**The Second Lecture**

**The Physical Adaptation Source in Detail**

Instead of looking at types of sounds as the source of human speech, we can look at the types of physical features humans possess, especially those that may have supported speech production. We can start with the observation that, at an early stage, our ancestors made a major transition to an upright posture, with bi-pedal (on two feet) locomotion. This really changed how we breathe. Among four-legged creatures, the rhythm of breathing is closely linked to the rhythm of walking, resulting in a one pace – one breath relationship. Among two-legged creatures, the rhythm of breathing is not tied to the rhythm of walking, allowing long articulations on outgoing breath, with short in-breaths. It has been calculated that “human breathing while speaking is about 90% exhalation with only about 10% of time saved for quick in-breaths” (Hurford, 2014: 83) .

Other physical changes have been found. The reconstructed vocal tractof a Neanderthal man from around 60,000 years ago suggests that someconsonant-like sound distinctions were possible. Around 35,000 years ago we start to find features in fossilized skeletal structures that resemble those of modern humans. In the study of evolutionary development, there are certain physical features that are streamlined versions of features found in other primates. By themselves, such features would not guarantee speech, but they are good clues that a creature with such features probably has the capacity for speech.

**Teeth and Lips**

Human teeth are upright, not slanting outwards like those of apes, and they are roughly even in height. They are also much smaller. Such characteristics are not very useful for ripping or tearing food and seem better adapted for grinding and chewing. They are also very helpful in making sounds such as f or v. Human lips have much more intricate muscle interlacing than is found in other primates, and their resulting flexibility certainly helps in making sounds like p, b and m. In fact, the b and m sounds are the most widely attested in the vocalizations made by human infants during their first year, no matter which language their parents are using.

**Mouth and Tongue**

The human mouth is relatively small compared to other primates and can

be opened and closed rapidly. It is also part of an extended vocal tract that has more of an L-shape than the straight path from front to back in other mammals. In contrast to the fairly thin flat tongue of other large primates, humans have a shorter, thicker and more muscular tongue that can be used to shape a wide variety of sounds inside the oral cavity. In addition, unlike other primates, humans can close off the airway through the nose to create more air pressure in the mouth. The overall effect of these small differences taken together is a face with more intricate muscle interlacing in the lips and mouth, capable of a wider range of shapes and a more rapid and powerful delivery of sounds produced through these different shapes.

**Larynx and Pharynx**

The human larynx or “voice box” (containing the vocal folds) differs

significantly in position from the larynx of other primates such as monkeys. In the course of human physical development, the assumption of an upright posture moved the head more directly above the spinal column and the larynx dropped to a lower position. This created a longer cavity called the pharynx, above the vocal folds, which acts as a resonator for increased range and clarity of the sounds produced via the larynx. Other primates have almost no pharynx. One unfortunate consequence of this development is that the lower position of the human larynx makes it much more possible for the human to choke on pieces of food. Monkeys may not be able to use their larynx to produce speech sounds, but they do not suffer from the problem of getting food stuck in their windpipe. In evolutionary terms, there must have been a big advantage in getting this extra vocal power (i.e.a larger range of sounds) to outweigh the potential disadvantage from an increased risk of choking to death.

**The Tool-Making Source**

In the physical adaptation view, one function (producing speech sounds must have been superimposed on existing anatomical features (teeth, lips) previously used for other purposes (chewing, sucking). A similar development is believed to have taken place with human hands. By about two million years ago, there is evidence that humans had developed preferential right-handedness and had become capable of making stone tools. Tool making, or the outcome of manipulating objects and changing them using both hands, is evidence of a brain at work.

**The Human Brain**

The human brain is not only large relative to human body size, it is also lateralized, that is, it has specialized functions in each of the two hemispheres. Those functions that control the motor movements involved in complex vocalization (speaking) and object manipulation (making or using tools) are very close to each other in the left hemisphere of the brain. That is, the area of the motor cortex that controls the muscles of the arms and hands is next to the articulatory muscles of the face, jaw and tongue. It may be that there was an evolutionary connection between the language-using and tool-using abilities of humans and that both were involved in the development of the speaking brain. A recent study kept track of specific activity in the brains of experienced stonecutters as they crafted a stone tool, using a technique known to have existed for 500,000 years. The researchers also measured the brain activity of the same individuals when they were asked to think (silently) of particular words. The patterns of blood flow to specific parts of the brain were very similar, suggesting that aspects of the structure of language may have developed through the same brain circuits established earlier for two-handed stone tool creation.

 If we think in terms of the most basic process involved in primitivetool-making, it is not enough to be able to grasp one rock (make one sound); the human must also bring another rock (other sounds) into contact with the first in order to develop a tool. In terms of language structure, the human may have first developed a naming ability by consistently using one type of noise (e.g. BEE). The crucial additional step was to bring another specific noise (e.g. GOO) into combination with the first to build a complex message (BEE GOO). Several thousand years of development later, humans have honed this message-building capacity to a point where, on Saturdays, watching a football game, they can drink a sustaining beverage and proclaim .This beer is good. As far as we know, other primates are not doing this.

**The Gesture Source**

It seems reasonable to assume that, once our distant ancestors became more skilled at working with their hands, they would have used them to do more than just bang rocks together. Eventually, they must have developed some use of manual gesture, a communicative resource that continues to accompany the everyday talk of modern humans. In the case of sign language users, their complex system takes the place of everyday talk. The use of gesture was almost certainly established before modern humans developed. Studies of chimpanzees in their natural environment have reported over sixty different hand signals and movements. These tend to be used as single gestures, each with a single function, a feature of gestures in very young humans. At around ten months of age, human infants begin using distinct gestures, such as raising both arms, hands open and outstretched, asking to be picked up. By around twelve months, human toddlers are becoming bipedal, able to stand on two legs and starting to walk (with support) and can use their outstretched (right) hand to point to objects to establish joint attention. Unlike chimpanzees, they soon develop gestures for “bye-bye”(waving arm/hand), “show” (holding out an object) and “rejection” (open hand struck against object offered). Also, unlike chimpanzees, young humans accompany these developing gestures with a variety of vocalizations described as “babbling.” The sounds that are produced begin as repeated syllables, such as ba-ba-ba, that gradually include other combinations which become more complex (ma-da-ga-ba) Eventually, a coordination of gestures and vocalizations occurs. This can be observed in the use of an index finger pointing gesture and a vocalization such as baba (or mama, or papa, or dada, or gaga) when a familiar figure is present or enters the room. Chimpanzees don’t do that. For some scholars, this looks like evidence that the development of language was based on the connection that already existed between the human brain and the human hand. That close connection in the motor cortex between the muscles of the hand(s) and the muscles of the face used in articulation would at least support the idea that human gesture and vocalization shared a physical source. Speaking, from this perspective, consists of “articulatory gestures.”

The continued presence of gesture while we are engaged in conversation is certainly part of how we express ourselves when we speak. However, speaking is more than just moving the muscles of the face to produce single “words” in the same way that the muscles of the hand produce single meaningful gestures. When we speak, we engage other areas of the brain in a way that allows us to express ourselves more fully than simply through manual gesture. Gestures continue to be part of the communicative behavior of modern humans, exemplified by the inclusion of gesture images like “thumbs up” as an emoji when we’re texting, but they don’t seem to provide an explanation of how we developed the phrases and sentences we also use while texting.

**The Genetic Source**

 We can think of the human baby in its first few years as a living example of some of these physical changes taking place. At birth, the baby’s brain is only a quarter of its eventual weight and the larynx is much higher in the throat, allowing babies, like chimpanzees, to breathe and drink at the same time. In a relatively short period of time, the larynx descends, the brain develops, the child assumes an upright posture and starts walking and talking.This almost automatic set of developments and the complexity of the young child’s language have led some scholars to look for something more powerful than small physical adaptations over time as the source of language. Children who are born deaf (and do not develop speech) become fluent sign language users, given appropriate circumstances, very early in life. This seems to indicate that human offspring are born with a special capacity for language. It is innate, no other creature seems to have it and it is not tied to only one specific variety of language. Is it possible that this language capacity is similar to a genetic blueprint already present in the newborn human?

**The Innateness Hypothesis**

As a solution to the puzzle of the origins of language, the innateness hypothesis would seem to point to something in human genetics, possibly a crucial mutation or two, as the source. In the study of human development, a number of gene mutations have been identified that relate to changes in the human diet, especially those resulting in an increase in calorie intake, possibly tied to the ability to digest starch in food and a substantial increase in glucose production. These changes are believed to have enhanced blood flow in the brain, creating the conditions for a bigger and more complex brain to develop. We are not sure when these genetic changes might have taken place or how they might relate to the physical adaptations described earlier. However, as we consider this hypothesis, we find our speculations about the origins of language moving away from fossil evidence or the source of basic human sounds toward analogies with how computers work (i.e. built-in hardware in the brain, with added software from individual languages) and concepts taken from the study of biology and genetics. The investigation of the origins of language then turns into a search for the special “language gene” that only humans possess.