-making. These learning patterns may be vertical traditions (when a behavior is passed from parent to offspring), oblique traditions (when adults who are not blood-related pass the culture to younger generations), or horizontal traditions (when peers learn from each other).

Vertical musical tradition, such as the Sami yoik, is found in all human cultures and in several

finch species, including the zebra finch (*Taeniopygia castanostis*) and the Northern bullfinch (*Pyrrhula pyrrhula*) [HN23]. Oblique musical tradition is the central component of every music lesson and is probably the most widespread mode of learning songs among birds (14). Horizontal musical tradition is found on every children's playground, in hand-raised juvenile chaffinches (*Fringilla coelebs*) [HN24], white-crowned sparrows (*Zonotrichia leucophrys*) [HN25], and in Anna's hummingbirds (*Calypte anna*) [HN26], which when raised together develop very similar songs (14). Horizontal transfer of songs is also found among humpbacks —every whale in the same breeding area sings the same song and the song slowly evolves from year to year (2), but whales from different oceans sing completely different songs. By comparing any given whale song with a collection of song tapes, the year and the ocean from which the songs came can be identified. A recent report documented the extraordinary finding that the arrival of a few humpbacks from the Indian Ocean (Australia's west coast) to the Pacific Ocean (Australia's east coast) resulted in the resident Pacific whales ditching their own song in favor of the newcomer's ditty, a transformation that was complete within 3 years (15).

Universal Music

Ambient sound is a central component of natural habitats. Abstracting the voice of a single creature from a habitat and trying to understand it out of context is a little like trying to comprehend an elephant by examining only a single hair at the tip of its tail (before cloning, of course). The ambient sound of an environment mimics a modern-day orchestra: the voice of each creature has its own frequency, amplitude, timbre, and duration, and occupies a unique niche among the other musicians (16). This “animal orchestra” or biophony represents a unique sound grouping for any given biome and sends a clear acoustical message.

Musical sounds form an exciting, natural conduit between members of our own species, between our species and others, and between the arts and sciences. By looking at musical commonalities, our understanding of music is enlarging, and by viewing musical sounds as an intuitive, nonverbal form of communication, we can better understand our own development in a biodiverse world.

It has been postulated that there is an unproven (and probably unprovable) concept called mathematical Platonism, which supposes that there is a universal mathematics awaiting discovery. Is there a universal music awaiting discovery, or is all music just a construct of whatever mind is making it—human, bird, whale? The similarities among human music, bird song, and whale song tempt one to speculate that the Platonic alternative may exist—that there is a universal music awaiting discovery.

It is not known when the ancient art of making music first began. But, if it is as ancient as some believe, this could explain why we find so much meaning and emotion in music even though we cannot explain why it makes us feel the way it does. Such an impenetrable vagueness about this most basic of human creations seems to signal that the roots of music lie closer to our ancient lizard brain than to our more recent reasoning cortex, that music has a more ancient origin even than human language.