This semester I have not discussed the interesting side branch of the Neanderthals in Europe—please review the reading on this—from 300,000 to 127,000 ya in Europe, *H. heidelbergensis* developed Neanderthal traits—apparently mostly due to the cold Pleistocene conditions of Europe—and the Neanderthals continued in Europe until around 30,000 ya.

When we last looked at Africa, it was populated by late *Homo heidelbergensis*—1200-1300 cc brain; massive, solid browridges; mode 3 flake tools—unlike the European *Homo heidelbergensis*, the African ones did not develop the Neanderthal traits—they were not experiencing the strong selection pressures of the cold sub-arctic European climate—instead, a bit later, from about 190,000 to 100,000 ya, the African *H. heidelbergensis* populations started developing physical traits of modern *Homo sapiens*—but at first, the new *H. sapiens* continued to act like their *H. heidelbergensis* ancestors—that is, their bones look like modern *H. sapiens*, but their behavior did not—they made similar mode 3 flake tools, no houses, art, etc.—only later, around 50,000 ya, were they clearly, consistently acting and thinking like modern *H. sapiens*—and only then did some migrate out of Africa and begin out-competing all other hominins they encountered.

Physical features of *Homo sapiens*
− smaller face
− smaller teeth (all of the teeth got smaller: incisors, canines, premolars, molars)
− projecting chin (“mental eminence”)
− greatly reduced browridges
− slightly larger cranial capacity: averages around 1400 cc—vs. our immediate predecessor, *H. heidelbergensis*, 1200-1300 cc—note that Neanderthals also evolved larger brains, in their separate lineage: parallel evolution—higher, more vertical forehead
− taller, rounder cranium when viewed from the side—less like a football, more like a bowling ball
− longer, more lightly built limbs
− longer hands and fingers—don’t have the odd incisor wear found on Neanderthals—these last two points, especially, suggest increasing reliance on tools for many tasks, rather than teeth and strength

− from 200,000 to 100,000, these features became more common in Africa
– eventually shifting all the *H. heidelbergensis* populations of Africa towards *H. sapiens*
– these early *H. sapiens* continued to make mode 3 flake tools like their *H. heidelbergensis*
  ancestors had
  – did not make houses, ornaments, art, etc.
  – had one basic, fairly inflexible set of behaviors that changed little from place to place or
  over time
– Many populations of *H. sapiens* in Africa were apparently somewhat isolated from each other
  – allowing them to evolve differences specific to each region
  – these were not enough to make them separate species, just different populations
  – just as people from Norway look different from people from Italy
– Some time between 100,000 to 50,000 ya, some African *H. sapiens* began to behave more like
  modern humans
  – making shelters, more sophisticated tools, decorative items, etc. (more on this later)
– Two theories about this behavioral change
  – “Human revolution” theory
    – little change up to around 50,000 ya
    – then a sudden change in cognitive abilities
      – probably in one small, isolated population
      – maybe due to one or a few genetic mutations
      – maybe due to unusual, strong selection pressures… or?
    – this change was in brain function only; it did not leave any detectable traces in the bones
    – it resulted in a sudden elaboration of tools, art, shelters, trade, etc.
  – Gradualism view
    – *H. sapiens* in Africa gradually evolved this modern behavior from 100,000 to 50,000 ya
      – all across Africa, in different ways in different regions
      – with interbreeding spreading the alleles that favored more complex thinking and
        behavior
    – which is correct?
      – the debate is ongoing, and too complex to cover in this class
      – but the gradualism position seems to be winning
– Either way, by about 50,000 ya
  – there were *H. sapiens* in Africa that thought and behaved basically like modern human
    foragers do
    – these could be called “cognitively modern” *Homo sapiens*
  – since they had been evolving in partially isolated parts of Africa, they were already
    somewhat different from place to place
  – people from one of these populations, presumably in the northwestern part of Africa, moved
    into the Middle East
    – some of their descendents moved into Europe
    – others moved into Asia, including the extreme, Arctic north (this would have been an
      incredibly harsh environment; this was still during the Pleistocene!)
    – others to southern Asia
- and from there, to Australia by 40,000 ya
  - getting to Australia required crossing 100 km of open ocean
  - same for some of the other islands where they have been found
  - meaning that they did this multiple times, each time with enough people to found
    surviving populations
  - this presumably means that they had seaworthy boats at 40,000 ya!
- from about 40,000 to 30,000 ya, cognitively modern *H. sapiens* coexisted with Neanderthals
  in the Middle East and Europe
  - they remained physically distinct
    - so they evidently did not interbreed much, which genetic studies have also indicated
  - they also remained culturally distinct
    - the Neanderthals that used bone awls and personal ornaments like *H. sapiens* do at
      Arcy-sur-Cure around 33,000 ya were a rare exception
  - by 30,000 ya, the Neanderthals were gone
  - and only the cognitively modern *H. sapiens* remained
  - that is, cognitively modern *H. sapiens* replaced the Neanderthals
    - they apparently out-competed them in some way
- in Asia, by 30,000 ya, cognitively modern *H. sapiens* had replaced any remaining Asian *H. heidelbergensis*, and *H. erectus*
- Cognitively modern *Homo sapiens*
  - No clear physical differences from earlier *H. sapiens*, at least that we can see in their bones
  - But a huge difference in thinking and behavior
    - much more sophisticated, complex technology
    - handled a wider range of environments
    - traveled long distances or traded for raw materials
    - explosion of symbolic behavior…
- Technology of cognitively modern *Homo sapiens*
  - from about 45,000 to 10,000 ya
  - Mode 4 stone tools
    - based on blades, rather than flakes
      - blades are long, narrow flakes, rather than wider ones
    - mode 4 blades can be made by a more efficient technique
      - mode 3 flakes are often made by
        - preparing a core
        - striking off the desired flake
        - then reshaping the core again for the next desired flake
          - this reshaping requires removing flakes that become waste
        - a mode 4 blade core is first worked to a cylindrical or truncated cone shape
        - when a blade is struck off from the core, it leaves the core prepared for removing the
          next one with little or no additional reshaping
          - done properly, there is very little wasted material
        - the blades are then retouched into the desired final shape
– this produces much more cutting edge per pound of stone
– Much wider variety of materials used
  – bone, antler, ivory, shell, etc.
  – tools made by *H. heidelbergensis*, Neanderthals, and early (not cognitively modern) *H. sapiens* usually involved only stone and wood, and probably sinew or other fibers
– Much wider variety of distinct tool types
  – lots of very specific, standardized stone tool types
    – obviously made to a specific, preconceived plan
    – obviously intended for particular purposes
  – bone or antler spear points, often barbed
  – atl-ats (spear throwers)
  – spears with detachable foreshafts
  – awls and needles for working hides
  – and many other types
– made tools from specific materials suited to particular uses
  – they obtained specific stone types and specific shells from hundreds of kilometers away
    – vastly farther than Neanderthals or *H. heidelbergensis* had gone for materials
  – implies understanding of materials and long-term planning to get them
  – either by making very long distance procurement journeys and bringing stuff back
  – or by trading with neighbors
  – either way, implies complex social arrangements
– developed numerous distinctly different regional styles of tools, or “cultures”
  – people in different regions and periods had their own tool styles, suggesting modern human ethnic groups or cultures
  – unlike the Acheulean tradition
    – in which *H. ergaster* and early *H. heidelbergensis*
      – made the same, repetitive handaxes
    – in whatever environment they found themselves in
      – for 1.3 million years, with little change
  – unlike the Neanderthal’s mode 3 tool style
    – pretty much the same across all of Europe
    – and pretty much unchanging for 100,000 years
  – Upper Paleolithic tool cultures were different in different places in Europe, not to mention different parts of Africa, Asia, and Australia
    – and most Upper Paleolithic tool cultures lasted just thousands of years
    – still very conservative, but changed far more rapidly than anything before
– they handled a much wider range of environments
  – from extreme Arctic conditions as in north Asia, where it gets to –50 degrees in the winter now, and would have been much colder yet during the Pleistocene
  – extremely dry desert
  – coastal marine environments requiring boats and fishing technology
– definitely big game hunters
− mostly large, herd animals
− caribou, bison, wooly rhinoceros, mammoth, horse, etc.
− also some fish and birds
− in some regions, *H. sapiens* groups specialized on just one or two species
  − red deer in Spain
  − mammoths in central Asia
− do these different hunting specializations suggest early ethnic groups or cultures?
− definitely built shelters
  − Russia and Czech Republic: pit houses with roofs made of mammoth bones (presumably covered with hides)
− definitely sewed clothing
  − implied by surviving in extremely cold climates
  − lots of bone awls and needles
  − a few burials with lots of beads that appear to have been sewn onto clothing
− explosion of symbolic behavior
  − cave art
    − paintings on cave walls
    − carvings or engravings on cave walls
  − decorations on artifacts
    − tools with handles carved into sculptural animals
    − tools and other objects with designs scratched or engraved on them
  − figurines
    − animals
    − human (usually but not always female) heads: many faceless and abstract, but some portraits?
  − human figurines, usually but not always female
− personal ornaments
  − necklaces, pendants, etc.
  − beaded hats and clothing
− clearly ritual burials with offerings
  − bodies painted with red ochre
  − bodies buried wearing beaded hats, clothes, ornaments, etc.
  − such burials imply complex ideas about death and/or the afterlife
  − one adolescent male buried with hundreds of beads, covered with red ochre, with four "batons" made from antlers, three held in his right hand
    − these "batons" do not appear to be tools
    − they were probably for some non-utilitarian purpose, maybe ritual objects such as a shaman might use
    − if so, implies complex ideas about the supernatural apart from just treatment of the dead
− Upper Paleolithic, cognitively modern *H. sapiens* were apparently very successful
  − apparently much higher population than Neanderthals
  − many more sites, yet in a much shorter span of time
- longer life expectancy
  - some Upper Paleolithic *H. sapiens* reached 60 years old
  - 2/3 died over 30
  - while Neanderthals rarely lived past 45
  - and only 1/3 died over 30
- Boyd and Silk suggest that having these additional older, more experienced people around would have been important for cultural development
  - would have fostered accumulation of knowledge and skills
  - would have promoted transmission of knowledge and skills to the next generation
- suffered fewer injuries
- suffered less disease

- How do we know that *H. sapiens* encountered and replaced other hominins?
  - there are other possibilities
  - local populations outside of Africa could have evolved modern *H. sapiens* traits
  - pre-*sapiens* populations could have been interbreeding, exchanging alleles, and evolving more or less together
  - or local populations could have interbred with immigrant *H. sapiens*
  - but none of these fit with the evidence as well as replacement by *H. sapiens*
  - the archaeological dates for Upper Paleolithic burials and tool styles fit a replacement model
  - too many details and too complex arguments to deal with here
  - several different lines of genetic evidence fit with a replacement model
  - these arguments are also quite technical, and the textbook bites off too much in trying to explain them here
- you only need to know the general conclusions at the level presented here for this course

- Genetic evidence 1: Humans are all genetically very similar
  - much more so than chimpanzees
  - this suggests that we all descended fairly recently from a small number of individuals
  - here is an analogy to explain this reasoning
    - imagine that only the Japanese colonize Mars, and send only Japanese settlers
    - a thousand years later, everyone on Mars will be fairly similar
    - they will all look Japanese
    - because they all descended from a relatively small population, with relatively similar alleles
  - it is possible to mathematically estimate how small the original population was, and how long ago
  - different researchers disagree on the timing and size of the population
    - ranging from just a few thousand to several hundred thousand individuals
  - but they all do indicate that a relatively small population gave rise to all the modern people in and out of Africa

- Genetic evidence 2: African populations and individuals are more genetically variable than are individuals and populations from all the rest of the world
  - again, this fits with the model of just some Africans being the founders of all the populations outside of Africa
since then, all populations have been evolving differences
but some of the African ones were already different from the ones that left
so they have had longer to accumulate additional differences than have the populations outside of Africa, which all started out roughly the same
- Genetic evidence 3: all non-African populations are relatively closely related, while some African ones are more different
  - this has been shown with both mitochondrial DNA (mtDNA) and Y-chromosome DNA
    - if you don’t know what those are, don’t worry about it
- Conclusions from various different genetic methods:
  - European and Asian populations split from each other and from one African population fairly recently
  - while some African populations have been separated for much longer
  - this fits with the model of one group of Africans leaving and becoming the ancestors of all the *H. sapiens* in the rest of the world
    - that is, replacing all the earlier hominins out there, rather than interbreeding with them
- Conclusions
  - despite all the differences on details presented in the textbook, overall, almost everyone now agrees that
    - physically and cognitively modern humans arose in Africa
    - then spread out and replaced all other hominins around the globe