THE PENNSYLVANIA STATE UNIVERSITY
SCHREYER HONORS COLLEGE

DEPARTMENT OF ANTHROPOLOGY

ORIGINS OF MUSIC

ANDREW I. HUGHES
Spring 2011

A thesis
submitted in partial fulfillment
of the requirements
for a baccalaureate degree
in Anthropology
with honors in Anthropology

Reviewed and approved* by the following:

Nina G. Jablonski
Professor and Head of Dept. of Anthropology
Thesis Supervisor

Timothy M. Ryan
Assistant Professor
Honors Adviser

* Signatures are on file in the Schreyer Honors College.

ABSTRACT

Music is a human universal with a deep history. No other creature seems to make music quite like us, yet it seems that music is inseparable from our species. That music is important is unquestionable, but why it is important is harder to explain. Even more difficult is how humans ever began making music and why it has become such an integral part of our lives. In this paper I trace the history of explanations of music's origins from ancient mythologies to current science, and explain the two current schools of thought involved in the field, the "Non-Adaptationist" school and the "Adaptationist" school, and their arguments. I also explore the relative age of music, the relation of music to language, and, in less detail, the relation of human music to the communication systems of other species, as well as suggesting some possible directions for future research.

TABLE OF CONTENTS

Introduction

Looking back through the history and prehistory of our species, music seems to be inseparable from modern humans, as far back as can be traced. Music appears to have played an important role in every human culture, past and present (Hauser & McDermott 2003: 663). Farther back, before the written word or even oral tradition recalls, the archeological record reveals that the importance of music was well developed as evidenced by carefully constructed bone flutes and other similar instruments (Gray et al. 2001). However, even the earliest instruments in the archeological record were fairly advanced. The first instruments were our throats for making melody and our limbs for percussion. This deep history of music as part of the human experience suggests its importance, but details of this history remain a mystery. This is due to the difficulty of studying something that the archaeological record can only shed so much light on, as vocalizations and drumming performances do not fossilize. Also, some of the earliest instruments were most likely made from wood, animal hides, or other materials that rarely fossilize. However, difficulty in study should not excuse science from the quest for knowing. If anything, this should push us harder, in a need to shed some kind of light on such an important part of what makes us human and separates us from the rest of the animal kingdom.

In this thesis I will be providing an overview of the history of accounts of the origins of music. I will also be examining hypotheses from current science that attempt to explain the existence and function of music in our species, mostly from one of two directions. One side of the discussion, known as the "Non-Adaptationist" school, see music as simply a culturally created faculty that is built on pre-existing systems and is

biologically useless. The opposing side, known as the "Adaptationist" school, holds that music evolved in our ancient ancestors as a biological adaptation that was useful during the prehistory of our species. I will also explore other topics is less detail, specifically the relative age of music, the relation of human music to language and the possible relation of human music to the communication systems of other species.

Before delving into the origins of music, it would be helpful to first define what "music" is. Merriam-Webster's base definition of music is "vocal, instrumental, or mechanical sounds having rhythm, melody, or harmony". However, for a more precise, useful definition, W. Tecumseh Fitch splits "music" into two subcomponents, song and instrumental music. Fitch defines song as "complex, learned vocalizations", and instrumental music as "the use of the limbs or other body parts to produce structured, communicative sound, possibly using additional objects" (Fitch 2006). The sum of these parts will be the operational definition of music that is referred to in this thesis.

History of Explanation

The question of the origins of music is one that appears to be quite old. As with most mysteries, early explanations came in the form of mythologies. An overview of some of these mythologies can be found in a 1930 article by Siegfried Nadel, first published in volume 16 of *The Musical Quarterly.* Nadel writes that the Egyptians believed that they had received music from the god Thot, who was also said to have been the inventor of writing and hieroglyphs (Nadel 1971:283). The Greek philosopher Heraclides explains that Amphion, the son of Zeus, was the inventor of music and that he received his artistry from his father, who was the King of the Gods (Nadel 1971:283).

The Chinese musical system, noted for its complexity, was said to have been the gift of a magic bird called Fung-Hoang, and the early Hindustani ragas were said to have been magical songs sung by the gods (Nadel 1971:283). In regarding music as something divine, these, among many other similar mythologies, underline the holy importance of music in these cultures, as well as their shared belief that it is something separate from mankind.

This way of thinking continued for most of recorded human history, even up into the 17th century, when theorists again considered the question of music's origins. Men like John Wilkens hypothesized that "just as Adam and Eve were given language by God, they also must have received music in the same way" (Thomas 1995:34). It was assumed that the voice of God, music, language, and understanding, were all immediately present for Adam in the Garden of Eden and, it is assumed, carried with him upon his ejection.

In a 1634 work called *Questions harmoniques*, a French philosopher and music theorist named Marin Mersenne provided his answer to the question of music's origins, writing, "one can answer that Adam sung the praises of God, and consequently that he invented Music, or that he received it through divine inspiration" (Thomas 1995:34). The views held by these men of the divine origins of music are not much different from those of the ancient mythologies. The only real differences lie in the way in which it fits into their conception of the divine and its interaction with mankind. Beyond that, it is still held that music is something given to man from a divine source, which is mainly how all of life was understood for most people until Charles Darwin published his ever important work, *On the Origin of Species by Means of Natural Selection*, in 1859.

The Origin of Species altered how many people saw the world, and led to the questioning of the origins of other things. One of these questions was, if human life was only a part of a long chain of creation with divine intervention removed, how did art come to be, and why are humans the only creatures who seem to occupy their time with it? Darwin notably wrote in his 1871 *The Descent of Man and Selection in Relation to Sex*, his first work following the *Origin of Species,* that "as neither the enjoyment nor the capacity of producing musical notes are faculties of the least direct use to man in reference to his ordinary habits of life, they must be ranked among the most mysterious with which he is endowed" (1871:1207). However, the mystery of music's origins was one that was not completely ignored during that blossoming time of inquiry.

Herbert Spencer, an English philosopher and contemporary of Darwin, was one of the first biologists to provide an attempted hypothesis for music's complicated origins. Spencer believed that the origin of music could be found in language. He believed that passionate or excited speech, when the voice is raised to an above average tone and the syllables elongated, could have led, over time, to singing, which would, in turn, lead to music. Thus, according to Herbert Spencer, music would naturally arise from emotional speech and, "from speech that expresses strong psychic emotions" (Nadel 1971:280). The problem here is, aside from the difficulties found in the actual hypothesis, that this simply moves the question to how language originated, as this would lead to the passionate speech that would evolve into music. While Spencer's hypothesis did leave something to be desired, it was a start, and much more was to come in the field of musicology.

Charles Darwin, in *The Descent of Man*, also ventured a hypothesis at the difficult question of the mysterious origin of man's musical faculty. He attempted to use the idea

of sexual selection, which was the basis of his book, to explain how something like music could originate. Darwin hypothesized that "musical tones and rhythm were used by the half-human progenitors of man, during the season of courtship, when animals of all kinds are excited by the strongest passions" (Darwin 1871:1209). This function of music was borrowed from the use of songs in other species, most notably songbirds, for which music does serve as a factor in their sexual selection. Darwin also laid out the idea that, in this way, music could have originated in our species, and then evolved, eventually giving birth to human language. This can be seen as directly opposed to Spencer's hypothesis, which led to a debate between the two, involving many other scholars (Patel 2010:8). These two basic sides of the argument still exist today, being known as the Adaptationists, followers of Charles Darwin, and the Non-Adaptationists, followers of Herbert Spencer.

In the intervening time since Spencer and Darwin hypothesized about the origins of human music, scholarship in this area has been sparse. However, in the last decade or so, the field has experienced considerable growth. One of the major landmarks of this renewed interest is *The Origins of Music*, a book of essays given at a workshop on the origins of music held in Fiesole, Italy, May 1997, edited by Steven Brown, Björn Merker, and Nils L. Wallin, which contains twenty-seven papers on topics spanning vocal communication in animals, theories of music origin, universals in music, and music, language and human evolution (Wallin, Merker & Brown 2000). Since the publish of *The Origins of Music*, many new articles, books and studies have come out, helping to expand the field of biomusicology (the study of music from a biological point of view, a term

coined by Nils L. Wallin in 1991), and push it in new directions that will eventually shed more light on what has long been seen as almost impenetrable topic (Wallin 1991).

Non-Adapationist Ideas

The Non-Adaptationist camp holds that music is something that is culturally created and is simply built on pre-existing systems, such as those for language. Non-Adaptationists believe that music is biologically useless to humans and that it simply stimulates brain mechanisms that have evolved to reinforce some other adaptive behaviors that allow for the experience of pleasure (Patel 2010:8). For the Non-Adaptationists, the universality of music does not prove that it arose as a biological adaptation. Dr. Aniruddh Patel of the Neurosciences Institute gives the control of fire as an example of another human universal that is not a biological adaptation. Patel writes, "[The use and control of fire] extends deep into our species' past and is found in every human culture, yet few would dispute that it arose as an invention rather than a biological adaptation" (Patel 2010:9). He states that fire is simply something that was culturally created and provides something that all humans value, such as "the ability to cook food, keep warm, and see in dark places", and that music is a similar cultural creation (Patel 2010:9-10). For most Non-Adaptationists, the value of music for humans is seen as the pleasure experienced by the stimulation of mechanisms that were evolved for the reinforcement of other behaviors. For this reason, scientists like Dr. Steven Pinker of Harvard University have begun to refer to music as "auditory cheesecake", or "an exquisite confection crafted to tickle the sensitive spots of at least six of our mental faculties" (Pinker 1997:534). Though these Non-Adaptationists seem to simply shrug off

music as of little importance to science or humankind, their ideas can serve as a useful null-hypothesis for the question of the origins of music.

One newer hypothesis born out of the Non-Adaptationist camp comes from Dr. Aniruddh Patel. Patel finds fault in the "auditory cheesecake" definition of music and is working towards a hypothesis that defines music as a cultural creation built upon diverse, preexisting brain functions, but highlights the importance of music in human culture, and its ability to trigger complex emotions and transform an individual brain throughout a lifetime. Dr. Patel, in his 2008 work, *Music, Language, and the Brain*, published by Oxford University Press, redefines music as a "transformative technology of the mind", or TTM, explaining how music is biologically powerful and can have lasting effects on nonmusical abilities such as language and attention (Patel 2010). In an essay from 2008, written for a symposium called *Music: It's Evolution, Cognitive Basis, and Spiritual Dimensions*, Patel explains that "there is growing evidence that learning to play a musical instrument changes the structure of the brain, from sub-cortical circuits that encode sound patterns, to neural fiber tracts that connect the two cerebral hemispheres, to localized patters of gray matter density in specific regions of the cerebral cortex" (Patel 2008:5). Patel also remarks in this essay how, in some cases, the ability to produce or respond to music sometimes remains intact despite severe brain disorders. He explains that "music can make a fragmented mind coherent again for a time, can help a frozen Parkinson's patient to walk, or allow a non-fluent aphasic patient to produce fluent verbal output in the form of a song" (Patel 2008:6). Patel believes that such examples prove that music has become embedded in our nervous system as well as deeply integrated into "the very fabric of our being" (Patel 2008:6). Patel desires to look critically at the complex

emotional experiences brought about in humans by music, which, he believes, prove that there is a true biological function for music, even if it was not evolved as an adaptation to fill such a purpose.

Adaptationist Ideas

Since Darwin's "sexual selection" hypothesis was put forth in the 1871 *Descent of Man*, a slew of new hypotheses have risen out of the Adaptationist camp, all connected by the idea that music arose as an evolutionary adaptation to primitive life in our species' past. While there are almost countless possible Adaptationist hypotheses, as they are mostly based on speculation and examples of the functions of music borrowed from other species and current groups of more "primitive" human societies, there are a few that are more convincing than the others, and thus the most commonly held. In a 2001 article called "Is Music an Evolutionary Adaptation?", published David Huron in the *Annals of the New York Academy of Sciences*, Huron outlines several of the more convincing evolutionary hypotheses that could explain the adaptive qualities of music.

The first hypothesis outlined by Huron is that of mate selection. This is essentially the sexual selection hypothesis that was first proposed by Charles Darwin in *The Descent of Man*. As Darwin hypothesized, and so have many others after him, musical ability could have been used by our early ancestors to attract mates, or as a courtship behavior, in a similar fashion to the way that some animals use color or displays to attract a mate. Like in songbirds, the reason for this as a means of mate selection could be that the ability to sing well may imply that the singer is in a condition of good physical well

being, or equipped with good genes. This hypothesis could account for why human musical interest seems to peak during adolescence (Huron 2001).

Another hypothesis outlined in Huron's article is that of perceptual development. In this hypothesis, listening to music could have been used as an "exercise" in hearing, teaching people to be more perceptive (Huron 2001). Individuals who were more perceptive would have been more fit for survival in an environment where hearing something potentially dangerous, such as a predator, could keep the individual and possibly the individuals fellow group members, out of harm's way. The ability to alert other group members of the danger at hand would have also made some sort of meaningful vocalizations adaptive, much like the alarm calls of vervet monkeys, studied in Amboseli Nation Park, Kenya, who make "acoustically different alarm calls to at least three different predators: leopards, martial eagles, and pythons" and respond to the alarm calls with appropriate behaviors for each (Seyfarth, Cheney & Marler 1980). The importance for perceptual fitness in this case is obvious, with the consequence for not making or responding to the correct alarm call putting the individual or even the group at great risk. The importance of perceptual fitness is further examined in Daniel Levitin's 2006 book, *This Is Your Brain On Music*. In chapter six Levitin explains, "the auditory startle is the fastest and arguably the most important of our startle responses" for the same reasons stated above, and that a "vestigial or supplementary auditory system also appears to be in place involving the cerebellum. This preserves our ability to react quickly—emotionally and with movement—to potentially dangerous sounds" (Levitin 2006:181-182). Further, Levitin explains that "the cerebellum acts as something of a timekeeper in the auditory habituation circuit which is critical for filtering out

unimportant repetition in the environment and also to notice change in that repetition" (Levitin 2006). These are the types of mechanisms that would be developed by music if it were indeed an adaptation that was selected for as an exercise in perception.

Another similar hypothesis that is outlined in Huron's article is motor skill development. This hypothesis states, "singing or other music-making activities might provide (or have provided) opportunities for refining motor skills" (Huron 2001:47). One example given by Huron is that singing might have been necessary in the development of speech in our species, by the refining of the motor skills used in singing and later used in speech (Huron 2001). Another possibility could be the use of drumming in refining motor skills using the limbs. As bipedalism opened the door for a whole score of uses for our early ancestors free limbs, perhaps drumming served as a recreational activity that also refined motor skills, leading to more effective usage of our free limbs. Recreational drumming has been observed in our closest ancestors, the chimpanzees. In her 1986 book, *The Chimpanzees of Gombe: Patterns of Behavior*, Jane Goodall relates their activities in the chapter on communication. She explains that the most important of non-vocal sound signals is the drumming display, "when the chimpanzee leaps up and pounds with hands and feet against the buttresses of a large tree. This produces a sound that can carry over long distances" (Goodall 1986:133). Goodall explains that drumming is primarily a male activity that is "typically accompanied by pant-hoots and is frequent when the chimpanzees are traveling in large mixed parties", though it is occasionally performed "without accompanying calls, mostly during tense travel in the 'danger zone' where the community range overlaps that of its neighbors" (Goodall 1986:133). Since Goodall's time at Gombe, there have been other groups of chimpanzees whose drumming

displays have also been documented, including groups at Kibale National Park, Uganda and Taï National Park, Ivory Coast (Acardi, Robert, Boesch 1998; Acardi, Robert, Mugurusi 2004). These studies revealed further information about this phenomenon. From a six month study in Taï National Park, it was determined that "individuals may differ in their temporal integration of drumming into the pant hoot vocalization", from which it was suggested that "there may be acoustic cues available for chimpanzees to recognize unseen males by their drumming performances alone" (Acardi, Robert, Boesch 1998). In a later study, recordings made of chimpanzees at Taï National Park were compared with recordings made of the chimpanzees at Kibale National Park in order to determine whether regional variation exists in the drumming of male chimpanzees. Acoustic analysis revealed that male chimpanzees from Kibale drummed less frequently in conjunction with vocalizations, included fewer beats, and drummed for shorter durations than male chimpanzees from Taï. Interestingly, these differences disappeared "when only those bouts produced in conjunction with a call were compared", and when Kibale chimpanzees drummed and called together, they "tended to integrated drumming into the vocalization at a later point than did the Taï males (Acardi, Robert, Mugurusi 2004). Additionally, while individual differences in temporal patterning of drumming bouts were previously recorded among male chimpanzees from Taï, no such individual differences were apparent for the Kibale chimpanzees (Acardi, Robert, Mugurusi 2004). Though this drumming doesn't seem to be entirely recreational, in *The Chimpanzees of Gombe*, Goodall relates that there are "certain favorite drumming trees along chimpanzee trails, the sight of which usually triggers drumming displays from many members of a traveling party, including some females and youngsters" (Goodall 1986:133).

It seems that, though drumming is mostly used as a form communication, at times it is simply done for sheer enjoyment, which is interesting in a species that is so closely related to humans, but usually shows no obvious examples of a musical faculty. However, this gives a glimpse of a rather non-musical, but potentially musical activity in our closest relatives.

The next two possibly hypotheses go hand in hand, to a certain extent. These are the "safe time passing" hypothesis and the "conflict reduction" hypothesis. Both of these hypotheses operate on the idea that, as humans became more effective food gatherers, they had more spare time to pass in ways other than sleep (Huron 2001). The "safe time passing" hypothesis asserts that sleep is way to pass time out of the way of harmful predators, but as humans became more efficient at gathering food they had more time and an animal can only sleep so much, so they had to find some other safe way to pass away their spare hours. The "safe time passing" hypothesis proposes that making music could have been simply a safe way to pass time not used sleeping or gathering food by our early ancestors (Huron 2001). The "conflict reduction" hypothesis claims that, like the "safe time passing" hypothesis, increased spare time would have been available to our early ancestors, and that singing and other types of music making could be a safer way to pass time, rather than other activities which could possibly cause harmful inter-group conflict (Huron 2001). The "conflict reduction" hypothesis can also be used as a part of the "social cohesion" hypothesis, which will be explored in greater detail later in this paper.

Another important Adaptationist hypothesis not brought up in Huron (2001) is the development of music through mother/infant interaction in our early ancestors. This mother/infant type of music-like vocal communication, called "motherese", is found in

all cultures and seems, according to evolutionary biologist W. Tecumseh Fitch, to be "as ubiquitous as music itself" (Fitch 2006). Such "motherese" vocalizations could have been used by our early ancestors to strengthen the bond between mother and child, as well as to regulate infant arousal. Keeping a child "hushed" during a potentially dangerous close encounter with a predator could have been extremely evolutionarily advantageous during the lifetimes of our early ancestors (Fitch 2006). Fitch furthers this idea, referencing a 2001 article by Trehub & Nakata, "A documented infant preference for song over speech provides an argument against the hypothesis that song is simply a non-adaptive byproduct of speech" (Fitch 2006).

The last two Adaptationist hypotheses dealt with here seem to be the most convincing, having a good deal of evidence supporting them. These are the "group effort" and "social cohesion" hypotheses, which go hand in hand, both focusing on the importance of music in terms of the group. This would have been key in our early ancestors, being very social primates. The "social cohesion" hypothesis states that music making within a group may "contribute to group solidarity, promote altruism, and so increase the effectiveness of collective actions such as defending against a predator or attacking a rival clan" (Huron 2001:47). Thus, groups who made music collectively would have a survival advantage over groups that did not. The "group effort" hypotheses focuses in on the advantages of music in collective activities, such as the work songs used by slaves or prisoners during the early days of America. An interesting example of this can be found in the work of ethnomusicologist, Alan Lomax. During the years 1947-1948, Lomax recorded work songs at Parchman Farm, a penitentiary in Mississippi. During an interview with one of the prisoners, Lomax asks if singing makes the work

easier or if it is simply a way of slacking, to which the prisoner responds that singing does make the work easier because singing takes the mind off of the work, allowing an individual to continue the difficult labor as long as is required, "…it look like it be hard for you to make it—your day be long, it look like—so to keep your mind from being devoted on this one thing, well you just take up singing" (Alan Lomax Collection, 1947).

While one advantage of the use of music in group work for these men and our early ancestors would surely have been to distract each of the individuals from the difficult labor at hand, the music also provides a steady beat with which the workers can keep time in doing something like chopping wood, hoeing a field, or maybe in the case of our early ancestors, pushing or pulling a heavy object. Further along in the same interview conducted by Alan Lomax, the prisoner also acknowledges this benefit, saying that it isn't the quality of the singing voice that matters, but simply the ability to keep the correct time, "that's all it takes, you can just whistle and if you know the time and can stay in time with that, you can whistle and cut just as good as you can if you were singing" (Alan Lomax Collection, 1947). This example of a use of music that kept prisoners and slaves alive in long and difficult work conditions provides an insight into music as something that can be functional rather than simply recreational. The focus here is not on the sound of the music, or a melody, but instead on the rhythm of the music, to pass the moments by, to keep a group of workers together in time and the work moving forward. From this point of view, those who sung would have an easier time with work, on an individual level, as well as the group level.

The connection to music, rhythm, and the group goes still deeper, tying together the "group effort" and "social cohesion" hypotheses. In a 2009 article called "Synchrony

and Cooperation", published in *Psychological Science*, Scott S. Wiltermuth and Chip Heath explored speculations that "rituals involving synchronous activity may produce positive emotions that weaken the psychological boundaries between self and the group" (Wiltermuth & Chip 2009:1). This would explain why most world religions include synchronous chanting and singing in rituals, and why marching is still used in the training of modern armies even though it is useless in combat. Wiltermuth and Chip performed three experiments that tested this hypothesis.

During the first experiment, participants in groups of 3 were led on walks around a college campus. The groups were split into synchronous groups, which walked in step, and control groups, which walked normally. After the walks, a questionnaire was filled out in order to convince the participants that the experiment was over. After this a supposedly separate experiment was done with the participants by another experimenter, who conducted the Weak Link Coordination Exercise, designed to model a situation in which group productivity is a "function of the lowest level of input" (Wiltermuth & Chip 2009:2). Essentially, participants choose a number from 1 to 7 without any communication between themselves, and the payoff was to increase "as a function of the smallest number chosen" and decrease with the distance between the individual participant's chosen number and the smallest number chosen within the group (Wiltermuth & Chip 2009:2). The game is designed to measure expectations of cooperation, because if everyone chooses the number 7, the whole group does well, but if individual participants fear that another group member may choose a lower number, the rational choice would be to choose a lower number as well (Wiltermuth & Chip 2009:2). After playing six rounds of the game, with the smallest number being announced between

each round played, the participants answered, on a 7-point Likert scale (1 = not at all, 7 = very much), “How connected did you feel with the other participants during the walk?”, “How much did you trust the other participants going into the exercise?”, and “How happy do you feel?” (Wiltermuth & Chip 2009:2). The results came out to be consistent with the hypothesis of synchrony-cooperation, in that the participants who walked in step chose higher numbers in the first round than the participants who did not walk in step, with choices in the following founds being not significantly different (Wiltermuth & Chip 2009:2). Also, the participants who were part of the synchronous groups reported feeling more connected with and more trusting of their fellow participants than those who were part of the control group. Participants in the synchronous groups did not report feeling happier than those in the control groups (Wiltermuth & Chip 2009:2).

For the second experiment, participants in groups of 3 performed tasks requiring different degrees of synchrony while listening to music through headphones. The song “O Canada” was chosen in order to test if synchrony can induce cooperation when the soundtrack is an out-group anthem, as the participants involved were all residents of the United States (Wiltermuth & Chip 2009:2). The groups were assigned to one of four conditions. The first was the control condition, in which the participants listened to “O Canada” while holding a plastic cup above the table and silently reading the lyrics to the song. The synchronous-singing condition was essentially the same as the control condition, except the participants sang the words to the song at the appropriate times. A synchronous-singing-and-moving condition did the same as above, except in addition to singing in time they also were moved their cups from side to side in time with the music (Wiltermuth & Chip 2009:2-3). Participants in an asynchronous condition were expected

to do the same as the synchronous-singing-and-moving condition, except all of the participants in the asynchronous condition all heard different versions of "O Canada", causing them to sing and move their cups at different times. All groups were told that they may hear different versions than their other group members, but only the asynchronous condition actually did (Wiltermuth & Chip 2009:2-3). All participants were told they would be paid between $1 and $5 based on their groups performance, and that all of their group members would receive the same payment. Every participant received $4 in order to reinforce feelings of success. After this, using the same 7-point Likert scale, the participants were asked, "How much did you feel you were on the same team with the other participants?", "How much did you trust the other participants going into the exercise?", "How similar are you to the other participants?", and "How happy are you right now?" (Wiltermuth & Chip 2009:3). The Weak Link Coordination Exercise mentioned above was also performed with these participants. The groups composed of the two synchronous conditions chose higher numbers in the first round of the exercise, and reported greater feelings of being on the same team than the other conditions. They did not report being any happier (Wiltermuth & Chip 2009:3). This second experiment showed that synchronous activity can increase future cooperation, and that large-muscle movements were not needed to produce the cooperation, as similar amounts of cooperation were found in the groups that were only singing (Wiltermuth & Chip 2009:3).

In the third experiment, the same cups-and-music task was used as in the second experiment, described above. After this, participants engaged in a "public-goods game", in which each of 3 participants possessed 10 tokens which, over five rounds, could be

contributed to a public account or kept in a private account (Wiltermuth & Chip 2009:4). A token was worth $0.50 to a participant when kept in their private account, and nothing to the other group members, but when contributed to the public account, a token earned $0.25 for each group member (Wiltermuth & Chip 2009:4). A more direct value is obtained by a participant keeping tokens in their private account. However, if all of the tokens are contributed to the public account, the group's earnings are maximized. Participants who were involved in the synchronous conditions contributed more in the first round, and significantly more during the remaining rounds. Essentially, "synchrony made contributions to the public account more persistent over time", with no continuous fall in contributions over time, as is the usual pattern for public-goods games, and which occurred in the asynchronous conditions (Wiltermuth & Chip 2009:4). Additionally, the participants of the synchronous groups reported greater feelings of being on the same team, reported more feelings of similarity to their counterparts and reported higher feelings of trust. As in the other experiments, there was no report of being happier in the synchronous groups than in the asynchronous or control groups (Wiltermuth & Chip 2009:4-5).

Throughout all of the experiments, participants acting in synchrony with others showed higher cooperation in subsequent group exercises, including the situations that required personal sacrifice (Wiltermuth & Chip 2009:1). While higher cooperation was shown throughout for both the synchronous singing and moving group and the synchronous singing group, results show that the synchronous singing and moving group was at times a bit higher than the synchronous singing group, and never lower. While there was not a large difference by any means, had "synchronous moving, no singing

group" been included in the experiments, it would have been interesting to see where the group would fall. Regardless, the results of this study suggest, "acting in synchrony with others can increase cooperation by strengthening social attachment among group members" (Wiltermuth & Chip 2009:1). Along with this research, other studies have also determined that not only does synchrony increase perceptions of team affiliation, but it "leads individuals to believe that counterparts moving in unison are, in point of fact, increasingly similar to themselves in terms of personal attributes", which in turn can lead individuals to perceive themselves as united (Valdesolo, Ouyang & DeSteno 2010; Valdesolo & DeSteno 2010:4). Valdesolo and DeSteno hypothesize that individuals who perceive themselves as united would "be [more] likely to engage in greater efforts to protect and aid each other when victimized by external forces", and in a 2010 study, have shown that synchrony can lead to altruistic behaviors among humans (Valdesolo & DeSteno 2010). The social cohesion and altruism properties found in music would helped to reduce conflict within groups, as well as account for the use of music in religious and warfare activities.

This shows that the synchronous behavior found in music making and dancing has qualities that could have surely given one group an advantage over another in our species' past. When looking at the effects of music and synchronicity directly on labor, in combination with its effects upon the cohesion of a group, the advantages are clear. Because our early ancestors were without fangs, claws, or any other obvious defense mechanism, group effort was relied upon for defense against predators and for hunting for food as well. A group that was not unified and collectively motivated behind one specific goal would not be nearly as successful as one that was. Thus, music, which can

be effectively used to promote social cohesion, would have been very important in the survival and success of our ancestors.

The use of music as a means to unify and collectively motivate was not simply used in our pre-history. There are countless historic and current examples of tribal societies that use music as a means to unify a hunting or raiding party, and help to collectively motivate the group for the task at hand. One historic example of this from the American West can be found in ethnographic recounts the Gros Ventre, a Native American tribe from northern Montana. In Gros Ventre culture, there were specific songs that were always sung during the forming of a raiding party, during the time after the party was formed, but before they had left, and specific songs that were sung during the days when the party traveled to their destination (Flannery 1953). After a raid, depending on the outcome, other specific songs were sung on the way back home, and then more specific songs were sung upon arrive home and in the days following the raid (Flannery 1953). The is certainly not unique to the Gros Ventre, and the distinction of songs used for certain purposes versus those used for other purposes marks the importance of the music as more than something to just pass the time.

These examples do not necessarily point directly to either the "group effort" or "social cohesion" hypothesis as an exact model for the cause of the advent of human musical abilities, but they certainly point out that these hypotheses may be a step in the right direction, and that more focus should be put on looking into them deeper in the future. More studies focusing on music's abilities to unify a group and form social attachments would certainly be a good start. It would be interesting to discover if results would vary from culture to culture, or if the tempo or meter of the music had any varying

effects on results. Also, with the rise of neurobiological studies and brain imaging technologies, it would be interesting to further investigate how music interacts with the human brain, especially in men versus women, adults versus children, and cross culturally. One interesting study might be to investigate what effect on the brain and emotions music of ones own cultural group has upon an individual, versus the music of another cultural group, including tribal music, and vice versa. Since music within tribal cultures is more characteristically tied closer to all aspects of life, and not relegated to performance by an elite class of "musicians", investigating this in a tribal setting could shed important light on the subject, and hopefully get us closer to the adaptive function that music served for our early ancestors.

Relative Age of Music

Though musicality exists in other species, such as songbirds and whales, these activities, though some interesting similarities exist, do not seem to have much connection with human music. The evolutionary divergence between humans, birds and whales is probably much too far apart for any real connection in evolutionary terms. The evolutionary lineage of birds split with mammals about 310 million years ago, while the last common ancestor that humans had with whales dated back to about 58 million years ago (Hauser & McDermott 2003:664). Thus, musicality must have risen independently within these species. One possible connection could be the influence of birdsong on the creation of human music (Head 1997). There is a chance that our early ancestors began to vocalize in attempt to imitate the songs that they heard. If not, there is at least a good

chance that some amount of imitation occurred in the vocalizations of our early ancestors, at the very least influencing the evolution of our musical abilities.

In terms of when the dawn of music actually took place in our ancestors, there is not much evidence of primate musical activities before the genus *Homo*. However, the musical history of humans and their immediate ancestors stretches back exceptionally far into the past. For instance, in 1995, a bone flute fashioned from the femur of a now-extinct European bear was uncovered in an ancient burial mound at Divje Babe, Slovenia. This flute was dated using electron spin dating, and was determined to be between 43,000 and 82,000 years old (Huron 2001). This does not mean that the earliest musical instrument has been found, far from it in fact. This bone flute is simply the oldest instrument that has been found at this point. Also, a flute is fairly complicated in terms of instruments. It seems that, as they are most common among contemporary hunter-gatherer societies, percussive instruments such as rattles, shakers, and drums would have predated bone flutes (Huron 2001). These instruments are not only easier to play, but a lot less complicated to conceive and construct for primitive societies without the availability of tools designed for instrument construction. If this is taken into account, and it is assumed that the ancient Slovenian musicians created and used percussive instruments before bone flutes, then the creation of instrumental music can be estimated to be somewhat earlier than 100,000 years ago, claims David Huron (2001). However, it is not unreasonable to assume that before the creation of any instruments at all, singing was used as the general means for music making for quite a long time. In fact, Huron predicts that singing may have predated instrument making by 50% of the intervening time, making the creation of music dated around 150,000 years ago, or even, on a long

shot, 250,000 years ago (Huron 2001). Thus, according to the timeline conceived by Huron, the archaeological record implies that the dawn of music must have occurred anywhere between 50,000 years ago and a quarter of a million years ago. It would be reasonable to hypothesize that the earliest members of *Homo sapiens* possessed some form of music.

Music & Language

As the general view in Non-Adaptationist literature is that music was probably built upon already existing systems used for human language, and that language had to have then existed prior to music (which then begs the question, what are the origins of language?), the general Adaptationist view is that music existed as a sort of protolanguage, or at least developed in common with language. Thus, the link between the two must be explored.

At the core of the two, transmission of meaning is the most important connection between music and language, although music is more involved with emotional meaning and language is involved with informational meaning. However, it is not simply auditory communication that ties them together. For both music and language, physical expression is an important component. In language, there is a great deal of meaning that is passed through what many call "body language," as well as through "speaking with the hands." Beyond this, some human communication systems, such as American Sign Language, rely solely on the physical transmission of meaning. In music, while some sort of auditory aspect is generally seen as necessary, dance has been used as a physical expression of meaning that has gone hand in hand with music for almost certainly as long

as music has been in use. In some societies, dance is used to narrate complete storylines, whose meanings are understood by the viewers (Mithen 2006). The main difference is that the transmission of linguistic meaning is limited by the different between the used language of the transmitter and the known language of the receiver, while musical meaning is not. In fact, a German man could explain all of the beauty and meaning in the works of Bach to an English speaking man with no results, but provide the English speaking man with a recording of the works of Bach and he could almost immediately feel and understand the meaning that is being conveyed. Perhaps this is because, according to Iegor Reznikoff, "the level of sound is much more primitive in our consciousness than the level of speech" (Reznikoff 2004). In fact, according to Reznikoff, sound is related to the very first levels of consciousness that appear in the period before birth, while speech and language is very specialized and is only acquired by a child around the age of three years (Reznikoff 2004). Interestingly, the best way to recover from loss of speech is through the act of singing, because it is more elementary to sing the words of a known melody than to speak them, and because sounds and rhythms are the foundations of speech (Reznikoff 2004).

In terms of brain usage, the old idea was that the right hemisphere was used for language, and the left hemisphere was for music. However, Daniel Levitin explains in *This Is Your Brain on Music* that this is not the whole story. During a study of musical syntax/musical structure processing, it was found that while listening to music attentively a subsection of the Brodmann Area 47 region in the frontal cortex on the left side, called pars orbitalis, is activated, but, additionally, an analogous area in the right hemisphere was activated as well (Levitin 2006:127). Levitin explains "this told us that attending to

structure in music requires both halves of the brain, while attending to structure in language only requires the left half" (Levitin 2006:127). Perhaps the most interesting discovery in this experiment was that the same regions in the left hemisphere that were active in processing musical structure were the same as those that activate when deaf people communicate with sign language (Levitin 2006:127). It seems that there is a connection here between the structure of music and language, which holds in it the transmission of meaning. This does not reveal whether music served as a protolanguage, or simply that the two arose together, though it does show a strong connection between the two that must be explored further.

It must be noted here that, though the Non-Adaptationist and Adaptationist schools may seem as though two different sides of a coin, their hypotheses may not be as mutually exclusive as they are made out to be. In example, musical ability in our early ancestors could have simply been an exaptation or preadaptation built upon the gestural and oral communication abilities that were emerging at the time. In a field as young as biomusicology, it is important to remember that the total polarization of an issue can stand in the way of new advancements in thinking and severely inhibit the growth and expansion of new ideas within the field. We must remain conscious of this in order to avoid falling into such a trap.

Conclusion

The field of musicology, and the study of the origins of music in particular, seems to rear more questions than answers the more it is explored. As discouraging as this can be, the significance of music to humankind, its universality, and its deep roots in the

prehistory of our species, makes the study an endeavor of utmost importance. However, because the acquisition of hard facts and evidence is relatively rare in this field, a lot of arguments must be surrendered as no more than a lot of speculation, no matter how strong and well thought out the speculation may be. In an effort to push the field out of a lot of speculation and wheel spinning, it is important to make an attempt at experimental data, which could shed more light on the hypotheses that have already been formulated. As Daniel Levitin writes in *This Is Your Brain on Music*, "a good experiment is theoretically motivated, and makes clear predictions as to which one of two or more competing hypotheses will be supported" and is able to be generalized to other conditions, such as "to people not studied, to types of music not studied and to a variety of situations" (Levitin 2006:94). While these are all good guidelines, it is important to remember that in the search for the origins of music, the music that would most likely have first produced by our early ancestors would have been either rough melodic vocalizations or simple percussive displays with the bare limbs. While other early forms of music and instruments must be considered, such as shakers, rattles and drums, we must not become too caught up with music in its modern state, especially modern western music, which, though it surely shares the same roots, is far different than the music of our early ancestors. Perhaps the emotional connection with music has not changed since the early days of music. This could be a good area to look into, and delve deeper into what music makes us feel, how music makes us feel that way, and why music makes us feel that way, which very well could provide a link back to the origins, or at least a step in the right direction.

References

Arcadi, Adam Clark, Daniel Robert, and Christophe Boesch. "Buttress Drumming by Wild Chimpanzees: Temporal Patterning, Phrase Integration into Loud Calls, and Preliminary Evidence for Individual Distinctiveness." *Primates* 39.4 (1998): 505-18.

Arcadi, Adam Clark, Daniel Robert, and Francis Mugurusi. "A Comparison of Buttress Drumming by Male Chimpanzees from Two Populations." *Primates* 45.2 (2004): 135-39.

Alan Lomax Collection. "What Makes A Work Song Leader?" *Prison Songs, Vol. 1: Murderous Home*. 1947.

Darwin , Charles. *The Descent of Man, and Selection in Relation to Sex*. London: John Murray, 1871.

Fitch, W. Tecumseh. "The biology and evolution of music: A comparative perspective." *Cognition* 100 (2006): 173-215.

Flannery, Regina. *The Gros Ventres of Montana: Part 1 - Social Life*. Washington: Catholic University of America Press, 1953.

Head, Matthew. "Birdsong and the Origins of Music." *Journal of the Royal Musical Association* 122.1 (1997): 1-23.

Huron, David. "Is Music an Evolutionary Adaptation?" *Annals of the New York Academy of Sciences* 930 (2001): 43-61.

Mithen, Steven J. *The Singing Neanderthals: the Origins of Music, Language, Mind, and Body*. Cambridge, Mass.: Harvard UP, 2006.

Nadel, Siegfried F. "The Origins of Music." Readings in Ethnomusicology. Ed. David P. McAllester. New York: Johnson Reprint, 1971. 277-89.

Levitin, Daniel J. *This Is Your Brain on Music: the Science of a Human Obsession*. New York, NY: Dutton, 2006.

Patel, Aniruddh D. "Music as a Transformative Technology of the Mind." *Music: Its Evolution, Cognitive Basis, and Spiritual Dimensions*. Wolfsons College, Cambridge University. 18-20 Sept. 2008. Essay.

Patel, Aniruddh D. *Music, Biological Evolution, and the Brain. Emerging Disciplines: Shaping New Fields of Scholarly Inquiry in and beyond the Humanities*. Ed. Melissa Bailar. Houston: Rice University Press, 2010. 91-144.

Pinker, Steven. *How the Mind Works*. New York: Norton, 1997.

Reznikoff, Iegor. “On Primitive Elements of Musical Meaning”. *The Journal of Music and Meaning.* 3, Fall 2004/Winter 2005 <http://www.musicandmeaning.net/issues/showArticle.php?artID=3.2>.

Thomas, Downing A. *Music and the Origins of Language Theories from the French Enlightenment*. Cambridge: Cambridge UP, 1995.

Valdesolo, Piercarlo, and David DeSteno. "Synchrony and the Social Tuning of Compassion." *Emotion* xxx (2010): xxx-xxx. (Article in Press)

Valdesolo, Piercarlo, Jennifer Ouyang, and David DeSteno. "The Rhythm of Joint Action: Synchrony Promotes Cooperative Ability." *Journal of Experimental Social Psychology* 46.4 (2010): 693-95.

Wallin, Nils L. *Biomusicology: Neurophysiological, Neuropsychological, and Evolutionary Perspectives on the Origins and Purposes of Music*. Stuyvesant, NY: Pendragon, 1991.

Wallin, Nils L, Björn Merker, and Steven Brown. *The Origins of Music*. Cambridge, Mass.: MIT, 2000.

Wiltermuth, Scott S., and Chip Heath. “Synchrony and Cooperation.” *Psychological Science* 20:1 (2009): 1-5.

ACADEMIC VITA of Andrew I. Hughes

Andrew I. Hughes
1759 Windy Hill Rd.
Lancaster, PA 17602
aih5025@psu.edu

Education:

Bachelor of Arts in Anthropology, Penn State University, Spring 2011
Minor in English
Honors in Anthropology
Thesis Title: Origins of Music
Thesis Supervisor: Nina G. Jablonski

Awards:

Dean's List
Abington Honors Program
Class of 1922 Memorial Scholarship
Hallowell Scholarship
Pennsylvania Farm Show Foundation Scholarship

Activities:

Outward Bound Program (Sailing the Florida Keys), Spring 2010