OTHER SPECIES' COUNTERPOINT

An Investigation of the Relationship between Human Music and Animal Songs

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Contents

List of Figures

Abstract

Music is typically considered a solely human activity. We may think that bird and animal songs sometimes sound as if they were musical, and may use them in our own music, but at least in the Western world, they are usually assumed to be purely functional calls to satisfy the animal's biological needs, such as attracting a mate or defending territory, and nothing more. They are seldom thought of as the subjectively created aesthetic sounds that we consider our own music to be. Yet in recent years, science has been discovering that animals share more of our mental capabilities, awareness of both self and the world, and emotional depth than previously thought. Former gold standards of human uniqueness, such as speech and tool use, are being found not to be limited to our species at all. Is it possible that some animals may also share our ability to create and experience aesthetic sound?

I attempt to answer this question by drawing on tools and knowledge from a variety of fields, including philosophy, semiotics, ornithology, bioacoustics, cognitive ethology, and ethnomusicology. I focus on exploring what I perceive to be very real similarities of structure, function, sound, and meaning between certain animal and human songs, referring frequently to sound examples from a variety of avian and mammalian species and from a diversity of human musics. It would of course be impossible to prove absolutely that some animals create music, since we can not communicate with them about their experience of sound, but I believe that more evidence suggests a similarity than a dissimilarity between their songs and our own. In the course of this work, my understanding of music came to change substantially. I end by describing my new understanding of music, and by addressing some of what I think might be the implications, both musical and philosophical, of including within its compass some animal songs.

The composition “all spring” based on the poems of Rae Crossman, and incorporating several bird song imitations, is also a part of this dissertation. “All spring” was commissioned by the Canada Council for the Motion Ensemble.

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INTRODUCTION

I am often asked how I came to study the unusual topic of animal sounds and their relation to human music. While I can give no single answer, the following experiences certainly all contributed to my interest in this subject.

In the fall of 1997 I was living in Amsterdam, and one of my first nights there I awoke to hear an unfamiliar and splendid bird singing outside my window. Perhaps because I was in a new environment, I listened to the bird with greater attention and for a longer time than I usually would. I became entranced by its song. Not only the beauty of this European blackbird song (as I found out the next day that it was) intrigued me[1], but also my own thoughts about the ways in which this song was and was not like what I would usually consider "music." Individual motives ("syllables") of this particular bird's song were much like something we would typically hear in human music: scalar passages, major triads in a variety of inversions, simple three- or four-note diatonic patterns, little trills and ornaments. The continuity of what the bird sang, however, was quite unlike what we would usually consider music: motives were repeated a seemingly arbitrary number of times in a row; motives were always repeated as is, without development; the bird jumped from one kind of motive to another with no connecting tonal, rhythmic, or melodic relation;

[1] Despite the similar name, European blackbirds (*Turdus merula*) are not closely related to redwing blackbirds (*Agelaius phoeniceus*) or any other of the North American blackbirds. Rather, they are in the same family as American robins (*Turdus migratorius*) and song thrushes (*Turdus philomelos*).

periods of silence and sound seemed to be interspersed at random.[2] I thought about this for months, and ended up writing a piece of music, *night black bird song*, which explored the difference between human and blackbird ways of arranging the same collection of motives. As research for this piece, I spent many hours listening to blackbirds, and discovered that each blackbird's song is unique. While blackbirds as a species can easily be recognized, the voice of each individual blackbird can also be clearly distinguished. A friend had a lovely blackbird beside her house who, in addition to the standard triads and scalar passages, would copy surrounding sounds such as telephones ringing and cats meowing, and would use a great variety of "extended vocal techniques," leaping up octaves at odd moments, or singing with a tone quality that would be called "distortion," were it on an electric guitar.[3] The beautiful night-time singer outside my window, unfortunately, was only a temporary guest, and was soon displaced by a much less inventive singer, one with only three or four dull motives which he repeated endlessly. He was probably a young bird, just beginning to build up his repertoire. Perhaps as he matured his song grew to contain more variety and polish.[4]

Although I had always liked animals, and had intuitively sensed that each animal was an individual, something more than just a representative of his or her species, it is this experience, more than any other, which made me consciously aware of animals as subjective beings, each with a unique way of perceiving and relating to the world. I became fascinated with examining the way individuality manifests itself in non-human

[2] This seems far from what we usually consider to be music in the Western tradition, although when I described these bird-song traits to my teacher at the time, Louis Andriessen, he said "sounds like Stravinsky!" But Stravinsky, too, was sometimes accused of being unmusical, precisely for abandoning the more expected, developmental Western musical techniques in favour of a more fragmentary, seemingly arbitrary, bird-like way of arranging music. See chapter four (especially pp. 116 - 123) of *Music, Myth, and Nature or the Dolphins of Arion* by François-Bernard Mâche (1983, trans. Susan Delaney, Philadelphia: Harwood Academic Publishers, 1992) for a further discussion of Stravinsky and birdsong.

[3] While female blackbirds do sing on occasion, they do so much less often than males. With such an active and prolific singer as this, it is a reasonable assumption, though not a certainty, that this particular bird was male.

[4] European blackbirds are among those species which continue to improve their songs throughout their singing lives. For further discussion of bird song learning patterns, see Chapter Five.

animals, and with comparing their individuality with our own. I read, watched, and listened and gradually became more aware of the details of various animal behaviours, both individual and species-wide. I was constantly on the lookout for opportunities to observe animals interacting with their surroundings.

The following year I was in Greece, and was delighted to notice that the street cats there had an entirely different behaviour than the Canadian, American and Northern European street cats I was used to. While I had always known street cats to be shy and skittish, scavenging food from garbage cans in dark alleyways, the Greek street cats were bold and aggressive. They followed people who had food, and would come quite close to try to snatch the food away. They would even follow people into restaurants and sit under the table begging and pestering them for food, in a way I had previously considered only dog-like. When I returned, I excitedly told everybody about how not only the people, but also the cats in Greece had a different culture. I was half serious, half joking, but a couple of years later, I came across a tiny newspaper clipping about animals in different places having different cultures. It was pleasingly validating to find confirmation of my perception that these behavioural differences could be considered "cultural."

As I began thinking about animal as possessors of culture, I read the book *Next of Kin* by Roger Fouts, which tells of his work since the late 1960s with chimpanzees and sign language. Washoe, a female chimpanzee born in 1965, was his most famous charge: she was able to learn hundreds of signs, and to communicate in a way quite comprehensible to humans. Her signs were both understandable and conceptually appropriate. She not only used individual signs for objects and activities, but was able to combine signs into coherent and meaningful sentences. She, along with a number of other chimpanzees, and the gorilla Koko, helped begin to put to rest the once prevailing notion

that only humans could use language.[5] Fouts' intelligent and sensitive telling of his experiences working with Washoe and others is fascinating, and gives clear examples of the emotional and mental similarities between humans and the great apes. To learn of the intellectual and behavioural similarities between us and our closest relatives made me curious to see if there were not also experiential similarities -- how were apes participating in and reacting to the world? Being a musician, I wondered: if their language capacities are so similar to our own, what about their musical abilities? I fantasized about working with chimpanzees and music. What would chimpanzees do if presented with, say, chimpanzee-strength xylophones? Would they be able to keep a steady rhythm? To play rhythmic patterns? To match pitches? To imitate human tunes? My initial questions were highly anthropocentric (human-centered): they had to do with how chimpanzees could learn, respond to, or create a human type of music, rather than what their own relationship to the world of sound was (just as the language researchers had been teaching apes human sign languages rather than deeply studying and learning the chimpanzees' native means of communication). It was only after some time that I became aware of my anthropocentrism, and began to wonder about what a chimpanzee's own experience with music would be like. What would chimpanzees do with instruments if left to their own devices? Would they enjoy playing? Would they be sensitive to pitch? Rhythm? Sounds? Would they create tunes? If so, what would they sound like? Unfortunately, finding chimpanzees to work with seemed an insurmountably difficult problem.

The following year, in what initially seemed like a separate intellectual pursuit, I was thinking a lot about the idea of "noise," and how it has been used throughout the history of Western art music. I was reading and listening extensively. Many of the noises used in music, I discovered, are animal noises: concert halls are full of frogs and crickets, cats and chickens, cuckoos and nightingales, whales and wolves. I became interested in

[5] In fact it is still debated whether the great apes have language, or merely some of the rudimentary aspects of language, but more and more people seem to accept great ape communication as real language. Humans can no longer simply be assumed to be the only language-users, as they were earlier in this century. For further discussion of this, see chapter five of *Next of Kin* by Roger Fouts (New York: William Morrow and Company, Inc., 1997).

examining the different ways composers throughout history have treated these animal sounds. Mediaeval and Renaissance composers (among them Jean Vaillant [late 14th century], Pierre Passereau [early 16th century] and Clément Janequin [1485-1558]) frequently "beautified" the sounds, and wove them into the typical musical textures, or used them to create unusual new textures which were at the extreme end of the stylistically permissible. They also used animal imitations symbolically: nightingale calls might be used to represent beauty, purity, and fidelity, for example, while cuckoo calls might symbolize deception. Baroque composers (among them Biber [1644-1704] and Telemann [1681-1767]) were more likely to use humorously crude imitations of animal sounds as a contrast to their usual more refined mode of composition. The excuse of imitating animal sounds seemed to be a way of allowing normally unacceptable, noisy sounds a brief appearance in music. Classical composers occasionally included animal sounds as colourful exoticisms with which to evoke the natural world: quail, cuckoo, and nightingale imitations in Beethoven's 'Pastoral' Symphony come readily to mind. Romantic composers used idealized versions of birdsong similarly, as part of programmatic representations of nature. Early twentieth century composers tended to use more precise imitations -- Ottorino Respighi (1879-1936), for example, went so far as to use a recording of a real birdsong in his tone poem "*Pini di Roma*" (Pines of Rome) -- but for a programmatic purpose much like that of the Romantics. More recently, some composers have gone beyond simple programmatic borrowings of animal songs, and have allowed the animal songs to substantially affect the style of the music itself: Olivier Messiaen (1908 - 1992) is one of the best known such composers. A devout Catholic, Messiaen believed birds to be the first and best musicians, and considered birdsongs the purest form of praise to God: they thus figured prominently in his works. Birdsong provided not only motives, but complete rhythmic, timbral, and structural musical worlds. More recently, composers such as François-Bernard Mâche (b. 1935) and R. Murray Schafer (b. 1933), have also allowed animal songs to dictate entirely the structures of some of their pieces.

I was intrigued by the different nature of these musical uses of animal sounds, which ranged from composers taking over the animal songs and turning them into

something acceptably musical; to imitating animal sounds more exactly, but keeping them at a safe distance by humor or exoticisation; to relegating animal sounds to programmatic pieces; to giving the animal sound an elevated, mystical significance; to allowing animal songs to take over music, thus giving human music a partially animal-created sound-world or structure. This latter possibility was most exciting to me, as it represents the furthest departure from usual human music. Knowing that human composers had trusted animal songs to provide significant portions of the musical material and structure, I began to wonder what animal songs themselves had to say. At a level beyond that of either surface or structural comparisons between animal songs and our own: how do the animals themselves experience their songs? Do animals' songs occupy a similar place in their lives that music does in ours? Do animals sometimes sing to create an aesthetic experience, as we do?

Mâche and Zoömusicology

I began to look at the existing literature about the relationship between animal songs and human music, both that written from a scientific perspective and that written by musicians. An early exploration of the topic was 17th century Italian Jesuit scholar Athanasius Kircher's compendium *Musurgia Universalis*[6], which includes descriptions and transcriptions of a variety of bird and animal songs. More recent investigations include F. Schuyler Matthews' *Field Book of Wild Birds and Their Music*, with detailed accounts of and musical notations of the songs of many birds from the American Northeast; ornithologist Edward Armstrong's *A Study of Birdsong*; philosopher Charles Hartshorne's *Born to Sing: An Interpretation and World Survey of Bird Song*; and various writings of

[6] Athanasius Kircher, *Musurgia Universalis* (Rome, 1650; with a forward by Ulf Sharlau, New York: Hildesheim, 1970).

Messiaen[7]. One of the most interesting and extensive recent explorations of the connection between music and animal sounds is French composer François-Bernard Mâche's *Music, Myth, and Nature*[8]. Mâche writes not only of the role that animal and other natural sounds play in his own works, but also of the deeper, unconscious structural similarities between some animal songs and some human music. He convincingly compares the structure of Stravinsky's "Sacre du Printemps" with that of the song of the Blyth's reed warbler (*Acrocephalus dumetorum*). Both Stravinsky and the Blyth's reed warbler, Mâche observes, have the tendency of "juggling with three sound objects of which one (A) is more frequently [used] than the others, reiterated several times in succession."[9] Mâche suggests that musical structures such as Stravinsky's, which seemed radically new to listeners at the time, are in fact no less "natural" than the flowing melodic structures which have more traditionally been considered musical in the West -- only that they are related to a different natural model. Mâche believed that this change in musical model was no mere accident, but rather the direct result of Stravinsky having composed *le Sacre* in Ustilug (Ukraine), by the Bug River, where many aquatic warblers with songs as described above would have lived.[10]

Following the example of the philosopher and ornithologist Charles Hartshorne, Mâche goes so far as to state that "there is not a single musical procedure which does not have its equivalent or its prototype in one or the other of the innumerable signals of animals."[11] While this statement is unprovably bold, it is also invitingly provocative, and

[7] F. Schuyler Matthews, *Field Book of Wild Birds and Their Music* (New York: G. P. Putnam's Sons, 1904); Edward A. Armstrong, *A Study of Birdsong* (Toronto: General Publishing Company, 1963); Charles Hartshorne, *Born to Sing: An Interpretation and World Survey of Bird Song* (Bloomington, Indiana: Indiana University Press, 1973); Olivier Messiaen, *Traité de Rythme, de Couleur et D'Ornithologie* (1949-1992) en sept tomes, Tome V en 2 volumes, "1er Volume - Chants d'Oiseaux d'Europe" (Paris: Alphonse Leduc, 2000).

[8] Mâche, *Music, Myth, and Nature*.

[9] Ibid., 117.

[10] Ibid., 121.

[11] Ibid., 115.

suggests an interesting way of approaching the topic. What attributes of human music are also present in animal song? What are ways in which human music-making behaviour is similar to animal sound-making behaviour? Are there aspects of sound-making which are uniquely human, or can an equivalent always be found in some non-human species? Can we speak of animal musical cultures? Is there any reason to consider the music-like sounds of animals as fundamentally different than human music, or are they simply different species' versions of the same activity? Ongoing curiosity about and desire to explore these questions led me to this current work, and it is these sorts of questions that I will try to answer.

Mâche terms the exploration of musical animal sounds "zoömusicology,"[12] a word now adopted by Italian/Finnish scholar Dario Martinelli, author of the excellent and comprehensive *How Musical is a Whale?*,[13] and a small but growing number of people investigating the relationship between animal sounds and music. Others have used the term "biomusic." Well-known contributors to the field of biomusic are pianist Patricia Gray, ornithologist Luis Baptista, and bioacoustician and musician Bernie Krause. Several conferences in biomusic have been held, most prominently one at the American Association for the Advancement of Science in 2000 and one at the California Academy of Sciences in 2001. While one understanding of "biomusic" seems almost identical to "zoömusicology," biomusicology in fact seems to be a larger field, which encompasses not only zoömusicological explorations, but also neuroscience (often only as it applies to humans), and studies of the evolutionary origin of music in humans.[14] I will thus refer to my investigations as "zoömusicological," realizing that they could also fall under the categories of "biomusic" or "biomusicology."

[12] The umlaut, suggested by semiotician John Deely, points to the correct pronunciation of the word zoömusicology, with "zoö-" rhyming with "doe," rather than with "zoo."

[13] Dario Martinelli, How Musical is a Whale?: Towards a Theory of Zoömusicology (Helsinki: International Semiotics Institute/Hakapaino, 2002).

[14] The various chapters of *The Origins of Music* (Nils L. Wallin, Björn Merker, and Steven Brown, eds., Cambridge, MA: MIT Press, 2001) describe a whole range of approaches which might be considered biomusicological.

A variety of fields have recently emerged which, though not specifically focused on music, are closely related to zoömusicology. "Cognitive ethology," Donald Griffin's hybrid of cognitive science and behavioural ethology deals specifically with questions of animal consciousness, intentionality and awareness. Colin Allen and Marc Bekoff are well-known younger scientists in this field. "Bioacoustics" also includes many speculations relevant to the study of animals and music. Well-known scientists working in bioacoustics include Roger Payne and Katy (Boynton) Payne, both of whom were involved with the human discovery of humpback whale song. "Zoosemiotics," founded by Thomas Sebeok in the 1960s, is the discipline "within which the science of signs intersects with ethology [and is] devoted to the scientific study of signalling behaviours in and across animal species,"[15] including some speculations on aesthetic sound. As well, zoömusicology draws on knowledge and ideas from a great number of more traditional fields, among them philosophy, aesthetics, ornithology, zoology, animal behaviour, ethology, bioacoustics, ethnomusicology, and music theory.

My own approach

In this dissertation, I try to provide a comprehensive overview of the issues surrounding animal sounds and their relationship to music, and to give a series of arguments which support my eventual conclusion that some animals do sometimes make music. Both Mâche and Martinelli have embarked on similar ventures, in *Music, Myth and Nature* and *How Musical is a Whale?* respectively, but each with a slightly different focus. Mâche looks primarily at mythological stories of the origins of music which have to do with the natural world, the connection between music and language, and sound models which are found both in nature and in human music. Though he refers to many animal songs themselves, he refers less to studies of what the animals are doing when they sing and what role the songs may play in the animals' lives. One could say that his focus is on

[15] Thomas Sebeok, "The Word Zoosemiotics" in *Perspectives in Zoosemiotics* (Paris: Mouton & Co., 1972), 178.

what animal songs and other natural sounds mean to humans, rather than on what they mean to the animals themselves. Martinelli, whose work is grounded in semiotics and philosophy, explores thoroughly the role songs may play in animals' lives, but looks somewhat less at specific examples of how they compare to human music.

Aside from Mâche and Martinelli, most relevant literature is either scattered -- one may find a couple of paragraphs about animal songs in a book about music or a couple of paragraphs about music in a book about animal songs -- or deals with only a part of the field. The books by Matthews, Armstrong and Hartshorne already mentioned, for example, discuss only birdsong and its relation to the musical, and not other animal songs. Roger Payne's *Among Whales* has one chapter about humpback whale song and music, but without reference to other species. I know of no comprehensive comparisons by scientists of songs across animal classes. Several books and studies, such as Nils Wallin's *Biomusic* and Steven Mithen's *The Singing Neanderthals*, deal with the biological basis of music in humans, but talk little about connections between human music and other species' songs.[16] There are a few books written by musicians, such as David Rothenberg's *Sudden Music* and Jim Nollman's *Dolphin Dreamtime* and *Orca Cafe* but these tend to focus on the subjective experience of interacting with animal songs.[17] These musicians intuitively sense a close relationship between human and animal songs, so devote less energy to justifying it in scientific or philosophical terms. And there are numerous detailed scientific studies of the songs of individual species, but these seldom compare across related species, let alone animals from different classes, and even less often make mention of the aesthetic.

In a way what I am doing is gathering together all the relevant research by scientists and thought by philosophers, and reinterpreting it through the eye (or perhaps, more

[16] Nils Wallin, *Biomusicology* (Stuyvesant, NY: Pendragon, 1991); Steven Mithen, *The Singing Neanderthals: The Origins of Music, Language, Mind and Body* (London: Phoenix, 2006).

[17] David Rothenberg, *Sudden Music* (Athens, Georgia: University of Georgia Press, 2002); Jim Nollman, *Dolphin Dreamtime: Talking to the Animals* (London: Anthony Blond, 1985).

appropriately, the ear) of a composer, as someone who is daily trying to figure out what music is and what it means. Though I write from my experiences as a musician, I do refer frequently to the relevant scientific and philosophical literature. Animal music is a topic that could too easily be dismissed as "new agey," or somehow not serious, and it is important that I show that there is ample empirical evidence and substantive thought to support the idea of animals as music-makers. I intend that scientists, philosophers, and others, as well as musicians, might find this work and the conclusions I draw worthy of consideration. I also devote a considerable portion of this dissertation to an overview of the history of how humans have thought about animals. Though not all of this history is explicitly related to music or the aesthetic, understanding this history enables us to better understand current perceptions of the relationship between animals and music.

My writing about the biology of animal sounds can unfortunately only be from the point of view of someone not trained as a scientist. I do look forward to a future increased presence of scientists examining these issues from their own perspectives, and even more importantly to collaborations between musicians, scientists, philosophers, and others with deep knowledge in relevant fields. In some ways, writing as a non-scientist frees me, however, to make the sort of broad comparisons that are currently necessary for zoömusicology. I can propose ideas that I think and believe to be true, not just observations from infinitely repeatable and highly controlled experiments. Scientists themselves sometimes lament that "you only get to publish what you have proven to be true (or believe you have so proven). There's not much chance to put down deeply held suspicions."[18] Zoömusicologists are not yet so bound!

It is possible also that writing from outside the discipline of science may help me avoid some traps common in scientific thinking. One such trap is scientists' (to my way of thinking) overly-zealous avoidance of any hint of anthropomorphism. (For more discussion of this, see Chapter One). I believe that in their desire to avoid mistaken anthropomorphism when studying animals, scientists, and others wanting to appear

[18] Payne, *Among Whales*, 15.

scientific, often make the opposite mistake of failing to recognize commonalities between humans and other animals where they do exist. In the case of music, many scientists assume that only humans can be musical (or use language, or be self-aware, etc.), without investigating whether this is really the case. While it would be impossible to prove absolutely that some non-human animals do indeed have an equivalent to our music (just as it is impossible for us to know for certain that any human beside ourselves is really having an aesthetic experience with music), I believe that given the evidence available to us, there is no reason to believe that they don't.

Another problem that plagues much popular scientific writing is the tendency of authors to polemicize -- to make something into a controversy or a contentious debate when there is no need to do so. Different ways of looking at something are often only subtly different, and people on both sides of the argument may actually agree on most of the important points. Two points of view may be complementary rather than conflicting. Polemicization attracts attention, and perhaps sells books, but in the long run is merely a colourful distraction from the more important and interesting matters at hand. A typical polemicist's trick is to exaggerate to the point of absurdity the ideas of their opponent. For example, in his review of animal behaviourist Donald Griffin's well-researched and thoughtful book *The Question of Animal Awareness*, (1975), in which Griffin suggested that it may be worth considering that some animals may be able to think and have some degree of consciousness, psychologist Nicholas Humphrey wrote disparagingly: "Away with critical standards, tight measurements and definitions. If an anthropomorphic explanation feels right, try it and see; if it doesn't, try it anyway."[19] Humphrey thereby avoided having to engage seriously with any of Griffin's ideas, which may have been new and controversial, and which Humphrey may legitimately have disagreed with, but which were certainly not lacking in "critical standards, tight measurements and definitions."

[19] Humphrey, N., Review of Donald Griffin, *The Question of Animal Awareness: Evolutional continuity of mental experience* (New York: The Rockefeller University Press, 1976) in *Animal Behaviour*, 25, (1977), 521-522, quoted in Colin Allen, "Philosophy of Cognitive Ethology," <http://host.uniroma3.it/progetti/kant/field/ceth.htm>. (Accessed 14 May, 2006).

Sadly rare are the more level-headed scientists such as biologist John Bonner, author of *Evolution of Culture in Mammals*,[20] who recognizes the essential non-dichotomy of many debates. Bonner writes of the tension between "reductionists" and "holists," for example: "In principle it would appear so easy to be both [holistic and reductionist] at once, but human nature is such that it enjoys taking positions on philosophical or political dichotomies, ignoring totally the possibility that some of these dichotomies are not genuine antitheses of the either-or category, but are complementary."[21] Creating an opposition between the biological and the cultural, as often occurs in comparisons between the animal and the human, is likewise unnecessary. "There is a tendency to oppose the words biological and cultural, but Marion Levy has pointed out to me why this is unfortunate. Culture, as I have defined it, is properly achieved by living organisms. Therefore in this sense it is as biological as any other function of an organism . . . ."[22] In both his level-headedness and in his ability to write in a way that is accessible both to specialists and the general public, Bonner is a n inspiration.

Perhaps related to the tendency to polemicize is that much of the existing material which discusses animal songs tends to fall into one of two extremist camps. On the one hand, there is an abundance of highly reductionist scientific writing, which frequently tells of experiments which range from the coldly indifferent to the cruel. Animals are treated as numbered objects rather than as individual subjects. Many early studies of birds in which the birds are deafened or otherwise brain damaged by the scientists, or are raised in isolation, and then killed so their brains can be studied would fall into this camp. And, on the other hand, there is a large body of literature (most of which would be considered "new-age"), which ascribes bird and other animal songs mystical and magical healing and spiritual power. Neither approach is appealing, and neither, it seems to me, is the best position from which to explore the subject. Furthermore the extreme polarization of the

[20] John T. Bonner, *The Evolution of Culture in Animals* (Princeton, NJ: Princeton University Press, 1980).

[21] Bonner, 8.

[22] Ibid., 9.

two approaches ensures that they will stay forever separate: new-agers and reductionists will be so put off by each other that they will have a hard time learning from the insights that do exist in each method.

In some ways my work has much in common with that of an ethnomusicologist, in that I am studying the sounds which I perceive to be musical in the context of specific cultures (in this case the cultures of other species rather than of other groups of humans), though of course studying "music" across species poses even more difficulties than studying music cross-culturally within a species. The possibilities for misinterpreting behaviours and motivations, enormous when dealing with humans, are even greater when dealing with non-human animals, and any direct conversation with another species about their "music" is, at least for the foreseeable future, impossible.

The reader will notice that most of the human music examples I give come from Western classical music. I do this because that is my own background: these are the examples I know at the deepest level. I am trained as an oboist, pianist, and composer, and have been surrounded by Western classical music and ways of thinking about music for as long as I can remember. It is within this context that I first began to form my own ideas of what was acceptable as music, and to become aware of what other people considered music or not music, and it is from classical musicians that I have sometimes heard sentiments like "well, what that bird is singing may sound like music, but of course really it's just a mating call" -- sentiments which at once link and demolish the link between human and non-human sounds. Were I from a different musical background, my questions would surely be different: perhaps it would be so obvious to me that animal and human sounds are related that a dissertation on the topic would seem unnecessary; or perhaps it would seem so far-fetched that these questions would never occur to me.

I use examples from musical cultures besides my own from time to time, but try to limit these to examples with which I have some direct experience, or to places where they complement examples taken from Western music. It takes a lifetime to know even one or

two musical cultures thoroughly, so comparisons including a large number of musical systems are likely to be only at a surface level. Yet broad, shallow comparisons can be useful, especially when acknowledged as such, and are often an essential starting point for future, more focused study. The far greater danger is that were I to use primarily examples of non-Western music for comparison with animal sounds, this would unhealthily exoticize both, since it would only be speaking of sonic experiences necessarily foreign to me. It would suggest that animal sounds could only be connected with other foreign sounds and not with my own native musical experience. I wish to examine whether animal songs are music in the sense that I understand most deeply, and I can do this only by referring often to the music closest to me.

This certainly does not mean that the musical sounds made by non-human animals should only be examined from the perspective of a Western, academic, classical musician. This perspective may in fact be one of the weaker positions from which to start contemplating the potential musicality of other species, because Western classical music is a rather unusual form of human music. Its extensive use of harmony, tendency to be dissociated from dance or other physical manifestations, and dependance on notation, for example, are rare among the world's musics. A more complete zoömusicology -- as I hope one day we will have -- must certainly involve the perspectives of people from many different human musical cultures, and would draw on other ways of describing the animal/human musical relationship than purely the academic.

Even if I manage to minimize superficial cultural eclecticism, however, I realize that I will certainly be guilty of species eclecticism -- of drawing widely from examples of sounds from as many species as possible. I don't know how this can be avoided at this stage of research in this subject. We know very little about the sounds of other species -- why they are being made, what they mean, and how they relate to our own sounds. If I am writing of a music which occurs at the zoological level -- in many species -- rather than simply at the human level, then I need examples from as many species as I can find. I have acquainted myself with as much current research as possible, but realize that we are at a

very rudimentary stage of understanding animal sounds, and that many of our current interpretations are likely to change. It is thus probable that some of the examples I use, though based on the best research now available, will turn out to be misinterpretations. I believe, however, that enough of our present understandings will prove adequate that the basic arguments of my thesis will stand.

Invertebrates, reptiles, amphibians, and fish, the reader will notice, are largely absent from my study, and are mentioned only in passing throughout this work. Because music, in my conception, is at some level voluntarily created (see chapter eight for further explanation), I have chosen to look at the musical sounds of only those animals whose consciousness I can imagine.[23] By no means do I wish to imply that animals which are not mammals or birds do not have consciousness or could not produce some sounds that might legitimately be considered musical, only that it is difficult enough for me to conceive of it that I do not wish to defend such a position. In this earliest of studies in a young and controversial field, I am taking the liberty of choosing the examples which speak most strongly to me of the possible link between human and non-human music. Furthermore I am looking primarily at animals whose sounds are close enough to something that might occur in human music that similarities are readily apparent. Again, this is the privilege of an early zoömusicologist: I will let those who later join a well-established field wrestle with the sounds which overlap less obviously with our own music.

It is certainly true that some species produce aesthetically more interesting or varied sounds than others: even leaving human judgment entirely aside, some animals, such as earthworms, are mute. To find aesthetic sound in several species outside of humans, however, indicates that musical or aesthetic sound is not something that happens at the human level, but at the larger zoological level. That some species are not "musical" does not mean that animals as a whole are therefore "unmusical," just as that some humans are not musically active does not mean that music is not a human phenomenon. According to

[23] This is not to suggest that I can imagine their consciousness accurately -- only that I imagine that I can imagine it!

Mâche, to find "music" in even a few species outside our own is enough to "call into question the definition of music, and more widely that of man and his culture, as well as the idea we have of the animal itself."[24] I do not wish to suggest that animal musics are necessarily as complex, or as diverse within a species as human musics (though some may be), but rather that if there is a difference between their musical sounds and ours, it lies in the relative complexity, not in the musicality.

I do believe that we can legitimately consider some animal songs to be music, but I don't wish to insist that the reader also come to this point of view. Rather I strive to give a balanced account of the issues, which I hope will lead the reader to question whether the ways in which we currently tend to separate animal sound-making from human music are in fact valid or necessary. Some of this questioning may of course lead to larger (and certainly not simply solvable) questions about, among other things, the nature of music, the aesthetic, the functional, the natural, the created, the human, and the animal.

Chapter summaries

Chapter 1

The first chapter briefly describes the history of the dualistic view of the human/animal relationship which has prevailed in the Western world for the past three millennia. I examine some of the attitudes and ideas about animals in the Greek, Jewish, and Christian cosmologies which have been formative of modern Western thought, and look at how even with the rise of supposedly objective, non-religious scientific thinking, beginning in the seventeenth century, our basic attitudes towards animals have remained rooted in these ancient philosophical and theological systems. Though many have written histories of the human relationship with other animals, I know of no one aside from Martinelli who has connected this history with how we perceive animal songs. I expand on the work of Martinelli, and attempt to explain why we are now at a stage where it is common to hear things such as "bird songs may sound like music, but really are just ways

[24] Mâche, 95.

of attracting mates and defending territory," and tie this in with other still-operative paradigms which deny animals subjectivity, such as mechanism and behaviourism.

Chapter 2

Despite the prevalence of these dualistic notions of the human and the animal, there is a parallel, if less prominent, historical trend, of considering animals and humans as profoundly related: this is explored in the second chapter. This sense of continuity and equivalency appears to be growing, and changes seem to be taking place in our collective cosmologies which are making us more open now than at any time since perhaps the late eighteenth century, the period of scientific romanticism, to the exploration of abilities and attributes we share with non-human animals, including the aesthetic. In the past hundred years, tremendous advances have been made in understanding animal sociality, communication, and cognition. Things which were once thought to create an absolute dividing line between humans and non-humans, such as language and tool use, have now been found in many species. Scientists and philosophers alike are more ready to consider previously unthinkable ideas, such as animal creativity, aesthetic sense, thought, and pleasure, and the various conjunctions of these, including art and music. Western musicians are more willing to realize that Western human art music is not the only valid form of musical expression: the idea of animals creating music is a stretch, but one that some are now willing to entertain.

Chapter 3

In order to answer questions of whether animals do indeed possess music or an aesthetic sense, both terms must first be defined. There are many ways of describing music and the aesthetic, and I believe that most have some validity, although they represent widely different points of view, or are more suitable for particular circumstances. In the third chapter I develop working definitions of "music" and "the aesthetic" which are most appropriate for this essay. How do we define "music," and how does that limit what we are willing to consider as potentially musical? What is the aesthetic? What is its relationship with the rest of human activity? I look at various definitions and descriptions

of the aesthetic, including the ideas of the aesthetic as play of pattern and noise; the aesthetic as that which intensifies experience; and the aesthetic as that pursued for its own sake, linked with functionality indirectly if at all.

Chapter 4

The fourth chapter delves more deeply into the question of the aesthetic, and looks at various theories of the origin and function of the aesthetic, and its auditory subset, music. I describe some of the most prominent scientific and philosophical theories of the aesthetic and its origins, and look at what implication these might have for our understanding of the relationship between animal and human sounds.

Chapter 5

The fifth chapter takes one of the common understandings of the aesthetic -- that it is something at most indirectly linked with the functional -- and looks at figuring out which animal sounds might be considered aesthetic on the basis of animal behaviour. Some animal sounds do seem clearly primarily functional, and while they may also have some aesthetic component, functionality seems a complete enough explanation that no other need be sought. Other sounds are inadequately explained by functionality: however, many of these sounds have aesthetic-seeming qualities, such as play with patterns, and tendency to correlate sound with emotion or physicality, and thus it makes sense to wonder if the aesthetic itself may be their very reason for being. This chapter is divided into two parts, the first of which deals with birds, and the second with mammals.

Chapter 6

The sixth chapter deals with determining what is musical from an ethnomusicological perspective. Can any of the ethnomusicological methods of identifying music in a human culture be used also for animal sounds? I look at various proposed musical universals and near-universals -- traits by which we recognize whether something is music -- to see if any of them could apply also to non-human musical sounds, either as universals for other individual species or, more significantly, as universals for all musical

species. I look also at behavioural aspects of human music making, and how these might compare with animal sound-making behaviour. What place does music-making occupy in human life and activities? Do any non-human sounds occupy an equivalent place in the life of the animals which create them?

Chapter 7

The seventh chapter deals with the scientific question of homology and analogy. If animal and human aesthetic sounds are indeed related, how are they related? Do they share a common origin? A common musical ancestor? Or have music and music-like sounds evolved separately in different species?

Chapter 8

In the eighth chapter I describe how my thinking on the topic of animals and music has developed in the course of this study. I describe my new understanding of music, and how it can be applied to aesthetic animal sounds without either creating an arbitrary seeming division between the human or an animal or becoming such a broad definition that it mistakenly identifies too much sound as musical.

Conclusion

The concluding chapter raises questions about the implications of this research, and suggests directions for future work.

CHAPTER 1

The Human/Animal Relationship: Discontinuity

Mind/body dualism

For as long as history or myth can tell, human music and the sounds of animals have been associated with each other. Hunters and shamans of many traditional cultures incorporate ritual imitations of animal sounds into their songs[25]; mechanical instruments for recreating bird song date back several thousand years[26]; canaries (the domesticated descendants of *Serinus canaria*) and bullfinches (*Pyrrhula pyrrhula*) are prized for their ability to learn human songs; human performers improvise with animal songs, both live and recorded[27] ; and composers such as Janequin, Biber, and Messiaen are known for their borrowings of bird and other animal songs. Many cultures readily acknowledge a deep connection between human music and animal song, believing that humans learned music from the animals, or that humans and animals can communicate through use of each other's voices[28].

Individual Western musicians may also feel a kinship between their own music and the songs of animals, but mainstream Western musical thought, for at least the last three millennia, has maintained that any apparent connection is only superficial, emphasizing

[25] Mâche, 36.

[26] Grove's Dictionary of Music and Musicians, *Bird Instruments*, 2002, <http://www.grovemusic.com>. (Accessed 10 March, 2003.)

[27] Jim Nollman's improvisations with Orcas, David Rothenberg's improvisations with birds, and Paul Winter's improvisations with wolf recordings come immediately to mind.

[28] Mâche, chapter 1.

instead the aspects of music which were perceived to be uniquely human. At what can be seen as the distant dawn of Western music, Greek and Roman theorists celebrated the rationality of music to the extreme point of preferring that speculated to that heard. Centuries of such thinking was summarized by the fifth century Roman philosopher Boethius: "How much more admirable, then, is the science of music in apprehending by reason than in accomplishing by work and deed." [29] While this statement seems extreme in such a concise form, the belief in a split between a music of culture, intellect, and refined spirituality, and physically-grounded music of the body, senses, and raw emotions has remained a constant for most Western musicians and philosophers.

Early thinkers wrestled explicitly with the dualism of sensuality and mind in music. St. Augustine, for example, in considering the role of song in the nascent Christian church wrote: "when it happens to me to be more moved by the singing than by what is sung, I confess myself to have sinned criminally, and then I would rather not have heard the singing."[30] European colonists considered the central importance of the bodily movements associated with music, dance, and ritual in some non-European societies (and indeed in less "civilized" parts of European society) to be evidence of the "savagery" and "lack of culture" of non-European peoples.[31] Dance or popular music, both more body-oriented, are often accorded inferior status by the musical elite. Twentieth century aesthetician Roman Ingarden's dismissal is typical: "We may doubt whether so-called dance music, when employed only as a means of keeping the dancers in step and arousing in them a specific passion for expression through movement, is music in the strict sense of the word."[32]

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[29] Torquatus Severinus Boethius, cited in Enrico Fubini, *A History of Music Aesthetics*, trans. Michael Hatwell (London: Macmillan Press, 1990), 72.

[30] St. Augustine, *Confessions*, Book X, reprinted by Christian Classics Ethereal Library at Calvin College, 13 July, 2005, <http://www.ccel.org/ccel/schaff/npnf101.vi.X.XXXIII.html>. (Accessed 14 May, 2006).

[31] Susan McClary and Robert Walser, "Theorizing the Body in African-American Music," *Black Music Research Journal*, 14, no. 1 (spring 1994), 75 - 84.

[32] Roman Ingarden, *The work of music and the problem of its identity*, trans. Adam Czerniawski (London: MacMillan), 46.

Only since the development of "new musicology" in the 1980s, by such thinkers as Susan McClary and Suzanne Cusick, has this blatantly physical music been given consistent scholarly treatment. "New musicology," though influential, remains on the outskirts of academic musical thought. Rare are such thinkers as music-semiologist Jean Molino, who considers physically based music to be more truly representative of the musical experience than abstract musical works for performance, and believes that "to have a less artificial and less inexact idea of musical signification, one must abandon "great" music and instead turn to contemporary and primitive forms of dance music, from ritual to disco. . ."[33]

Many philosophers have examined the application of dualism to the aesthetic. John Dewey (1859-1952), for example, associates mind/body dualization in our understanding of the arts with our more general tendency to give "Prestige. . . to those who use their minds without participation of the body."[34] In *Art as Experience*, he looks at our separation of the human (associated with the intellectual, the spiritual, the rational, and the refined) from the animal (associated with the physical, the biological, and the rawly emotional.) "Why is the attempt to connect the higher and ideal things of experience with basic vital roots so often regarded as betrayal of their nature and denial of their value?,"[35] he asks. "Why is there repulsion when the high achievements of fine art are brought into connection with common life, the life that we share with all living creatures? Why is life thought of as an affair of low appetite, or at its best as a thing of gross sensation, and ready to sink from its best to the level of lust and harsh cruelty."[36] Dewey believes this comes from a fear of life itself: "Oppositions of mind and body, soul and matter, spirit and flesh all have their origin, fundamentally, in fear of what life may bring forth."[37] This fear of life

[33] Jean Molino, "Towards an Evolutionary Theory of Music and Language," 165-176 in *The Origins of Music*, Wallin, Merker and Brown, eds., 170.

[34] John Dewey, *Art as Experience* (1934; New York: Perigree Books, 1980), 21.

[35] Ibid., 20.

[36] Ibid.

[37] Ibid., 22.

and its processes leads us to unnecessarily restrict our experiences, Dewey argues, and thus we come to resent that which shows us possibility for richer and more varied ways of being by not separating out one kind of experience from another.

> Usually there is a hostile reaction to a conception of art that connects it with the activities of a live creature in its environment. The hostility to association of fine art with normal processes of living is a pathetic, even tragic commentary on life as it is ordinarily lived. Only because that life is usually so stunted, aborted, slack, or heavy laden, is the idea entertained that there is some inherent antagonism between the process of normal living and creation and enjoyment of works of esthetic art.[38]

Dewey views this dualization of the intellectual and the physical (and its corollary the human and the animal) as not only tragic and unnecessary, but also logically unsound. "Art itself," he writes, "is the best proof of the existence of a realized and therefore realizable, union of material and ideal . . . [and] Wherever continuity is possible, the burden of proof rests upon those who assert opposition and dualism."[39] Though Dewey does consider humans to be distinguished from non-human animals, he considers acknowledgment of our physical and psychic kinship with animals to be important, something that would strengthen rather than weaken our engagement with the arts. "Full recognition, therefore, of the continuity of the organs, needs and basic impulses of the human creature with his animal forbears, implies no necessary reduction of man to the level of the brutes. On the contrary, it makes possible the drawing of a ground-plan of human experience upon which is erected the superstructure of man's marvelous and distinguishing experience."[40]

Use of animal sounds in dualized musical world

Borrowed animal sounds, undeniably related to the physical and the biological bodies of the animals which produce them, do appear frequently in Western art music, but usually only as greatly simplified, stylized motives used as raw material; the "art" is seen to

[38] Ibid., 27.

[39] Ibid.

[40] Ibid., 22.

be in the composer's construction of the piece, not in the animal sounds themselves. The animal sound, as described in the introduction, is often either romanticized or grotesquely caricatured: it may be used symbolically; as a humorous foil to the composer's more refined, "serious" music; as part of a pastoral fantasy; or as an exotic flavouring. Seldom is it an equal participant in the creation of the music. Rather than being used to emphasize our similarities with other species, these animal borrowings are used to highlight our differences. Examples would include pieces such as Passereau's madrigal "Il est bel et bon" in which chicken sounds are used to create a humourous, percussive, rhythmic passage which would otherwise have been hard to achieve in music of the time; Biber's *Sonata Representativa*, the fourth movement of which, "Fresch" ("Frog," in old German), uses sharp dissonances and playing on two strings slightly out of tune with each other, sul ponticello playing, and an irregular leaping rhythm which would otherwise be completely uncharacteristic of baroque music, and the seventh movement of which, "Die Katz" ("the cat") uses pitch bends and slides; the quail, cuckoo, and nightingale calls of the third movement of Beethoven's Sixth Symphony (the "Pastoral," 1808); and the recorded bird songs in Respighi's *Pini di Roma* (1923-24). In the rare cases where animal song more thoroughly informs the structure of a piece, the piece is usually placed outside the realm of serious art music, as in Mozart's *Musical Joke* (1787), composed as a memorial to and in the style of his recently deceased pet starling.[41]

Messiaen's mysticization of birdsong, though on the surface very different, was in some ways a sort of flip side of the common practice era tendency towards trivialization of animal sound. Whereas most earlier composers saw animal songs as *a priori* less worthy of consideration than human music, Messiaen believed bird songs to be inherently more spiritual and perfect. Neither approach treats the bird song as equivalent to the human song, since in both cases the song is assigned its value purely on the basis of its being a

[41] Luis Baptista and R. Keister, "Why Bird Song is Sometimes Like Music," paper given at a meeting of the American Association for Advancement of the Sciences, Feb. 17-22, 2000, Washington, D.C. Drs. Luis Baptista (California Academy of Science) and Meredith West (Indiana University) discovered that Mozart's *Musical Joke* uses direct quotations from starling song, dissonances imitating the starling's ability to sing two notes at once, and starling-like fragmentations and combinations of motives.

bird song. Animals may be seen as less than human or more than human, but almost never as equal.

Much of Western science, religion, and philosophy has supported the idea that human music and animal song are not related in any substantive way. While we do not question the validity of considering of the aesthetic in the study of human sound, animal sound-making is typically described only in terms of its biological function or statistical occurrence -- and where biological function is found, we tend to assume that there cannot concurrently be an element of creativity, pleasure, or the aesthetic. Sounds which serve obvious territorial, courting, social bonding, or individual identification purposes, those which are easily quantifiable, and those which are clear-cut examples of simple communication, such as warning or mating calls, are studied in great detail. Sound which does not fit into any of these categories tends to be dismissed as "anecdotal," "insignificant," or "redundant," or is simply ignored.[42] It is interesting to consider that were the same reductionist scalpel applied to our own music, all that is currently performed as concert music, from Mediaeval church music to heavy metal shows, would be considered entirely interchangeable, and therefore "redundant," since they all take place in more-or-less the same context and can be understood to serve more-or-less the same purpose. An early music and a heavy metal concert, for example, would likely both take place during an evening performance in a specially designated listening space, would cost money to attend, would be performed for large groups of (musically) like-minded people, would provide aesthetic enjoyment, entertainment, and perhaps social commentary, and would create a sense of group cohesion.

Human/animal dualism

Denying animals the possibility of aesthetic sound-making is of course part of a larger tendency to dualize the human and the animal, and fits into a long history of

[42] Personal communication with Luke Rendell, post-doctoral researcher in Marine Biology, Dalhousie University.

downplaying the idea that there might be meaningful similarities between humans and animals, not just in the aesthetic realm, but in all aspects of cognizance and sentience. Western approaches towards understanding animals, while diverse, have on balance been dominated by theologies, theories, and beliefs which assert a discontinuity between humans and non-humans.

Perhaps in an effort to distance themselves from "pagan" religions and peoples, for whom animals were often of central spiritual importance, both Greek philosophers and early Jewish theologians typically went to great lengths to show that animals were far removed from humans.[43] In the mainstream of both cosmologies, animals were considered to have been placed on earth explicitly for the benefit of humans, and thus something entirely other. In the biblical account of creation, after making humans, "God said to them . . . have dominion over the fish of the sea, and over the birds of the air and over every living thing that moves upon the earth."[44] And in Aristotle's remarkably similar telling, from the 4th century BCE:

> In like manner we may infer that, after the birth of animals, plants exist for their sake, and that the other animals exist for the sake of man, the tame for use and food, the wild, if not all at least the greater part of them, for food, and for the provision of clothing and various instruments. Now if nature makes nothing incomplete, and nothing in vain, the inference must be that she has made all animals for the sake of man.[45]

Early Christianity, influenced as it was by Greek and Jewish thought, adopted these views essentially unchallenged. According to St. Augustine (354 - 430 CE) ". . . to refrain from the killing of animals and the destroying of plants is the height of superstition, for . . . there are no common rights between us and the beasts and trees . . ." Centuries later, Thomas Aquinas, one of the founders of modern Roman Catholicism, echoed these

[43] Mâche.

[44] Genesis 1.28, NRSV.

[45] Aristotle, Politics, Book I, Part VIII (350 BCE), trans. Benjamin Jowett (1994-2000), <http://classics.mit.edu/Aristotle/politics.1.one.html>. (Accessed 14 May 2006).

opinions. "Things, like the plants, which merely have life, are all alike for animals, and all animals are for man"[46] -- "it matters not how man behaves to animals, because God has subjected all things to man's power."[47] That the pope could announce in 1984 "it is certain that animals are intended for man's use"[48] indicates that this view still holds sway in at least some portions of the Western world.

It was easy in all three of these world-views (the Greco-Roman, the Jewish, and the Christian) to deny animals intrinsic value because humans were considered to be utterly distinguished from animals by possessing a fully-functioning soul. Animals had, at best, souls of an inferior sort. According to Aristotle, for example, plants have a "vegetative soul" and animals a "sensitive soul," but only humans have a "rational soul," which he considered the most significant kind, because it is what allows moral choices, and therefor the potential to choose for good, which is the essence of humanity. Jewish commentary was similarly dismissive. "An animal is not mindful of what it does . . . an animal is ignorant of what leads to death . . . an animal is only destined for slaughter and has no portion in the world to come."[49] Some, such as mediaeval theologian Solomon Ibn Gabriel, considered animals lacking souls entirely. "[God] hast formed man from a pinch of clay and breathed into him a soul, and didst impart to him the spirit of wisdom whereby man is distinguished from the beast."[50]

Those in the Judeo-Christian tradition who did advocate sensitivity to animals did

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[46] Thomas Aquinas, "Summa Theologica" II, II, Q. 64 (13th C.), reprinted by the Christian Classics Ethereal Library at Calvin College (11 Jan., 1998), <http://www.ccel.org/ccel/aquinas/summa>. (Accessed 14 May, 2006).

[47] Ibid., Q. 102, art. 6.

[48] Pope John Paul II, cited in Rod Preece, *Animals and Nature: Cultural Myths, Cultural Realities* (Vancouver: UBC Press, 1999), 123.

[49] Midrash Eccles 3:18, *sifrei Deut. 306.*

[50] Keter Malhut, cited in Elijah Judah Schochet, *Animal Life in Jewish Tradition: Attitudes and Relationships* (NY: Ktav Publishing House, 1984), 209.

so more because it was good for humans than because it ultimately mattered. For example, the following Mitzvoth (good deeds in the Jewish tradition):

> 160. Not to take the mother-bird with the young
> 161. To set the mother-bird free when taking the nest

are explained thus by 13th century commentator Nachmanides:

> It was not a matter of God's mercy extending to the bird's nest or the dam and its young, since his mercies did not extend so far into animal life as to prevent us from accomplishing our needs with them, for, if so, He would have forbidden slaughter altogether. But the reason for the prohibition is to teach us the trait of compassion and that we should not be cruel, for cruelty proliferates in one's soul . . .[51]

His contemporary Thomas Aquinas explained biblical passages advocating kindness towards animals in the same way. "If in Holy Scripture are found some injunctions forbidding the infliction of some cruelty towards brute animals . . . this is . . . for removing a man's mind from exercising cruelty towards other men . . . ."[52] Abuse of animals was further to be avoided in case it might lead to "a temporal loss for some man."[53]

In the portion of the world dominated by this Greek and Judeo-Christian thinking, where animals are placed on earth solely for the benefit of humans, where animals are possessed of an inferior soul, if a soul at all, and where considerate treatment of animals is only for the moral betterment of humans, it is no surprise that animal creative or aesthetic sense was not considered. The odd story does involve animals as bearers of the aesthetic -- notably, a dove is said to have dictated chant to sixth century pope St. Gregory (thus creating the first "Gregorian Chant") -- but here the dove was acting as an agent of God, singing God's message, not as an ordinary bird, singing its own message.[54] The bird is a romanticized, mystical, symbolic being, lacking entirely its own voice or individuality.

[51] Nachmanides, commentary on Deuteronomy 22:6.

[52] Thomas Aquinas, commentary on Deuteronomy 25.

[53] Ibid.

[54] Martinelli, 174.

Likewise, appreciation of the sounds of the natural world was an appreciation of the fact that the cosmos, or God, had designed everything so perfectly that it was even pleasing to people, rather than of any individual animal's ability to create beauty.

The rise of scientific and extra-religious philosophical thinking in the West did little to improve animals' position in the world. René Descartes (1596-1650), influenced by the above-mentioned Judeo-Christian attitudes, developed his theory of "mechanism," according to which animals are essentially machines, or "automata," which, lacking a human soul, are unable to think, feel, or perceive, and thus to be denied any subjectivity.

> . . . when I investigate what is most probable in this matter, I see no argument for animals having thoughts . . . it is more probable that worms and flies and caterpillars move mechanically than that they all [animals] have immortal souls . . .
> . . . it seems reasonable, since art copies nature, and men can make various automata which move without thought, that nature should produce its own automata, much more splendid than artificial ones . . .[55]

He scorned those who disagreed: "The greatest of all the prejudices we have retained from our infancy is that of believing that the beasts think."[56] Cartesian mechanism has been particularly influential over animal-related thought and ethics for the past four centuries, perhaps because it was a form of "scientific" thinking which came into conflict neither with the prevailing Christian doctrine about soul nor with common exploitative uses of animals. Mechanism conveniently allows humans to use animals at will, and has provided the theoretical framework which underlies many of the more extreme experimental and farming practices. Increasing urbanization perhaps contributed to the spread of Cartesian ideas. Whereas rural people would have had daily interaction with animals, and thus would constantly be reminded of traits that people and animals have in common, such as protectiveness towards young, ability to express affection, or fear of pain or danger, and would have to balance these observations with their desire to use or abuse animals, city

[55] René Descartes, Letter to Henry More, cited in David M. Rosenthal, *The Nature of Mind* (New York: Oxford University Press, 1991), 37.

[56] Descartes (1589), cited in Barbara Orlans, *In The Name of Science: Issues in Responsible Animal Experimentation* (New York: Oxford University Press, 1996), 4.

people saw few (aside from horses, dogs, and cats) and could more easily regard animals with disinterested detachment (or sometimes with unrealistic sentimentality and personification), as entirely "other." A description of mechanism in the time of Descartes comes from an observer at a Jansenist seminary in France. "[Scientists] administered beatings to the dogs with perfect indifference and made fun of those who pitied the creatures as if they felt pain. They said the animals were clocks; that the cries they emitted when struck were only the noise of a little spring that had been touched, but that the whole body was without feeling."[57]

A century and a half later, the lot of animals had improved little. Influential German philosopher Immanuel Kant (1724-1804), like Aristotle, believed humans to be distinguished from other animals by possession of reason, and wrote that animals, "whose existence depends not on our will, but on nature, have nevertheless, if they are not rational beings, only a relative value as means and are therefore called things"[58] In this anthropocentric system of ethics, humans are free to use other animals as they please: "So far as animals are concerned we have no direct duties. Animals are not self-conscious and are there merely as a means to an end. The end is man."[59] Like earlier Judeo-Christian writers, Kant believed that gratuitous cruelty to animals should be avoided not because of human duties towards the animals themselves, but because "he who is cruel to animals becomes hard in dealings with men," while "tender feelings towards dumb animals develop humane feelings towards mankind."[60]

A relatively recent approach to understanding animals is behaviourism, as developed by Russian psychologist and physician Ivan Pavlov (1849-1936), and later the

[57] Cited in Peter Singer, *Animal Liberation: A New Ethics for Our Treatment of Animals* (New York: Random House, 1975), 101-102.

[58] Immanuel Kant, "Groundings," cited in Steven M. Cahn and Peter Markie, *Ethics: History, Theory, and Contemporary Issues* (New York: Oxford University Press, 1998), 428.

[59] Kant, "Lecture on Ethics," cited in Preece, *Animals and Nature*, 123.

[60] Kant, "Lecture on Ethics," ibid., 239-240.

Americans John B. Watson (1878-1958) and B. F. Skinner (1904-1990). Behaviourism concentrates on the role of "conditioning" -- being trained to respond to a given stimulus in a fixed way -- rather than real thinking in determining animal actions. Only quantifiable external influences and reactions are evaluated: the internal is entirely disregarded because it cannot be observed or proved. Behaviourists gather information primarily from strictly controlled lab experiments, and often regarded different species as relatively interchangeable for experimental purposes.[61] The early behaviourists in fact understood human behaviour in the same way as animal behaviour, and one of the initial goals of behaviourist experimentation on animals was to shed light on human behaviour, but it is easy to apply the behaviourist outlook to animals and not to ourselves, given the strong subjective nature of our experience.[62] Cultural primatologist Frans de Waal writes of how "people untrained in the behaviorist doctrine were prepared to buy its premises in relation to animals but definitely not in relation to themselves."[63] This led to "a strategic withdrawal" on the part of behaviorists, in which they maintained (or propagated) their behaviourist views only with respect to non-human animals. Little by little, they "abandoned their unified theory and increasingly began to treat animals and people as different.[64] Whereas

[61] Frans de Waal, *The Ape and the Sushi Master: Cultural Reflections of a Primatologist* (New York: Basic Books, 2001), 56-57.

[62] Behaviourists also make a similar mistake to solipsists, in assuming that because something, in this case the internal life of animals (and humans), cannot be proved to exist, that is sufficient proof that it does not exist. A nifty refutation of this solipsist mistake is cited by James King in "Personality and the happiness of the chimpanzee" (Francine L. Dolins, *Attitudes to Animals: Views in Animal Welfare* [Cambridge: Cambridge University Press, 1999], 101.)

> Two hunters, Ntino and Iko were out strolling one day through the forest. They came across some chimpanzees who were playing in the branches of a mulemba tree.
> 'Look at the chimpanzees,' Ntino said. 'Look how they swing so easily through the branches. This is the happiness of a chimpanzee.'
> 'How can you know?' Iko said. 'You are not a chimpanzee. How can you know if it is happy or not?'
> 'You are not me,' Ntino said. 'How do you know that I do not know the happiness of the chimpanzee?' (William Boyd, Brazzaville Beach)

[63] de Waal, 50.

[64] Behaviourism has not disappeared from our attempts to understand humans, but has become the domain primarily of clinical psychologists rather than research scientists and theorists. Cognitive therapy and the other various forms of behaviour therapy are all highly influenced by behaviourism.

the human species was granted a mental life (although one not nearly as influential as most of us think it is), animals were kept at the level of stimulus-response machines."[65]

The simplicity of the behaviourist explanation made it appealing to many. However, it can lead scientists to overlook complexities that less ideologically biased observation would bring to light. Even in cases where the behaviourist understanding seems adequate, it may not tell the complete story. According to Hartshorne, for example: ". . . in selecting for behavior, evolution may be indirectly selecting for modes of feeling that promote such behavior."[66] This would apply equally well to "conditioning": what seems like a conditioned response might, for all we know, be mediated by emotion or thought, rather than purely reflexive conditioning.

Ethology, as developed by Konrad Lorenz (1903-1989) and Niko Tinbergen (1907-1988) in the middle part of the twentieth century, was concerned with interpreting animal behaviour at a somewhat deeper level than behaviourism, and as such involved careful field studies, and recognition of each species as unique. Ethology ascribes animals' behaviours primarily to instinct, or "fixed action patterns," however, rather than to thought or choice. Though each species is granted its own, unique set of instincts and characteristics, individual animals are still seen as governed almost entirely by their species-dictated biology.

Although Charles Darwin (1809-1882) himself had believed that animals possessed emotion and reason, his successors and popularizers often focused only on the rigidly reductionist "survival-of-the-fittest" aspect of his evolutionary theory, ignoring both Darwin's emphasis on the strong connections between all living creatures, and his recognition of the subtleties that mediated between the rigorous mathematics of genetic reproduction and the struggle to survive, and the more flexible, interactive relationship

[65] de Waal, 51.

[66] Hartshorne, "Wisdom as Moderation," 108, cited in Daniel Dombrowski, *Hartshorne and the Metaphysics of Animal Rights* (Albany: State University of New York Press, l988), 121.

between living beings and their environment. The crude, "survival-of-the-fittest" understanding of Darwinism, sometimes termed "vulgar Darwinism," often appeals to the incompletely informed public, and may be used as justification to see animals as mere embodiments of natural selection, not as subjective entities.

The hardcore post-Darwinian sociobiologist approach, developed since the 1970's by Edward O. Wilson (b. 1929), Richard Dawkins (b. 1941), and others, would be to consider human and animal behaviour alike as highly influenced by genes which have been selected for because of their "survival value." Due to the polemical nature of the debate surrounding sociobiology, sociobiological views are often presented in exaggerated form (by both sociobiologists and anti-sociobiologists), suggesting that behaviour is controlled only by genes.[67] The lay public is prone to latch on to this hyperbolized interpretation of the sociobiologist claim, which is often distorted further by the media, and then to apply it only selectively. Because we experience our own emotions, thoughts, and desires so strongly it is easy for us to make the mistake of applying the reductionist sociobiological way of understanding, like the behaviourist viewpoint, to other animals (or to groups of humans), but not to ourselves. Science writer Stephen Budiansky takes a sociobiological approach towards animal behaviour: about dogs he writes "The degree to which seemingly complex behaviors are rigidly and genetically programmed is quite frightening at times -- frightening for what it suggests about motivation and free will, at least. "[68] But he makes joking acknowledgment of the tendency to selectively apply the sociobiologist outlook. After explaining away dogs' apparent intelligence and loyalty as nothing but genetically selected ways of manipulating people to get food, he writes "Of course, I should hasten to

[67] Sociobiology has been further tarnished by its possible association with social Darwinism and eugenics. For a brief overview of some of the controversies surrounding E. O. Wilson and sociobiology, see Helen Fisher, "'Wilson,' They Said 'You're All Wet!'," review of E. O. Wilson's "Naturalist," *The New York Times* (16 October, 1994), reprinted on <http://www.nytimes.com/books/98/12/06/specials/wilson-naturalist.html>. (Accessed 25 May 2006). I've never understood the vitriolic genes vs. environment or nature vs. nurture type of debates, because it seems obvious to me that both are essential to making us (that is, any living creatures) what we are, and that neither can operate independently of the other.

[68] Stephen Budiansky, "The Truth About Dogs," *The Atlantic Monthly* (July 1999), 46.

add, my dog really is smart. She also loves me."[69]

Interestingly, those most strongly opposed to sociobiology may also be unlikely to consider animals as potentially intelligent, creative, aware, or subjective beings, since arguments against sociobiology are often based on a desire to separate humans from the animals. Sociobiology is often criticized for "reducing humans to the level of animals," while the assumption that to look at animals and humans in the same terms would necessarily be lowering humans is left unchallenged. Many anti-sociobiologists hold the view that while genetics may explain animal behaviour, humans exist in another realm, only minimally affected by their biological nature. According to John Bonner,

> If one looks at the criticisms of sociobiology by anthropologists and social scientists, they are almost entirely related to the idea that a reductionist approach will not be useful in the social sciences. The study of human societies occupies a separate hierarchical level and must be considered on its own terms and not in terms of the biological level lying below. In their view, human societies are too complex, too different from anything found in the animal world to be interpreted in any meaningful way by biological analysis.[70]

Our tendency to regard ourselves as separate from other animals is often reflected in popular understandings of our place in the "tree of life." Though the scientific "tree of life" model no longer puts humans at the top (of earthly beings) as did its predecessor, the Aristotelian "Great Chain of life," or "*Scalae Naturae*," and in fact shows the interrelatedness of all beings, it can be misunderstood to privilege humans by the incompletely-informed public. Humans are often perceived as the perfection of the evolutionary chain, not as one of myriad and diverse species, each uniquely suited to its life and environment. Standard terminology such as "higher" and "lower" animals is easily interpreted as a value judgment (even when not consciously intended as such), and reinforces the notion of human superiority.

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[69] Stephen Budiansky, "Dog's Best Friend," *The New York Times*, 5 December 2002, sec. A, 43.

[70] Bonner, 7.

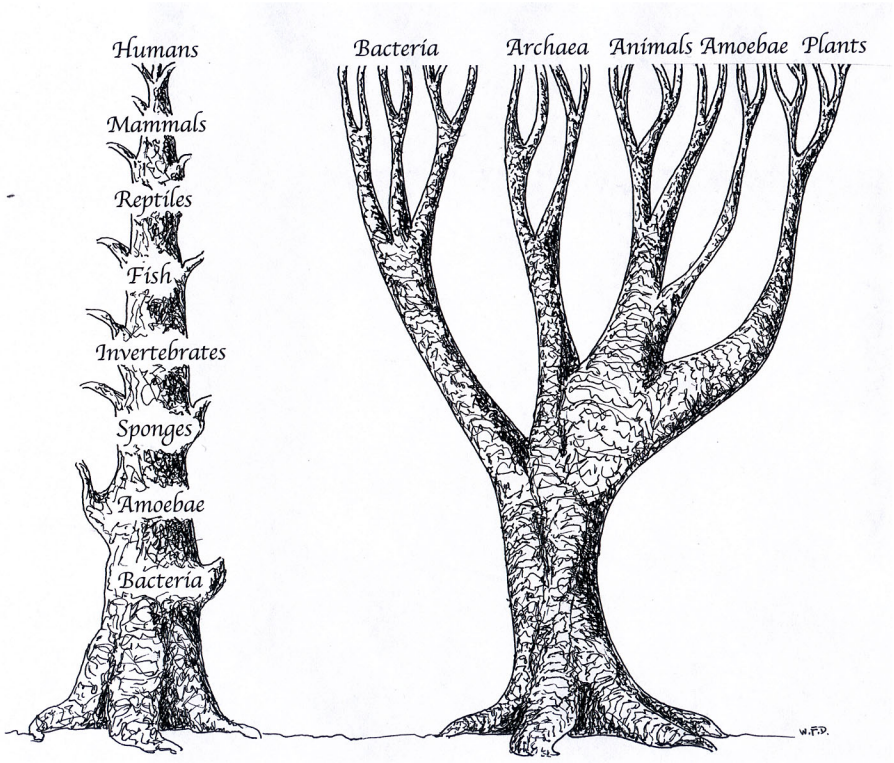

Fig. 1. A comparison of the Aristotelian "great chain of life," which placed humans at the top, with the more modern "tree of life," in which all species are equal. (Drawing by W. Ford Doolittle, department of Biochemistry, Dalhousie University)

Because of the widespread discomfort in linking ourselves too closely with animals, "anthropomorphism," the attribution of human characteristics to the non-human, is often feared far out of proportion to its prevalence or its potential for damage.[71] Accusations of "anthropomorphism" are often used to short-circuit any discussion which

[71] I am referring here to the intellectually serious form of anthropomorphism -- identifying traits in animals that we recognize also in ourselves -- rather than to the clearly unscientific form of "talking animal" anthropomorphism that so pervades our culture. "Talking animal" anthropomorphism ranges from the harmlessly cute to the offensive, but nowhere has anything to do with serious study or understanding of animals. For further reading on anthropomorphism, please see "The Myth of Anthropomorphism" by John A. Fisher (pp. 96-116 in Marc Bekoff and Dale Jamieson, eds., *Interpretation and Explanation in the Study of Animal Behaviour* (Boulder, Colorado: Westview Press, 1990).

challenges mechanistic or behaviourist assumptions. Single instances of mistaken anthropomorphism, such as the classic example of thinking that a basset hound is sad because it has droopy eyes and looks sad by human standards, are taken as evidence that comparisons between animals and humans are always wrong, when in fact there is nothing mistaken about comparing non-human animals and humans when similarities do exist. Regarding the issue of animal thought, for example, cognitive ethologist Colin Allen writes:

> . . . the charge of "anthropomorphism" is question-begging, for the attribution of human-like mental qualities to nonhumans is incorrect only if they genuinely lack those qualities. The question of whether animals lack the mental properties is precisely what is at issue, so it can't simply be assumed that it is unreasonably anthropomorphic to consider the question of animal minds.[72]

Bonner likewise recognizes the rigid avoidance of anthropomorphism as nothing more than a reflection of scientists' biases. "Those interested in the similarities between man and animal have no fear of anthropomorphisms, while those who see man as special in some major way feel that our whole man-oriented language is dangerous and misleading when applied to animals. Here is a clear instance where human culture interferes with our science."[73] Bonner notes that a certain amount of anthropomorphism is in fact inevitable. Even if we scrupulously avoid any conscious anthropomorphisms, ". . . this danger exists no matter what terms we use. It comes down to the very core of the problem of objectivity: we see the world through our own eyes, our own minds."[74] If we think that by avoiding explicit anthropomorphism we are being completely objective, we are deluding ourselves.

Scientists often go to such great lengths to avoid accusations of anthropomorphism that they violate deeper scientific principles, such as that of "intellectual parsimony," or Ockham's razor, choosing the simplest reasonable explanation for observed behaviour. If,

[72] Allen, "Philosophy of Cognitive Ethology."

[73] Bonner, 9 - 10.

[74] Ibid., 10.

for example, a particular animal has relatively similar brain and neurological structure to a human, is in a situation that would cause a human a particular emotion, and is behaving as if it, too, has that emotion, it would be more parsimonious to suppose that the animal and the human are experiencing a similar emotion than that there are two entirely different systems at work, which mimic each other, but have nothing in common. The yelping of a dog being beaten can more parsimoniously, and therefore more plausibly, be explained as an expression of pain than as the "noise of a little spring"[75], as some Cartesians would have had it, since dogs and humans are both mammals with similar nervous systems and brain structures, and since we, too, would yelp with pain if struck. Parsimony, of course, isn't enough to prove an interpretation or theory, but in absence of evidence that supports a more complicated theory, the parsimonious explanation is to be preferred.

Despite the relative ease with which we empathize with animals in situations such as the above, some consider this a likelier source of misunderstanding than a way of deepening understanding. Cognitive philosopher Daniel Dennett, for example, writes that "It is in fact ridiculously easy to induce powerful intuitions of not just sentience but full-blown consciousness (ripe with malevolence or curiosity or friendship) by exposing people to quite simple robots made to move in familiar mammalian ways at mammalian speeds."[76] He correctly recognizes that superficial behavioural similarity may in itself be meaningless, but neglects to point out that between humans and other animals (especially mammals, and particularly primates) there are highly similar biological structures and mechanisms, and thus it makes sense to investigate whether there are also psychological and emotional similarities, while between humans and robots (at least any robots we are currently capable of constructing) there are not. Naturalist Alexander Skutch writes of the ill-founded prejudice against comparing animal and human psychology:

> Without being disparagingly accused of anthropomorphism, the anatomist can apply to the bones in a bird's wing the same names given to those in a human arm.

[75] Cited in Singer, 102.

[76] Daniel Dennett, 1995, cited in Emily Eaken, "No Longer Alone: The Scientist who Dared to Say Animals Think," *New York Times*, 3 February 2001, sec. B, p. 11.

> Indeed, the structural similarities of all terrestrial vertebrates, and the anatomical features they share with fishes, are among the strongest supports of the theory of evolution. It would seem that animals so similar to humans anatomically might also, in some measure, resemble them psychically. It is not evident why anthropomorphism, respectable in comparative anatomy, should be so rigidly excluded from comparative psychology.[77]

An irony symbolic of our tendency to allow anthropomorphism only selectively is that we believe animal medical experimentation will be useful because animals are so similar to ourselves that medical knowledge gained on them will be useful for us, but we justify depriving animals of their lives, liberty, and comfort because we believe them to be so different from ourselves that they do not really feel pain or have self-interest. Thus, we may sometimes find ourselves in the strange position of feeling that it is okay to test a pain medication on a rat because, we believe, it does not really feel pain as we do.

In discussions discouraging anthropomorphism, warnings about the "Clever Hans" phenomenon are given repeatedly.[78] These typically fail to note that although Clever Hans of course could not solve complicated arithmetic questions, and that to assume that he could was indeed false anthropomorphizing, he was in fact highly empathetic to and perceptive of his human observers. Empathy and perception, of course, are human skills just as much as ability to do arithmetic (and, arguably, more basic human skills, since all normal humans employ empathy and perception in their interactions with other humans, but not all humans do or need to do complex arithmetic): thus he did share significant abilities with the humans surrounding him, just not those skills that the humans initially thought he shared.

Rigid avoidance of anthropomorphism is often mistaken for intellectual

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[77] Alexander Skutch, *The Minds of Birds*, (College Station, Texas: Texas A&M Press), xvi.

[78] "Clever Hans" was a horse who lived in Germany in the beginning of the twentieth century. He was reported to be able to solve complicated math equations, the answers to which he tapped out with his foot. For a long time many, including his owner, believed Hans really was able to do the math. Psychologist Oskar Pfungst, however, discovered that Clever Hans would only give the right answer if he was interrogated by someone who themselves knew the answer. What Clever Hans had really been doing, rather than solving complicated math problems, was scrutinizing his questioners for subtle signs that he had reached the right number of foot taps. (Martinelli, 90.)

sophistication, even when it reveals lack of rigorous thought. Typical humanistic thought informed by a dogmatically anti-anthropomorphistic attitude, for example, is the following, by philosopher Peter Kivy:

> Now there is no harm in saying that we can, at times, hear the noises birds make *as* music -- *as if* they were music... However as soon as we take being able to hear bird noises *as* music to imply that therefore they *are* music, we are saying that they *literally* have syntactic properties; and *that* is a conceptual impossibility. A natural object *cannot*, as a matter of logic, have syntactic properties, whether it is a bird's "song" or anything else (unless you include human language and thought among the stock of "natural objects"). The winds and tides may, by chance, produce on the beach an arrangement of pebbles that looks like letters spelling out a well-formed, grammatically correct English sentence. But it cannot be one: it cannot possess the syntactic and semantic properties that English sentences possess. Only language users can, under the proper circumstances, impart to "objects" real syntactic and semantic properties. However much bird "songs" may sound like music, they cannot *be* music -- unless, of course, we ascribe to birds a mental life comparable to our own, which few of us will want to do.[79]

Kivy not only makes the illogical implication that the action of a bird's brain is more like that of the wind and tides than like that of a human mind, but thinks that this is so obvious that it needs no explanation, and that other people will necessarily believe the same. While birds and humans certainly have different minds and worlds, to take as a given that the workings of a bird's brain are closer to those of inanimate nature than to those of another animal mind, the human, seems at the very least empirically unsound.

A string of claims for human uniqueness, too, is part of the history of our attempts to distance ourselves from other animals. In addition to the above-mentioned claims, that only humans have souls (as believed by Aristotle, some of the early church fathers, and Descartes); that only humans are rational (espoused by Aristotle and Kant); and that only humans can feel or have subjective experience (a corollary of a dualistic Cartesian mechanism which grants humans but not animals souls, and then assumes that only those with a soul can feel or experience, since the body is purely mechanical); are claims such as only humans have language; humans are the only tool users; humans are uniquely

[79] Kivy, Peter, *Music Alone* (Ithaca, NY: Cornell University Press, 1990), 24.

dependent on culture and learning for survival, while all other animals rely only on instinct; only humans are self-aware; and, though non-humans might feel low level emotions such as pain or pleasure, only humans can experience deeper or more complex emotions.

Research which grew out of these mindsets tended to be highly reductionist, and was more likely to involve invasive experimentation in laboratory settings devoid of stimulation than observations of animals' behaviours and capabilities. With this the prevailing type of research, there was of course little room to examine the potentially aesthetic in animal songs. Even if the researchers were curious about the possibility of songs having an aesthetic component (though this seems unlikely), this would hardly be the best circumstances under which to explore this.

Fortunately, dualism is not the only filter through which humans have tried to understand other animals. In the following chapter, I survey the history of thinkers who have sought to emphasize our similarity with rather than our difference from other animals. I then examine some of the more recently held human uniqueness claims (most prominent among them that only humans use language, and that only humans are dependent upon culture) to see whether they do in fact reliably distinguish our species.

CHAPTER 2

The Human/Animal Relationship: Continuity

History of continuity

Though the various dualistic approaches towards understanding animals considered in the previous chapter have tended to prevail in mainstream Western thought, there is a parallel, if less influential, stream of thinkers who have championed the intrinsic worth of animals, and have emphasized the continuity between living creatures of all species. Such thinking, too, goes back to the time of the Greeks. Hippocrates, in the fifth century BCE, for example, believed that "The soul is the same in all living creatures, although the body of each is different." Pythagoras, similarly, is purported to have said "the animals share with us the privilege of having a soul." He and many other Greek philosophers in fact believed in metempsychosis -- the transmigration of human souls into animals or animals' into humans after death. One of the remaining fragments by Empedocles, also in the fifth century BCE, testifies to this belief:

> For I was once already boy and girl
> Thicket and bird, and mute fish in the waves.
> All things doth Nature change, enwrapping souls
> In unfamiliar tunics of the flesh.[80]

This belief in transmigration, while not shared by contemporaneous Jewish thinkers, was to find its way into mediaeval Kabalistic mysticism, and later into Hassidic mythology. Typically in both Kabalistic and Hassidic thought, humans were reincarnated as animals only as punishment for some wrongdoing in a previous lifetime. A dead father,

[80] Empedocles, cited and translated in Schochet, 257.

guilty of a misdeed, comes in a dream to warn his rabbi son, who has just bought a fish for Shabbat "Know that I was reincarnated as that fish. . . . Be careful, my son, how you eat this fish."[81] Clearly this is different than recognizing animal souls as valuable in their own right, simply as animal souls, but it does imply an interconnectedness between animals and humans, and suggests that one should treat each animal as if it were potentially ensouled.

Mainstream Christian theologies never accepted the idea of transmigration of souls, but some of the founding figures of the church believed animals to be valuable in their own right. St. Basil, fourth century Bishop of Caesarea (part of modern-day Israel) wrote "O God enlarge within us the sense of fellowship with all living things, our brothers the animals, to whom thou hast given the earth as their home in common with us . . . May we realize that they live not for us alone but for themselves and for Thee and that they love the sweetness of life."[82] And of course St. Francis of Assisi, in the 14th Century, was a strong advocate in favour of kindness towards animals. "One who undertakes holy obedience is subject and submissive to all persons in the world and not to man only but even to all beasts and wild animals. . ."[83]

One of the primary modern exponents of animal integrity was philosopher John Locke (1632-1704). While he believed that "it is the *understanding* that sets man above the rest of sensible beings,"[84] he in fact accorded animals far more intrinsic worth than many of his contemporaries. Locke recognized thought and memory in non-human animals, in because of his observations of birds singing.

> This faculty of laying up and retaining the ideas that are brought into mind, several other animals seem to have to a great degree, as well as man. For to pass by other

[81] Shivhei haBesht, cited in Schochet, 252.

[82] St. Basil, cited in Michael. W. Fox, *The Boundless Circle: Caring for Creatures and Creation* (Wheaton, IL: Quest Books, 1996), 50.

[83] St. Francis, cited in Fox, 75.

[84] John Locke, *An Essay Concerning Human Understanding* in two volumes, annotated Alexander Campbell Fraser (1690; New York: Dover, 1959), vol. 1, 25.

> instances, birds learning of tunes, and the endeavours one may observe in them to hit the notes right, put it past doubt with me, that they have perception, and retain ideas in their memories and use them for patterns.[85]

Although he believed that animal thought was typically simpler than human thought, he recognized that this is not always the case:

> Take one in whom decrepit old age has blotted out the memory of his past knowledge . . . How far such an one . . . is in his knowledge and intellectual faculties above the condition of a cockle or an oyster, I leave to be considered. And if a man had passed sixty years in such a state, as it is possible he might, as well as three days, I wonder what difference there would be, in any intellectual perfections, between him and the lowest degree of animals.[86]

Most significantly, Locke believed that there was no absolute line dividing humans and animals. Rather:

> Of finite spirits there are probably numberless species, in a continuous series or gradation. . . All quite down from us the descent is by easy steps, and a continued series of things, that in each remove differ very little one from the other. There are fishes that have wings, and are not strangers to the airy region: and there are some birds that are inhabitants of the water, whose blood is cold as fishes, and their flesh so like in taste that the scrupulous are allowed them on fish-days. There are animals so near of kin both to birds and beasts that they are in the middle between both: amphibious animals link the terrestrial and aquatic together; seals live at land and sea, and porpoises have the warm blood and entrails of a hog; not to mention what is confidently reported of mermaids, or sea-men. There are some brutes that seem to have as much knowledge and reason as some that are called men: and the animal and vegetable kingdoms are so nearly joined, that, if you will take the lowest of one and the highest of the other, there will scarce be perceived any great difference between them: and so on, till we come to the lowest and the most inorganical parts of matter, we shall find everywhere that the several species are linked together, and differ but in almost insensible degrees. [87]

That some of his zoological observations were a little questionable in no way negates the world view behind this passage. Humans are still at the top, but not considered something absolutely other as in so many previous philosophies.

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[85] Ibid., 200.

[86] Ibid., 191.

[87] John Locke, *An Essay Concerning Human Understanding* in two volumes, vol. 2, 68.

Numerous scientists and thinkers since Locke have echoed his belief in the continuity between animals and people. Botanist Carl Linnaeus (1707-1778), despite his clearly stated disregard for non-humans, for example, wrote "I could not discover the difference between man and orangutan . . . It is remarkable that the stupidest ape differs so little from the wisest man, that the surveyor of nature has yet to be found who can draw the lines between them."[88]

Scottish philosopher David Hume (1711-1786), like Locke, saw animal intellectual abilities as self-evident.

> 'Tis from the resemblance of the external actions of animals to those we ourselves perform, that we judge their internal likewise to resemble ours; and the same principle of reasoning, carry'd one step farther, will makes us conclude that since our internal actions resemble each other, the causes, from which they are deriv'd, must also be resembling. When any hypothesis, therefor, is advanc'd to explain a mental operation, which is common to men and beasts, we must apply the same hypothesis to both.[89]

He considered arguments against this view to be so insubstantial as to be unworthy of serious debate. "Next to the ridicule of denying an evident truth, is that of taking much pains to defend it; and no truth appears to be more evident than that beasts are endowed with thought and reason as well as man. The arguments are in this case so obvious that they never escape the most stupid and ignorant."[90]

A brief period of scientific Romanticism, which featured a rich cross-pollination of metaphorical and scientific ways of interpreting the world, flourished in the late eighteenth and early nineteenth centuries in Europe and North America. Metaphysical beliefs such as transmigration of souls were given scientific explanations. According to Erasmus Darwin (1731-1802, grandfather of Charles), for example, the Pythagorean belief

[88] Carolus Linnaeus (1735), cited in Preece, *Animals and Nature*, 149.

[89] David Hume, *A Treatise of Human Nature*, (1739: reprinted Harmondsworth, UK: Penguin, 1969), 226, cited in de Waal, 70-71.

[90] Ibid.

in metempsychosis stemmed from the organic fact of "perpetual transmigration of matter from one body to another during their lives as well as after their deaths."[91] The readily perceived commonality of matter between all living creatures made it easily acceptable to find common traits between human and non-human animals. Many believed that animals were ". . . endowed with most of our faculties & pashions & . . . intellect."[92] Romantic scientists perceived all of nature to be motivated by desires and passions (as opposed to mechanistic biological necessity), and believed that each animal was "adapted for procuring its particular pleasures."[93] The idea of animals making sounds for their own purposes thus fit well into this world view, and slowly began to supplant the previously held notions that animal songs were created either by animals to praise god or by god to delight and entertain humans (or, since the time of Descartes, that they were just the meaningless by-product of the animal's mechanical inner workings.)

Charles Darwin, writing in the mid-nineteenth century, immediately following the period of scientific Romanticism, was explicitly interested in issues of animal intelligence and feeling, as shown by his 1871 publication "The Descent of Man and Selection in Relation to Sex."

> It has, I think, now been shown that man and the higher animals, especially the Primates, have some few instincts in common. All have the same senses, intuitions and sensations -- similar passions, affections, and emotions, even the more complex ones; they feel wonder and curiosity; they possess the same faculties of imitation, attention, memory, imagination, and reason, though in very different degrees.[94]

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[91] Erasmus Darwin (191 n.) cited on Ashton Nichols, *The Loves of Plants and Animals: Romantic Science and the Pleasures of Nature,* Romantic Circles Praxis Series, ed. Orrin Wang <www.rc.umd.edu/praxis/ecology/nichols/nichols.html>. (Accessed 19 May, 2006).

[92] Ibid.

[93] Ibid.

[94] Charles Darwin*, Descent of Man and Selection in Relation to Sex* (London: Murray, 1871; reprinted USA: reprinted online at <http://www.zoo.uib.no/classics/descent.html>.), chapter 3 (Accessed 19 May, 2006).

Even more significant to the present investigation, Darwin believed that animals not only produce sounds which seem beautiful or musical to us, but actually have their own aesthetic awareness: ". . . animals have some sense of beauty, although they admire widely different objects."[95] Darwin's contemporary and popularizer T. H. Huxley (1825-1895), though often more prone to a narrow, survival-of-the-fittest kind of hyper-Darwinism, similarly believed that "man is, in substance and in structure, one with the brutes. . . ."[96]

Less known in North America and Western Europe, the early 20th century Estonian biologist Jakob von Uexküll's "Umwelt" theory recognizes that each animal perceives its surroundings ("Merkwelt") according to its unique needs and interactions ("Wirkwelt"). In his 1934 paper *A Stroll through the Worlds of Animals and Men: A Picture Book of Invisible Worlds* Uexküll suggested that his readers should, upon walking through a meadow:

> . . . first blow, in fancy, a soap bubble around each creature to represent its own world, filled with the perceptions which it alone knows. When we ourselves then step into one of these bubbles, the familiar meadow is transformed. Many of its colorful features disappear, others no longer belong together but appear in new relationships. A new world comes into being. Through the bubble we see the world of the burrowing worm, of the butterfly, or of the field mouse; the world as it appears to the animals themselves, not as it appears to us. This we may call the phenomenal world or the self-world of the animal.[97]

Semiotician Winfried Nöth describes it thus: "Umwelt. . . is not any objective physical or biological environment of an organism, but a subjective world consisting of the organism's specific perceptual field or world (Merkwelt) and the sphere of its practical interaction, the

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[95] Darwin, *Descent of Man*, chapter 4.

[96] Cited in Peter Singer, *Animal Liberation*, 231.

[97] Jakob von Uexküll, "A Stroll through the Worlds of Animals and Men: A Picture Book of Invisible Worlds," *Instinctive Behavior: The Development of a Modern Concept* (1934; reprint, ed. and trans. Claire H. Schille, New York: International Universities Press, 1957), 5-80. I am grateful to Dario Martinelli for introducing me to the work of Uexküll.

operational field (Wirkwelt)."[98] A simple example of applying Umwelt theory would be to recognize that what for us is a table may be, for a termite, "food," for a cat, a place to get a better view of things, and for bacteria, the entire universe. Umwelt theory is helpful for developing an understanding of animals that neither falsely anthropomorphizes them nor denies them subjectivity, and has become a useful theoretical framework for much contemporary animal study.[99]

While many scientists who studied animals in the end of the nineteenth century and throughout the twentieth followed the mechanist or behaviourist traditions, (rather than the more inclusive approaches suggested by the Romantic scientists, Darwin, or Uexküll), there does exist a strong and continuous tradition of naturalists who were quite willing to credit animals with sentience, intelligence, self-determination, and creativity. Among these are such authors as Len Howard, Theodore Xenophon Barber, W. H. Hudson, Charles Witchell, and Alexander Skutch. Writing in the late nineteenth century, Witchell believed birds could sing as an expression of joy, both present: "There is no reason why we should not credit birds with the possession of a sense of pleasure in the aspect of their surroundings";[100] and future: "The stimulus which induces birds to sing particularly at dawn may be the same as that which leads them to the same exercise in the rain -- the pleasure of of anticipating approaching incidents . . . ."[101] His contemporary, Hudson, readily compared animal and human aesthetic activity: "There are human dances in which one person performs at a time, the rest of the company looking on; and some birds in widely separated genera have dances of the same kind."[102] Naturalist writing ranges from the casually anecdotal to the keenly observed and brilliant. Removed slightly from mainstream ornithologists and biologists, these bird- and nature-loving naturalists are free to report

[98] Winfried Nöth, *Handbook of Semiotics* (Bloomington: Indiana University Press, 1990), 158.

[99] Martinelli and de Waal are among those influenced by Uexküll.

[100] Charles A. Witchell, *The Evolution of Birdsong* (London: Adam and Charles Black, 1896), 65.

[101] Ibid., 62.

[102] W. H. Hudson, cited in Witchell, 67.

what they observe and to propose new theories without immediately having to conform their observations to the more rigid scientific molds.

The animal rights movement began gathering strength in the early 1970's, following on the heels of the unprecedentedly widespread successes of such social liberation movements as feminism and civil rights. The movement came rapidly to public attention in 1975 with the publication of Peter Singer's controversial "Animal Liberation." Influenced by the utilitarian philosopher Jeremy Bentham (1748-1832), famous for his words about animals "The question is not, Can they *reason*? nor, Can they *talk*? but, Can they *suffer*?," Singer based his argument for the fair treatment of animals on animals' desire to avoid pain and to continue living, rather than on their cognitive abilities or self-awareness. According to Singer, there was no reason, other than blatant speciesism (no more acceptable to him than racism or sexism), to *a priori* privilege human interests above those of other animals. However, Singer recognized that a certain basic level of cognition (he draws the line at mollusks) is essential for a creature to have a desire at all. Singer was one of the first to bring to a large audience the idea that animals as individuals were something to be considered, and whose needs and wants were to be compared with the human. Tom Regan, author of the equally influential *The Case for Animal Rights* (1983), who shares many of his attitudes towards animals with Singer, grounds his arguments for the necessity of treating animals well in his belief in the unalienable rights of all sentient beings, rather than in the ability of some animals to hold interests.

Those coming from an ecological perspective have also recently emphasized the need for humans to be more aware of their close relationship to other species. Eco-theologians such as Thomas Berry write of a sense of interconnectedness with all beings as an essential part of spirituality. Eco-anarchist Derrick Jensen writes of the necessity of rethinking our relationship with the living world not only for our physical survival, but also for our psychic integrity. Founder of "deep ecology," Arne Naess, writes of the inherent equality of all beings of whatever species (and even including non-living entities such as

mountains and rivers): each being has value not because of any internal properties such as sentience, intelligence, or ability to hold interests, but simply because it is.

Increasingly as these various more animal-friendly approaches have come to the fore, research into such issues as the thought processes, communicative abilities, emotions, potential for culture, and consciousness of non-human animals has become acceptable, if still controversial. Key in bringing these issues to scientific debate was Donald Griffin's *The Question of Animal Awareness*, first published in 1975. Griffin studied high-level apparently cognitive behaviour among animals, and argued that much that had traditionally been ascribed to "instinct" was in fact more parsimoniously explained by recognizing that animals had the ability to reason and problem-solve. Initially the subject of widespread ridicule and derision from the scientific community, Griffin's ideas, through the very controversy which surrounded them, were able to reach a large audience. Although still not accepted by all, Griffin's way of understanding animals seems gradually to be replacing the hardcore mechanism and behaviourism which previously held sway. A recent *New York Times Article*, for example, describes how zoos, partially under the influence of Griffin, have begun providing animals with toys and puzzles for mental enrichment, rather than providing only for their basic physical needs as they did previously.[103]

Discovering similarities

Language

As scientists and philosophers began to examine animals with fewer (or at least different) ideologically-based prejudices, many of the long-standing assumptions about animals began to prove unfounded. As de Waal writes, "Human uniqueness claims are a bit like advertisements for squirrel-proof bird feeders. I have yet to find a single feeder that stands up to the American grey squirrels in my backyard without being so convoluted that it

[103] Emily Eaken, "No Longer Alone: The Scientist Who Dared to Say Animals Think," *The New York Times*, 3 February 2001, Arts & Ideas Section.

scares off the birds."[104] Former gold standards of human uniqueness, such as language and tool-use, have been found not to be limited to our species at all, but to be widespread in the animal world.

Language, for example, is found in animals as unlike us as bees. In the 1920's the German naturalist Karl von Frisch began to research the kinetic behaviour of bees, which he was eventually able to decode, as described in his book "The Dance Language and Orientation of Bees," published in 1964. Upon arrival at the hive after a successful foraging expedition, the returning "scout" bee "dances" to the bees who have remained in the hive the details of where to find the food, and what kind is to be found. Information about water sources, resin, and potential nesting sites can be conveyed as well.[105] Initially many scientists, unable or unwilling to believe that bees could have a language, went to great lengths to disprove this finding, suggesting that the dance is perhaps merely reflective of the bees having travelled in a certain direction, and serves no communicative purpose. Even when a definitive experiment, devised by Princeton biologist Jim Gould in the 1970's proved that the bees did indeed communicate precise, flexible information through their dances -- they are able, for example, to correct for complicated detours in giving directions to their hive-mates -- many scientists tried ingenious methods to avoid accepting that bees could have "language." Some, for example, not finding any other grounds on which to reject bee language, suggested that language must be vocal, something which would certainly surprise people who communicate with American Sign Language or any of the many other highly effective non-vocal languages![106] Articles still appear from time to time by scientists attempting to discredit the idea that bees really communicate such complicated information, but have thus far been vigorously refuted.

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[104] de Waal, 362.

[105] James L. Gould and Carol Grant Gould, *The Animal Mind* (New York: Scientific American Library, 1994), 88-113.

[106] Personal conversation with Jim Gould.

Early attempts to teach human language to chimpanzees failed, again leading many scientists to pronounce that only humans had sufficient mental capacity for language. In fact chimpanzees have no problems with the comprehension of simple human language (just as humans can understand the rudiments, but not the subtleties of chimpanzee communication), but chimpanzees' larynxes do not have enough control to produce human-like speech. When Roger Fouts and Allen and Beatrice Gardner began to teach American Sign Language to chimpanzees in the 1970's, they discovered that chimpanzees were not only able to learn several hundred signs, but were able to use them to communicate symbolically. To be considered symbolic a communicative event must satisfy the following three criteria: it must be "representative of some other event," "freely created," and "transmitted by culture."[107] The sign language use of Fouts' and the Gardeners' chimpanzees was amply able to meet these requirements. The most famous of the chimpanzees, Washoe, for example, used the sign "dog" to refer to real dogs, pictures of dogs, and the sound of a dog barking. Unprompted, she combined the signs she knew to create new words: upon seeing a a swan for the first time she made the signs for "water" and "bird," and used the signs "water"-"candy"-"fruit" to describe watermelon.[108] Adult chimpanzees who had been trained in sign language were observed teaching it to their young and using it to communicate with them and, in one touching example, a young chimpanzee was observed trying to teach sign language to a cat![109] Similarly promising results have been achieved with gorillas (of whom one of the best known is Koko), and most recently with bonobos.

It is true that this simian use of human sign language lacks complicated syntax, but

[107] Pollio, 1974, cited in Griffin, *The Question of Animal Awareness*, 33.

[108] Fouts, *Next of Kin*. The jury is still out on whether Washoe was really coining words, or if these examples were just suggestively coincident combinations of signs. Because most scientists and linguists have an ideological investment in either proving or disproving the idea of humans as the sole language users, it is difficult to obtain entirely objective-seeming interpretations of events. I find the evidence in favour of apes being able to use language symbolically the more convincing, but it makes sense that many scientists would be slow to accept this evidence, since to do so would necessitate a paradigm shift in the understanding of the relation between human and non-human animals.

[109] Fouts, 154.

we must remember that these are second languages for the apes, and that they are surely not taught by the best possible means. Human-designed language as used by apes must be seen as akin to pidgins -- languages devised between people who share no common language, which in their first generation tend to lack grammatic complexity -- rather than as fully developed languages.[110] While apes may never use language in as complex a manner as humans, we will certainly not know the extent of ape linguistic abilities until humans and apes have been working together on communication for many generations, and until humans are as willing to learn the subtleties of the various ape communication systems as we are to teach apes our own language.

Animals more divergent from humans than the great apes may also be capable of using a language made up of discrete, symbolic signs. Vervet monkeys are now famous for their predator-specific alarm calls, which appear to be culturally transmitted rather than instinctive. Young vervets typically overgeneralize, using the call for snakes for any long thin object, the call for birds of prey for any bird, and the call for leopards for a variety of terrestrial animals, and must be taught by their elders to use the calls only where appropriate. And parrots, long thought merely to mimic human sounds, have been found able to use human language symbolically, and with full awareness of its meaning.[111] Irene Pepperberg's famous African Grey parrot Alex has learned to verbally discriminate between shapes, colors, and materials, and can further answer abstract questions about the differences and similarities between objects.

Some consider a sure sign of a symbolic communicative system -- a true language -- to be that it can be used to lie.[112] According to Italian semiotician Felice Cimatti, the ability

[110] Second-generation speakers of a pidgin do develop complex grammatic structures, and in this way a pidgin can become a new language.

[111] R. M. Seyfarth, D. L. Cheney, and P. Marler, "Monkey response to three different alarm calls: evidence of predator classification and semantic communication," *Science* 210 (14 November, 1980), 801-803.

[112] For further discussion of this, see Martinelli, 38-42.

to lie within a given system implies that:

> 1. There is a shared communicative code, in which a sign is associated with a meaning.
> 2. The sender of the message must be able to break the association between sign and meaning (which implies that the relationship between the sign and its meaning must be arbitrary.)
> 3. The sender must be able to imagine the reaction of the receiver.
> 4. The sender must be able to take advantage of the intentional miscommunication.[113]

Even according to these criteria, several species give strong evidence of having real language. Numerous examples of great apes lying have been documented. Koko the gorilla, for example, after a temper tantrum in which she destroyed a steel sink, signed "cat did it." Ornithologist Gerhard Thielcke writes of an apparent incidence of a lying song thrush (*Turdus philomelos).* In his aviary were a number of species, including the song thrush in question. When potentially threatening seeming wild birds would fly past the window to the outside, the song thrush would habitually sound his alarm call, which would send all of the other birds scurrying for cover. The song thrush then began using the alarm call also when worms were placed in the food dish, so the other birds would go hide, thus buying himself several extra seconds of time to get the worms.[114] Even the little-appreciated chicken has been known to lie. Roosters will sometimes sound the call for good food when there is no food present, but they want to entice an appealing hen to come closer![115]

Tool use

Tool use is likewise now known to be common among animals. Gorillas use blades of grass which they sharpen with their teeth to "fish" for ants, and satin bowerbirds use chewed-up twigs as paintbrushes, with which they apply blue "paint" made of crushed

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[113] Felice Cimatti, *Mente e linguaggio negli animali* (Rome: Carrocci, 1998), 79-85, cited in Martinelli, 39.

[114] Gerhard A. Thielcke, *Bird Sounds* (Ann Arbor: University of Michigan Press, 1976), 100.

[115] Peter Marler.

berries to their bowers. Japanese greenbacked herons fish by break twigs into small pieces and dropping them into the water to attract minnows. Otters use stones to break open the shells of clams and oysters. Even such "simple" animals as crabs have been known to pick up stinging anemones and wield them in self defense,[116] and to pile stones into a sort of staircase to help them climb to otherwise unreachable ledges.[117]

Culture

Culture, also once thought to be the province of humans alone, is being found increasingly to play a large role in the life of many animals. Cultural behaviours are those which are socially learned: behavioural information which is passed on not by genes or by individual learning through trial and error, but by each member of a species learning from other members (often parents or other older individuals.) Both language and many instances of tool use are culturally transmitted, but I include culture here as a separate category because it can encompass all realms of behaviour, not just the linguistic and the manipulative. John Bonner describes culture as "the transmission of information by behavioral means, most particularly by the process of teaching and learning,"[118] and music semiotician Jean Molino, similarly, as a system of "symbolically encoded conceptual phenomena that are socially and historically transmitted within and between populations."[119] Learning, both in humans and in a variety of species of animals, ranges from simple imitation with no explicit teaching on the part of the imitated, to imitation with positive or negative feedback from a mentor, to highly complex educative interactions between a student or young animal and a parent, teacher, or role model.[120] Any or all of these forms of learning can be used for cultural transmission. Just as learning is necessary for culture,

[116] Donald R. Griffin, *Animal Minds: Beyond Cognition to Consciousness*. (Chicago: University of Chicago Press, 1992), 1.

[117] Personal observation, Helen Lofgren.

[118] Bonner, 9.

[119] Jean Molino, "Toward an Evolutionary Theory of Music and Language," 167.

[120] Bonner, 8-9, 72.

culture provides evidence that learning has taken place, and thus that the activity in question is not "instinctive."

Great apes, as one might expect, are among the animals most highly dependent on culture. Field research among chimpanzees has revealed that each community has slightly different customs for such diverse activities as food selection and procurement, grooming of self and others, self-medication with plants, killing parasites, and social communication. Some culturally transmitted customs are present in some form in all communities, but vary according to surroundings: for example, different plants are used as medicinally by different chimpanzee groups depending upon what is available and what is customary. Arbitrary communicative symbols may also be different in each chimpanzee community. The signal to stop, for example, has been observed variously as a scooping, underhand motion, as waving, and as holding the hand up with the palm out (as we may do) in three different communities.[121] Other cultural traits are present in only a few populations. Chimpanzee mothers in the Taï forest (in Côte d'Ivoire), for example, spend up to seven years teaching their young to open nuts using stone tools, while other groups of chimpanzees are entirely lacking this skill.[122] They may, however, have developed other specialized methods of getting food, such as "fishing" for termites with twigs.

Many species farther from the human are also highly influenced by culture. Bullfinches who have been taught human songs, for example, teach their offspring the learned human song, rather than the standard bullfinch song.[123] They are equally prone to learning and propagating canary song, when raised by canaries.[124] Birds of the same species in different regions often sing slight variations of the same song, and recognize

[121] Fouts, 85.

[122] Bijal P. Trivedi, "Chimp Nut-Cracking Site Offers Clues to Early Tool Use" on *National Geographic News*, 23 May 2002, <http://news.nationalgeographic.com/news/2002/05/0523_020523_0523TVchimps.html>. (Accessed 20 May, 2006).

[123] Thielcke, 95.

[124] Mâche, 152.

from these dialects which birds are part of their community and which are outsiders. Such information can help them determine, among other things, which birds are potential competitors or potential mates.

One of the most stunning examples of a partially culturally transmitted animal behaviour is the construction of bowers by bowerbirds. There are approximately 20 species of bowerbirds, all native to Australia or New Guinea. The males of each species build an elaborate bower structure, which they use to entice females for mating. There are three basic types of bower structures: "mats," in which an area of ground is covered with a thick bed of plant material such as leaves, straw, or moss, and ringed with decoration; "avenues," in which a platform path is partially enclosed by two parallel walls made of straw or twigs; and "maypoles," in which an elaborate towering twig structure is built surrounding a sapling. Each species favours one of these basic designs, but there are considerable variations between species. Golden bowerbirds (*Prionodura newtoniana*), for example, build two maypole-type structures, and suspend a roof between them. Vogelkop bowerbirds (*Amblyornis inornatus*) build either a simple, tall, single maypole, or a complicated maypole which broadens at its base into a hut up to six feet wide, depending on the region it which they live. The bowers are typically decorated with a diverse array of brightly covered found objects, including leaves, flowers, berries, moss, pebbles, bones, shells, insect wings, feathers, bits of aluminum foil, coins, glass, clothespins, and bottlecaps. Different species typically favour different colours and types of objects. Satin bowerbirds (*Ptilonorhynchus violaceus*), for example, collect primarily blue objects, while great bowerbirds (*Chlamydera nuchalis*) favour white and orange.

While each species has its characteristic favourite shapes, colours, building materials, and decorative objects, there is also considerable variation among individuals within a species. The avenue-style bowers of Spotted bowerbirds (*Chlamydera maculata*), for example, vary in width; in whether they have a double or triple row of

walls; and in whether they are constructed out of straw and sticks or just sticks.[125] Ornamentation varies even more widely than structure. According to Frans de Waal, male bowerbirds "frequently visit the completed bowers of adult males in the neighborhood and see how the ornaments are laid out. There are ample learning opportunities here, and it has been noted that bower decorations differ in color and arrangement from region to region, which suggests culturally transmitted styles."[126]

Experiments with raising bowerbirds in isolation support the idea that bower construction is a partly cultural phenomenon. Isolated bowerbirds will arrange sticks on the ground, but will not develop them into the elaborate structures that fully socialized individuals do. Birds improve in their building with age. When new materials are introduced into their environment, they figure out ways of incorporating them into their building. This often takes some time, however, indicating that they do not just indiscriminately use whatever is around, but rather must figure out what to do with each new material. Ornithologist Gerald Borgia observes:

> I just did an experiment in which I offered straw, or I should say grass, to males who were building stick kinds of bowers. Usually males who use grass, such as spotted bowerbirds, use it to line the avenues of the bowers. In this case when these males who normally didn't use grass in any part of their bowers were offered grass, they put it all over the bower as if they didn't know what to do with it. And in some cases when I came back a week later they had gotten it so that so that the grass was actually lining the walls of the bower. So what it looks like to me is that it sometimes takes some time to sort it all out and make modifications to their bowers. That seems to be a kind of learning.

Some have argued that though animals may exhibit some insignificant cultural variations, humans are nonetheless unique in being dependent on culture. This is likewise untrue: many species rely equally on cultural information for survival. Ape young, for example, would die without cultural teaching, needing to learn from their elders such basic skills as how to get food and how to find shelter. De Waal writes that "Rehabilitation

[125] NOVA interview with Gerald Borgia, "On the Trail of the Bowerbird" (December 2001) <www.pbs.org/wgbh/nova/bowerbirds/trail.html>. (Accessed 20 May, 2006).

[126] de Waal, 151.

programs, in which home-reared apes have been released into the wild, have taught us how critical it is for these animals to know what to eat, where to go, and what to avoid. Having grown up in the absence of adult models of their species, young apes are rarely successful in the forest, often starving to death."[127] Some species of birds, too, may be dependent on cultural learning. California condors raised in sanctuaries in an effort to increase their numbers were tragically unable to learn to scavenge food. "The normally shy, magnificent foragers had been turned into barnyard chicks perching on rooftops."[128]

Emotion

Many scientists and thinkers now believe that a rich emotional and social life, too, is a part of the experience of many non-human animals. A number of authors have written about this in relation to a variety of species. Anthropologist Elizabeth Marshall Thomas's *The Hidden Life of Dogs* (1993), *The Social Lives of Dogs* (2000), and *The Tribe of the Tiger* (1994)[129] give particularly compelling accounts of the complex inner lives of the species with which we are most familiar. She writes of strong friendships among dogs, for example, the joy the dogs experience in being together, and the mourning processes the dogs may go through when separated from the objects of their affection. Bernd Heinrich writes of similarly strong partnerships among ravens in *Mind of the Raven: Investigations and Adventures with Wolf-Birds* (2000).[130] These typically begin while the ravens are juveniles, several years before they begin breeding. Some of these friends may later become mates, and others not, thought the ties of friendship may last several years or more.

Elephants are particularly emotional animals. Katy Payne, one of the leading

[127] de Waal, 27.

[128] de Waal, 28.

[129] Elizabeth Marshall Thomas, *The Hidden Life of Dogs* (New York: Houghton Mifflin Co., 1993); *The Social Lives of Dogs* (New York: Simon & Schuster, 2000); *Tribe of the Tiger* (New York: Simon & Schuster, 1994).

[130] Bernd Heinrich, *The Mind of the Raven: Investigations and Adventures with Wolf-Birds* (New York: Harper Collins, 2000).

elephant researchers believes that they may be even more strongly ruled by emotion than humans. Her account of her discovery of elephants' use of infrasonic sound for long-distance communication, *Silent Thunder* (1998),[131] gives some idea of the depth of their social relationships. In *When Elephants Weep: The Emotional Lives of Animals* (1994)[132] . Jeffrey Moussaieff Masson and Susan McCarthy also write of the depth of elephant emotion, describing friendships and caring among elephants, groups of elephants caring for a sick member of their band, and elephants ritualistically circling and covering with grass and branches a dead companion.

Other books which include exploration of these and other emotions in a variety of species include *The Pig Who Sang to the Moon: The Emotional Life of Farm Animals* (2003), also by Moussaieff Masson and McCarthy, *The Parrot Who Owns Me: The Story of a Relationship* (2002) by ornithologist Joanna Burger, and *Minding Animals: Awareness, Emotions, and Heart* by Marc Bekoff and Jane Goodall.[133] Increasingly, books discussing animal emotion are by people who are not only animal lovers, but also leading scientists.

Awareness

Scientists have long argued that though animals may be aware of what is going on in the external world, they lack self-awareness. Self-awareness is, of course, particularly hard to test. Recent experiments have shown that both dolphins and chimpanzees recognize themselves in mirrors, which certainly suggests a certain kind of self-awareness.

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[131] Katy Payne, *Silent Thunder: In the Presence of Elephants* (New York: Penguin Books, 1998). Payne is also famous for her work on whale song, which will be discussed chapter five.

[132] Jeffrey Moussaieff Masson and Susan McCarthy, *When Elephants Weep: The Emotional Lives of Animals* (New York: Delta, 1995).

[133] Jeffrey Moussaieff Masson and Susan McCarthy, *The Pig Who Sang to the Moon: The Emotional Life of Farm Animals* (Ballantine Books, 2003); Joanna Burger, *The Parrot Who Owns Me: The Story of a Relationship* (Toronto: Random House, 2001); Marc Bekoff and Jane Goodall, *Minding Animals: Awareness, Emotions, and Heart* (USA: Oxford University Press, 2003).

However, it will probably be a long time before we have any deep knowledge of the nature of self-awareness in non-human species.

Complexity

All this is not to suggest that all non-human animals exhibit all of these supposedly human traits: I would be highly surprised to hear reports of tool-using snakes, or emotional sea cucumbers. Nor is it to suggest that other species necessarily use language, tools, or culture to the extent that we do: so far as we know, no species other than our own uses a language of 100,000 words and seemingly infinite grammatic variety, for example. As a species, we seem to have a talent for complexity. Rather, I suggest that language, tool use, culture, emotional depth, and the various other abilities often regarded as unique to humans are in fact things that occur at the animal level (whether a given species uses it or not), rather than at the human level, and that they develop to suit the needs of each species. Frans de Waal writes of the importance of suitably broad definitions of the attributes that some want to define as exclusively human. About culture, for example, he writes:

> It is not hard to come up with a definition of culture that rules out all species except our own. . . Such exclusive definitions tend to focus on the highest achievements associated with a process, declaring these as absolutely essential. My own bias, however, and that of many fellow primatologists, is quite the opposite. We tend to look beyond the brief evolutionary history of the human race, eyeing a much longer past and a much wider range of animals. All the fancy things that humans do with tools and culture are certainly worthy of attention, but they are best kept out of initial definitions."[134]

Unnecessarily restricted definitions can in fact limit our understanding of these behaviours. "Broad definitions have the . . . advantage that they permit us to see the full range of a phenomenon. For example, one could define language so narrowly that the babbling of a toddler does not fall under it, but does this mean that babbling has nothing to do with language? Narrow definitions . . . often mistake the tip of the iceberg for the whole."[135]

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[134] de Waal, 25-26.

[135] de Waal, 26.

Aesthetics

As studies of animal awareness, thought, language, culture, and emotions have entered public awareness and the academic mainstream, "animal aesthetics," too, is becoming a topic of scientific and scholarly interest. Romantics have long sung the praises of birdsong and natural beauty, but this is typically sentimental and uncritical, the material of poetry, but not of scholarship. Such writings may be beautiful, and of interest to those who already suspect a connection between animal and human aesthetics, but are unlikely to convince skeptics. Writers and thinkers in this tradition tend not to distinguish between the sentient and the nonsentient. Typical is the following line from Wordsworth "every flower / Enjoys the air it breathes."[136] This works well poetically and metaphorically, but if taken literally makes essentially the same mistake as Kivy, of failing to distinguish between the plausibly sentient and the most-likely non-sentient, although erring in the opposite direction. While I am far more sympathetic to this generous attribution of sentience than to Kivy's miserliness (and in any case, poets are not bound to literal truths), the world outlook it suggests is so far from that held by most of the Western world that it can do nothing to help remedy the popular misconceptions about animals.

Another problem, related to the Romantic over-attribution of sentience in that it presupposes kinship between human and non-human creativity, and thus can do nothing to demonstrate such a relationship to those who do not already perceive its existence, is the tendency to take surface similarities to necessarily be evidence of deeper relations. When asked "What are parallels between human and bird music?," for example, ornithologist Luis Baptista (who elsewhere does deal with the issue in greater depth), answered:

> I know of birds who have voices with tonal qualities that sound like real instruments. The strawberry finch has beautiful single notes that come down the scale and sound just like a flute. There is another bird, the diamond firetail from Australia, whose voice sounds like some kind of woodwind, an oboe perhaps. Then, in Costa Rica, I've encountered a wonderful night bird, and it sings four notes coming down the scale, and the quality of its voice is just like a bassoon.
>
> Then, if you look at pitch, scholars have found that certain birds use the same musical scales as human cultures. One scholar has found that the hermit

[136] Wordsworth, cited on Nichols, *Romantic Science.*

> thrush actually sings in the pentatonic scale used in Far Eastern music. One of the most incredible cases is the canyon wren, who sings the chromatic scale, and his song reminds me of the introduction and finale of Chopin's Revolutionary Etude.[137]

Such correspondences may be intriguing, but they say nothing about whether the birds in question are experiencing the sounds they produce as a kind of music, or whether other birds are perceiving them as such, and if the sounds are perceived as musical by the birds, whether they are intending to create aesthetic experience, or simply enjoying it as it comes along. Elements used in human music, such as clear tones, triads, and scale-like passages, may also occur as the by-product of physical, mechanical or electrical activity. Trains sound a minor triad, for example, and tea kettles may whistle a pure, sustained tone -- but this does not mean that trains or tea kettles are creating music!

But there are also increasing numbers of more substantial explorations of and arguments for the presence of the aesthetic in animal songs. In addition to the writers already mentioned in the introduction, such as Armstrong and Hartshorne, whose work comes from the 1960s and 70s, a number of more recent writers too, particularly ornithologists, have included substantial portions on the aesthetic in their works. Peter Marler and Hans Slabbekoorn's text *Nature's Music: The Science of Birdsong* (2004) includes chapters about the functions of birdsong, including some exploration of its relation to human music, by nineteen leading ornithologists. Donald Kroodsma's *The Singing Life of Birds* (2005) helps explain the songs of many musically interesting birds to the general public. No similar books yet exist about singing mammals, but I suspect it will not be long before some appear. *Communication and behavior of whales* (1995), edited by Roger Payne, includes several chapters about whale song, though the scope of the book is more general. Whale biologists Luke Rendell and Hal Whitehead have written a substantial article on "Culture in Whales an Dolphins" (2001), and are continuing work in this area. A recent and interesting player in the field is psychologist Tecumseh Fitch, whose article "The Biology and Evolution of Music in Comparative Perspective" (2005) provides the

[137] Luis Baptista, quoted in Gray et al., "BIOLOGY AND MUSIC: Enhanced: The Music of Nature and the Nature of Music," *Science* (5 January, 2001), 52-54.

beginnings of the sort of comprehensive, cross-disciplinary approach I think we will ultimately need to gain better understanding of the relationship between animal songs and our own music.[138]

Music which reflects continuity

As the scientific and philosophical world opens itself to new consideration of nonhuman aesthetics, Western musicians, too, are beginning to accord aesthetic interest to animal song itself. No longer simply appropriating exotic animal motives and caricaturing or prettifying them for use in conventional musical structures, many composers, among them the Canadian R. Murray Schafer, Americans David Rothenberg, Jim Nollman, Kyoko Kobayashi, John Luther Adams, and Judy Klein, French François-Bernard Mâche, Scottish/Dutch Magnus Robb, and Brazilian Albery de Albuquerque have been allowing animal songs to thoroughly structure their compositions, and thereby to suggest new kinds of human music. Robb, active as a recorder of bird songs as well as a composer, has combined these two interests in many pieces. "Summoning Dawn," for example, involves a sort of transcription or translation of the song of the Himalayan rubythroat (*Erithacus pectoralis*) for human voice. Mâche's "Sopiana" for flute, piano, and tape has the instrumentalists synchronized with recorded bird sounds. Jim Nollman improvises interactively with orcas, sharing equally with them in structuring the resultant music, and Rothenberg improvises with birds, both live and recorded. Klein uses a three minute clip of wolves howling as the central part of her work for tape "The Wolves of Bays Mountain." Albuquerque uses the rhythms and contours of native Brazilian birdsong to generate motives for gentle, light jazz, which sounds not at all like simple imitations of bird songs, but is nonetheless intimately related to them. Schafer's "Dawn Birds" consists of a

[138] Peter Marler and Hans Slabbekoorn, eds., *Nature's Music: The Science of Birdsong* (San Diego: Elsevier, 2004); Donald Kroodsma, *The Singing Life of Birds* (New York: Houghton Mifflin, 2005); Roger Payne, ed., *Communication and behavior of whales*, AAAS Selected Symposia Series (Boulder, Colorado: Westview Press, 1983); Luke Rendell and Hal Whitehead, "Culture in Whales and Dolphins," *Behavioural and Brain Sciences* 24 (2001), 309-324; Tecumseh Fitch, "The Biology and Evolution of Music in Comparative Perspective,"*Cognition* (in press, 2006), 43 pp.

collection of bird-like motives, played in a quasi-aleatoric way by an unspecified small group of wind instruments who spatially surround the audience, and recreates the experience of hearing birdsong in the woods or, in the case of outdoor performance, joins in with the birdsong which is already there -- and typically stimulates an increase in the birdsong.

The genre of "Soundscape" composition, pioneered in the 1970's by Schafer, Barry Truax, Hildegard Westerkaamp, and others who participated in "The World Soundscape Project," integrates natural, animal, human, and constructed sounds, often using the human or constructed sounds as a way into hearing the animal and natural as music. Currently active soundscape composers include, in addition to those mentioned, Claude Schryer, David Dunn, and Annea Lockwood. Typically they are from the "new world" -- Canada, the United States, Australia, New Zealand -- or from sparsely populated parts of the old world, such as Finland and Sweden, where sounds of the natural world are more a part of daily life than in more densely peopled countries. Soundscape composition is influenced by the Cageian aesthetic that anything can be heard as music, and thus does not necessarily contribute to the idea that animal sounds may also be music in the traditional, more limited sense. However, it does much to promote the idea of animal sounds as something worth listening to.

In some ways these human uses of animal song may seem to be yet another example of humans exerting dominance over animals. Human composers are in a sense appropriating animal songs and using them for their own ends -- as ingredients in their own creative vision.[139] Animals are given credit for the sounds they provide, but in most cases they are not active participants in a collaboration. Jim Nollman's improvisations with orcas may be an exception, although it is certainly only Nollman and not the whales who records,

[139] A musically less exploitive situation occurs in Afghanistan, where musicians bring canaries or nightingales to concerts to sing with the musicians. The Afghan musicians believe birds have their own musical culture, and while they seldom imitate birdsong, enjoy very much having the human and bird musics performed together. (Unfortunately for the birds, this is a physically, if not musically, exploitive situation, as the birds are caged.) John Baily, "Cross-Cultural Perspectives in Popular Music: The Case of Afghanistan," *Popular Music* 1:1 (1981), 105-122.

makes public, and reaps social benefits from the sessions. The species whose songs are used may be brought to public awareness, which may help with human appreciation of the species and conservation efforts, but it is primarily the human composer who is rewarded. Yet I think this kind of appropriation may represent a first step towards fuller recognition of the creativity of animals and the aesthetic quality of some of their sounds. If our previous tendency was to consider animal songs as nothing but base noise, mechanical byproducts, or purely instinctive, functional signals, then to recognize them as aesthetically valid in their own right represents significant progress, and is an essential step on the way to considering animals as subjective individuals, creating sound which is indeed musical.[140]

[140] I am aware of the potential for a circular argument here -- that if we perceive animals as subjective individuals we may be more likely to recognize that they may create aesthetic songs, and if we recognize that they may create aesthetic songs we may be more likely to perceive them as subjective individuals -- but this seems inescapable for the kind of theorizing I am doing here. To move forward in this investigation, we need to be able to provisionally accept both assertions.

CHAPTER 3

What is Music? What is the Aesthetic?

Music

In order to further examine whether some animal sounds can be considered "aesthetic" or "musical," we will need to figure out exactly what these words mean. Both are notoriously difficult to define, so an essential task is to establish suitable working definitions. To begin with, "music" is problematic. Traditional definitions such as the following from the Concise Oxford English Dictionary:

> **music** • n. 1. the art or science of combining vocal or instrumental sounds (or both) to produce beauty of form, harmony, and expression of emotion. > the sounds so produced. 2. the written or printed signs representing sound.[141]

seem naive and unsuitable for describing what we know and accept as music today, and are furthermore biased towards common-practice era Western art music. Among other things, this would exclude some electronic music, which may use neither voice nor instruments, and may be unnotated; music which is meant to disturb or provoke rather than to produce beauty; and music from outside the Western classical tradition, which may be more about enhancing or inducing spiritual experiences, presenting words, accompanying social activity or dance, encouraging social cohesion, or creating ritual, than about "beauty of form, harmony, and expression of emotion."

Otherwise more inclusive definitions typically maintain that music is a sonic phenomenon organized by humans. In the view of musicologist Philip Tagg, for example,

[141] *The Concise Oxford English Dictionary*, Judy Pearsall, ed. (New York: Oxford University Press Inc., 2002).

"Music is that form of interhuman communication in which humanly organized, non-verbal sound is perceived as vehiculating primarily affective (emotional) and/or gestural (corporeal) patterns of cognition."[142] Ethnomusicologist Ellen Koskoff's definition, derived from consultation with a variety of musicians, is similar: "Music is a system of sound structures given and received (i.e. communicated with intention) by all humans (although in different ways by different societies, but, nonetheless, found universally), where emotions and experiences which are part of our universal 'humanness' are manifested through the universal medium of performance."[143] Music semiotician Jean-Jacques Nattiez explicitly allows that music may come from a non-human source, but maintains that "in actual fact, it is *man* who decides what is musical and what is not, even if the sound is not of human origin."[144]

A John Cageian definition on the other hand, one that allows that anything heard can be music, opens the door too wide to be useful in this situation. This sort of definition is invaluable for expanding our ears and consciousness, and often for helping people become aware of animal songs as potentially musical in the first place, but does not ultimately help to draw a link between animal songs and human music in the more traditional sense. Such a view would suggest that a Beethoven Sonata, a blackbird song, and a whistling tea kettle are all musical in the same way: I would argue that there is something more profoundly similar between the bird and Beethoven than between either the bird or Beethoven and the tea kettle.

Music is variously described as a type of communication, a language, a social convention, or aloof from all these, as a form of "art for art's sake." While each

[142] Philip Tagg, "Towards a definition of 'music'" (February-March, 2002), <http://www.tagg.org/teaching/musdef.pdf>., p. 3. (Accessed May 20, 2006). I am grateful to Dario for introducing me to the work of Tagg.

[143] Ellen Koskoff, "Thoughts on Universals in Music," *The World of Music* vol. 31, no. 2 (1984), 66-83.

[144] Jean-Jacques Nattiez, "Under What Conditions Can One Speak of the Universality of Music?" *World of Music* vol. 19, nos. 1/2 (1977), 92-105.

understanding has its use, in this context perhaps the most relevant is that of music as a type of communication, in the semiotic sense that it is a system of signals intended for interpretation. Musical communication is not limited to that between one person and another, but can also take place between an individual and a group or a group and an individual, between individuals within the same group, between members of one group with those of another, and even between an individual and him- or herself.[145] Singing to one's self while alone tests the limits of the idea that music is communicative, and though it certainly is not the best example of musical communication, it does not seem to me to negate music's essential communicative aspect. Sometimes in singing to ourselves we communicate from one part of our consciousness to another. Deleuze and Guattari, for example, write of a child in the dark singing to himself for comfort.[146] The child communicates a remembered or imagined sense of comfort and order to his present, frightened self. Other times we sing in a way that is expressive of how we feel -- such as humming a happy tune in the shower -- which would be passively communicative to anyone who walked by.

What music communicates, of course, is different than what language communicates. Information-carrying language communicates precise ideas, whereas music, along with the other arts, typically communicates on a more affective or symbolic level. One can imagine the sort of message which is transmitted through information-bearing language being translated to other languages with little loss of meaning, while a "translation" of music, poetry, or anything substantially aesthetic that does not fundamentally alter content or meaning is inconceivable. Music can be transcribed or transposed, but these are much less significant changes, akin to a change in speaking voice or dialect rather than of language.

The distinguishing line between musical and linguistic communication, even in

[145] Tagg, "Towards a definition of 'music.'"

[146] Gilles Deleuze and Felix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia*, trans. and with a forward by Brian Massumi (Minneapolis: University of Minnesota Press, 1987), 311.

humans, is not straightforward. Many sounds are clearly music, or clearly speech communication, but others seem to fall somewhere in between. I propose a continuum which might go something like this:

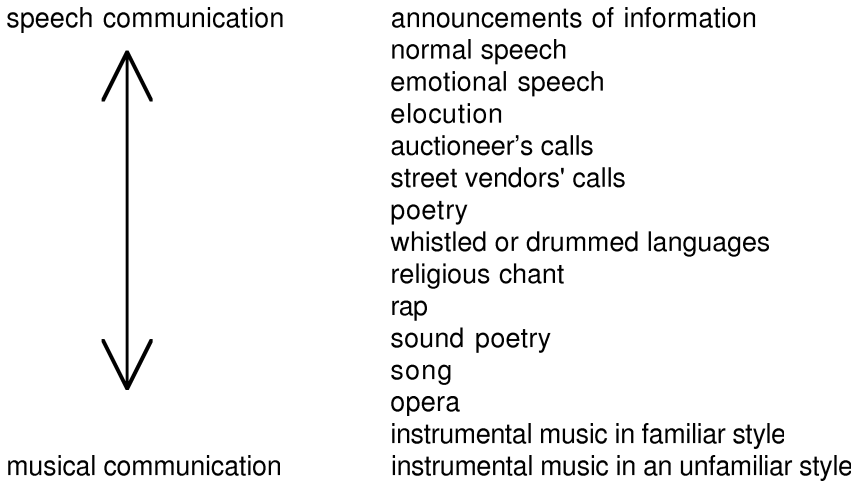

Fig. 2. Music - speech continuum.

Obviously any ordering of these is highly dependent on the culture and experience of the listener. A song in Finnish, for example, will sound entirely musical to me, while it might be conveying vital speech communication to a Finn. Spirituals are well known examples of songs which sounded purely musical to outside listeners, but which might also convey vital information for those in the know. Music in a style I am well acquainted with will likely communicate to me more speech-type information -- grammatical information, such as where beginnings and endings are, plus content information, such as symbolic musical references to extra-musical concepts -- than music in a style which is new to me.

Musical content and speech content are not necessarily present in inverse relation to each other. One can imagine a song in which both the words and the music have complete integrity and importance, and could each stand on their own, or a lazily sing-song rendition of a simple song, in which neither words nor music are actively communicated. Distinguishing between music and speech is further complicated by the fact that emotional

outbursts which are neither speech nor music are also common, and that this emotionality may inflect speech or music. There thus seems to be a sort of triangular relation, with each vocalization falling somewhere within.[147] The following would be a rough placement of sounds one might typically encounter:

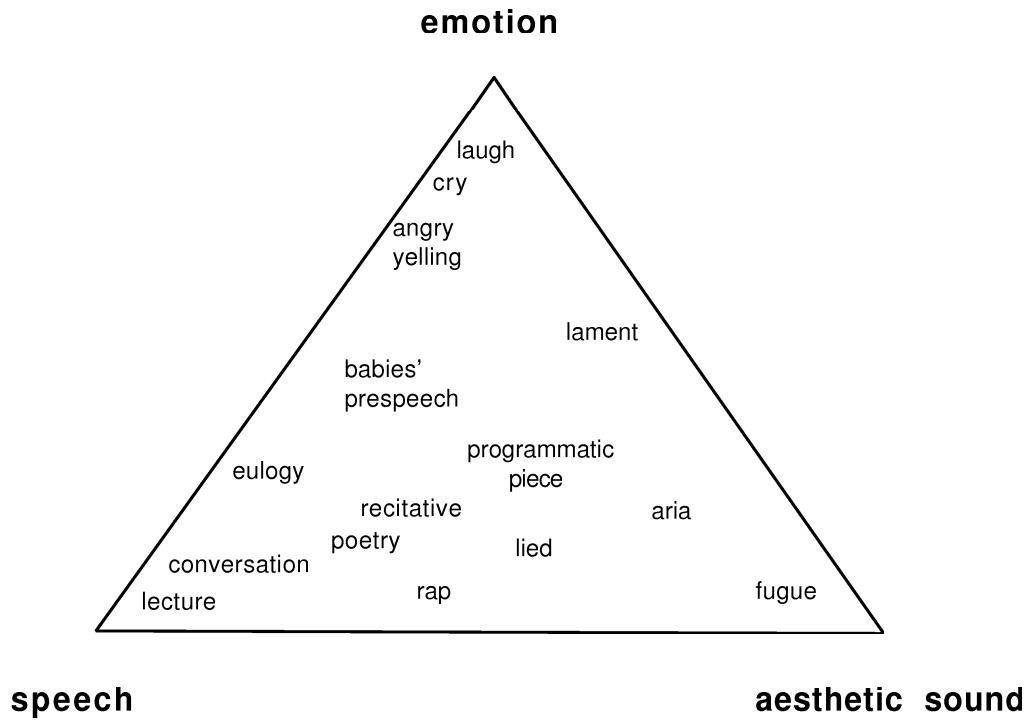

Fig. 3. Relative speech, emotive, and aesthetic content of various commonly heard sounds.

More precise placement would of course depend on which specific example of these utterances is taken, since they will vary greatly in their content, and our own relationship to the utterances will affect how we perceive them. Programmatic music, for example, will seem much more narrative -- speechlike -- if I know the programme, and conversation may seem more emotionally charged if I am involved in it.

[147] This is reminiscent of music psychologist Diana Deutsche's tripartite division of human sound into speech, music, and paralinguistic utterance. Cited in Susan Milius, "Music Without Borders," *Science News Online*, vol. 157, no. 6 (15 April 2000), <http://www.sciencenews.org/articles/20000415/bob11.asp.>. (Accessed 24 May 2006).

Probably few utterances are entirely of one type. A given event could be vocally represented in all three ways. For example, a death could be marked by a eulogy (speech), a lament (musical sound), and sobbing (emotion), but of course emotion would certainly also be part of the lament and the eulogy, and perhaps the eulogy would be worded poetically, giving it an aesthetic quality. The lament might contain some words, giving speech information. Even the sobbing might be controlled in volume or timing so as not to interfere with the eulogy or lament, so while not aesthetic or linguistic in itself, it would be shaped with awareness of these elements. A soccer triumph could likewise be celebrated by speech ("and the winner is . . ."), emotion ("yay!!!"), and music (the song of the winning team.) It is even possible for the same sound object to be used variously for speech, emotional outburst, or aesthetic purposes. Steve Reich's "Come Out," for example, takes a recording of the voice, originally communicating speech information, and turns it into music. The appropriation of "Ode to Joy" by a cell phone turns music into a primarily informative signal, one which communicates not only that the phone is ringing to the owner, but also something of the owner's taste to bystanders. Playing loud music when one knows it bothers the neighbours communicates aggression as much as anything aesthetic. I expect that the distinctions between types of animal sounds will have similarly blurred edges for their species. Mâche writes that in analyzing bird song ". . . Everything happens as if we were rediscovering in these songs the ambiguity which characterizes the relations between language and music . . ."[148]: It will often be a matter of judgment which sounds to include as "aesthetic" and which to leave out.

Further complicating matters is that some sound events which initially seem easy to classify as being primarily musical, linguistic, or emotional communication, may in fact be communicating many things on many levels, both vocally and by other means. A concert, for example, seems like it should be an unambiguously musical event. However, music is only a small part of what is really being communicated. Imagine a tenor recital in Toronto of several well-known classical and romantic favorites, plus one new piece by a Toronto composer. Tickets cost a hundred dollars, but are also given free to selected school

[148] Mâche, 105.

children. The standard repertoire communicates being part of an established cultural tradition: the new Canadian piece, a certain national pride, a means of group identification. Hundred dollar tickets indicate that this concert is a special, important event, while free tickets to school children show that the singer, or perhaps the presenter, is concerned with broadening the audience and educating the young. Perhaps the tenor is handsome, well-dressed, and amiable, projecting friendliness and approachability. Perhaps he seems deeply moved by the music: this may be, or maybe he is remembering some other moving event while singing, or maybe he is just acting this way to enhance the performance. This we will never know unless we ask him, and even then we will know only what he chooses to reveal. This type of factor and many more are part of any human musical performance. While I am looking primarily at musical sound itself, and not at all these levels of extra-sonic communication which surround it, it is important to remember that these things are going on too, and that just because they coincide with the performance does not mean it is not music. With animals, we often focus exclusively on the extra-sonic and extra-aesthetic aspects of sound making, and because we find such rich material for analysis there, too easily assume that that is all there is.

Human music is to a large extent a cultural phenomenon. While genes or the physical environment certainly play some role in determining an individual's musicianship, and while the interaction between human physiology, neuroanatomy and acoustics determines what kind of sounds people produce, it is primarily cultural exposure that will determine what kind of music a person makes. An Irish child brought up in an Indian musical environment will make Indian music, not Irish (though how easily the child makes either kind of music may be partially genetically determined.)

Cultural behaviours, as described in chapter two, are those which are learned from other members of the community. As such, they necessarily involve communication,[149] even if sometimes only the limited, one way communication that takes place when one individual imitates another without teaching or feedback. Dependent on at least limited

[149] Bonner, 72.

communication, then, culture can only take place in species with some degree of social behaviour. John Bonner writes: "Since both culture and a social grouping are by definition utterly dependent on communication, it is obvious that the evolution of the social condition will bear a close relation to the evolution of culture."[150] Social behaviour is not in itself enough to create culture, but it is a prerequisite: ". . . a complex social organization does not necessarily mean elaborate culture. Social existence is a necessary but not sufficient basis for culture."[151] Social behaviour, then, will in some way always be tied up with the musical behaviour of humans, or with the music-like behaviour of non-humans. Evidence of sociality will not in itself be enough to show that music is taking place, but where there is music or music-like behaviour, there will always be some degree of sociality.[152]

While I argue that some animal songs are akin to music, and perhaps are music in all concrete ways, it would merely be a matter of semantics to insist that the word "music" immediately be redefined to include animals' music-equivalent -- and I wish, especially so early in this dissertation, to avoid alienating potential readers on the basis of terminology. Perhaps the word "music" will one day be understood by all to be inclusive of the musical sounds of all species, but this would happen only after commonalities between human and non-human sounds are widely acknowledged. In any case, it may be useful to have a word which refers primarily to the sound-art of our species. "Song" as used by animal scientists describes a different subset from "music," including some vocalizations that clearly serve a non-musical purpose, and excluding others that are perhaps music-like in their function. I therefore propose the working term "aesthetic sound" to encompass both human music and the music-like sounds of other animals. "Aesthetic sound," allows for the possibility that human music and animal music-like sounds might be so much the same that we will

[150] Ibid.

[151] Ibid.

[152] There are examples of both human and non-human individuals raised in isolation developing an idiosyncratic sort of music, often one based on a combination of species-specific sonic tendencies and imitation of some of the surrounding sounds. These individuals, deprived of normal social contact, end up developing social relationships with themselves -- just as lone children play and talk to themselves. The person or animal in question remains fundamentally a social being, albeit one in a deprived setting.

eventually want to call them all "music," or might, although related, in fact be different to such an extent that using the same terminology for both is unwarranted. Applying the term "musical" to animal sounds is less troublesome, since it merely means that something resembles or has some attributes of music, and this is indisputably the case for some animal aesthetic sounds.

The Aesthetic

Awakening the senses

Using "aesthetic sound," of course, gives the equally difficult task of defining "aesthetic." Aesthetic is often used as a synonym for beautiful:

> **aesthetic** • adj. 1... concerned with beauty or the appreciation of beauty. > of pleasing appearance[153]

but this is unsatisfactory. Some art is far from beautiful, and in any case beauty is subjective. The original Greek meaning of Aesthesis (αισφησις) is "perceived by the senses," and this seems a more appropriate starting point. By comparing "aesthetic" with its linguistic opposite, "anesthetic" -- that which deadens the senses -- we understand that the aesthetic is that which awakens the senses.[154]

Form given precedence over content

Of course everything heard or seen somehow stirs the senses, but aesthetic can be used to mean that extra care has been given to the way something will be perceived. John Dewey describes it thus: "An object is peculiarly and dominantly esthetic, yielding the enjoyment characteristic of esthetic perception, when the factors that determine anything which can be called *an* experience are lifted high above the threshold of perception and are

[153] Concise Oxford English Dictionary.

[154] Discussion with Paul Koonce.

made manifest for their own sake."[155] In the aesthetic, more attention is given to the form than is strictly necessary for conveyance of the content or, in semiotic terms, more attention is given to the signifier than to the signified.[156]

Functional identity with non-functional stylistic change

English scholar and literary critic Morse Peckham, too, wrote of distinguishing the aesthetic on the basis of the extra attention given to form. "*Any object (or perceptual field) from any culture may, then, be properly categorized as having been the occasion for artistic perception if a chronologically arranged sequence of such objects shows both functional identity and non-functional stylistic dynamism.*"[157] Though he seems to me to overstate the case -- there are instances of fairly non-dynamic art (such as Gregorian chant), and examples of rapid non-aesthetic, non-functional stylistic changes (for example, yearly changes in car design, driven by market rather than by functional or aesthetic considerations) -- he nonetheless accurately describes much that we consider aesthetic.

Multiple levels of interpretation

Often the aesthetic is that which can be interpreted in many ways or on many levels.[158] What is important may be the depth and richness of information in a work of art or the multiple layers of meaning it contains, rather than the specificity of any single message it may convey. Poet Samuel Taylor Coleridge writes "poetry gives most pleasure when only generally and not perfectly understood."[159] By this he probably didn't mean that poetry is best read by those who don't take the time to understand it, but rather that the best

[155] Dewey, 57.

[156] Roman Jakobson, cited in Martinelli, 116.

[157] Morse Peckham, *Man's Rage for Chaos: Biology, Behavior and the Arts* (New York: Schoken Books, 1967), 71.

[158] Discussion with Paul Koonce.

[159] Coleridge, Anima Poetae 5, cited on Nichols.

poetry is that for which there is no one understanding, that one can look to again and again, and find a different meaning each time.

Play with pattern and noise, or the expected and the unexpected

A commonly recognized trait of the aesthetic is that it plays with the border between the expected and the unexpected -- or between pattern and "noise" (in the Batesonian sense of noise as something which disrupts pattern.)[160] Hartshorne, in comparing bird song and human music, writes that both birds and human artists try to find a balance between "expected repetition and the unexpected, that joint avoidance of monotony and chaos on a sufficient level of complexity, which is beauty."[161] Clearly a perceptible pattern is necessary as a framework against which to notice a deviation, or "noise," but a pattern which is too repetitive fails to hold aesthetic interest. "What stimulates organisms is change; what deadens the response is sameness."[162] The framework could either be something created locally -- a pattern or set of expectations within the music itself -- or a background of culturally or contextually expected patterns shared between the music creator and the listener. Composer Alexander Goehr writes of how the aesthetic appreciation of music may involve comparing what is heard to what is expected. A melody may be perceived in relation to a known scale, a rhythm against a meter, and a harmonic progression within the framework of a key or modality. That which strays from the expected pattern is exciting, so long as the connection is not entirely severed, but listeners may begin to feel alienated when they cannot perceive at all the framework against which the music operates. "Not to understand, not to perceive meaningful continuity might then be no more than a failure to relate passing foreground events to background,"[163] while a

[160] In this sense, and also in the sense of its indirect connection with utility, as discussed at the end of this chapter and in chapter three, music can be seen as related to play. See Martinelli for further discussion of music and play.

[161] Hartshorne, 9.

[162] Hartshorne, cited in Milius.

[163] Alexander Goehr, "Music as Communication," in D. H. Mellor, ed., *Ways of Communicating* (Cambridge: Cambridge University Press, 1990), 141.

successful aesthetic musical experience indicates an appropriate balance of the new and the predictable.

Intensification of experience

Dewey agrees that the aesthetic depends on the interplay between the patterned and the unexpected, and as such believes it to be potentially a part of the experience of all animals. "Because the actual world, that in which we live, is a combination of movement and culmination, of breaks and re-unions, the experience of a living creature is capable of aesthetic quality."[164] For Dewey, however, this is because the "The moment of passage from disturbance into harmony is that of intensest life,"[165] and living most intensely is at the heart of aesthetic experience. "It is the degree of completeness of living in the experience of making and perceiving that makes the difference between what is fine or aesthetic in art and what is not."[166]

Transcendent experience

Some describe these aesthetically induced moments of "intensest life" and "completeness of living" as a sort of transcendent, even religious experience, and consider pursuit of the transcendent to be the essence of music or the aesthetic. Any surface or describable aspects of the aesthetic are primarily a means of inducing a transcendent experience, and are relevant only as they allow or disallow that experience to occur. Conductor Markand Thakar, for example, writes: "There is also, however, an extraordinary experience available through music. The greatest Western art music, well performed, can lead to no less than a spiritual experience, an experience that transcends the physical parameters of time and space."[167] Though Thakar writes from a decidedly

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[164] Dewey, 17.

[165] Ibid.

[166] Ibid., 26.

[167] Markand Thakar, *Counterpoint: Fundamentals of Music Making* (New Haven: Yale University Press, 1990), *xv*.

Western art music perspective, devotees of many kinds of music, from Gregorian chant to new age to minimalism to trance music describe their musical experience in these terms. Much music from non-Western cultures has a similar intent.

Suspension of self-consciousness

Along these lines, aesthetic experience is sometimes described as that in which there is no separation of the conscious self from the unconscious self -- a brief suspension of our self-consciousness, or perhaps a brief uniting of the usually divided mind and body. Thakar describes it as ". . . the feeling of becoming lost -- of losing oneself in the experience. It is losing the self and becoming the sounds. It is the rare and magical experience of the entire work filling a single moment. This is the ultimate, highest, experience of musical beauty."[168] We lose self-awareness, and become completely absorbed in the aesthetic experience. An interesting irony is that animals are sometimes distinguished from humans on the basis of their supposed lack of self-awareness, and then we assume they can't have aesthetic experience like our own, precisely because they are not aware in the way that we are. Thus, because animals are not self-aware, they cannot have this experience of losing self-awareness. One might wonder why, if they are supposed to be lacking the self-awareness that sometimes separates humans from the aesthetic, animals aren't commonly imagined to be more in tune with the aesthetic than humans. But of course, anyone who is willing to grant that animals may have aesthetic experiences will also probably be willing to grant that they may be self-aware.

Authorship

It is interesting to note that historically the word "aesthetic" was applied to both art and natural beauty, and now is applied primarily to art.[169] Art is always something constructed, or at least framed, by a living being, and is generally intended in some way to communicate or be interpreted by another being, while the naturally aesthetic is of two

[168] Ibid.

[169] Alexander Skutch, *Origins of Nature's Beauty* (Austin: University of Texas Press, 1992), 1-2.

types, incidental and interactive. The incidentally aesthetic would include things like the sky, constellations, or motions of water -- things which we may find beautiful, or even communicative, but which are not created or evolved to be such, or dependent on being interpreted. The interactively aesthetic, like art, is created or evolved to be perceived by another being, and would include such things as bird song, flowers, and plumage. This can be further broken down into that which communicates in real time, such as bird song or courting rituals, and that which remains constant, or changes so gradually as to be imperceptible, such as feather markings or flower design.[170] There is clearly much overlap between the artistically aesthetic and the natural, interactively aesthetic, particularly that which changes rapidly and is flexibly communicative. Deciding whether there is in fact any difference between these two, or figuring out into which category such an activity as bird song or human music falls would depend entirely on where one draws the line between "natural" and constructed. I shall use the term "aesthetic" in the more modern sense -- to refer to something created by a creature with agency (whether human or not) -- but of course believe that in many cases the artistically and natural interactively aesthetic are the same.

Interestingly, a change in our perception of the authorship of an object can also change our perception of its aesthetic value. Dewey describes a situation in which "a finely wrought object, one whose texture and proportions are highly pleasing in perception"[171] is initially believed to be the product of an early culture. It is then discovered that it is instead a natural object. The object itself has not changed, "Yet at once it ceases to be a work of art and becomes a natural "curiosity." It now belongs in a museum of natural history, not in a museum of art."[172] This changes not only how we classify the object, but how we experience it. "The esthetic experience -- in its limited sense -- is thus seen to be inherently

[170] It intrigues me that there is frequently such an overlap between what appeals aesthetically to other species and to our own. Flowers, for example, are designed to attract bees and other pollinating insects, but we, too, find most (though not all) of them pleasing both visually and in scent.

[171] Dewey, 48.

[172] Ibid.

connected with the experience of making."[173] Not only the objective characteristics of a potential aesthetic object, nor the way it is experienced are enough to mark it as "aesthetic." We must also recognize an agency behind its creation. Our willingness to ascribe agency to individual animals, then, will affect our perception of the musicality of their songs.

Intent to create art

Some believe intent to be the only essential in creating art. Marcel Duchamp's found object pieces, such as "Fountain," the urinal placed in the museum, might fall into this category, as might some John Cage pieces which simply frame existing sounds. Trying to figure out why animals are making sounds and whether they intend to create aesthetic experience will certainly be part of the zöomusicological exploration, but because of our limited ability to know what is going on inside animal minds can at this point only play a minor supporting role, strengthening more observable evidence.

[173] Ibid.

CHAPTER 4

Origins and Functions of Music and the Aesthetic

The markers of the aesthetic mentioned in the past chapter are all positive traits -- qualities the aesthetic is perceived to possess. The aesthetic has also often been described as that which lacks functionality or biological necessity. Indeed, it is often at least partly on this basis that people separate animal sounds from human music. Human music is supposed to be only aesthetic -- beautiful, creative, and expressive, while animal songs, as interpreted by those coming from a mechanistic or behaviourist mindset, are supposed to be only biological and functional. Yet due to a convergence of recent thought trends, this sort of distinction is getting more and more difficult to maintain. On the one hand, as described in the second chapter, scientists and philosophers are increasingly willing to consider that animals have thought, awareness, and choice over their actions. And on the other hand, an abundance of recent theories suggest that the aesthetic (or its aural subset, music) may in fact be useful, or associated with the useful, in previously unrecognized or ignored ways.

Certainly an ability to create or appreciate the aesthetic is not so obviously connected with continuation of life as, say, enjoyment of food (which is essential for an individual to remain alive), or desire for sex (which is necessary for the preservation of a species), but it may be life-promoting in less direct or apparent ways, or may be an offshoot of essential life activities. As Hartshorne points out, "To say 'aesthetic' is to say 'not merely or too directly utilitarian.' But we must be careful to balance this consideration against the seemingly contradictory one that unless aesthetic activity has some connection with utility it will be unlikely to survive evolutionary change."[174]

[174] Hartshorne, 53.

An abundance of theories attempt to explain either the origin or the purpose of the aesthetic. Some deal explicitly with music (and their authors may think the visually aesthetic has entirely different purposes or origins), while others attempt to explain the aesthetic as a whole, with music being a subset thereof. Some discuss the aesthetic as a strategy developed culturally and quasi-consciously by species with agency, others as something which arose through the external pressures of natural selection. Some write of culture as an exclusively human phenomenon, while others include non-human primates, and a few a larger group of animal species. An overview of these theories follows. Though this may seem like a diverse grouping of theories, all could in a sense be seen as an answer to the question "why do we make music?"

Theories of origins

Sexual selection

One of the most prominent theories of music's origin is that it grew out of animal or pre-human mating calls. It is widely accepted that the members of some species sexually select for certain visually decorative characteristics in their prospective mates, and that this selection, over generations, leads to an intensified version of that characteristic. To use a well-known example, generations of peahens preferring to mate with peacocks with long tail feathers and vibrantly coloured tail displays has lead to the extravagance of today's peacock tail. A male without such a tail is at a disadvantage when attracting a female, and would be unlikely to be very successful in reproductive terms.[175] Philosopher of science Geoffrey Miller, among others, is reviving Darwin's long-overlooked willingness to link animal sexual selection with human visual and aural aesthetics. In regard to the aurally aesthetic, Darwin wrote: ". . . a strong case can be made out, that the vocal organs [of

[175] Species in which one sex does most of the choosing, such as peacocks, tend to be "dimorphic" -- the males and females look quite different from each other. In species in which both sexes are equally involved with selecting partners, males and females tend to be more similar in appearance, or "monomorphic."

animals] were primarily used and perfected in relation to the propagation of the species."[176] Human music, Darwin believed, is an outgrowth of these animal courting sounds, even though musicians are seldom conscious of this as they make music. "The impassioned orator, bard, or musician, when with his varied tones and cadences he excites the strongest emotions in his hearers, little suspects that he uses the same means by which his half-human ancestors long ago aroused each other's ardent passions, during their courtship and rivalry."[177] Darwin drew no hard distinction between the human and the non-human experience of the aesthetic. "It is probable that nearly the same emotions [as the human], but much weaker and far less complex, are felt by birds when the male pours forth his full volume of song, in rivalry with other males, to captivate the female."[178]

Sexually selected traits, according to Darwin, tend to be those that, among other things:

> 1) give a good indication of the physical health of the animal in question
> 2) give a good indication of the mental health of the animal in question
> 3) are difficult enough to produce, in terms of time, energy, and coordination of effort (whether consciously or at a cellular level) that unhealthy animals would not have sufficient resources to produce them[179]

Miller argues that music and the visual arts, in both humans and their pre-human ancestors, are ideal indicators of physical and mental health. Music, and its frequent companion, dance,

> . . . show many features that may function as indicators. Dancing reveals aerobic fitness, coordination, strength, and health. Because nervousness interferes with fine motor control, including voice control, singing in key may reveal self-confidence, status, and extroversion. Rhythm may reveal the brain's capacity for sequencing complex movements reliably, and the efficiency and flexibility of its central pattern generators. Virtuosic performance of instrumental music may reveal

[176] Darwin, *Descent of Man*, chapter 19.

[177] Ibid.

[178] Ibid.

[179] Geoffrey Miller, "Evolution of Human Music through Sexual Selection," in *Origins of Music*, Wallin, Merker, and Brown, eds., 338-344.

> motor coordination, capacity for automating complex learned behaviors, and having the time to practice (which in turn indicates not having heavy parental responsibilities, and hence sexual availability). Melodic creativity may reveal learning ability to master existing musical styles and social intelligence to go beyond them in producing optimally exciting novelty.[180]

Presumably the disadvantages of creating music -- the time involved, and the potential for attracting predators or competitors with the noise -- would be enough to deter less healthy humans or animals from doing it so well.

Many examples appear to lend credence to the Darwin/Miller theory. A simple case of sexual selection for increasingly competent singing is found in Black-capped chickadees (*Poecile atricapillus*). Socially (but not always sexually) monogamous, female chickadees listen to vocal competitions between males to ". . . compare different males' singing behavior directly and make immediate comparisons between potential partners on the basis of their relative vocal performance."[181] Female partners of high-ranking male chickadees will remain monogamous so long as their mate consistently wins the singing contests, but will seek extra-pair couplings if their previously well-singing mates begin to lose. Thus, the finest singers, who seldom lose a singing competition, will have no competition in reproduction, whereas those who cannot consistently sing well will have their chances of fatherhood diluted by their partner's liaisons with other (better-singing) males.

Miller equates the mating function of singing well in animals with music in humans. Of Jimi Hendrix he writes: "This rock guitarist extraordinaire died at the age of 27. . . His music output, three studio albums and hundreds of live concerts, did him no survival favors. But he did have sexual liaisons with hundreds of groupies, maintained parallel long-term relationships with at least two women, and fathered at least three children. . .

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[180] Ibid., 340.

[181] Daniel J. Mennill, Laurene M. Ratcliffe, and Peter T. Boag, "Female Eavesdropping on Male Song Contests in Songbirds," *Science*, vol. 296 (3 May 2002), 873.

Under ancestral conditions, he would have fathered many more."[182] Music has certainly been linked with sexuality by philosophers, particularly the ancient Greeks and the early Christians such as St. Augustine. Some celebrate the the apparent connection of music with sexuality, while others deplore it. When repressive regimes or religious orders ban music, it is usually at least partly because of its supposed link with sexuality.

Though the argument that music and the aesthetic arose from the pressures of sexual selection is widespread, not all find it convincing. Even if we temporarily let pass the questionable idea that "success" can be measured by the number of children and the number of sexual liaisons a man has (and our questions about why, if this is a case, Miller chose for an example someone who didn't, in fact, have very many children), many of the most famous and prolific musicians are highly "unsuccessful" reproductively. From the Western classical tradition, for example, the childless Handel, Haydn, Beethoven, Schubert, Chopin, and Brahms come readily to mind.

Cognitive scientist and musicologist David Huron doubts that human music has anything to do with animal mating songs because animal songs, as sexually selected traits, tend to be sexually dimorphic (that is, they are displayed differently or to a different extent in males and females). According to Huron, ". . . there is little to support the view that human music-making arose in a manner analogous to the songs of songbirds. In songbird species, only the male sings . . . there is a high sexual dimorphism for singing. . . . in

[182] Miller in *Origins of Music,* Wallin, Merker and Brown, eds., 331.

humans, there is no comparable sexual dimorphism."[183]

Well-being

Martinelli, like Miller, believes music and the aesthetic to be tied in with individual success, but on a more general level than that of sexual selection. According to Martinelli, participation in the aesthetic, whether as a performer or an observer, typically improves one's sense of well-being, of community, and of place -- and a contented, socially-secure, well-grounded animal, human or otherwise, is one that is better able to perform his or her biological functions.[184] Zoologist J. Z. Young takes this theory to the extreme, writing "the arts have the most central of all biological functions -- of insisting that life be worthwhile, which, after all, is the final guarantee of its continuance."[185]

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[183] David Huron, *An Instinct for Music: Is Music an Evolutionary Adaptation?*, The 1999 Ernest Bloch Lectures, published online at <http://www.music-cog.ohio-state.edu/Music220/Bloch.lectures/2.Origins.html>. (Accessed 20 May 2006). I believe that Huron is oversimplifying the matter a bit -- there are in fact many bird and mammal species in which the females sing, and in species where each sex plays a part in mate choice, sexually selected characteristics are not necessarily dimorphic. Furthermore, if one sees sex-specific singing roles as to some extent culturally determined -- which they may well be in non-human animals (female birds of many species who do not usually sing may do so in unusual circumstances, thus clearly they are able to sing, even if usually they don't) -- then the sexual division of animal singing roles does not seem entirely foreign to human musical cultures. In many of these, too, female participation is forbidden or strictly limited, and in others, specific instruments or musical roles are highly gendered. (I include Western classical music among the gendered musics. Although all male orchestras, such as the Vienna Philharmonic, are declining in number, many musical roles still belong primarily to one gender. Most of us would still be surprised to see an orchestra with female tuba-players, trombonists, and conductor, playing pieces primarily by female composers, or a classroom full of young male harp students.)

I don't agree with Mâche, who suggests that the relatively low number of "women tempted by a career as a composer, . . . both in relation to men and in relation to what is the case in other activities like literature or painting" might, if "not simply due to social conformism," have "its sources in these archaic, innate aspects of musical activity, which we should reveal and take into account rather than deny." (Mâche, 155.) There are, after all, a number of cultures and genres, though Western art music is not one of them, in which women do compose in equal or even greater numbers than men. And there are ample social barriers in this and other cultures to explain the lesser presence of women in composition. I'd think that if there is any truth to the idea that genetically-based sexual dimorphism may explain any current male/female differences in music making, these might stem from our pre-homo sapiens days, when perhaps some of our gender roles were being established. If any of these roles remain, they'd be due to cultural inertia, rather than to any current genetic differences.

[184] Personal conversation with Martinelli.

[185] J. Z. Young, cited in Ellen Dissanayake, *Homo Aestheticus: Where Art Comes From and Why* (Toronto: Maxwell, 1992), 10.

Art as mediator between order and chaos: creating chaos

Some believe art, itself a play between the expected and the unexpected ("pattern" and "noise"), to be part of human attempts to navigate between order and chaos in life. In *Man's Rage for Chaos: Biology, Behavior and the Arts*, Morse Peckham writes of the aesthetic as a safe chaos -- a protected realm in which we can get used to dealing with the unpredictable and to being innovative. "Man desires above all a predictable and ordered world,"[186] writes Peckham. But this is dangerous because ". . . the drive to order is also a drive to get stuck in the mud." We thus need something "which serves to break up orientations, to weaken and frustrate the tyrannous drive to order, to prepare the individual to observe what the orientation tells him is irrelevant, but what very well may be highly relevant."[187] We resist disorientation, and "Only in protected situations, characterized by high walls of psychic insulation, can ["man"] afford to let himself be aware of the disparity between his interests, that is, his expectancy or set or orientation, and the data his interaction with the environment actually produces." According to Peckham, "art offers precisely this kind of experience."[188] Through dealing with the unexpected in art, we can learn to deal with the unexpected in life.

Art as mediator between order and chaos: creating order

Philosophers Jacques Deleuze and Félix Guattari, on the other hand, see art as serving to help create order out of chaos. Very often, people use music -- or any patterned art -- to provide stability in otherwise frightening or unordered situations. In *1837: Of the Refrain*[189], they write of how "A child in the dark, gripped with fear, comforts himself by singing under his breath. He walks and halts to his song. Lost, he takes shelter, or orients himself with his little song as best he can. The song is like a rough sketch of a calming and

[186] Ibid., 313.

[187] Ibid., xi.

[188] Ibid., 313.

[189] Deleuze and Guattari, chapter 11.

stabilizing, calm and stable, center in the heart of chaos."[190] Music, existing in the realm between chaos and order, has the power to bring us from one to the other.

"Making special"

Art historian Ellen Dissanayake believes the aesthetic urge, which encompasses the visual and the auditory, to be a part of a larger, more essential human activity which she calls "making special."[191] She writes: "I proposed that we could understand the arts ethologically by considering them as ways of making important things and activities "special."[192] According to Dissanayake, people "make special" "to persuade [them]self and others that what [is] being done [is] worthwhile and effective."[193] If activities which have been made special are more successful than those done without any preparation, then "making special" may become an essential part of that activity.

> If you are an early human who wants to achieve a goal -- to kill an animal, for example, or to cure a sickness -- you will take pains, take the activity seriously. If you accidentally or deliberately say or do something extra, and are successful, you may well remember to do the extra something again the next time, just in case, as when a baseball player touches his cap and ear in a certain way before throwing a pitch or a pilot always carries a particular trinket that has in the past brought her or him good luck.[194]

Artistic activity, though now very different, may thus have arisen from the same urge to "make special" that may be part of superstition, ritual, or arbitrary cultural convention. For Dissanayake, "making special" is also "a reason for embellishment in other species -- notably songbirds, who elaborate their songs much more than is necessary simply to advertise their presence or individuality."[195] However, she believes that animal

[190] Deleuze and Guattari, 311.

[191] Dissanayake, 42.

[192] Ibid., 51.

[193] Ibid., 52.

[194] Ibid.

[195] Ibid.

embellishments fall short of the artistic: "animals . . . did not go on to invent arts or imaginative works of any kind."[196] Typical of those who dismiss animal creativity out of hand, Dissanayake does not realize the extent to which individual learning and species culture shape some animal songs. That she can write: "Human ritual is cultural, that is learned, not innate. Humans perform ceremonies deliberately, not instinctively, as birds build nests or sing,"[197] reveals her lack of deep knowledge in this area.

It's unfortunate that Dissanayake does not recognize imagination, culture and artistic activity in non-human animals, because "making special" is a concept that can most easily be transferred to other species. If anything, "making special" seems even more relevant to highly ritualized aesthetic activities such as the courtship songs and dances that are part of so many animals' lives than it does to freer forms of artistic expression. I suspect that if she came to know more about the complexity of animal culture, she might rethink her position, and end up making valuable contributions to the study of non-human aesthetics.

Dissanayake believes that "making special" may have some survival benefits to groups of humans. "Groups whose individual members had the tendency to make things special would have had more unifying ritual ceremonies, and thus these individuals and groups would have survived better than individuals and groups that did not."[198] She considers this a secondary benefit of making special, however, not its reason for existence.

Group bonding

Some believe that it is the benefit to the group rather than to the individual that is most important in the aesthetic. Huron suggests that if music is an evolutionary adaptation, it is this enhancement of group bonding that is in fact at its root. According to Huron,

[196] Ibid., 50.

[197] Ibid., 68.

[198] Ibid., 52.

animals tend to live in groups because they afford their members mutual protection from predators. Large groups are better able to find and fend off potential predators than are smaller groups, "But there are costs associated with maintaining a large group. . . . as group size increases, threats are more likely to arise from internal conflict within the group rather than from external predators. . . . As a consequence of these internal threats, animals within the group begin to form alliances with one another."[199] Primates tend to establish bonds and alliances by mutual grooming, and spend enormous amounts of time doing so. Mutual grooming establishes and cements friendships, and grooming partners are those who will come to the aid of a fellow primate in trouble. The amount of time that must be spent in grooming increases with group size, as there will be more relationships to forge and maintain. Human groups tend to be larger than those of other primates (apparently 150 people is typical), and were we to use mutual grooming as our primary means of social cohesion, we would need to spend 40 percent of our time doing so, at least if we did it in the same proportion of time to group size as other primates![200] This has lead evolutionary psychologist Robin Dunbar to propose his "grooming and gossip" theory of language development. Dunbar believes that language may have arisen as a means of establishing and maintaining social contact that could substitute for grooming. Speaking would have been a more efficient way of bonding than grooming, because several people can talk together at once, and can talk while doing other things. Japanese primatologist Nabuo Masataka explores the group-bonding aspect of language in his 2003 book *Monkeys with Mobiles*, about cellphone use among Japanese teenagers. Of this sort of communication he writes "Monkeys frequently communicate with one another with 'coo' calls. The main function is to maintain group cohesion. This is very similar to the use of mobile phones among teenagers. They send messages with mobile phones. They don't communicate any meaningful content -- it's about group cohesion."[201]

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[199] Huron.

[200] Ibid.

[201] Colin Campbell, "How R tngz, dude?," *Macleans Magazine* (21 December, 2005).

According to Huron, music would be an even more effective way of creating group bonds, because many people can make music together at once -- certainly a whole group of 150 could sing together, for example. For followers of this "grooming and gossip" theory, then, human music has more in common with primate grooming than with bird or other animal song! (In fact birds, too, engage in mutual preening, and birds sing to increase social cohesion, both duets between mated pairs, and choruses among the whole flock, so one might wonder if bird song also has a connection with bird grooming. Unfortunately, Huron does not explore this possibility.) An interesting corollary of Huron's grooming theory of the origins of music is that since the visual arts would have no similar large-scale social-bond-inducing effect to music, and thus could not have developed as a stand-in for grooming, they must have arisen for some entirely different purpose. To followers of Huron's theory, the visually and the aurally aesthetic would be unrelated.

Mood synchronization

Music may be used to invoke certain affects and moods and thereby to induce particular behaviour, and some believe this to be its original purpose. A lullaby, or Bach's Goldberg Variations, for example, may be used to induce sleepiness, and therefore sleep; a national anthem may be used to stir patriotic feelings and a sense of protectiveness towards one's country; or a love song may be used to entice a potential mate. The mood altering effect of music is perhaps even more pronounced on groups than on individuals: one thinks of a protest song sung by thousands in a demonstration, or a religious song sung by a whole congregation. Physicist and musician Juan Roederer writes:

> . . . the role of music in superstitious or sexual rites, religion, ideological proselytism, and military arousal clearly demonstrates the value of music as a means of establishing behavioral coherency in masses of people. In the distant past this could indeed have had an important survival value, as an increasingly complex human environment demanded *coherent*, collective actions on the part of groups of human society.[202]

[202] Juan Roederer, "The search for a survival value of music," *Music Perception* 1:350-356 (1984), 356, cited in Huron.

Ancient Greek philosophers, too, among them Plato and Aristotle, wrote extensively of the mood and behaviour altering uses of music. They believed music had the power to influence for good or for evil, and thus needed to be highly regulated. For the Ancient Greeks, however, the ability of music to alter moods would have been a secondary effect, one which could be employed by humans, but not the origin of music, since they believed human music to be a reflection of the "music of spheres" -- the aural manifestation of the perfect mathematical relationships of the universe.

Coordinated display to attract mates

When the affect of music is used to synchronize mood (and any resultant behaviour), its rhythm can be used to coordinate specific movement. Swedish primatologist Björn Merker writes of the development of synchronous display -- groups of males displaying in rhythm together -- in our pre-human ancestors, to simultaneously attract passing females and deter potentially competing groups of males. According to Merker, synchronous display is relatively rare in the animal kingdom. Only a handful of insects and frogs have truly rhythmically coordinated displays, and it occurs only in rudimentary form in modern non-human primates. Merker thus thinks that synchronous display -- the ability to perform actions in time to an externally imposed rhythm -- may be one of the key features which distinguishes humans from our nearest relatives.

Coordinated display for defense

Theoretical biologist Edward Hagen suggests that the endpoint of mood and movement coordinated through music is not display, but rather that the ability to use sound to coordinate display is one of the essential elements of successfully defending territory.[203] A socially cohesive group, which could act together to deter invaders, would be better able to defend its territory than a ragtag group: signalling the cohesive superiority of a group

[203] Given that a House-Senate conference committee recently approved a spending of $168 million for U.S. military bands, and only $98 million for the National Endowment for the Arts, one might be inclined to agree with this theory! (Judith Miller, article in the New York Times about the 76 military bands funded by the US department of Defense, 1997, cited in Edward. H. Hagen and Gregory A. Bryant, "Music and dance as a coalition signalling system," *Human Nature* 14 (2003), 21-51.

through elaborately choreographed music and dance displays is thus a way to avoid actual fights. Group defense of territory is observed in various non-human animals as well -- a group of conspecific birds might defend common ground together, for example.[204] However, humans are almost unique among animals, in that they forge bonds between unrelated groups. According to Hagen, group music and dance displays can be used not only as a one-way signal, to coordinate intragroup cohesion to help deter competitors, but as a two-way communicative system, to negotiate intergroup friendships and cooperation. Allied groups can then display together, thereby defending even larger common territories. Music is particularly effective for display between groups because "Complex music and dance performances can only be created by coalitions with considerable internal stability, yet these performances can be displayed to, and 'decoded' by, allies and enemies in a very short period of time -- music is *much* easier to appreciate than it is to compose and perform."[205] According to Hagen's theory, then, music and dance do not create social cohesion (as suggested by Huron/Dunbar), but are rather one of its manifestations. The visual arts could easily have arisen in the same way, first as a symbol of intragroup, and then of intergroup coordination, and would thus be linked with music for followers of this theory. Indeed, dance is already a type of visual display, and coordinated bodily ornamentation and movement could enhance the "we-are-a-cohesive-group" message sent to rivals, or could indicate alliances between unrelated groups.

Territorial definition

Deleuze and Guattari, too, recognize a territorial use of music, in this case, the simpler act of harnessing the sound field of projected music to occupy and define a space. "The role of the refrain has often been emphasized: it is territorial, a territorial assemblage. Bird songs: the bird sings to mark its territory." Though territory is initially tied to a land, its influence may reach even to group members in diaspora. "The Greek modes and Hindu

[204] Ibid.

[205] Ibid.

rhythms are themselves territorial, provincial, regional.[206] Even recorded music may be used for territorial purpose. "Radios and television sets are like sound walls around every household and mark territories (the neighbor complains when it gets too loud.)[207] For Deleuze and Guattari, however definition of a territory is secondary to the musical act which results in its territorialization. "The territory is not primary in relation to the qualitative mark; it is the mark that makes the territory. . . . In this sense, the territory, and the functions performed within it, are products of territorialization. Territorialization is an act of rhythm that has become expressive. . . That is why we cannot accept a thesis like Lorenz's, *which tends to make aggressiveness the basis of the territory. . .*"[208] The act of defining territory comes first: the uses, whether practical or symbolic, are secondary, and the defense of territory comes only after its establishment.

Overdevelopment of biologically necessary

Cimatti removes himself one step from these rather biological function-based theories of music's origin, suggesting instead that the aesthetic in sound may have arisen as an over-development of the biologically necessary -- though it is now certainly something that exists and is sought after in its own right. Primitive incarnations of courting, territorial, or group bonding songs may not have had anything to do with the aesthetic, but the mechanisms that allowed animals to reproduce these functional songs would also have allowed animals to create and pursue aesthetic singing. In the case of birdsong, for example, a certain mating song may, in an early version, have been simple and highly stereotyped, and the males would only have had to replicate this song to attract females. The same skills that would have allowed a male to best replicate the song, however -- sensitivity to what other males of his species are singing, ability to determine which version of the song is most desirable to females, and ability to conform his singing to his ideal -- could also have lead him to begin his own vocal experimentations. Perhaps he might have

[206] Deleuze and Guattari, 312.

[207] Ibid., 311.

[208] Ibid., 315.

imitated environmental sounds, or begun to extend his own song beyond what was strictly necessary for attraction. In many species, such as the chickadees mentioned above, females do prefer aesthetically more developed songs -- those which are more detailed, elaborate, or precise -- pointing at the same very direct use of the aesthetic espoused by Miller. In other species, although the males sometimes sing fancier versions, females ignore anything beyond the minimum standard mating song. Even then, however, the facilities that allow the male to create elaborations of his song may also be what allows him to sing the basic mating song itself accurately.

How do we put all of these conflicting theories together

Such are some of the more prominent theories of the origin of musical and aesthetic activity; others abound. This very plethora of theories, and the concurrent wealth of refutations thereof, shows our limited understanding of the link between music or the aesthetic and the functional. No such debates about the evolutionary usefulness of eating or reproduction exist. Theories of the origins of music and the arts are clearly affected by the outlook of the theorist -- whether the theorist perceives individuals or groups to be more important; co-operation or competition to be the operative paradigm; culture or instinct to be more formative; art to be essential or optional; aural and visual arts to be related or unrelated; and whether he or she wishes to link human and non-human sound-making or not.

In any case, whatever its origins, and however tenuous its links with utility may be, the aesthetic is not inherently antithetical to the functional. Though we may not agree on what the purpose of music is, there is no reason to believe that music or the aesthetic is simply that which has no purpose. Aestheticism and functionality are separate qualities, and may be possessed in independent measure. Neither current functional use nor speculated functional origins of a given song or visual work, human or otherwise, says anything about its aesthetic content. A good violinist may wish to win a competition to gain status or money, but this does not mean that the playing is only a functional means of

earning respect or money: it may also be deeply musical. Likewise, a valuable piece of art placed on someone's wall in part to indicate their social standing does not suddenly lose its aesthetic worth. Dissanayake writes about how even when the aesthetic is used in service of function, this says little about its origin.

> To be sure, once a feature exists, it can be used . . . for display and identification: hairstyles, hunting ability, even (as Glen Westfield wittily observed at the 1990 Human Behavior and Evolution Society annual meeting) how accurately or far a man can aim and urinate. But it does not follow that hair, hunting, and male urination initially evolved or prospered for the purposes of competitive display . . . . Display and communication are significant human behaviours and the arts may be called into their service and even developed there, but their evolutionary origin and purpose may have been and continue to be something very different.

Conversely, something not originally intended as aesthetic may be used as such: collage and musique concrete are two art forms based entirely on turning found objects, not originally aesthetic, into art. Thus even if various animal songs developed first as entirely functional means of marking territory, attracting mates, creating social bonds, or establishing hierarchies, or are used now as such -- or even, for that matter, if the first songs were incidental by-products of some other activity -- this does not preclude the possibility of their current aesthetic use. As Armstrong writes, "Evolutionary causes of present behavior lie deep in the past, but the animal is living now."[209]

One thing that interests me is that there are so many very different theories of the origins of music and/or the aesthetic, but that little has been done to see what they might all mean when taken together. For the most part, each thinker finds evidence to support his or her own theory, and perhaps to try to discredit one or two of the other theories, but no one seems to be devoting their time to figuring out what the fact that there are so many plausible and supportable theories might mean. Rather than supporting any one of these theories, I find myself wondering if there might not be some way in which all could be valid. Perhaps each might explain some aspect of music, but to understand the totality of music, we'd need to look to more than one explanation. Just as we may wear clothing to keep warm, to

[209] Armstrong, 3.

be attractive, to reflect our culture, to display our social status or role, to show off our sewing skill, or any combination of these, we may make music for any one or combination of the reasons described in this chapter.

CHAPTER 5

Animal Songs

As discussed in the previous chapter, sounds easily perceived as aesthetic may well have a connection with the functional, however indirect. This works both ways of course -- sounds we perceive as functional may also be aesthetic. We must be careful not to make the mistake of assuming that because many animal songs have some functional explanation, they must be purely functional, and therefore not aesthetic. Songs for which functionality provides an incomplete or unsatisfactory explanation may be nonetheless one of the richest places to begin looking for evidence of the aesthetic. If a song is not adequately explained in terms of its functionality, then why is the animal singing?

In many cases, functionality gives a good reason for the existence of a song, but not for its complexity. Animals may sing learned and individually tailored songs, for example, where it seems that an instinctive song would serve equally well. Elsewhere functionality explains some uses of a particular song, but not others, as when a mating song is sung out of season. And in a few cases, it is hard to come up with any plausible functional explanation for the animal song.

Examples of not-entirely or not-only functional animal sounds occur more frequently than one might imagine either from exposure to common understandings of animal behaviour or from reading scientific literature. Common understandings tend to generalize and simplify, while scientific modes of perception tend to focus on the quantifiable, the statistically most prevalent, or that which is possible to explain, and can be slow to incorporate newly or rarely observed occurrences. Inconsistent data is often

discarded, rather than examined as potentially supplying significant new information. Furthermore, the habit of recording, notating, or making sonograms of animal songs necessarily fixes the researchers' attention on a small sampling of songs. The most usual song version can seem like the only possible song. A single example of a song can come to seem like the prototype, when it may be just one of many possible versions, or even a unique variation. This is rather like a problem sometimes encountered in music classes, in which a handful of Mozart sonatas are used as examples of sonata form, and students end up considering Haydn or Beethoven sonatas, or even other Mozart sonatas, to be deviations rather than equally valid examples.

This chapter is divided into two sections, the first dealing with birds and the second with mammals. I look both at the typical singing behaviours in the various species which seem to have an aesthetic song, and at examples where some aspect of a song or a singing behaviour suggest that barebones functionality doesn't tell the whole story.

PART I: Birds

An understanding of typical bird vocal behaviour is a necessary as a framework against which to look at specific instances of bird song. Each species of bird has its own behaviour surrounding song acquisition and use, but there are enough similarities between large groups of birds that it makes sense to look at them together. A complete description of bird singing behaviour would of course take volumes, but a brief overview of the information relevant to this investigation follows.[210]

Birdsong: typical patterns

Songs and calls

Bird vocalizations are generally classified as either songs or calls. Songs tend to be

[210] Many books give a more complete account of bird song. One of the best is *Bird Song: Biological themes and variations* by C. K. Catchpole and P. J. B. Slater (Cambridge: Cambridge University Press, 1995).

longer and more complex, and in temperate species, those from Europe and North America, are most often sung by males during breeding season. Females of tropical species are also likely to sing songs, both solo and in duet with their mate. Calls, on the other hand, are usually short and stereotyped, and are sung by all kinds of birds, in all seasons. They typically occur only in fixed contexts, and convey very specific information, such as the presence of a food source or the approach of a predator. There is, of course, much grey area between the two -- songs may be simple, calls may be complex, non-tropical females may sing in exceptional circumstances, and many utterances combine characteristics of the two. Certain communicative roles may be filled by songs in one species and calls in another, or a bird may be able to use either a song or a call in the same situation. The distinction is nonetheless a useful one, maintained by ornithologists and birdwatchers alike.

Different songs sung by the same bird are called "song types," and the collection of all songs by a single bird is called a "repertoire." Each section of a song is a "phrase," and phrases are made up of smaller units, called "syllables." Syllables may be simple or complex: if complex, they are made up of "elements,", which can be defined as a continuous sound, represented as a line on a sonogram.

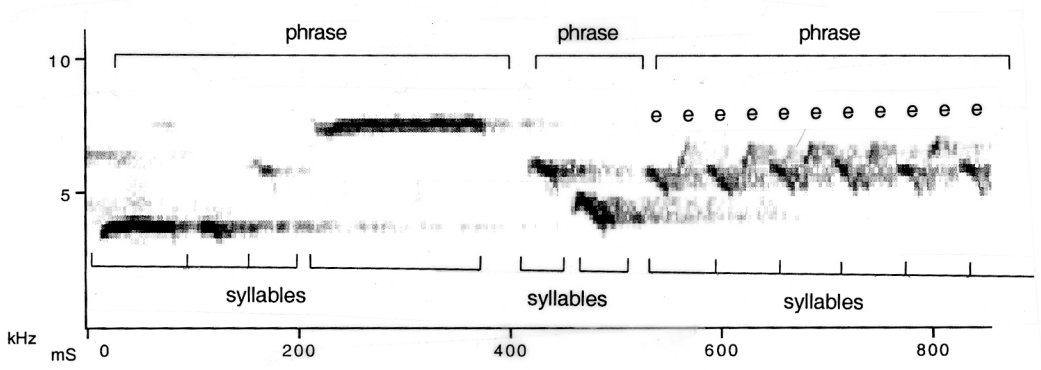

Fig. 4. Sonogram of the winter wren's song. (This is the same portion of the song transcribed in fig. 7.) "e" stands for "element."

As in human music, parsing of a song can be somewhat subjective.[211]

Physiology

Human vocal sound is produced in the larynx, the "voice-box," which lies at the entrance to the trachea and houses the vocal cords. Birds, too, have larynxes, but theirs do not contain vocal cords, and thus are not a primary part of the sound production system (though they can be used to make hissing sounds.) Bird calls and songs are instead produced in the syrinx, an organ not possessed by humans or other mammals, or any other animal class. The syrinx lies at the end of the trachea, where it branches into the two bronchi of the lungs, and incorporates also a small portion of each bronchus. The vibrating "tympaniform membranes" in the syrinx modulate the air passing through to produce the sound, while muscles attached to the syrinx control pitch and volume. An important difference between syringeal and laryngeal sound production is that each side of the syrinx can be controlled independently, enabling birds to perform many notes in rapid succession and even, in a number of species, including the veery (*Catharus fuscescens*) and Swainson's thrush (*Catharus ustulatus*), to perform duets with themselves.[212]

The great majority of birds producing songs which seem likely to be aesthetic belong to the order Passeriformes -- "perching birds," or passerines -- and further to the oscine suborder. Oscine passeriform song tends to be highly varied, intricate, and flexible in its presentation. Oscines, commonly known as "songbirds," or "true songbirds," are anatomically distinguished from the other, "suboscine" passeriformes and from non-passeriformes by both the number and the complexity of their syringeal muscles. Non-oscines (non-passeriformes and suboscine Passeriformes) usually have two pairs of

[211] Ornithologists also vary somewhat in the way they apply terms, though what I have described is fairly standard.

[212] Throat singers can learn to vibrate vocal cords independently, making more than one sound at once, but this takes much practice, and allows much less flexibility than the independent syringae of birds.

extrinsic syringeal muscles, while oscines have up to nine.[213]

Learning

Even more significant than the anatomical differences, however, is that oscines and non-oscines follow very different patterns of song development. The songs of most suboscine and non-passeriforme birds (and the calls of most birds) are usually largely instinctual. Repeated (and unfortunately rather cruel) experiments have shown that non-oscine birds will develop more-or-less normal songs even if the birds are deafened at birth, or are raised in absence of con-specific role models to familiarize them with their songs and calls. Hybrid non-oscine young will develop hybrid songs regardless of which species they are raised with, a strong indicator of the primarily genetic transmission of their songs. Calls and non-oscine songs are also highly stereotyped in most species, that is, each utterance of the same call or song will be essentially the same, and each bird will perform the same version of the call or song as his or her conspecifics. Individual variation is minimal. These highly instinctual, stereotyped vocalizations, seem more akin to involuntary human gestures and cries than to music as we understand it, and will not be the primary focus of this exploration.[214]

The songs of oscines (and a couple of exceptional non-oscines), on the other hand, have significant learned and individually constructed components, and in this regard seem to have much in common with human music-making. This ability to learn songs or spoken

[213] There is little agreement on the number of pairs of muscles possessed by different kinds of birds. Scientists are agreed that oscines have more muscle pairs than suboscines, but numbers given range from three to nine. Psittacidae, commonly known as parrots (which are not passeriformes), although they don't have songs, manage to produce complex vocalizations with only three pairs of muscles. Hummingbirds and some other suboscines, too, sing with a different musculature. (Thielcke, 15.)

[214] Exceptional species do develop individualized vocabularies of calls. Each raven, for example, develops a unique call which serves as a sort of name. When one raven is missing, the others will imitate the missing raven's calls to summon him or her. Bernd Heinrich, *Mind of the Raven* (New York: Harper Collins, 1999).

language is known as "vocal learning," and is a comparatively rare trait among animals.[215] Each bird species has its own way of learning to sing, but a typical non-tropical oscine pattern is the following. A young (usually male) bird spends his first spring, typically from his 30th to 100th day of life, listening to the songs of the adult males who surround him. The bird memorizes these songs, and the following fall or spring begins to try to produce them himself. Ornithologists call his initial vocal forays "subsong," quiet and highly variable singing which can be seen as a sort of practising for his eventual full song. The subsong gradually develops into what is called "plastic song," a song which roughly approximates the full song, but is less detailed, consistent or accurate. This slowly "crystallizes" into the "full song," and by the bird's second summer (when he is a little more than a year old) he will be singing the complete adult song. Some species, such as canaries, continue to learn songs all their life, though even in these species, young birds learn the songs the most easily. Songs are most commonly used (or perceived by scientists to be used) for attracting females, for defining and defending territory, and for identifying the individual who is singing.

In most oscine species, each local population has its own unique version or versions of the species song. Bird species vary widely in the number of song types they sing. The common yellowthroat (*Geothlypis trichas*), for example, has only one song, while each individual brown thrasher (*Toxostoma rufum*) has a repertoire of up to two thousand song types. In many species, each individual bird has his (or her) own versions. Songs may be more or less fixed in their presentation, depending on their species. Some consist of a continuous long melody or a chain of phrases which is always repeated in the same order, while in others there is a constant rearrangement of a set vocabulary of syllables.[216] Some birds, such as the European blackbird, include sounds copied from

[215] Auditory learning, the ability to associate sounds with meaning (but not to imitate the sounds) is much more widespread than vocal learning, and is found in most land and some aquatic vertebrates. It is through auditory learning that dogs learn to obey (or disobey) commands.

[216] W. H. Thorpe, *Bird Song: The Biology of Vocal Communication and Expression in Birds* (Cambridge: Cambridge University Press), 90.

other species or from inanimate sources, along with species-specific syllables and patterns. The songs of highly imitative birds, such as the mockingbird (*Mimus polyglottos*) and the marsh warbler (*Acrocephalus palustis*), can be recognized not by their specific content -- as this will depend on what that particular bird has heard and chosen to copy -- but by the way in which copied elements are arranged and presented. Each species has a characteristic way of arranging sounds: one species may repeat each syllable three or four times, for example, and then never return to that syllable within a song, while another may freely intersperse syllables, coming back to some of them many times within a song.

Auditory Templates

In the oscine species studied, birds raised without a "tutor" -- an older bird who can provide a good example of song -- during the formative first spring typically do not learn to sing properly. They will sing at best rough, uncharacteristic, malformed songs which are unrecognizable by other birds of their species. This is in stark contrast to suboscines, who will sing normally without a tutor. Oscine birds who have had the proper tutelage at the right age but who are deafened at the time that they begin to sing subsong will also not be able to sing well. They need to be able to hear what they are singing in order to match it to their memory of what they have already heard sung.

Cultural transmission, the young learning from the old, however, does not explain the entirety of oscine song. The malformed song developed by untutored or deafened birds may in fact have some things in common with the well-formed species song. It might, for example, approximate the expected contour, have a tendency to repeat motives the same number of times, or share some syllables. This has led ornithologist Peter Marler and others to develop the "auditory template" model for song learning, according to which birds are born with an innate "template," a very rough instinctive outline of the song they will eventually sing. They must, however, listen to older singers to fill in the details of their song. Birds differ in how much they can stray from their auditory template. Some species will learn only the song of their species, others, closely related songs if their own species song is not available, and still others, such as the bullfinches mentioned in chapter two,

who learned the human song their father sang rather than their species song, will learn any song available. In the most extreme case, birds such as the marsh warbler (*Acrocephalus palustris*) have no song of their own, and will learn the songs which are around them as they are maturing. The migratory route of the marsh warbler can, in fact, be traced by the song fragments it sings.[217] Even in these cases, however, there may be a preferred template of cadence or pitch. Species also vary in the degree of interaction they need to have with their tutors. Some species can learn from recordings, others from live tutors with whom they have aural but not visual contact, and some only if they are in direct contact with a tutor.

Lest this auditory template model seem completely remote from human music-making, I would add that humans also tend to make music within certain parameters, which could conceivably stem from a human species musical template. Certain characteristics, such as the use of intervals close to the major second, the recognition of octave equivalency, the use of the pentatonic scale, and the tendency to have some kinds of music with either pulse or meter, all further explained in chapter six, are so pervasive in human musical systems that they suggest that humans might incline towards certain sounds and structures. If we do have something like a template, we might well be unaware of it at a conscious level, since anything we consider music would inherently follow the template. In the field of linguistics, Noam Chomsky has proposed that humans have a language-acquisition template -- though the details of languages differ, we are physically predisposed to learn languages with grammars -- so the idea that humans may have some sort of learning template is not entirely foreign.

Birdsong: unexpected details

Were it the case that all oscine birds followed a strict educational plan of males listening to their elders sing during a critical period when young, practising with subsong only those sounds necessary to sing full song, abandoning subsong when the full song is

[217] Personal conversation with Magnus Robb.

developed, and finally using full song only for well-defined purposes such as territorial defense and mating, this would certainly not rule out a possible aesthetic component to singing. As mentioned before, the functional and the aesthetic can readily co-exist -- and territorial defense or sexual attraction are among the origins proposed for human music too. Nonetheless, it is easiest to argue for the aesthetic nature of songs which seem inadequately or incompletely accounted for by functionalist rationale. If a song is not serving a function, then why is the bird singing? Perhaps for enjoyment, interest, or appreciation.

Not-obviously functional songs can occur on the species level -- as something that all, or most members of a species sing, or on an individual level, as a particular bird's idiosyncrasy. Early 20th century naturalist Albert Brand writes of the less-obviously-functional songs, "And lastly, in the almost endless list of bird-song variations, are the abnormal songs. These we have to admit are disconcerting; but they add to the sport of bird-stalking." Fortunately, there exist many examples of these "abnormal songs," songs which fall outside of the easily biologically explainable pattern. The following illustrate some "abnormal songs" in a variety of contexts. We thus far only know a very little bit about the songs of a very small number of species of birds, so the examples I give represent only the tip of the iceberg, in respect to the true variety of birdsong.

Subsong

While subsong is used by all young song-learning birds as practice for full song, numerous species continue to sing subsong occasionally in adulthood, even when full song is completely developed. Subsong in adults could perhaps serve as a sort of ongoing practice, equivalent to vocal warm-ups and exercises for human singers. However, a number of species include things in their subsong that are never part of their full song, and therefore can not possibly be seen as practice. Chaffinches (*Fringilla coelebs*), for example, use imitation of other birds in their subsong but never in their full song. Magpies (*Pica hudsonia* and *Pica pica*), who have no full song at all, sing a sort of developmental

subsong, primarily in adolescence, but continued sporadically throughout adult life.[218] Jays, likewise lacking a full song, have been observed to "sometimes rest alone in a tree and continue for minutes on end to sing pleasantly in an undertone."[219] Ornithologist Alexander Skutch has no hesitation in ascribing these jay subsongs a music-like role. "Such *sotto voce* medleys appear to lack social or biological significance; the jay sings for its own comfort or enjoyment; as a human hums a tune when alone and falls silent when another person appears."[220]

Other species appear to choose whether or not to sing in a way that carries. Scarlet and summer tanagers (*Piranga olivacea* and *rubra*) both possess a full song, but will sometimes sing it so quietly while sitting on the nest that it can't be heard by other birds. For these species, the same song seems to be used both in a potentially functional, communicative context, and in a context apparently without these possibilities.

Mating song

One of the commonest explanations given for bird song is that it is for attracting mates. While it is true that the males of most species sing some sort of mating song; that in songbirds the mating song tends to be complex; and that the better singers within a species tend to be more successful in attracting mates, it is not true that singing of these songs takes place only by males during mating situations. The males of many species continue singing the so-called mating songs long past the breeding period. They continue to elaborate and improve them, and in many cases, the finest example of the song occurs several months after its utility as a mating call has disappeared.[221]

Some species sing the same song year round, using it both as a mating song and as

[218] Conversation with Magnus Robb.

[219] Skutch, *The Minds of Birds*, 90.

[220] Ibid.

[221] Thorpe, 6.

something apparently less functional, depending on the circumstances. The highly vocal male zebra finch (*Taenopygia guttata*), for example, uses the same basic song both as "directed" song, accompanied by visual courtship displays when he is attempting to initiate mating with a female (who only occasionally accepts), and as "undirected" song, unaccompanied by any movement, when he is alone or in a group but not trying to initiate sexual activity. The directed song is subtly more intense than the undirected version, but otherwise unchanged. Scientists have no good explanation for the undirected use of the song.[222]

Territory defense

Male song is also frequently described as a means of territorial defense: scientists believe that territorial song stands in for actual contests of strength between male birds. The poorer singer concedes disputed territory to the better; and a bird already possessing territory sings to warn other birds not to intrude. Defense of territory, however, only partially explains the so-called territorial defense songs of some species. Studies of the rufous-sided towhee (*Pipilo erythrophthalmus*), for example, have shown that only a small part of the so-called "territorial defense song" actually elicits any response from other rufous-sided towhees.[223] The great majority of the song is entirely ignored by the birds that the song is supposedly warding off. It is thus hard to see the song as simply a means of defending territory. Certainly, the most reductionist model of animal behaviour, which claims that animals always expend the least possible energy to obtain the desired result, in this case defending territory, seems quite inadequate in cases such as this.

Even if songs are used to "defend territory," this would not necessarily be evidence that the songs are purely instinctive and functional. Philosopher Daniel Dombrowski, for

[222] Richard A. Zann, "Directed and Undirected Song: Zebra Finches in Captivity and the Field" in Peter Marler and Hans Slabbekoorn, eds., *Nature's Music: the Science of Birdsong* (San Diego: Elsevier Academic Press, 2004), 240.

[223] Conversation with Raechel Winfree, department of Ecology and Evolutionary Biology, Princeton University, 2002.

example, asks: "Even if it is granted that the primary function of bird song is to "maintain territory," why must this be taken to mean that the bird is hostile, or that the bird can exclusively be described in the behaviorist's terms? Why not just as legitimately say that the bird *likes* its territory? Or why not say the bird, at least part of the time, finds joy in singing?"[224]

Hormones

Related to the tendency to describe song as purely a male territorial and mating phenomenon is the tendency to consider song a testosterone-induced function, a sort of secondary sex characteristic. Testosterone levels do affect a bird's likelihood of singing, and elevated testosterone levels during mating season partially account for the increase of male song during that time. Testosterone, however, affects not only the behaviour but also the feelings of the bird: thus it may be that testosterone does not directly cause the bird to sing more, but rather causes the bird to want to sing.[225] This again is not so different from factors affection our own music making. We are far more likely to sing if we are energetic, extroverted, and happy than if we are tired, shy, or depressed, and these states of being are all to some extent regulated by hormones. But just as we would never ascribe our music-making solely to hormonal conditions, we should recognize that hormones are only one of many factors affecting birdsong.

The role of hormones is, in any case, quite complex: we could certainly never say that testosterone alone is what causes birds to sing. One interesting discovery has been that in species such as canaries, in which both males and females sing, but males sing more, injecting the females with testosterone will cause them to sing more too. In species where females don't sing at all, however, injecting them with testosterone alone will not induce singing, but injecting them with estrogen while they are young will cause them to develop the brain structures necessary for singing, and consequently to sing in adulthood. No

[224] Dombrowski, 122

[225] Ibid.

amount of hormones, whether testosterone or estrogen, will induce vocal-learning in non-vocal learning species, however.[226]

Female song

Even in species where only males sing, song is not, in fact the purely male phenomenon that we sometimes think it is. According to a recent New York Times story "The account of mate choice, in which males do all the dancing-to-impress and females sit on the judging panel, is increasingly being viewed by scientists as too simplistic -- a broad-brush picture that tells only part of the story."[227] Females must know the songs as intimately as the males to be able to judge, even if they don't sing under usual circumstances. In the long run, it is female choice that shapes the evolution of the song. Beyond this, however, in many species males chose females as well. Though this article examines only female visual ornamentation in various species, it could easily apply to song as well.

Scientists sometimes make the mistake of assuming that if a bird is singing, it must be male, when subsequent research will reveal that the bird is female.[228] Females sing extensively in tropical species, and even among the some of the temperate oscine species, among them the great gray shrike (*Lanius excubitor*), the Lapland bunting (*Calcarius lapponicus*), the starling (*Sturnus vulgaris*)[229], the fairy wrens (*Malurinae*), the white-crowned sparrow (*Zonotrichia leucophrys*), and the European robin (*Erithacus rubecula*)[230] females sing regularly. In numerous other species, while it is generally the

[226] Erich Jarvis, "Brains and Birdsong," 226-271 in Marler and Slabbekoorn, eds., 253.

[227] Yudhijit Bhattacharjee, "In the Animal Kingdom, a New Look at Female Beauty," *New York Times* (25 June, 2002), reprinted on <http://www.nytimes.com/2002/06/25/science/life/25SPEC.html?ex=1148443200&en=f6fd4b4426f5220e&ei=5070>. (Accessed 22 May, 2006).

[228] Sarah Collins, "Vocal fighting and flirting: the functions of birdsong," 39-79 in Marler and Slabbekoorn, eds., 75.

[229] Witchell, 59.

[230] Collins in Marler and Slabbekoorn, 75.

case that males are singing the songs to attract females or to defend territory, in fact females do know the songs, and will sing them on occasion. Female redstarts (*Phoenicurus phoenicurus*), European blackbirds, willow-warblers (*Phylloscopus trochilus*), and bullfinches have all been observed to sing with some regularity. Even in some species in which females "don't sing," they have been observed to do so under exceptional circumstances. Females of several species in which normally only the male sings have been observed singing their mate's song when he dies, for example. Snow writes of a three year old female blackbird who, following an unsuccessful mating season, began to sing. Thus it cannot be the case that singing the songs is determined solely by male biological imperatives, because in many cases females are capable of singing the songs, and are at some level choosing whether or not to sing them.

Imitation/Abstraction:

Again arguing against a purely functionalist explanation of bird song is the fact that some birds will imitate the calls and songs of other species in their songs. A particularly interesting case is that of the marsh warbler, who will use imitations not only of other species' songs, but also their subsong, excitement calls, and alarm calls. About this, Mâche writes that "it is particularly remarkable that only the sound quality of recombined signals is recognized by the bird, to the exclusion of their original function as stimuli: the bird abstracts the music from its acoustic experience as many human musicians do."[231] Mâche writes here about the singing bird, but I would be curious to know too how the listening birds, both marsh warblers and birds of the species' imitated, react to the imitated alarm calls.

The marsh warbler imitations, which vary in length from a fraction of a second to several seconds, are strung together to create the marsh warbler's song. Ornithologist Françoise Dowsett-Lemaire has written about the possibly musical way in which the marsh warbler chooses which imitations to put next to each other. She notes that juxtapositions

[231] Mâche, 114.

typically involve two imitations with notes in common, or two imitations with the same rhythmic pattern. In a few cases, the notes or patterns of one imitation were altered to fit more smoothly with the subsequent imitation. Often, though not always, different imitations from the same species were rearranged, but grouped together to create passages of similar timbre.[232] Lemaire thought of these processes as explicitly musical. "The procedures described above are hardly different from certain techniques used in human musical composition. They make evident the aesthetic qualities of the song of the marsh warbler."[233]

Other species for whom imitation is known to play a key role in their song, in addition to the well-known mockingbirds, European starlings, mynah birds (birds of the starling [*sturnidae*] family native to eastern Asia), and European blackbirds, are the red-backed shrike (*Lanius collurio*) and the winchat (*Saxicola rubetra*).[234] Neither has yet been extensively studied.

Duets:

In a number of species, particularly tropical oscines such as boubous and mannakins, but also a few from temperate zones, mated pairs sing duets. These may involve simultaneous notes from the two birds, but more often take the form of call and response, or elaborately interlocking parts. Duetting is frequently described as a means of enhancing pair bonding. Certainly this seems a likely purpose or result of duetting. The birds must spend much time singing together to properly align the parts of their song. Ornithologists Thorpe and North have noted that in many pairs, when one partner dies the other bird will take over singing their part, along with his or her own, and this seems much

[232] Françoise (Dowsett) Lemaire, "Le Chant de la Rousserolle verderolle (*Acrocephalus palustris*), Etendue du repertoire imitatif, construction rythmique et musicalité," *Le Gerfaut* 64 (1974), 17, 23.

[233] (My translation. Original: "Les procédés décrits ci-dessus ne sont guère différents de certaines techniques utilisées dans la composition musicale humaine. Ils mettent en évidence les qualités esthétiques du chant de la Verderolle.") Lemaire, 23.

[234] Lemaire, 3.

harder to explain in functional terms. It suggests, perhaps, that the bird is missing his or her partner, that the song sounds incomplete without its second half, or both. Birds from duetting species have also been observed to sing their mate's part as a way of calling him or her.[235]

Group songs

Birds occasionally sing in coordinated groups of more than two. Lemaire has written of groups of up to five male marsh warblers singing together.[236] More recently, plain-tailed wrens (*Thryothorus euophrys*) have been observed to sing in mixed-sex quartets, and sometimes in groups of up to seven. These ensemble songs are highly intricate, with the males and females alternating interlocking parts so precisely that they could easily be mistaken for the song of one bird.[237] Little is known about the function, if any, of this group singing, though it has been proposed (as always) that it somehow serves to defend territory or facilitate breeding.

Individual song

Some species may devote even more effort to singing when raised alone than when raised in their normal social context, again suggesting that functional communication is only one aspect of bird song. Sedge warblers (*Acrocephalus schoenobaenus*), for example, develop more complex songs when reared in isolation than they do under usual circumstances. Those raised in the wild have approximately 70 syllables which they use in their song, while those raised in isolation have on average 95. Catchpole writes: "Sedge warblers are like jazz musicians . . . Their songs are complex and varied. It seems that

[235] Thorpe, W.H., and M.E. North. 1966 "Vocal imitation in the tropical boubou shrike *Lanarius aethiopicus major* as a means of establishing and maintaining social bonds," *Ibis* 108 (1966), 432-435, cited in Mario Vaneechoutte and John R. Skoyles, "The memetic origin of language: modern humans as musical primates," *Journal of Memetics - Evolutionary Models of Information Transmission* (1998), <http://jom-emit.cfpm.org/1998/vol2/vaneechoutte_m&skoyles_jr.html>. (Accessed 23 May 2006).

[236] Lemaire, cited in Mâche, 147.

[237] Jennifer Viegas, "Birds sing in barbershop quartet," *Discovery News On-line*, 19 Sept., 2005, <http://www.abc.net.au/science/news/stories/s1463185.htm>. (Accessed 30 May 2006).

being isolated has caused the birds to improvise even more than normal."[238] One can speculate that the birds add these extra syllables as a form of self-entertainment, as sonic play when other ways of engaging with the world are limited.

PART II: Mammals

Though the class *aves* is rich in musical species, not many species of mammal sing songs which have the aural characteristics of the aesthetic, such as the tendency to play with patterns and complexity beyond what seems necessary for function, and even fewer are known to use vocal learning. Nonetheless, a handful of species do sing songs which are worth examining in this context. I will look here at species whose songs sound aesthetic, even though they don't involve vocal learning, at species which use vocal learning even though they don't appear to have an aesthetic songs, and at the few species which combine both, Several members of the cetacean family (whales and dolphins), in particular, make complex sounds which share much with our own music, and which are hard to dismiss as the product of bare minimum functionality.

Cetaceans: Mysticetes

Much less is known about the songs of whales than about birdsong. Both the oceanic habitat and the great size of whales make observation difficult. Their large range -- sperm whales, for example, have a range of 1000 kilometers horizontally, and one kilometer vertically[239] -- means that they can quickly and easily disappear from researchers by going too deep or too far, and individual whales can be difficult for humans to identify. Laboratory research of the sort done on birds is impossible because of the logistical difficulties, as well as the ethical issues, of keeping whales in captivity. Fundamental facts

[238] Nicola Dixon, "Warblers are born to sing," *New Scientist* 30 November 2002, 14.

[239] Hal Whitehead, "Society and Culture in the Deep and Open Ocean: the Sperm Whale and Other Cetaceans" in *Animal Social Complexity,* Frans B. M. de Waal, Peter L. Tyack, eds. (Cambridge, MA: Harvard University Press, 2003), 444.

about singing whales, such as their method of sound production, how they learn their songs, and which individual whales are likely to sing, thus remain unknown. Nonetheless, what research there is supports the idea that some cetacean species may use sounds aesthetically.

Humpback whales (*Megaptera novaeangelae*), part of the baleen, or mysticete suborder, are the cetacean singers best known to humans. Humans have probably been aware of their songs for millennia -- it is suggested that the siren songs of Greek mythology were in fact humpback whale songs amplified by the hulls of wooden boats[240] -- but it was not until the late middle part of the last century, with the invention of underwater listening and recording equipment, that it was discovered that these sounds were made by whales. In 1970 marine biologist Roger Payne released the first commercially available recording of humpback whale songs ("Songs of the Humpback Whale"), which attracted immediate and widespread public interest. Scientists, musicians, and lay people alike found them remarkably effective as "music," not only in terms of surface similarities to human music, such as choice of notes, rhythms, and structure, but also in terms of (perceived) emotional content.

Shortly after the "discovery" of humpback song, Roger Payne and his colleague Scott McVay, among others, began to analyze the songs and the singing behaviour surrounding them, and found that both fell into highly organized patterns.[241] Behavioural constants of humpback song include the following:

• It is primarily males who sing.[242]

[240] Roger Payne, *Among Whales* (New York: Scribner, 1995), 160-161.

[241] Ibid., 144.

[242] Though evidence shows that it is primarily males who sing, in some cases our belief that males are the singers may cause us to assume that a singing whale is male, when in fact it is hard for us to tell the sex of a whale, so we do not know for sure. (Personal conversation with Katy Payne.)

• Humpbacks adopt a downwards-facing posture while singing.[243]

• Singing occurs primarily during the six months of the mating and calving season (the winter), on the breeding grounds, and only infrequently during the six months spent on the feeding grounds.

• All whales in the same ocean basin sing the same song, but whales in different ocean basins sing different songs.

Structural constants of humpback song include the following:

• Songs last 5 to 30 minutes (15 is typical.)[244]

• Each song is made of 2 to 9 themes, strung together without pauses.[245]

• Each theme is made up of 2 to 4 repeated phrases (which may further be divided into subphrases).[246]

• Transition from one theme to another is abrupt.[247]

• The phrases and subphrases are in turn are made up of 4 to 6 units.[248]

• Units are defined as continuous sounds, lasting 1 to 2 seconds.

• Songs are strung together without pauses, in song sessions lasting up to 24 hours.[249]

• In a song, each theme can be repeated any number of times or can be left out, but the order of themes always remains the same. (Thus, in a song with 5 themes, A, B, C, D, and E, we might hear something like AABCDDDE or ABBBEE, but not ACBBDE.)[250]

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[243] R. Payne, *Among Whales*, 145.

[244] Ibid., 144.

[245] Ibid.

[246] Peter Frumhoff, "Aberrant Songs of Humpback Whales (*Megaptera novaeangelae*), Clues to the Structure of Humpback Songs," 8-127 in *Communication and behavior of whales*, Roger Payne, ed.

[247] Ibid., 82.

[248] "Humpback Whale Song Characteristics" (2003), <www.arl.nus.edu.sg/web/research/whale> (22 May, 2006)

[249] Ibid.

[250] Ibid.

• Some years later, Linda Guinee and Katy Payne further discovered that humpback whales employ "rhymes" in their songs -- different themes or phrases that end in the same way.[251]

Taking Roger Payne and McVay's observed "rules" of humpback whale song as a starting point, Katy Payne discovered in the early 1970's that the song sung by a group of whales is constantly changes gradually but steadily throughout each singing season. It remains unchanged during the six relatively silent months of each year spent on the feeding grounds, but starts changing again from where it left off upon the whales' return to their breeding ground.[252] The more time passes, the more different the song becomes, so that after about 5 years, the song will have become completely different from the original. The songs are so different even from one year to the next that by hearing a recording of a whale song, scientists can tell from which ocean and which year it comes.[253]

Most remarkably, all the singing humpbacks within an ocean appear to be changing their songs at the same time. Katy Payne and others have suggested that individual whales may be leading the innovations, with the other whales rushing to copy them, but scientists have not yet been able to observe this happening.

Humpback song changes according to set rules. Any aspect of a theme may change -- frequency of notes, contour, duration, timbre, number of notes, rhythmic patterning, and relative duration -- but it will do so gradually and systematically.[254] One can (almost)

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[251] Guinee and K. Payne speculate that whales, like humans, may use rhymes as mnemonic devices, to help them remember songs. Indeed, they found that rhymes were more common in complex songs than in simple ones. R. Payne, *Among Whales*, 151, and L. Guinee and K. Payne, "Rhyme-like repetition in songs of humpback whales," *Ethology* 79 (1988), 295-306.

[252] Katharine (Katy) Payne, "Singing in Humpback Whales," *Whalewatcher* (spring 1985), 4. Further information about changing whale song can be found in K. Payne, P. Tyack, and R. Payne, "Progressive changes in the songs of humpback whales (*Megaptera novaeangelae*), A detailed analysis of two seasons in Hawaii," 9-57 in Payne, ed., *Communication and behavior of whales*.

[253] R. Payne, *Among Whales*, 152.

[254] K. Payne, "Singing in Humpback Whales," 4.

always see how the new version of a theme is derived from a previous version. Roger Payne describes a typical theme change:

> If a whale's song contains a downward slide, the slide will be sung more and more slowly over time and eventually may be broken up into a series of distinct notes. As time passes, some of these notes may be dropped so that a descending chromatic slide has now become four notes in a descending arpeggio based on thirds. The whale might then drop the middle notes in the arpeggio, making it into a descending one-octave jump. Next, the whale might double the first note and treble the second, later adding a hum at the end. With time the hum might become louder and be repeated many times before the first of the two tonal notes.[255]

The end version of a theme developed in such a manner will seem completely different than the original, but will in fact be derived by a series of small steps. The transformation of the theme could take place over several months or years, but would almost always include all the intermediary steps.[256] Only once have scientists ever observed what seemed to be the sudden introduction of a completely new theme into an existing song, but even in this case, it's possible that the scientists had missed observing the development of the theme, or that it was derived in some way apparent to the whales but not to us, or that the theme was copied from a whale visiting from a different ocean.[257]

When whales introduce a new phrase, they initially sing it very rapidly, but over time it is gradually stretched out to become slower and slower, until eventually it is dropped entirely and replaced either by something derived from it or by something derived from other material elsewhere in the song.[258] If the new theme is to be adopted it will be adopted by all the singing whales very quickly: otherwise it will be abandoned. Roger Payne likens this to the human marketplace: unless a new style is widely accepted in the marketplace, it will have a very short life[259]. Once all singers have adopted a new phrase, however, it will

[255] R. Payne, *Among Whales*, 150.

[256] Ibid., 151.

[257] R. Payne, *Among Whales*, 151.

[258] Ibid., 150.

[259] Ibid., 157.

stay a part of the song for a long time. A theme that is sung only part of the time is one that is in the process of being adopted or of being abandoned.

Though the whale songs almost always evolve systematically and gradually, as described above, in one case the whales from one ocean basin were observed to adopt in its entirety the song from another ocean basin. In 1995 and 1996, researchers found that the whales along the East Coast of Australia, in the waters of the Great Barrier Reef were singing a song which was changing gradually, in the usual fashion. Two of the singers (out of 82), however, were singing an entirely different song, one which was nearly identical to that sung by whales in the West Coast of Australia at that time. Since the two populations normally have very different songs and infrequent contact, this strongly suggests that the two whales with the different song were recent immigrants from the West Coast. By 1997, almost all of the whales from the East Coast population had switched to the song first sung by the two West Coast whales, and by 1998 the old song had completely disappeared. From 1996 onwards, the song on the West Coast and the same song as transplanted to the East Coast developed in different directions, lending even more support to the idea that its appearance in the East Coast was the result of its introduction by West Coast immigrants.[260] This also confirms that the direction in which a song changes is not something predetermined. Though this pattern of wholesale song adoption is rare -- in the 40 years that scientists have been tracking humpback whale song, it has been observed only once -- it is significant in that it shows that humpback whales are able to change their song in more than one way, and that their imitative capabilities go far beyond those required for the gradual, systematic change which is their norm.

No humpback song has ever been found to recur in its entirety. A few phrases have reappeared in disjunct populations with little opportunity for contact with each other, or in the same population after not having been sung for decades, suggesting that there could be some sounds which are universally appealing to humpbacks (perhaps even

[260] Michael J. Noad, Douglas H. Cato, M. M. Bryden, Micheline-N. Jenner, and K. Curt S. Jenner, "Cultural revolution in whale song," *Nature*, vol. 408, (30 November 2000), 537.

"innate"), but these recurrent sounds make up only a very small percentage of humpback song.[261]

Humpbacks are the only species whose song is known to develop in such a uniform and systematic manner. Roger Payne writes that humpback song is so far a "unique instance among non-humans of a continuously evolving conformist culture in a large and dispersed population"[262] Some species of birds, too, may have developing dialects, but these tend to be much more geographically localized, with more individual variation between birds.

Thus far, humans know little about why humpback whales sing. As one would expect, scientists have theorized that male humpbacks sing to "attract females," to "challenge other males,"[263] or to maintain a sort of "floating territory."[264] Though any or all of these explanations seem plausible, definitive evidence to support or contradict any of these theories has yet to be found. A number of more unusual theories have also been proposed. Some of these are outlined by Roger Payne in Among Whales, along with his thoughts on why these theories, though possible, seem unlikely.

- Humpback whales might sing songs as a means of showing how long they can hold their breath, which would indicate fitness, and therefore desirability as a mate: but this would not explain why humpback song is so elaborate and constantly changing -- simple, long notes would serve equally well for this purpose.[265]

- Humpback songs could contain information, such as where the best food is to be found or what are the current most effective fish-catching techniques: but if this were the case, one would not expect the gradual, constant change of the songs, and

[261] Eduardo Mercado III, Louis M. Herman, and Adam A. Pack, "Song copying by humpback whales: themes and variations," *Animal Cognition* 8 (2005), 93-102.

[262] Rendell and Whitehead, 312.

[263] R. Payne, *Among Whales*, 152.

[264] K. Payne, "Singing in Humpback Whales," 3.

[265] James Darling, cited in R. Payne, *Among Whales,* 154.

one would also expect more frequent return of phrases many years apart.[266]

- The songs could serve as a sort of mantra to induce a meditative state: but why would humpbacks meditate for only half the year, and why only or primarily the males?[267]

- Humpback song could involve a quasi-mathematical attempt to sing every possible combination of musical sounds (like human change ringing[268]): but it is hard to imagine any evolutionary pressures which would select for whales doing that. (Payne adds that it is also hard to imagine why humans would change ring!)[269]

- Humpback songs could be like Australian aborigine song lines, serving as sort of aural maps which would help them in their journeys across the ocean: but this also would not explain why the songs are constantly changing, since presumably whales would travel by relatively similar routes each year. Furthermore, whales may come from several different feeding grounds to one breeding ground, and if the song reflected their route travelled, their songs would be different.[270]

A recent theory, proposed by neuroscientist Eduardo Mercado, is that humpback whale songs serve primarily as a sort of sonar, enabling the singing whales to locate each other at great distances. Critics of this theory suggest that sonar doesn't not explain the complexity and the continual change of the song, when more stereotyped sounds would suffice.[271] I would also wonder, if this were the case, why it would be that only or primarily the males would use sonar, and why would they only need to use it during half the year?

Roger Payne finds a combination of first two theories mentioned most likely: that songs are used at once to attract females and to intimidate other males. He suggests that humpback whales may engage in the relatively uncommon "lek" mating system, employed

[266] R. Payne, *Among Whales*, 154.

[267] Ibid., 154-155.

[268] Change ringing is a way of ringing tuned church bells in a series of mathematical patterns (instead of a recognizable melody), which originated in England in the 17th century and is practised to this day in England and British-influenced countries.

[269] R. Payne, *Among Whales*, 155.

[270] Ibid., 156.

[271] Eduardo Mercado III and L. Neil Frazer, "Humpback Whale Song or Humpback Whale Sonar? A Reply to Au *et al*.," *IEEE Journal of Oceanic Engineering*, vol. 26, no. 3 (July, 2001), 406.

also by grouse, prairie chickens, some species of deer and antelope, certain fish, and marine iguanas, in which males gather on a "lekking ground" to display, and females choose from among the displaying males.[272] The song could serve both to space the males properly and to draw the females closer. Payne recognizes that even if the whale songs do serve a mating or challenging purpose, however, they may also be significantly aesthetic, and acknowledges the similarity between humpback song creation and our own. "In composing their songs humpback whales obey a large body of laws of composition that humans composing within such strictures would call musical conventions."[273] In *Among Whales*, Payne writes extensively of the emotional, aesthetic reactions he has to humpback song.

Other scientists find none of the theories of what humpback song is for fully convincing. Even the suggestion that songs are primarily used for mating and for male challenge is less than universally accepted. Mercado, for example, points out that most whales who have been observed to approach a singing male are in fact also male.[274] Claims that whale song has to do with territoriality (which goes hand in hand with male challenge) are also not backed up by solid evidence. According to Hal Whitehead, another of the most noted whale researchers, "...no cetacean is known to defend geographical territory"[275]

In any case, even if mating, challenge, or territory may provide a reason to sing, they don't provide a reason for the continual, uniform change off humpback song. Whitehead and Rendell write "... the continuously evolving songs of humpback and bowhead whales have no conceivable environmental or genetic cause..."[276] In thinking

[272] R. Payne, *Among Whales*, 158.

[273] Ibid., 150.

[274] Mercado and Frazer, 407.

[275] Hal Whitehead, "Society and Culture in the Deep and Open Ocean" in *Animal Social Complexity,* de Waal and Tyack, eds., 463.

[276] Rendell and Whitehead, 319.

about humpback whale song and the way it continually changes, I am reminded strongly of something Morse Peckham wrote on the aesthetic. "Any object (or perceptual field) from any culture may, then, be properly categorized as having been the occasion for artistic perception if a chronologically arranged sequence of such objects shows both functional identity and non-functional stylistic dynamism."[277] This seems very well to describe what is happening in humpback song. The song may function partly for mating, but the rate of change appears to be far beyond what could conceivably be necessary for functionality.

Though humpbacks are the most famous mysticete singers, other mysticetes, including blue whales (*Balaenoptera musculus*), fin whales (*Balaenoptera musculus*), minke whales (*Balaenoptera acutorostrata*), and bowhead whales (*Balaena mysticetus*), sing too. None of these species' songs seem to approach humpback song in terms of complexity, but they are impressive and fascinating in their own right. Blue whales sing the loudest song of any animal, and may be audible for thousands of miles under water. Their songs vary according to geographical location[278], as well as between individuals, and there is some evidence that blue whales can imitate each others' songs.[279] Minke whales, in addition to making more usual whale sounds, produce a bizarre mechanical-sounding noise which has long puzzled scientists.[280]. Bowhead whales, like humpbacks, have population-wide songs which gradually change[281]. None of these species have yet been extensively studied.

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[277] Peckham, 71.

[278] Kathleen M. Stafford, Sharon L. Nieukirk, and Christopher G. Fox, "Geographical and seasonal variation of blue whale calls in the North Pacific," in *Journal of Cetacean Research and Management*, vol. 3, no. 1 (2001), 65.

[279] Kathleen M. Stafford and Sue E. Moore, "Atypical calling by a blue whale in the Gulf od Alaska," *Journal of the Acoustical Society of America*, vol. 117, no. 5 (May 2005), 2727.

[280] This sound can be heard at <http://people.ucsc.edu/~jgedamke/VOC1.wav (Accessed 22 May, 2006)

[281] Würsig and Clark, "Behavior," in J. J. Burns et. al., eds, *The Bowhead Whale* (Lawrence, Kansas: Society for Marine Mammalogy, 1993), 57-99.

Cetaceans: Odontocetes

A number of members of the odontocete suborder, toothed whales and dolphins, also make complex sounds. Bottlenose dolphins (*Tursiops truncatus*), one of the species most studied by scientists, have been observed to use particularly flexible and intricate vocalizations for communication. Researchers have classified dolphin sounds into three types, "click trains" (series of clicks), "burst pulses" (clicks repeated so frequently that they sound like continuous buzzes), and whistles, though it is not known whether dolphins also hear these as three distinct categories, or whether these are three kinds of sounds along a continuum. Males and females vocalize equally. Each bottlenose dolphin, in addition to having the usual repertoire of clicks, buzzes, and whistles, has its own "signature whistle," which serves as a sort of name. Dolphins will sing their own signature whistle as a means of indicating their presence, but will also imitate other dolphins' whistles to attract their attention. Bottlenose dolphins develop their own, unique, signature whistles during their first year of life, being influenced by, but not directly copying, whistles they hear around them. Though most of these surrounding whistles would come from other bottlenose dolphins, occasionally young bottlenose dolphins take influence from non-bottlenose sounds, including the whistles of other dolphin species and, in captivity, even whistles used by human trainers.[282] Dolphins are adept at imitating other sounds, too, both dolphin and non-dolphin in origin (a dolphin at the Epcot Center has recently been taught to sing the "Batman" theme), and also at creating new sounds.

Killer whale (*Orcinus orca*) vocalizations are classified by scientists as clicks (used both for echolocation and socially), whistles (used socially), and calls (used for maintaining contact between "pods"). Killer whales live in highly organized societies, in which several matrilineal families ("matrilines") who frequently interact with each other join together to form a pod. Each pod has a unique dialect of calls. Several pods with related

[282] Deborah Fripp et al., "Bottlenose dolphin (*Tursiops truncatus*) calves appear to model their signature whistles on the signature whistles of community members," *Animal Cognition* 8 (2005), 25.

dialects form an "acoustic clan."[283] In most species with different dialects, the dialects will be separated geographically, but in killer whales, those belonging to different acoustic clans may sometimes overlap.[284] The dialects, then, rather than geographical displacement, serve to distinguish the members of the clans, helping killer whales both to recognize who is part of their clan and to figure out who is from a different clan, and thus a potential mate. These different dialects are developed at least partially through selective imitation of those in the same pod, and are considered by scientists to be culturally transmitted. Killer whale imitative abilities go far beyond those needed to learn their pod-specific calls. A captive killer whale from Iceland, for example, learned the entire vocal repertoire of its tank-mate from British Columbia.[285]

Sperm whales (*Physeter catoda*), though also odontocetes, make primarily clicking sounds. Slower clicks, believed to be used for echolocation, are used by all sperm whales, while faster, patterned series of clicks called 'codas', believed to be used for social communication, are made only or primarily by females. Different sperm whale 'units' (groups made up of about ten female whales and their young) sing different codas. Like killer whale dialects, sperm whale codas are believed to be culturally transmitted, and serve to differentiate the members of different units. Sperm whale acoustic clans, also like those of killer whales, may occupy the same geographic territory.

Other odontocetes as well, including other species of dolphins, belugas (*Delphinapterus leucas*), and pilot whales (*Globicephala melaena*) are highly vocal: belugas were even known as "canaries of the sea" by nineteenth century whalers.

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[283] H. Yurk et al., "Cultural transmission within maternal lineages: vocal clans in resident killer whales in southern Alaska" *Animal Behaviour* 63 (2002), 1103.

[284] Yurk et. al, 1104.

[285] D. Bain, "Acoustic behavior of Orcinus: Sequences, periodicity, behavioral correlates and an automated technique for call classification," in *Behavioral biology of killer whales*, eds., B.C. Kirkevold and J. S. Lockard (1986), cited in Rendell and Whitehead, 317.

Belugas[286] , as well as pilot whales[287] , have been observed to be able mimics. Like bottlenose dolphins, killer whales, and sperm whales, these species are all highly intelligent and social, so we have every reason to believe that their vocalizations too will be richly complex and expressive. None have yet been studied in depth by humans.

Despite the complexity of odontocete vocalizations, they are not typically called "songs" by scientists. In part this may have to do with relatively arbitrary assignation of the word 'song'. Bird song was initially called song because it reminded human listeners of our own songs, and humpback whale song reminded the first scientists who heard it of bird song, whereas early human researchers on dolphins and other odontocetes were more interested in their speech-like communicative abilities than their aesthetic sensibilities. But in part this also has to do with some observed differences between mysticete and odontocete vocalizations. The odontocete vocalizations appear to be more directly communicative and expressive of emotions than humpback song, perhaps being closer to our language and paralinguistic utterances than to our music. As well, we tend to define song, whether it be human, bird, or cetacean, as something involving patterned repetition of smaller units of sound. Though sounds are certainly repeated in odontocete vocalizations, they do not appear to be consistently patterned. They set up no expectations against which the play with met and unmet expectations, characteristic of the aesthetic, could be enacted.

Odontocetes nonetheless demonstrate many abilities which we employ in music-making, as well as in language. These would include the ability to imitate and to learn vocally, the ability to playfully rearrange sounds, and the ability to connect sound with emotion. It is perhaps possible that they do sometimes engage in aesthetic sound play, but that we do not yet recognize when it happens.

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[286] R. L. Eaton, "A beluga whale imitates human speech" in *Carnivore* 2 (1979), 22-23.

[287] Personal communication with Luke Rendell.

One person who has done extensive work investigating the potential "musicality" of odontocetes is improviser Jim Nollman. Since the 1970's Nollman has been seeking out opportunities to play music with animals. Though he has interacted with a number of species, his primary work has been with killer whales. He has had substantial interaction with belugas and sperm whales as well. Nollman is not interested in teaching animals our music (as people may teach songs to birds or dolphins), nor in forcing animals to interact with humans (as happens to captive animals or when humans pursue animals), but rather in playing music in an accessible location and seeing if and how animals choose to respond.

Nollman's "Orca Project"[288] has been going on for more than 25 years. In the straits off Vancouver Island, Nollman has created an underwater performance and recording space for "interspecies music." He has developed new underwater instruments as well as means of broadcasting more usual instruments underwater. The music is played quietly (never louder than a small outboard motor), and from a fixed location, so that interested orcas and other animals would have to approach to participate rather than being forced to hear sounds that could be disruptive. He plays at the same time each day, so the orcas will know when to expect the music. The music is always live, and frequently improvised, to enable two-way communication between the humans and the orcas. Nollman plays himself, and has also invited an large diversity of musicians to participate, playing in styles ranging from reggae to Irish drumming to Tibetan prayer chant.

Nollman's results have been interesting, and at times remarkable. He has found that though most orcas are not interested in the music, a few are consistently drawn to it, often returning to the same spot at the appointed hour, day after day, for interacting with the music. Imitative call-and-response types of interaction between the human musicians and the whale singers occur frequently. This may go in both directions, either with the humans responding to the whales or with the whales responding to the humans. When the whales were copying humans, they would typically wait until the human phrase was

[288] Nollman favours the term "orca" because it does not have the negative implications of "killer whale."

finished before entering.[289] Nollman reports that in one instance when he was copying the orcas, if he would make a mistake in copying a phrase they would repeat it until he got it correct.[290] The orcas respond very differently to different kinds of music. Most incredibly, when Nollman repeated a simple harmonic pattern for several days, one orca singer began to match notes to the predictable harmonic progression.[291]

Other marine mammals: pinnipeds

Some non-cetacean marine mammals, too, make complex, culturally transmitted sounds. It makes sense that these animals would have highly developed vocal abilities, given that sound transmits even better in water than in air, while visibility in a marine environment is very limited. Seals in particular, more closely related to dogs than to cetaceans, are known to make a wide variety of vocalizations. Many of these are quite flexible, and at least partially learned. Seals are capable of imitation, even of non-seal sounds, at a level that rivals that of the best avian imitators. The seal best known to humans for his imitations was the harbor seal Hoover, orphaned as a pup in 1971, raised for 4 months by human family who found him in Maine, and later housed at the New England Aquarium. Hoover, so named because he sucked up fish like a vacuum cleaner, learned to say many of the words and phrases that he would have heard, like "hello there," "how are ya," "get outta here," "get down," "come over here," and "Hoover," as well as to imitate laughter, all with a Maine accent like that of the family who found and nurtured him, but had not intentionally instructed him. Of course wild seals, too, would have these imitative abilities, but would devote most of their energies to imitating other seals. (If one seal is imitating another seal, we probably wouldn't notice -- we'd just think they all sounded like seals!) Researchers are currently investigating vocal learning and imitation in

[289] Marc Bristol, interview with Jim Nollman in *Mother Earth News*, 73 (January/February 1982), reprinted on <http://289ewww.motherearthnews.com/library/1982_January_February/Homegrown_Music_and_Musical_Instruments__A_Talk_with_Jim_Nollman (Accessed 22 May, 2006).

[290] Ibid.

[291] Ibid. More can be read about Nollman's work with orcas in his book "The Charged Border" and on his website, www.interspecies.com (Accessed 22 May, 2006).

grey and harbor seals, and at St. Andrews University in Scotland, a project is underway to recreate the circumstances under which Hoover would have learned to speak.

Though seal vocalizations are not considered songs (because they tend to be directly functional or emotionally expressive, rather than longer, more patterned sequences of sounds), those of walruses are. They make a wide variety of complex sounds, and their songs appear to shift slightly from year to year. Unfortunately, almost nothing is yet known about the content and usage of their songs, or how they learn them.

Wolves

Wolves are not vocal learners, but they are able auditory learners. This means that though they don't learn to make sounds in imitation of sounds they hear, they do learn to associate their sounds with activities or objects, and to modulate them to be appropriate for a given situation. I include them here because of the structural and social complexity of their howls. Wolf howls are not usually described as songs, but they are highly ordered and stylized, a far cry from the wild howling we may sometimes imagine. Though wolves howl instinctively, they must learn the social contexts for their howls, and their role within group howls. Howls are used in a variety of circumstances. Individual wolves howl, it is speculated, to identify themselves, and to establish and maintain contact with other wolves in their pack, while wolf packs howl together to reinforce group bonds, and perhaps to celebrate events such as a successful hunt. Howling also declares the presence (and thus territory) of one pack to other packs. Wolf packs are structured very hierarchically, and group howls reflect pack structures. Each wolf's howl represents his or her place in the pack. The alpha male wolf begins the howl, and the others join in. Each wolf uses a distinct howl in the group howling sessions. For another wolf (or human) to imitate that howl would be a sign of aggression. If the pack structure changes (if, for example, the alpha male is displaced), the group howl will reflect this.

Primates

Though our closest relatives, the great apes, don't make sounds which have much

in common with our music -- their calls are innate and stereotyped, shaped only to a small degree by learning and imitation, and consist primarily of grunts and hoots -- a slightly more distantly related primate family, the gibbons, do make sounds we perceive as musical. Both the males and the females of the eleven species of gibbons, and their close relatives the siamang, have characteristic solo songs. Females of most species sing a stereotyped song phrase known as a "great call," as well as shorter, more variable phrases, while males sing only shorter, varied phrases (similar to, though not exactly the same as, the female short phrases).[292] In nine of these species, the males and female mated pairs also sing together in elaborate, rhythmically coordinated duets, which tend to have a fairly fixed structure. Typically, the duet begins with an introductory phrase, to which both gibbons contribute. This is followed by alternation of great calls from the female, and the varied phrases from the male. The male phrases typically start short and simply, and increase in length and complexity throughout the bout of singing. The female may also contribute some short, varied phrases. Once mated, the females of most species, and the males of a couple of species, sing only in the context of the duets. The duet bout often ends with a physical display by the female or both gibbons -- this would typically involve some vigorous brachiation (swinging by the arms from branch to branch) and shaking branches.[293]

The songs of each gibbon species are sufficiently different that they can easily be distinguished by sound. In all species, singing takes place primarily in morning, though the exact hour varies from species to species. Song bouts typically last from 15 to 30 minutes, and occasionally up to 2 hours. The gibbons use very pure, "musical"-sounding tones in these songs, and a pitch level similar to that which we employ in our music, typically between 200 and 5,000 Hz[294]. There are distinct notes, but usually joined together with slides, and sometimes elaborated with warbles: if we were to try to imitate a gibbon,

[292] Thomas Geissmann, *Introduction to Song Vocalizations*, <http://www.gibbons.de/main/index.html>. (Accessed 22 May, 2006).

[293] Ibid.

[294] Humans can hear from 20 to 20,000 Hz. Geissmann, *Introduction to Song Vocalizations*.

the theremin might be the most appropriate instrument. Gibbons have long been perceived as musical, particularly in China, where the tradition of keeping gibbons as pets goes back as long as written history.[295] Several examples of ancient Chinese poetry describe the moving, mournful song of the gibbons.[296]

Thomas Geissmann, one of the foremost gibbon researchers, believes that the solo gibbon song probably serves in defense of territory and perhaps mate attraction.[297] The duets, he believes, are likely to serve to strengthen the bond between mated pairs, as pairs would have to spend time together working out the interlocking of the duet. Once the duet is solidified, it could also be used to advertise the strength of the pair.[298]

Unlike the other animal songs which we have so far investigated as potentially aesthetic (and unlike human song), gibbon songs are believed to be largely innate rather than learned. This was initially assumed because of the rigidity of their duet and song structure, though in fact songs with rigid structure which change little over time could be culturally transmitted.[299] (For a human example of culturally transmitted but minimally

[295] Sadly, the gibbons species that lived in China is now extinct, and little is known about them.

[296] An excellent resource on gibbons is Thomas Geissmann's Gibbon Research Webpage, <http://www.gibbons.de (Accessed 22 May 2006).

[297] What a surprise: yet another animal song believed to be used for mating and territory defense! Though there is no reason to doubt these explanations (and in some cases there seems to be good evidence to support them), it is also important to remember that what we observe and the conclusions we draw from it are affected by our cultural preconceptions. Property ownership and defense thereof is important to people in the Western European cultural tradition that most of these scientists come from, which might make us more likely to perceive the equivalent "territoriality" in other animals. In a culture where keeping the peace is of utmost importance, perhaps scientists might say that the songs were for "keeping peace." Of course these "peace-keeping songs" might do so by preventing territory overlap, and these "territorial songs" might have the result of keeping things peaceful, but the way in which they would be presented would an entirely different impression. For an excellent discussion of this, see Frans de Waal's *The Ape and the Sushi Master*.

[298] Thomas Geissmann, *The Gibbons (Hylobatidae), An Introduction*, section 6, "Behavioral Ecology," <http://www.gibbons.de/main/index.html>. (Accessed 22 May 2006), modified from Thomas Geissmann, *Vergleichende Primatologie* (Heidelberg: Springer Verlag, 2003).

[299] Thomas Geissmann, "Inheritance of Song Parameters in the Gibbon Song, Analyzed in 2 Hybrid Gibbons (*Hylobates pileatus X H. lar*)," in *Folia primatology* 42 (1984), 217.

changing songs, I think of Gregorian or other religious chant.) Observation of the song development of hybrid gibbon young has provided more substantial evidence that gibbon song is largely innate. Hybrid young, rather than developing the gender-appropriate song of the same-sex parent who raised them, will develop a unique (but gender appropriate) hybrid song, involving some characteristics of the songs of both parental species. Hybrid siblings, one raised by parents of one species and the other raised by parents of the other species will develop the same song. This strongly indicates that the song is not learned from the parents.[300]

Gibbon song is also not one hundred percent predetermined, however. Individuals do have slightly different songs, likely indicating the ability to be somewhat flexible in song production (though this could also indicate genetic differences).[301] Mated pairs will make small but significant variations in their songs so they will fit together smoothly when they sing in duet. Precision in the duets is essential, and the gibbons will stop their song if too many mistakes are made. Newly introduced gibbon pairs will be unable to complete their duet together 76% of the time because one of the gibbons will make a mistake, whereas those who have had 18 weeks to accommodate to each other's singing will only have to stop because of mistakes in only 21% of the songs.[302] Gibbons are normally monogamous (quite unusual among primates), but if their partners are forcibly changed, they will alter their songs to fit with their new partner's.[303]

Evidence suggests that though under normal circumstances gibbons will sing exclusively the appropriate song for their gender, they do know the song of the other

[300] Thomas Geissmann, "Gibbon Songs and Human Music," 103-123 in *The Origins of Music,* Wallin, Merker, and Brown, eds., 108-110.

[301] Robert Dallman and Thomas Geissmann, "Different Levels of Variability in the Female Song of Wild Silvery Gibbons (*Hylobates moloch*)," 629-648 in *Behaviour* 138 (2001)

[302] E. G. Maples, M. M. Haraway, and C. W. Hutto, "Development of coordinated singing in a newly formed siamang pair (*Hylobates syndactylus*), 367-378 in *Zoo Biology* 8 (1989).

[303] Thomas Geissmann, "Duet Songs of the Siamang, *Hylobates syndactylus*: II. Testing the Pair-Bonding Hypothesis During a Partner Exchange," in *Behaviour* 136 (1999), 1005-1006.

gender. Females have been observed to fill in the male portion of the song if their mate has been missing or unable to sing.[304]

Bats

Our slightly more distant cousins, the bats (*chiroptera*) use vocal learning to a much greater extent than any non-human primates. Like dolphins, many species of bats appear to have "signature" calls, unique for each individual, which they use to identify each other.[305] That the signature calls vary as much between twins as between unrelated individuals suggests that these differences are learned rather than genetically determined (though they could also be randomly produced.) Other evidence, too, supports the idea that bats engage in vocal learning. A study on lesser spear-nosed bats (*Phyllostomus discolor*), for example, shows that hand-reared bat pups raised in social and acoustic isolation will develop calls unlike those of their mothers, whereas those raised hearing recordings of their mothers' calls will develop calls similar to their mothers'.[306] Unrelated wild bats in the same group (this time greater spear-nosed bats (*Phyllostomus hastatus*)) have also been observed to have similar calls to each other.[307]

Bats, like whales, are particularly difficult to study. In the wild they are hard to follow, and individuals are hard to identify. Knowledge of their sounds depends on specialized recording equipment, since most of their sounds are too high for us to hear.

[304] S. Srikosamat, "Imitation of vocal duet by a widow of the pileated gibbon (*Hylobates pileatus*) in Southeast Thailand" in *International Journal of Primatology* 3 (1982), 336. Males may fill in missing female parts as well, but I know of no scientific literature which explores this.

[305] Bats have not been observed to imitate each other's signature calls as dolphins do, but bat vocalizations have been far less studied than those of dolphins. Vincent M. Janik and Peter J. B. Slater, "Vocal Learning in Mammals," *Advances in the Study of Behavior*, vol. 26 (1997), 63.

[306] Karl-Heinz Esser, "Modeling aspects of speech processing in bats--behavioral and neurophysiological studies," *Speech Communication* 41 (2003), 181.

[307] Janette Wenrick Boughman, "Greater spear-nosed bats give group-distinctive calls," *Behavioral Ecology and Sociobiology* 40 (1997), 61.

Though they can be captured, most species don't show their whole range of behaviours in captivity. For example, captive bats rarely exhibit such fundamental behaviours as courtship or territorial defense. Our understanding of the extent of bat vocal learning, communication, and flexibility is thus quite limited.[308] Our knowledge of the songs themselves is quite limited too, so unfortunately thus far it is hard to know whether the internal characteristics of the song suggest that it may be aesthetic.

Mice

Though similar in appearance to bats, mice are only distantly related. But their songs, too, are recently coming to human attention, thanks also to improved recording equipment. Mice, as well as other rodents, have long been known to be highly vocal, making a number of emotional and communicative calls in ranges audible to us. Their mating songs, however, are above our range of hearing, typically being higher than 30,000 Hz, and thus have remained unknown to us until recordings on sensitive equipment were made and then lowered in pitch.

These songs are sung by the males in presence of females or when they detect female pheromones.[309] Though a number of studies have examined the conditions under which mice produce these songs, few have yet looked at their content. Studies of mouse song promise to be quite interesting, however. Their songs, when lowered several octaves so that we can hear them, sound much like bird song. They consist of discrete utterances, with species-specific differences, as well as differences between individuals (even between individuals who are genetically identical). Little is yet known about the structure of these songs -- whether there are distinct, recurrent syllable types; how the syllables are patterned;

[308] Oliver Behr and Otto von Helversen, "Bat serenades--complex courtship songs of the sac-winged bat (*Saccopteryx bilineata*)," *Behavioural Ecology and Sociobiology* 54 (2003), 106-107.

[309] Timothy E. Holy and Zhongsheng Guo, "Ultrasonic Songs of Male Mice," *Public Library of Science: Biology* vol. 3, no. 12 (1 November, 2005), <http://biology.plosjournals.org/perlserv?request=get-document&doi=10.1371/journal.pbio.0030386 (Accessed 22 May 2006).

how the songs are developed or learned. Tim Holy and Zhongsheng Guo, discoverers of these ultrasonic songs, suggest that wild mouse songs may be even more complex than those of the laboratory mice whose songs were first discovered, since laboratory mice are the result of many generations of genetic selection for non-vocal characteristics, and since the laboratory is devoid of the stimulus that a natural environment would provide.

The discovery of mouse song is in itself quite exciting, but perhaps the most significant aspect of this discovery is that an animal family so well known to us, not only through millennia of cohabitation (usually unintentional, on our part), but also through a century of intensive experimentation, is only now being discovered to sing. If we have been unaware of the songs of a species so close to us, perhaps there are many songs in species less familiar to us that we haven't found yet. It used to be common to say that mammals don't sing (this by Westerners who were unfamiliar with gibbons, probably), or more recently that only whales sing. But with the recent "discovery" of mouse and bat songs, it seems that many mammals sing.

Elephants

While wild elephants are not known to make aesthetic sounds, captive elephants have given strong evidence of possible aesthetic inclinations. "Unemployed" former logging elephants in Thailand, now living in a conservation centre, have been given a set of specially made elephant-sized Thai instruments to play with. Many of the elephants have become quite interested in these instruments, and voluntarily play daily. Recordings of the playing sessions of the "Thai Elephant Orchestra" are easily mistaken for music by humans. Certainly elephants have no biological need to play large, specially constructed Thai-style musical instruments, and no equivalent behaviour has been observed in the wild. While of course we can't know for certain that their use of these instruments has anything in common with our music, parsimony suggests that the similarity of their approach to our own, and the similarity of sounds and sound structures created, along with the relative similarity of brain structure and intellectual capacity, makes similarity of intent more likely than complete dissimilarity.

As with humans (and, apparently, orcas), only some individuals of the elephant species seem drawn to playing music. Each has favourite instruments, and others that it leaves untouched. Like human improvisers, elephants find sounds and sound patterns they like and thoroughly explore these before adding new elements. Strong evidence that the elephants in some way relate the sounds they make to human music they have heard lies in the fact that although their instruments include more notes than are used in the Thai scales, they initially choose to play only those notes which are part of the scales with which they are familiar.[310] Gradually, they explore the new notes, and eventually begin to incorporate them into their playing. Music, for these elephants, appears to be what anthropologist Desmond Morris describes as a "self-rewarding activity," an action "which, unlike most patterns of animal behaviour, [is] performed for [its] own sake, rather than to attain some basic biological goal."[311] Other studies have shown that elephants possess many skills we associate with good musicianship, such as perfect pitch, ability to recognize learned melodies played back in transposition or at different speeds, and recall of melodies over a period of years.

Elephant vocalization, like mouse vocalization, has only recently become a subject of intensive study. It, too, can only be heard by humans with technological assistance, since much of it is too low. In the early 1980s, Katy Payne, also known for her whale research, and her colleagues discovered that elephants make infrasonic sounds, which are believed to be used to communicate over long distances (up to ten kilometers), and to communicate emotional information. These sounds are at around 14 Hz, and can only be felt by humans as a low rumbling. Elephants have also recently been discovered to employ vocal imitation. Mlaika, a ten year old female African elephant (*Loxodonta africana*) living with a group of orphaned elephants in Tsavo, Kenya, has been observed on a number of occasions to imitate the sounds of the trucks she can hear from her enclosure,

[310] Dave Soldier and Richard Lair, liner notes for *The Thai Elephant Orchestra* Mulatta Records CD, 2000.

[311] Desmond Morris, *The Biology of Art* (London: Methuen, 1962), 10.

and Calimero, a 23 year old male African elephant imitates the chirping sounds made by the Asian elephants (*Elephas maximas*) with whom he has shared an enclosure for 18 years in a zoo in Rome.[312]

The recent discoveries of elephant imitation and infrasonic sound, combined with elephants' intelligence and their propensity towards "music-making" in captivity, suggests to me that elephants might in fact make some sort of aesthetic sound in the wild, which we have not yet found. Certainly many of the elements essential for a musical species, such as ability to engage in vocal learning and tendency to play with patterns, are present Much research remains to be done.

[312] Joyce H. Poole et al., "Elephants are Capable of Vocal Learning," *Nature* 434 (24 March, 2005), 455-456.

CHAPTER 6

Musical Universals

Thus far we have looked primarily at some of the outer parameters of music and aesthetic sounds. We've seen philosophical, historical, and scientific arguments which suggest that the inclusion of non-human animals within the realms of music-makers is valid. We've seen that definitions of music and the aesthetic which are suitable for human music also tend to be suitable for some animal songs. And we've seen that functionality or lack thereof do not do a good job of distinguishing between human music and animal songs. Now is the time to look at some of the inner properties of music. How do we recognize music? What are its characteristics? What sort of materials and processes does it use, and how are these manifested in the aesthetic songs of humans and other species?

"Musical universals" are a recurrent, if controversial, topic in ethnomusicology, and looking at some of these so-called "universals" seems a good place to start for comparison of animal and human sounds. If some of the human musical universals can be found also in the aesthetic sound of some animals, this could lend support to the idea that they are related. Presence of musical universals across species would not in itself be enough to prove that animals make a music comparable to that of humans, of course. Universals across species could be coincidental, or a product of the physiology of sound-making, or merely illustrative of acoustic principles of the universe. And though there may be some universal traits shared by all music, not all things which share these traits would necessarily be music. But if we do find sonic universals existing in conjunction with evidence of related sound-making behaviour among diverse musical species, this would argue strongly for the close relationship between animal and human songs.

Of course all this is not to suggest that all the songs of non-humans would be likely to contain all human musical universals. And this is certainly not to imply that there is a universal music of all non-human animals, as if non-human animals were all closely related to each other, and humans uniquely distant -- surely each species would have its own set of universals. But perhaps among the various species-specific universals there will be a few shared by all or many species, including humans. This might indicate a common zoological musical sense, one which would underlie any species-specific musical imperatives.

Unfortunately, attempts to find universals even in human music have met with only limited success. Proposed "universals" based on specific musical traits have often disappeared when more cultures are studied, or hold true only when the ethnomusicologist examines other cultures so thoroughly from the perspective of his or her own culture that the real differences that exist between the musics are overlooked. Even when a seemingly solid universal is found, it is impossible to know if is truly universal, because we cannot know all music of all places and times. At best something can be a proposed universal, true for all known music, but ever awaiting the discovery of some other type of music which might prove the exception. The potential for confusing tautologies with universals -- for example declaring that all music has a melody, or is beautiful, or has a steady rhythm, and then dismissing any music which does not possess this characteristic -- further complicates the issue.[313]

Perhaps due in part to the difficulty of finding universals even for human music, few have devoted much energy to finding out whether any human universals apply also to animal music. Martinelli has an extensive chapter on zoömusicological universals, but most others who compare specifics of animal songs with specifics of human music do so only on the superficial level of pointing out similar surface characteristics (such as tone

[313] Ken Gourlay, "The Non-Universality of Music and the Universality of Non-Music," *World of Music (Universals II)*, vol. XXVI , no. 2 (1984), 29-30.

qualities or note choices) and assuming they must mean the same things to their respective singers, without further investigation.

Despite the difficulty of working with universals, a few do seem solid enough to make looking for their presence in animal songs worthwhile. Some of the most robust apparent universals are those based on the physics and biology of sound-making. Philip Tagg has identified four universal relationships in human music which have to do with the nature of making sound from a living body, situated in a physical environment. All of them seem equally applicable to the songs of many non-human species. They include the relationships:

> 1. • between [a] musical tempo (pulse) and [b] heartbeat (pulse) or the speed of breathing, walking, running and other bodily movement...[314]

This would seem to hold true for animals as well as humans. Birds, with their faster metabolisms, and hearts beating up to 900 times a minute, have much faster songs than we do. Many bird songs sound at their original speed like clicks or buzzes to us, and need to be slowed by a factor of four or more for us to even begin to perceive their melodic complexity. Other songs, such as that of the pied butcherbird, which seem to take place at a more human speed, in fact involve detailed ornamentation on each note, which we can hear only when the playback is slowed. Whales, on the other hand, with their much larger body size and slower heartbeat (as low as six to ten beats per minute in larger species), sing songs that take place over a much greater duration and at a slower pace than the human. Humpback Whales have been heard to sing for up to 24 hours continuously, and their songs involve many long, slow notes and gradual glissandi. Gibbons, somewhat closer in size to humans than either whales or (most) birds, sing at a pace and for a duration that seems quite typically musical to us, with songs and song sessions lasting a couple of minutes to half an hour.

[314] Tagg, *Towards a Definition of Music*, 5-6.

> 2. • between [a] musical loudness and timbre (attack, envelope, decay, transients) and [b] certain types of physical activity. This means no-one can make gentle or 'caressing' kinds of musical statements by striking hard objects sharply, that it is counterproductive to yell jerky lullabies at breakneck speed and that no-one uses legato phrasing or soft, rounded timbres for hunting or war situations.[315]

This certainly seems as true for non-human singers as for humans. Birds sing quietly, gently, and flexibly to their young in the nest, and use harsh, loud, stereotyped warning calls to warn off intruders. Gibbons sing melodious, long-phrased, intricate duets with their partners, and loud, percussive hoots when playing boisterously with a group.

> 3. • between [a] speed and loudness of tone beats and [b] the acoustic setting. This means that quick, quiet tone beats are indiscernible if there is a lot of reverberation and that slow, long, loud ones are difficult to produce and sustain acoustically if there is little or no reverberation...[316]

Animals do adjust their songs to the acoustic setting. Whales use low sounds which carry well across the ocean floor. Birds who sing in open spaces are more likely to use rapidly varying pitch than those who sing in the forest, where the density of trees would interfere with the transmission of a complex song. Forest birds instead tend to use pure, sustained tones, which will not be distorted by the trees. Low sounds travel better than high sounds close to the ground, so birds doing much of their singing and displaying close to the ground, such as various species of grouse, tend to use primarily low sounds. Water birds have short, high, penetrating calls which cut through the constant low frequency background roar of the ocean.[317] Loon expert Jeff Fair writes "We know that an animal's call is often developed in relation to the environment. . . Many loon calls . . . are about the same frequency or pitch as the cries of gulls. It's a frequency that carries well through the white noise of aquatic environments. The calls have a specific shape that is molded by the

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[315] Ibid.

[316] Ibid.

[317] Catchpole and Slater, 79.

landscape."[318] Fair writes further about the possibility that loons may tailor their songs to each individual pond, suggesting that reflection of the environment may be an integral part of the definition of loon song (and perhaps that of some other species as well.) Animals may even control the acoustic setting in which they produce sound. The (male) kakapo (*Strigops habroptilus*), a rare, nocturnal, flightless parrot from New Zealand, for example, tramples an acoustically resonant hollow into the ground to sing from, which enables the sound he makes to carry up to five kilometers across the forest floor.

> 4. • between [a] musical phrase lengths and [b] the capacity of the [human] lung. This means few [people] can sing or blow and breathe in at the same time.[319]

This, along with other physically imposed limitations, of course applies to all species. Birds, with their smaller lungs, tend to have very short motives and phrases (although they can create the illusion of continuous sound by producing sound alternately from both sides of their syrinx), while insects which produce their sounds mechanically, for example by rubbing their wings together, are not limited by air supply, and thus tend to have continuous songs. Cold-blooded, insects are instead restricted in their sound-making by temperature, since they can only perform when they are warm enough to move at adequate speed.

While these four correspondences may seem trivial on first glance -- as if they might be the inevitable result of physical or biological reality rather than facets of anything inherently musical -- they in fact are central, as they provide an underpinning for all human music, a framework around which all music must operate. They remind us that music comes from the body, and that the body interacts with its physical and emotional

[318] "On Loons and Landscape: A Conversation with Jeff Fair," *Wild Earth* (Richmond, VT: Wildlands Project, spring, 2003), 44.

[319] Tagg, *Towards a Definition of Music*, 5-6.

environment, and that these facts determine music's very nature.[320] Finding that these principles are embodied in many potentially aesthetic animal songs, too, suggests that these songs may have the same relation to the physical that human music does. If all species are operating with similar physically- and biologically-based restrictions when creating sound, perhaps the ways in which we engage with these restrictions might be similar too.

Ethnomusicologist Charles Boilès finds no absolute sound universals except that music exists in all cultures, and doubts that universals could be found which would be recognized by everyone. Expressing an outlook similar in spirit to Uexküll's Umwelt theory, he writes "Any individual or any group of individuals perceives music to exist according to a set of particulars; at the level of cross-cultural comparison, any or several of the particulars accepted by the group may be rejected by another."[321] But he does find a limited number of ways that music is created or realized -- not one "universal" way for all musics, but several ways, at least one of which is embodied in each type of music.

Boilés observes, for example, that in all cultures, the sound aspect of music may be accompanied by one or more of the following visual aspects: graphic (eg. notation, or correspondence between a piece of music and a painting), kinetic (eg. dance or sound sculpture), or kineluminescent (use of light or color.) Not every culture has all of these, but all have at least one. This would seem to hold true for animals as well. While graphic representation of, or accompaniment to aesthetic sound is unknown in non-human animals (unless bowerbirds' decorated bowers are considered graphic accompaniment to their mating song), many species have kinetics associated with their sound production. In addition to courtship "dances" which accompany song in mating rituals, exhibited in some form by most species, many animals adopt specific poses for singing (just as human singers often have characteristic poses and gestures.) Humpback whales, for example,

[320] Electronic music does not come from a living body, of course, but it is nonetheless created by people who have the experience of living in and making sound with their bodies. In any case, electronic music represents an extremely small percentage of all human music.

[321] Charles Boilès, "Universals of Music Behaviour: A Taxonomic Approach," *World of Music (Universals II)* vol. 31, no. 2 (1984), 51.

sing relatively close to the surface of the ocean, with their head pointing down at a 45 degree angle and their flippers spread wide.[322] Wolves use a characteristic howling posture, with their head pointing up, their legs rigid, and their body leaning slightly forward.[323] Kineluminescence may even occur in certain animals. The display of brightly colored feathers or fur markings during courtship rituals could be considered kineluminescent as well as kinetic, and the satin bowerbird (*Ptilinorhynchus violaceus*) takes great pains to paint his bower, where he will be singing and displaying, bright blue. No species seems to produce all of its aesthetic sound entirely dissociated from at least one of these physical manifestations.

Boilès also distinguishes types of human music on the basis of specificity. He recognizes four kinds of music in human cultures. Ranging from the most to the least specific these are: determinate (artifacts, such as scores and recordings), programmatic (known pieces, "the repertoire"), immediate (music with generative rules such as raga, jazz, and other forms of improvised and partially improvised music), and probabilistic (such as chance or soundscape music.) Determinate musical artifacts, though currently common in the West, are rare in the totality of human musical culture, and seem not to exist among animals, but both programmatic and immediate aesthetic sounds are prevalent in many species. "Programmatic" animal sounds would include relatively fixed songs, such as those of gibbons and those of birds who learn precise and rigid songs from adult tutors. The songs of imitative birds such as mockingbirds and lyrebirds, which are made of "found sounds," pieced together according to a species-specific pattern, fit into the "immediate category," as would those of birds such as sedge warblers, which constantly vary and elaborate upon their individual repertoire of syllables. Humpback whale songs, as many kinds of human music, might fit somewhere in between, being programmatic in their day-to-day manifestation, but immediate in their long-term tendency to change. "Probabilistic" is the trickiest kind of music to recognize, since it depends on the intent, of

[322] Roger Payne, "New Light on the Singing Whales," *National Geographic* vol. 161, no. 4 (1982), 472.

[323] Martinelli, 261.

either performer or listener, that it be perceived as music. Until our ability to communicate with or understand the minds of animals is far greater than it is today, we will not be able to know if this is taking place. That certain animals seem interested in some human music -- canaries, for example, will readily sing along with human musicians -- suggest that some animals are at least capable of being aesthetically attracted to things they have not created.

Few specifics of musical sound or materials seem to be "universal," but a number of them belong to the realm of what ethnomusicologist Bruno Nettl calls "near-universals." About the near-universals he writes: "It may be helpful to consider various levels of universals -- those extant in music at all times, those present in each musical utterance, others present in some sense in each musical system or musical culture, and yet others found in most but not all cultures."[324] Nettl divides near-universals into "things found virtually everywhere with the occasional exception, followed perhaps by what could best be labelled statistical universals." Mâche, too, considers near-universals to be significant, and to be potentially helpful in showing a link between animal and human music. He writes of near-universal musical traits, "It is enough that they should appear in independent contexts . . . and that their function presents analogies too close to put down to chance."[325] The search for near-universals may in fact be more appropriate than the search for absolute universals since even within a given musical culture, what constitutes music will not necessarily be agreed upon by all: what one person perceives as a universal will not universally be perceived as universal.[326]

Near-universals would include some of the more specific musical traits, the patterns of sound which help us recognize that something is music. They would not necessarily be present in almost all examples of music: rather, almost all cultures would have some kind of music that embodied these characteristics. Some of the more widely acknowledged

[324] Bruno Nettl, "An Ethnomusicologist Contemplates Universals in Musical Sounds and Musical Culture," in *Origins of Music*, Wallin, Merker, and Brown, eds., 463.

[325] Mâche, 34.

[326] Nattiez, cited in Koskoff, 69.

near-universals in human music are recognition of octave equivalence, and the use of discrete pitches, often arranged into a scale. Nettl further recognizes that:

> All societies have vocal music. Virtually all have instruments of some sort, although a few tribal societies may not, but even they have some kind of percussion. Vocal music is carried out by both men and women. . . . All societies have at least some music that conforms to a meter or contains a pulse. The intervallic structure of almost all musics involves, as the principal interval, something close to the major second but to be sure, not with precision. . . . All societies have some music that uses only three or four pitches, usually combining major seconds and minor thirds.[327]

Ethnomusicologist David McAllester adds to this list the ubiquity of tonal centers and the tendency of music to be "going somewhere."[328] Slightly less widespread, but statistically prevalent musical traits are cadential elements, pentatonic scales, duple and quadruple meter, and the use of certain instruments, most notably drums, rattles, and flutes.[329]

Some of these near-universals may, of course, be specific to humans, and will not be found in any other species. Others may independently be specific to several species, though not to aesthetically inclined animals as a whole. And perhaps a few will be universals at the basic zoological level. Using human near-universals as a starting point certainly has its limitations. It may cause us to overlook sound which is aesthetic in the Umwelt of another species, although we do not perceive it as such, but it is nonetheless interesting to investigate which, if any, of the human universals or near-universals may be common to the aesthetic sound of species besides our own. Our own music has to serve as the starting point for us to recognize the music of other species. In the following pages, I examine each of the near-universals mentioned previously, with examples of how they may apply or not to the aesthetic sounds of some non-human species.

Recognition of octave equivalency

[327] Ibid.

[328] Koskoff, 66-69.

[329] Nettl, "An Ethnomusicologist Contemplates Universals," 470.

Most human cultures recognize octave equivalence: that is, two notes an octave apart are usually considered the same note. A man and a woman singing a song in octaves will be considered to be singing the same song. Though octave generalization has been little studied in non-human animals, a few studies show that it is not limited to humans. The most extensive study deals with octave perception in rhesus monkeys (*Macaca mulatta*).[330] Researchers trained two rhesus monkeys, a male and a female, to indicate whether two sounds were the same or different. The researchers began by training and testing the monkeys with recordings of natural and environmental sounds, such as coyote howls and car crashes. Once the monkeys were reliably indicating whether any two given sound examples were the same or different, the researchers began including melodies at several different transpositions in the mix. They found that the monkeys reliably identified tunes transposed by an octave or two octaves as the "same." Tunes transposed by a fifth or an octave and a fifth were perceived as "different."[331]

Of course it is hard to know exactly what the rhesus monkey research means. A review of the rhesus monkey experimentation by evolutionary psychologist March Hauser and music psychologist Josh McDermott suggests that though humans and rhesus monkeys may both generalize octaves, this could mean very different things for the two species. They point to the fact that humans also tend to recognize melodies transposed by intervals other than an octave as the same, whereas rhesus monkeys do not.[332] This is an interesting point, though further study would certainly be needed to draw any conclusions. We don't know what the monkeys were understanding by "the same." Given a similar test, humans would give a very different response depending on whether they were looking to identify

[330] Anthony A. Wright et. al., "Music Perception and Octave Generalization in Rhesus Monkeys," *Journal of Experimental Psychology*, vol. 129, no. 3 (200), 291-307.

[331] Interestingly, simple, tonal melodies such as "Old MacDonald," "Yankee Doodle," or "Happy Birthday" were most easily identified in transposition, labelled "the same" about 80% of the time, while random atonal melodies were considered the same less than 55% of the time. This suggests that rhesus monkeys share not only our tendency to generalize octaves, but also some aspects of our conception of melody. (Wright et al., 5.)

[332] Marc D. Hauser and Josh McDermott, "The evolution of the music faculty: a comparative perspective," in *Nature Neuroscience* vol. 6 no. 7 (July, 2003), 663-668.

the same melody (whatever key or octave), the same key, or the same octave.

Rhesus monkeys are not the only species to have been observed to generalize octaves. Earlier studies have shown that white rats (an albino laboratory strain of the Norway rat, *Rattus norvegicus*)[333] and bottlenose dolphins (*Tursiops truncatus*)[334], too, recognize octaves as equivalent. Not all species seem to exhibit octave generalization, however. One study shows that although European starlings (*Sturnus vulgaris*) have a sort of absolute pitch recognition -- they always sing the same motive at the same pitch -- they do not generalize between octaves as humans with perfect pitch do.[335] Further studies of other species, both "musical" and otherwise, would be necessary to have any real understanding of pitch generalization across species. One hypothesis suggested by the very limited research available would be that mammals generalize octaves and birds do not, but of course nowhere near enough research has been done to even begin to support this idea.

Discrete pitches

Most human music uses discrete pitches. There are, of course some exceptions. Much 20th and 21st century Western music uses sliding pitches, noises, and sounds rather than or in equal measure with pitches; drumming and other percussive music is often unpitched; and the traditional music of the Samaritans near Tel Aviv and Nablus has "indistinct pitches and only very vaguely defined relationships among the voices."[336] But for the most part, slides, noises, and other non-note sounds, when they occur, tend to be

[333] H. R. Blackwell and H. Schlosberg, "Octave generalization, pitch discrimination, and loudness thresholds in the white rat," *Journal of Experimental Psychology* 33, (1943), 407 - 419.

[334] J. V. Ralston et. al, "Melody Recognition by an Atlantic Bottlenose Dolphin," *Journal of the Acoustical Society of America* (1988).

[335] J. Cynx, "Auditory frequency generalization and a failure to find octave generalization in a songbird, the European starling (Sturnus vulgaris*), Journal of Comparative Psychology* 107 (1993), 140-146.

[336] Nettl, "An Ethnomusicologist Contemplates Universals" in *The Origins of Music*, Wallin, Merker, and Brown, eds.

decorative, with discrete pitches providing most of the relevant musical information. Though animal songs in general seem to contain more slides, warbles, and non-pitch sounds than most human music, in many species (particularly birds), discrete pitch is similarly favoured. Among species which use primarily discrete pitches are the musician wren (*Cyphorinus arada*), the pied butcherbird (*Cracticus nigrogulari*), the hoopoe lark (*Alaemon alaudipes*), the hill blue flycatcher (*Musicicapa banyumas*) and the rufous-throated solitaire (*Myadestes genibarbis*), to name a few. In many other species, including the European blackbird (*Turdus merula*), the nightingale (*Luscinia megarhynchos*), and the spotted morning thrush (*Cichladusa guttata*), motives with discrete pitches are used in equal measure with warbles, slides, and percussive sounds.

A number of bird species sing songs in which each motive is made up of discrete pitches in fixed intervallic relation to each other, but each iteration of that motive will be gradually transposed up or down. The white-browed robin chat (*Cossypha heuglini*) sings a motive which travels upwards, for example, while the brown-backed solitaire (*Myadestes occidentalis*) sings a motive which descends each time it repeats. The separateness of each pitch is maintained, even though the frequency is gradually changing throughout the song. In these cases, the interval of transposition is generally smaller than the intervals between notes in the motives. This would be as if humans were gradually transposing a diatonic melody by microtones. Such transpositions are significant because they show that the birds have both a sense of relative pitch, as the contours stay the same in each transposition, and a sense of the motive as a unit, independent of the pitch-level it occurs at.

In species where warbles and slides, rather than discrete pitches, do make up the bulk of the song, fixed pitches are often used as anchor points. This seems to be the case for a number of mammals as well as birds. Wolves, humpback whales, and gibbons all mark structural points of their melodies with pitches, even though they move between them with slides.

Scale

In human musical systems, the discrete pitches can typically be arranged in order of frequency -- in scales -- which contain information (for those familiar with the musical culture) about pitch hierarchy. In Western musical culture, for example, the first note of each scale is the "tonic," the "home" note, and the fifth note is typically the "dominant," the "challenging" or "contrasting" note. Some bird species use series of ascending and descending pitches which sound much like scales. The canyon wren (*Catherpes mexicanus*), for example, sings something like a descending chromatic scale, and the common potoo (*Nyctibius griseus*) sings alternating five and six note descending scale passages, which sound almost like human pentatonic and hexatonic scales on the following pitches:

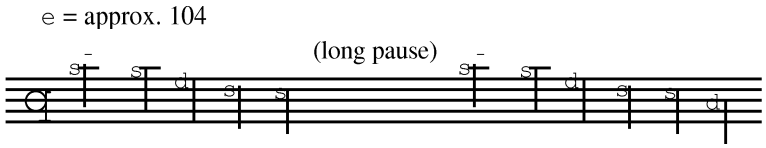

Fig. 5. Rough transcription of the song of the common potoo. The notes have small "ornaments" at their beginnings, but these are the most prominent pitches. (The recording transcribed is from the CD "The Diversity of Animal Sounds,", Cornell Laboratory of Ornithology [2001], track 29.)

Simply because birds sing things which sound like scales, however, does not mean that these have the same signification for the birds that scales do for us. While our scales imply tonal relationships, a scale-like arrangement of notes for a bird might simply be an array of notes (more like a chromatic scale for us, which lists all our notes, but does not imply a hierarchy), or a physical exercise of tightening or relaxing muscles, which incidentally results in the raising or lowering of pitch. For many of the birds, the scale-like passage they sing seems to be the song, not just the material or framework from which the

song is drawn. This is very different than human use of scales, and strongly suggests to me that the use of apparent "scales" by at least some non-human species does not have the same signification that the use of scales does for us.

Tonal centers and tonal hierarchies

Lack of scales does not mean there can't be some sort of pitch hierarchy. Coming back to certain pitches at structural points in the song, as many animals do, suggests there might indeed be a pitch hierarchy, though it would be hard for us to distinguish this from a sense of absolute pitch which causes an animal always to sing the same motive in the same pitch. Many bird songs are easily perceived by humans to have a tonal hierarchy. (This is not to say that they do have a tonal hierarchy -- I can't know hoe the bird is experiencing its song -- only that they seem to). This is particularly recognizable where the pitches overlap with those used in our own tonal structures. The musician wren, for example, uses pitches which seem drawn from a major scale, and many other species sing substantial portions of their song in what sounds like human scales.

Some avian song structures even sound to us as if they imply a tonal center (as if they are in a key). Long passages of the musician wren's song sound not only as if they are taken from the major scale, but as if the pitches are chosen according to the same tonal rules we follow. The tropical boubou's duet song contains what sounds like a harmonically and melodically appropriate use of the 1st, 5th, and 6th notes of a major scale.

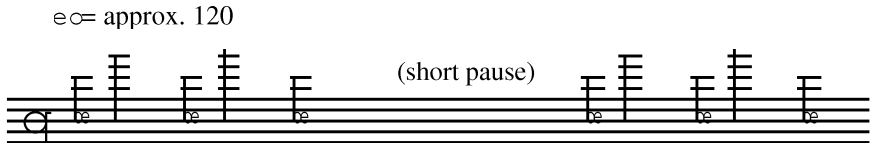

Fig. 6. Rough transcription of the tropical boubou's duet. The parts lock together so intricately, that it is hard to tell which bird sings which part. These notes are connected together with very subtle glissandi. (Recording from the CD "Les plus beaux chants d'oiseaux," recorded by Jean C. Roché, Auvidis [1987], track 16.)

The winter wren song (which needs to be slowed considerably to be comprehensible by humans), contains a most remarkably tonal sounding passage, in which an apparent arpeggio of a tonic chord is followed by what sounds like a sustained trill on the apparent dominant.

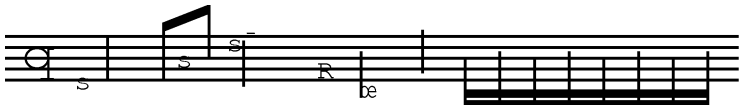

Fig. 7. Rough transcription of a portion of the winter wren's song. (Not at original pitch or speed.) ("The Diversity of Animal Sounds," track 35.)

Other species may well have structures consistent with the constructions of other musical cultures, but of course I would not recognize these as quickly as examples which sound like music I am familiar with.

Birds who draw on pitch collections father from human scales, too, may have songs which sound hierarchically structured, and which seem to imply a tonal center. Both the hoopoe lark and the pied butcherbird, for example, sing highly microtonal songs, in which different pitches appear to have different structural significance. Both return repeatedly to the same notes, and the motives appear to develop tonally throughout the song, In the hoopoe lark, a slow, chromatic melody gradually expands outwards while still seeming to keep the starting pitch as a sort of "tonal centre," while in the pied butcherbird the phrases are often linked by common tones and what sound like permutations of melodic motifs.

Steps and leaps

Perhaps related to the tendency to use scales, human music is proposed to have as a universal a tendency towards predominance of steps of approximately a major second. This would, of course, vary greatly between cultures, between genres within a culture, and

between the repertoires for different instruments. Vocal and wind music would be more likely to use steps, and string and brass music more likely to use some leaps, simply because of the physics of sound production for these instruments. My impression is that this is one near-universal that has less relevance for non-humans than for humans. Most bird songs, especially those using mostly discrete pitches, seem to use many leaps. Of course, songs like that of the hoopoe lark do favour steps (in this case even smaller than our seconds), but they seem to me to be a minority. Mammal songs, on balance, seem to favour slides between notes which are as close to each other as a second.

Simple songs

Three- or four- note songs, examples of which might be the children's songs "Rain, Rain, Go Away" and "It's Raining, It's Pouring," also seem to me to be a phenomenon relevant to humans, and perhaps a few other specific species, but not to animals as a whole. Some non-human species do sing simple songs with only three or four notes, but the species with more complex songs do not necessarily also have these simple songs. This universal is contested for humans too, however. Nettl points out that "we who come from a conventional background in Western music tend to privilege melodic movement and to give particular emphasis to intervals. The [various different three- and four-note] pieces are quite different from each other in rhythm and also in other ways -- singing style or timbre, dynamics, and perhaps much else."[337] That is, what we perceive as a simple three-note melody might be perceived by someone else as an exploration of timbre, or as an intriguing rhythmic pattern, and not as a simple three note melody at all. When we perceive an animal song as being made up of three or four simple repeated pitches, we may likewise be missing complexity in other areas of the song.

Vocal sound

The voice is the primary means of sound production for most species of mammals and birds, including ourselves, and as such is also the primary means of producing aesthetic sound. Animals that only produce sound mechanically, such as insects, seem far

[337] Nettl, "An Ethnomusicologist Contemplates Universals," 469.

enough away from being musical in many other senses -- their sounds are stereotyped and instinctive, for example -- that it would be hard to consider them musical in the same sense as humans. This universal thus seems equally applicable for all musical species. (In fact, this is one universal that may be even more applicable for non-humans than for humans, since humans make lots of non-vocal music too!)

Carried out by both males and females

The fact that in many bird and mammal species it is primarily males who sing is often given as a reason why we should consider animal songs to be fundamentally different than our own. David Huron's belief that ". . . there is little to support the view that human music-making arose in a manner analogous to the songs of songbirds [because] In songbird species, only the male sings . . . . in humans, there is no comparable sexual dimorphism"[338] is a common one. This is a little misguided for several reasons. First of all, the perception that only males sing is somewhat inaccurate (as discussed in chapter 5). While it is true that in many of the most studied species of birds males sing more than females, even in some of these species females do sing substantially. But more importantly, the predominance of male song found in the most-studied bird species does not even apply to birds as a whole. In temperate zones, where most ornithologists live (and consequently conduct their research), females sing comparatively little, but in tropical regions, where in fact the majority of bird species live, females often sing equally with males, both solo and in duet.

Furthermore, the argument that human song and animal song can't be related simply because some animal song is dimorphically distributed is in itself faulty. If we were comparing two species of birds, one in which only males sing and one in which both sexes do, we wouldn't say that their songs have nothing to do with each other simply because of their unequal distribution between the sexes. That female birds in species where females don't normally sing, such as zebra finches, will sing when injected with estrogen (or with testosterone in some species), whereas neither the males nor the females of non-singing

[338] Huron.

species, such as quails, will sing, no matter what they are injected with, strongly suggests to me that equally distributed singing represents the ancestral condition for singing birds. Though humans are less closely related to birds than any two species of birds are to each other, in all ways the argument that human and animal song are unrelated because of the supposed sexual dimorphism of animal song makes little sense.

Drums/resonating chambers

Almost all human cultures use drums in addition to voice. If only one instrument exists, it will be the drum. Though animals produce primarily vocal sounds, a few species drum too. Members of the family *picidae*, woodpeckers, flickers, and sapsuckers, are the best known animal drummers. Each species has its characteristic pattern, and individuals within each species have their own variation. One bird, the palm cockatoo (*Probosciger aterrimus*) uses a stick to drum against hollow trees. Other bird species use parts of their body against the air to make sounds. Snipes use their tail feathers to make a drumming sound while flying, and ruffed grouse (*Bonasa umbellus*) stand on the ground and beat their wings against the air to produce a similar sound.

None of the apes, with the possible exception of gibbons, sing an aesthetic song, but gorillas (*Gorilla gorilla*) make ample use of "body percussion." Silverback males typically end hooting bouts with chest beating. This strikes me as being much less closely related to human drumming than bird drumming, however, because of the lack of vocal learning ability in non-human primates.

Meter/pulse

Few animal songs seem to conform precisely to a meter or pulse, but there are some songs which at least sound like they have a steady pulse. The thrush nightingale (Luscinia luscinia), for example, sings a highly rhythmic song, long passages of which appear to maintain a steady beat.[339] The bird sings a variety of rhythmic values over the underlying

[339] Magnus Robb first drew my attention to the apparent metricity of the thrush nightingale song.

beat without deviating from its regularity. Many other bird species, such as the song thrush, jump quickly from one tempo to another in their songs. Often, each motive is at a different tempo. The song will sound to us as if a few beats in one meter are followed by a few beats in another. This might resemble Stravinsky (as noted by Mâche) or John Zorn than like Bach, but is certainly no less valid a type of music.

Rhythm does not need to be regular as understood in the Western sense in order to be patterned, of course. Ethnomusicologist John Baily writes of his experiences playing birdsong recordings for Afghan musicians :

> I then put on a recording of real nightingale song, and they gave this a very positive response. They found it much more enjoyable to listen to than Messiaen's "Le Loriot." Aref responded to the bird with extended strings of verbalized tabla bols. He then found that the bird's song could be fitted into Tintâl (the 16 beat metrical cycle), and started clapping the tâl. This shows, I think, that when Aref hears the song of the nightingale he hears it from the point of view of a tabla player. For him, bird calls are structured like drum patterns.[340]

And of course the rhythm of bird and other animal songs doesn't need to be metric in any human sense to be possessed of its own rhythmic conventions. Animal songs are rarely rhythmically random -- motives of birdsong involve consistent rhythms as well as pitches, for example. Short passages of rhythmically repeated notes, steady, accelerating, or decelerating, are a particularly common motif for many species, both mammal and avian.

It has been suggested that regular meter in human music developed to enable people to play together in groups of two or more. That few animals sing together groups larger than two (except some bird species in heterophonous dawn choruses, wolves and coyotes howling, and humpback whales in overlapping song sessions), might explain why regular meter hasn't developed in most species. Animals which sing duets do depend on each partner being able to sing with relative rhythmic consistence, as well as on each partner

[340] John Baily, "Investigating inter-cultural music perception: Messiaen's 'Le Loriot' and Afghan reception of birdsong," *Proceedings of the Music Studies and Cultural Difference Conference*, Open University (July, 1997), <http:/www.open.ac.uk/OU/Academic/Arts/music/mscd/mscd1. htm1 (Accessed 24 May, 2006)

being able to make the minute adjustments necessary to stay in time with the other.

The plain-tailed wrens (*Thryothorus euophrys*), which have recently been observed to sing in groups of four to seven, sing a song with the form ABCDABCD. All males sing together on the A and C parts, and all females sing together on the B and D parts. These songs certainly have a steady, predictable rhythm, if not exactly a meter.

Tendency to be going somewhere

The "tendency to be going somewhere" is a pretty nebulous concept even in human music, and to find it in animal music seems near impossible. In human music, our ability to perceive a piece as "going somewhere" often depends on our fluency in the musical language in which it was written, something we can never have for animal songs. Certainly some animal song seems to be going somewhere -- the humpback whale song and that of the pied butcherbird, among others, seem very directed, and we can easily sense what seem to be the structural points of the song -- but who knows if this is how they sound to the animals who create them?

This "near-universal" seems a little questionable to me even in the context of human music, however. Lots of music seems more continuous than directed, including ambient music, drum circles, rounds, some ritual music, Gregorian chant, and indeed, almost any music which is meant to be sung and played over and over again with no prescribed stopping point. When music is criticized for "going nowhere," this may just be a thinly veiled attack on functional music or non-"art" music by a critic who feels that the only valid music is that which follows the very directed, climax-oriented pattern of most common pratice era Western art music. I've also heard music criticized for "going nowhere," when the critic simply meant they thought it wasn't good music.

Cadential elements

If by "cadential elements" we mean motives or phrases which signal the impending ending of a song, these are undeniably present in animal songs: they may even be one of

the primary signs of the existence of a musical syntax. Humpback whale rhymes are perhaps the most striking non-human example. Within a song, many quite different phrases may end in the same way. Birds, too, will often end each song in the same way, even though the middle part of the song may vary considerably each time it is sung. Gibbons also end their duets in a prescribed manner, though in their case the whole song is fairly prescribed.

"Statistically prevalent" elements

Other elements which have been identified as "statistically prevalent" in human music, such as pentatonic scales, duple and quadruple meters, and the use of certain instruments (in addition to drums) do not appear to be present in animal songs. Though things which sound like pentatonic scales and even duple or quadruple meters do appear occasionally in the aesthetic sound of non-humans, it would be impossible to ascribe these to anything other than chance without knowing something of the "music theory" of the animal who creates it. However, two of these statistically prevalent specifics could be seen simply as human refinements of more widely spread near-universals which are present to some degree in some animals -- a pentatonic scale is a refinement of distinct pitches, and meter of a steady rhythm. And the use of instruments would obviously be limited by animals' inability to construct them.

Putting together all these observations on the cross-species prevalence of human musical universals and near-universals, we can see that the physical and biological universals identified by Tagg, and the situational universals identified by Boilès seem to apply equally well to humans and non-humans, while the sound specific universals and near universals have a more mixed presence. Only one of these seems to apply absolutely to all musical species, the use of the voice. The use of discrete pitches is also widespread, if not quite enough so to be considered an interspecies near-universal. A couple of these, the tendency toward step-based construction, and the use of three- and four-note songs seem not relevant at all in animal song. (Interestingly, these are the near-universals which

are less widespread or satisfactory for humans too). But perhaps the majority of the near-universals in human music fall into the category of being present in some degree in some animal music. Ability to generalize octaves and equal distribution between males and females, for example, are unquestionably present in some species, but not in all. Scale, steady rhythm, tonal center, and the tendency to be "going somewhere" may all be present in some animal songs, but it is hard for us to know.

Universals and Near-Universals	Humans	Other Primates	Cetaceans	Other Mammals	Birds
rel. betw. tempo and pulse, breath, etc.	yes	yes	yes	yes	yes
rel. betw. loudness and activity	yes	yes	yes	yes	yes
rel. betw. speed/loudness and acoustic setting	yes	yes	yes	yes	yes
rel. betw. phrase length and lung capacity	yes	yes	yes	yes	yes
graphic, kinetic, or kineluminescent	yes	yes (kinetic)	yes (kinetic)	yes (kinetic)	yes (kinetic/ kineluminescent)
determinate	yes	no	no	no	no
programmatic	yes	yes	yes	unknown	yes
immediate	yes	maybe	yes	yes	yes
probabilistic	yes	unknown	unknown	unknown	unknown
octave equivalency	yes	(yes)	unknown	(yes)	(no)
discrete pitches	yes	yes (some)	yes (some)	yes (some)	yes (some)
scales	yes	(no)	(no)	(no)	maybe
tonal centers/hierarchies	yes	(yes)	(yes)	(no)	(yes)
steps	most	some	some	some	some
simple songs	some	some	(no)	unknown	some
vocal sound	yes	yes	yes	yes	yes
males & females	yes	yes	(no)	some	some
drums	yes	yes	(no)	(no)	some
meter/pulse	yes	(some)	(some)	(some)	(some)
going somewhere	(yes)	(yes)	(yes)	(yes)	(yes)
cadential elements	yes	yes	yes	(yes)	yes

Fig. 8. A comparison of human universals and near-universals across species. A "yes" means that some songs of some species within that category exhibit that universal, not that all do. Parentheses indicate things I suspect but do not know for certain to be true, or situations for which I have only partial knowledge.

One might object that some notable features of some human music do seem to have no equivalent in animal songs. These would include the use of complicated harmony, notation, and the development of a system of music theory. These are all prominent features of Western classical music, but are actually relative rarities in the totality of human music. Animal musics are not, in fact, unusual for their lack of these!

Finding these apparent correspondences between animal and human music, while interesting, however, might just show surface similarity, not necessarily similarity of function or significance. For us to know if these similarities have a deeper meaning, the aesthetic sounds created would need to occupy a similar place in the animal's species-specific Umwelt that music does in ours. One important indicator of whether something is music (as discussed in chapter 3) is that it be considered and treated as such, by performer, listener, or both. As Boilés writes, ". . . Our definition of music must arrive from an understanding of the intent that it be so."[341] We cannot ask animals their intent, but we can try to determine through observation and analysis if their intent appears to be comparable to that of our own. This involves situating an animal's sound-making behaviour within the context of the entirety of the species' behaviour and environment.

We've already mentioned some similarities of behaviour between our music and that of other species. Singing animals tend to adopt certain postures; singing is often associated with movement; singing is often related to such social functions as mating, maintaining territory, group membership, or individual identification;[342] singing is more likely to occur at some times and locations than others. Cognitive psychologist and musician Dane Harwood has identified some universals which point towards the place music defines for itself and occupies, both in relation to itself, and in relation to the other behaviours of the music maker.[343] In a way, these may be the most important universals, since they point to how to recognize music based on its own internal characteristics, rather than just on the basis of external qualities, which may too easily superficially resemble non-musical things. Interestingly, these universals, like the four physically and biologically

[341] Boilès, 51.

[342] In mentioning these I am not endorsing any one theory of music's origin or function, nor suggesting a causal relationship in either direction. This is just a reminder that these functions tend to occur in association with music, for whatever reason.

[343] Dane L. Harwood, "Contributions from Psychology to Musical Universals," *The World of Music* vol. 21, no. 1 (1979), 57.

related universals mentioned by Tagg, apply almost without exception to most aesthetic-sounding animal songs.

1. Units of musical structure relate to other such units in the same musical performance.

This would refer to structural elements such as the repetition, variation, or development of motives, and pitch relationships, within a piece or a series of pieces. This seems to me to be as true for most species of animals as it is for humans. With few exceptions, singing animals use repeated motives, and often return to motives at various points throughout a piece. Variation of motives occurs in the songs of most passerine birds. What sounds like "development" is readily apparent in the songs of humpback whales. And intentional pitch relationships are suggested by the large number of songs which return repeatedly to the same pitch.

2. Musical performance relates to prior performance.

In most species, the songs are fairly consistent from iteration to iteration. Performances will often relate to each other by simple imitation. In more improvisatory species, songs will usually share some, if not all motives, and the way of arranging them will probably follow similar patterns (such as the tendency to repeat motives a certain number of times), though the results will be different. In humpback whales, the songs develop throughout the singing season, each building on previous performances.

3. Musical activity derives meaning from the social environment of the performance.

This may be even more true for animal song than for human song (or perhaps this is just more obvious to us when we can observe from the outside). Almost all animal songs are at least sometimes used in important social interactions, including the attraction of mates, communication with rivals, and group identification.

4. Musical meaning accrues through the relationship of musical behaviour to other non-musical aspects of the real world.

Animal songs tend to occur at specific times of the day, and are affected by things such as weather and temperature, so this universal also seems to hold true. Many species also directly imitate non-musical sounds or the songs of other species by making foreign sounds a part of their own sound world. As well, animal songs relate to the activities and emotions of the singing animal.

In concluding this chapter, It is important to remember here that ethnomusicology is to a large extent an occupation undertaken by Western academics (not all of whom have much direct experience with music-making), or by those with Western academic training, and as such, ethnomusicologists, while looking at the music of the whole world, look at it very much from Western eyes. Thus, these universal, near-universal, or simply common traits are only those that a Western musician would perceive. Bruno Nettl writes "No doubt the prominence of melody over rhythm in the development of Western musical theory had provided the context for development of ethnomusicological procedures."[344] Almost certainly there are other universals, for humans and for all species, which have so far been overlooked by Western ethnomusicologists. A broadening of the field of zoömusicology will hopefully bring these to light.

[344] Bruno Nettl, "Types of Tradition and Transmission" in *Cross-cultural Perspectives on Music, ed.* Robert Falck and Timothy Rice (Toronto: Toronto University Press, 1982), 5.

CHAPTER 7

Homology and Analogy

In each of the the preceding six chapters, I have examined the connection between human and animal song from a different angle. I have looked at how the ways we have traditionally separated ourselves from other animals may affect our current perception of animals' potential musicality; at possible definitions of music and the aesthetic, and the difficulty of coming up with a way of defining these which is adequate for all types of human music, but which excludes all animal song; at theories of the origin of the aesthetic, some of which exclude animals *a priori*, but others of which firmly link the development of animal and human aesthetics; at the potentially aesthetic sounds of non-human animals in the context of their behaviour; and at the extent to which human musical universals may apply also to the aesthetic sounds of non-human species. Though none of the evidence given in these chapters proves absolutely that animals make music, it all combines to give strong support to the idea that there is a close connection between human and animal song.

If animal and human songs are indeed related, an important question is: how are they related? Surface similarities between human and animal song are often obvious, but the last six chapters suggest that there is also a deeper relationship. Why is this so? How is it that a number of diverse species evolved to sing aesthetic songs? Did a variety of species independently develop the need for music or the ability to create music, or is music-making an ancient and more fundamental trait, something which was also present in a music-making common ancestor? Are music in a bird, a whale, and a human the same thing? What would it even mean if we said animal and human songs were "the same"?

In biology, evolutionarily related parts of different species -- parts which developed from a similar part of a common ancestor -- are called "homologues." The hind leg of a dog, the leg of a sparrow, and the leg of a person are related by homology, because they all developed from the leg structure of our common ancestor, in this case a four-legged reptile-like creature that lived about 200 million years ago. Homologous structures may be similar in function, as are those three examples of legs, or may have been adapted to serve quite different functions. The front leg of a dog, the arm of a human, and the wing of a sparrow, too, are homologously related, but have been adapted in different ways, for specialized uses. All have some connection with their original locomotive purpose, but the wing has been modified for flight, and the human arm is used more often for manipulation of objects with the hands than for walking on all fours. Marine mammals have even more extremely adapted, but nonetheless homologously related, locomotive appendages. In seals, both front and hind legs are modified into flippers, with the fingers heavily webbed to improve swimming ability, and in cetaceans (whales and dolphins), the hind leg structure has diminished to such a point that it is entirely hidden within the flesh of the animal, and serves no present-day functional purpose.

When different structures evolve independently to serve the same purpose, this is called convergent evolution, and the structures are described as "analogous." Wings are used to fly, but the wings of a sparrow and a grasshopper have little in common in terms of origin: no common flying ancestor unites the two. The sparrow wing, as mentioned above, evolved from the front leg structure of our distant reptilian ancestor. What were to become sparrows and grasshoppers diverged long before the age of the reptilian ancestor, probably during the Cambrian explosion, about 550 million years ago. Though grasshoppers, like sparrows, have legs, their wings are not modifications of legs at all, but rather of what were originally body temperature regulating devices. We thus say that bird and insect wings evolved analogously, or by convergent evolution, because for both types of animal, conditions favoured the development of the ability to fly. Structural similarities between bird and insect wings have only to do with the physics of enabling the animal to fly.

The relationship between two similar structures will not necessarily be one of pure analogy or pure homology. Bat and bird wings, for example, are homologously related in that both are evolved from the foreleg of the reptilian common ancestor. Both even serve the same locomotive purpose as the reptile's foreleg. They are analogously related, however, in that the adaptations that these former forelegs underwent to allow birds and bats to fly took place long after the divergence of mammals and birds from their common reptilian ancestor. Evidence of the analogous rather than homologous development of the former forearm into an appendage used for flying is that the structures of bat and bird wings are quite different. There are some similarities, of course, because of the physical requirements of making a small creature airborne. Both bird and bat wings must be light and flappable and have a certain surface area when extended to support flight, for example, and both are located at the centre of the body for balance. But other aspects of the wing, such as the underlying skeleton, and the material which makes up the flying surface of the wing, are not at all the same. The structurally important bones of the bird wing are modifications of what where the reptilian ancestor's arm and second finger. The second finger has been greatly elongated and strengthened, while the other fingers have diminished almost to the point of disappearing, and serve little functional purpose. Feathers attached to the flesh of the arm and second finger provide the surface area necessary for flight. Bat wings, on the other hand, consist of skin membranes stretched between long "fingers," and between the last finger and the body. The "thumb" alone remains short and unattached to the skin membrane, and is used for crawling and manipulating food.

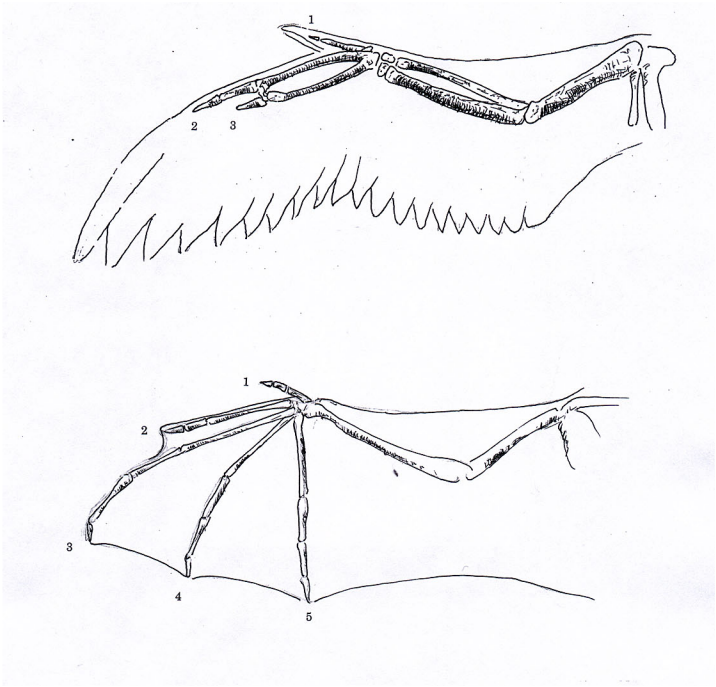

Fig. 9. A comparison of bird and bat wing structures. (Drawing by W. Ford Doolittle, department of Biochemistry, Dalhousie University)

The relationship between whale and seal flippers is one of "parallel evolution." Whales and seals are not closely related, having evolved into their present marine state independently, from orders of land mammals that are only distantly related. The cetaceans are believed to be descended from the ungulates, the diverse order which contains, among other things, elephants, deer, cows, horses, aardvarks, and manatees, while the seals are a member of the order *carnivora*, which also includes dogs, cats, raccoons, and bears.[345] Whale and seal flippers are homologous in that both are modifications of the ancestral reptile's legs, but they evolved in parallel -- separately but in the same direction -- into flippers long after their divergence from their common ancestor, because that design was favourable in the marine environment to which both had independently moved.

Homology and analogy can refer to feelings and behaviours as well as to physical structures. The protectiveness that dogs and humans both feel towards their young, for example, would most likely also have been present in our most recent common ancestor, a

[345] Scientists are not entirely agreed on this, but the theory that cetaceans descended from the ungulates is currently most prevalent.

small, shrew-like placental mammal which lived 70 million years ago, known to scientists as the "boreoeutherian ancestor," and would thus be homologous. Evidence of the homologous nature of human and dog protectiveness towards their young lies in the fact that almost all animals descended from the boreoeutherian ancestor (i.e. mammals) are protective of their young. The relatively similar brain structure of humans and dogs, too, supports the idea that our protective instincts would be homologous.

Like physical structures, feelings and behaviours also can combine homologous and analogous components. That both humans and dogs often feel protective of their territory (or home or property) is most likely explained by homology, since territoriality is widespread among mammals, and would probably have been present in the boreoeutherian ancestor. But human ways of expressing territoriality are often very different than a dog's, and some of these would be related only by analogy. A dog would likely growl to deter intruders, for example, whereas we would be more likely simply to put up a "BEWARE OF DOG" sign, and perhaps to acquire a growly dog.

Music as a whole does not seem to me to be homologous between humans and other animals. As far as I can tell, there appears to be no common musical ancestor from which birds, humans, whales, and other potentially musical species evolved. Though it is not impossible that the reptilian ancestor could have been musical, no evidence suggests this.[346]

Evidence that aesthetic song is not a homologously related trait across species, on the other hand, is strong. Vocal learning is a key aspect of musicality, but we know that even within one class, *aves* (birds), it arose independently three times. Vocal learning in mammals, too, probably evolved independently in a number of different singing orders and species. No vocally learning ancestor appears to unite humans, whales, seals, and bats.

[346] In this conclusion I differ from Martinelli, who claims that "sound manifestations in non-human animals are *homologous* to musical manifestations in humans. They are not simply analogous." (Martinelli, 106-107.) I do not find that he gives enough evidence to support such a claim.

Our closest relatives, the great apes, possess little or no ability for vocal learning, and make no sounds resembling aesthetic song. Our slightly more distant relatives, gibbons, do sing complex, aesthetic-sounding songs, but they are innate, not learned. The closest relatives of seals, whales, and bats respectively, are similarly lacking in vocal learning ability. Elephants, distantly related to whales, have recently been discovered to imitate vocally, but this, too, seems to have arisen independently, since none of the other ungulates are known to learn vocally. Of course it is theoretically possible that the boreoeutherian ancestor was a vocal learner, and that this ability was subsequently lost in most species, but this seems highly unlikely. Parsimony suggests independent development of vocal learning in each of the few species, families, or orders which employs it, rather than independent loss of vocal learning in the many animals which don't have that ability. Were music itself homologous in all singing species, we would certainly expect that an aspect of music as essential as vocal learning would be homologous too.

Various physical and neurological structures differ considerably between mammals and birds too. Singing mammals, for example, make sounds with their larynx, while birds, though they also have a larynx, produce song with their syrinx, a structure not possessed by mammals. Brain structure, and some of the neural pathways used in singing are also significantly different in birds and mammals.

Yet certain aspects of music-making do seem homologous in the various species which sing. Most of the universals suggested by Tagg, for example, stem from ancient, homologously related connections which certainly predate the divergence of mammals and birds. To give one example, the relation of sound to physical activity is widespread, not only in animals which sing an apparently aesthetic song, but in all animals which employ vocal communication. All animals communicating with their young, for example, use quiet, gentle, slow sounds, from a human singing a lullaby (probably musical), to a bird singing on the nest (quite possibly musical), to a guinea pig squeaking to its young (likely not musical). The parental protectiveness (perhaps even "love") which would lead an animal to sing to its young is also likely to be homologous. Sound is used to express

emotion not only in animals which sing aesthetic song, but in almost all vocal species. Most species of mammals, birds, reptiles, amphibians, fish, and even insects alike may make noises to express pain, fear, pleasure, and excitement. A good rule of thumb for identifying aspects of music that may be homologous across musical species might be to look for those things that exist not only in all musical species, but also in many or most related non-musical birds and mammals. In the case of, say, birds and humans singing lullabies or quiet songs to their young, these may well have evolved in parallel from the much more widely spread homologous phenomena of parental caring for young and the connection of vocal sound to emotion.

It's a little hard to discuss analogous aspects of animal and human song at this stage, because to call two things analogous is already to presuppose that they are somehow the same. We know that bird and bat wings are both used for flying, so it makes sense to say they are analogous, but whether a human and a bird singing are engaging in the same activity is what is under investigation. If we are prepared to accept the idea that human music and some animal songs are in some way "the same," however, we can see plenty of what look like analogous connections. Humans sing with their larynx, while birds sing with their syrinx. Animals create (almost) all their sounds directly with their bodies, while humans also use instruments and electronic equipment, for sound production. Humans drum on drums, while woodpeckers drum on trees, and chimpanzees on their bodies.

Music in different species, like wings in birds and bats, then, seems to contain elements of both homology and analogy. If we look at musicality as a whole, all evidence points to it being non-homologous, but if we break it down into its component parts, some of these show strong evidence of homology. As I came to understand that asking whether music in humans and potentially aesthetic song in animals are "the same thing" is a complex question, with a multitude of different kinds of answers, I came to rethink entirely my conception of music.

CHAPTER 8

Rethinking Music

When I began this investigation I had been thinking of music as one indivisible, easily recognizable phenomenon. The way we approach music, at least in the classical music culture within which I was educated, supports that view: we study "music," not "musics," and tend to focus on music coming from a relatively narrow range of backgrounds and performed in a limited number of contexts. I became curious about animal songs in part because of the many things they appear to have in common with human music, even though they are seldom included in musical discourse. It was clear to me that many current ways of defining music are too narrow to include animal song, but I thought that if only we could broaden our understanding of music just the right amount, we could positively identify all that which is music, while still excluding the non-musical. With a suitably flexible, inclusive definition, I thought, one which recognizes gray areas, and which does not *a priori* restrict music to humans, we could then look at the sounds of animals which appeared also to be aesthetic, and see if some of them embodied the same phenomenon.

The more I wrestled with the concept of "music" and with trying to figure out which sounds it encompasses, however, the more it began to seem that even for humans alone, "music" has no single definition that includes all, or even most things that we might commonly consider to be "music," and that excludes everything that we wouldn't. I had hoped to find something that seemed to be at the center of all music, whether an origin, a function, a sign of the aesthetic, or a sound universal, so I could then see whether some animal songs possessed it too, but I could not. The origins were murky; the functions

were unclear; signs of the aesthetic were subtle and subjective; universals weren't universal. The definition-based approach -- figuring out what is "music," and then seeing which species have it -- had been essential as a starting point, but now came to seem less than completely satisfactory. If I couldn't even come up with an appropriate definition for human music, how could I possibly hope to use such a definition as an aid in examining animal sounds?

I came to realize that, at least to me, it made more sense to think of "music" as a sort of umbrella term, under which are housed many individual and highly various musics, than as any single thing at all. Of course I am not the first person to think of "music" as a multiplicity of interrelated musics. Though I haven't encountered any scientists who suggest that music is not actually one thing, several from the worlds of music and philosophy do so. Ethnomusicologist Bruno Nettl asks: "But what of the possibility that music actually came into being at different times in different places, and developed separately, and it is only we who think it sounds the same, who think it is one phenomenon. . . ?"[347] Music philosophers Jean Molino and Wayne Bowman have similar views. Molino writes that "If music is not a unified and homogeneous reality, there is no reason to imagine that it emerged one day wholly made by evolution. The only legitimate approach . . . is to recognize that there is no "music in and of itself," no musical essence, but only some distinct capacities that one day converged toward what we today call music."[348] And Bowman writes, "The word 'music' is not the name of any single entity or 'thing' to which we can point in the world; nor is there a single way it all is, or a single end it all serves. Because 'music' is an abstraction, there are many ways it may reasonably be construed -- each partially valid, none absolutely or unconditionally so."[349] This sort of

[347] Nettl, "An Ethnomusicologist Contemplates Universals," in *The Origins of Music*, Wallin, Merker, and Brown, eds., 471.

[348] Molino, "Towards an Evolutionary Theory of Music and Language," in *The Origins of Music*, Wallin, Merker, and Brown, eds., 169.

[349] Wayne D. Bowman, *Philosophical Perspectives on Music* (New York: Oxford University Press, 1998), 16.

view, which had seemed to me just one of many possible when I first encountered it, now seemed the only way of making sense of music.

I did observe a number of elements which recurred in most, if not all music, however. I thought of them as "proto-musical" traits, since they seemed to exist at a level below the fully musical. They were the building blocks of music, though no one proto-musical trait was either necessary or sufficient to create music. Some of these proto-musical traits had to do with observable qualities of music, but at least as important as any similarities of eventual musical objects were similarities of some of the elements which go in to making music -- a similarity of raw materials rather than of finished product. These elements came from a diversity of realms: the sonic, the aesthetic, the social, the behavioural, the biological. No wonder it had been difficult to come up with one definition for music: any definition which involved all of these aspects would be quite unwieldy!

Few if any of the proto-musical elements I could identify as being important in some music seemed to be present in all music, however, and some things possessing many of these elements were not music. Music seemed to be more a potential outcome of the combination of a number of "proto-musical" traits than the definite result of combining a fixed set of ingredients. My new conception of music thus seemed to be defined by something more like a Wittgensteinian "family resemblance" than by a platonic ideal. Wittgenstein illustrates the idea of family resemblance by describing the similarity between different kinds of games. Just as we can recognize the members of a family as being related, without expecting that all of them will share any one trait, we can recognize that certain activities are games without expecting that there must be any one characteristic that they all share. Games are usually fun, though someone gambling away their last possessions is probably not having fun. Games are often competitive, though a parent playing a spelling game with a child is probably not competing. Many games are social, but solitaire is not. Many games involve the cultivation of special skills, while others rely purely on chance. Instead of all sharing one specific characteristic, there is a whole set of characteristics which are part of many but not all games. The following is a partial list of

things which may commonly be found or employed in a game:

rules
a board
“men”
cards
a field
a ball
a net
a stick
a racket
competition
scorekeeping
teams
uniforms
amusement
having fun
passing time
socialization
imagination
chance
skill
knowledge
intelligence

This list includes physical objects, such as sticks and balls, group dynamics such as socialization and competition, feelings such as being amused or having fun, and abilities, such as intelligence and skill. Few if any games involve all of the items on this list, but most involve a number of them. Generally, the more items are included, the more likely an activity is to be a game, though some activities could have several of these elements and not be a game. Dancing, for example, involves skill, is social, may have rules, and may be imaginative and competitive without being a game. It’s usually easy to tell what is a game and what isn’t, but some pursuits do fall into a grey area. Is jogging to stay fit a game? Probably not. Is running a 100 meter sprint in the olympics a game? Probably. Is running a three-legged race at the school picnic a game? Definitely.

Envisioning music, like a “game,” as a multiplicity of things related by family resemblance rather than as a monolith not only seemed to me to more accurately describe its complexities, but also helped tie together some loose ends that had thus far dogged my research. Perhaps the reason scientists have been unable to agree on the origin or function

of music (as discussed in Chapter Four) is not lack of insight, or the inability of science to understand an art, but rather that there is no single origin or function. If music is a combination of proto-musical traits, then of course each trait might have its own origin story, and each set of traits, as combined into a music, might have its own function. Molino is one of the few who writes explicitly about this possibility. "Evolution is a *bricolage*, and we have no reason to think that music . . . of which we are so proud, could have escaped this mode of production."[350]

And if there is no single music, then no wonder the repeated quest for musical universals has given such mixed results (as discussed in Chapter Six), despite the many attentions given it by generations of musicologists and ethnomusicologists. There is no single "music" for the universals to be universals to, but rather, many different musics, each with their own universals. Of course many of these musics are closely related to each other, hence the apparent and near universals. I realized that when Boilès wrote that "Any individual or any group of individuals perceives music to exist according to a set of particulars; at the level of cross-cultural comparison, any or several of the particulars accepted by the group may be rejected by another,"[351] he must have been referring not only to the perception of music, but to its constitution.

I began to identify some of the specific proto-musical traits which seemed common to many human musics. Just as the resemblances between members of a human family can come from all realms, including the genetic (eg. eye colour and hair texture), the cultural (eg. way of dressing and language spoken), and the environmental (eg. effects of the climate or pollution), these proto-musical traits, too, come from a variety of realms, including the physical, the intellectual, the social, the aesthetic, the emotional, the spiritual, and the biological.

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[350] Molino, "Towards an Evolutionary Theory of Music and Language," in *The Origins of Music*, Wallin, Merker, and Brown, eds., 169.

[351] Boilès, 51.

Some of the proto-musical traits are essentially preconditions which allow for the possibility of making music. Typically they are things we would take for granted and not consider in discussions of music, but without them it would be difficult to imagine music as we know it taking place. Among them would be:

-- ability to make sound at will
-- ability to control sound production
-- ability for vocal learning
-- ability to imitate
-- ability to create new sound combinations
-- ability to connect sounds to physical activity
-- ability to connect sounds to emotional state
-- ability to use sounds for communication
-- ability to coordinate sounds with an external rhythm, such as that of other musicians, dancers, or a metronome

The simplest and most fundamental of these preconditions are the ability to make sound at will and to control its production, since most of the other preconditions depend on this. A sound art which did not depend on voluntary production and control of sounds would be quite unlike anything we usually recognize as music.[352] At a slightly more complex level, the ability to engage in vocal learning is vitally important too, since music is usually understood to be at least partly cultural. Imitation, a close relative of vocal learning, allows sonic interaction with the world at large. Ability to connect sounds to emotional state or physical activity (as suggested by Tagg) and to use sound for communication are also important preconditions for music, since music usually occurs in a social context, to which its emotional and kinetic content is closely related. We play loud, happy, boisterous music at a festive dance, and slow, sad laments at a funeral. Ability to coordinate sound with external rhythm is also central to much music, since this is what enables group performance or connection of music to other activities. Certainly other proto-musical preconditions would exist too: these are just the ones that come most readily to my mind. Some of these preconditions, such as the ability to make sound at will and to control sound production, might arguably be used in all or almost all music while others, such as the ability to coordinate sound with an external rhythm, might be employed in a smaller number of

[352] Not to worry -- discussion of Cage is coming in the next few pages!

musics. It is hard to imagine a music which would not somehow involve at least a couple of these preconditions, and most musics involve most of them.

The presence of these preconditions in itself is not enough to suggest that music is being made, however. Speech, too, employs all of these abilities, and paralinguistic utterances, all except vocal learning. When these preconditions occur in aesthetic contexts, however, music very often results. Among signs that the aesthetic may be taking place (as discussed in detail in Chapter Three), would be the following:

-- cultural transmission
-- cultural change over time
-- regional differences
-- awakening of the senses
-- form given precedence over content
-- functional identity occurring with non-functional stylistic change
-- multiple levels of interpretation possible
-- abstraction of sounds
-- play with pattern and noise
-- play with the expected and the unexpected
-- intensification of experience
-- creation of a transcendent or trance-like state
-- suspension of self-awareness
-- intent to be perceived as aesthetic

Many of these traits are interrelated such as, for example, cultural transmission, cultural change over time, and regional differences, or abstraction of sound and the possibility of multiple levels of interpretation. I include all of these separately, since sometimes one aspect might be more readily apparent than the other related aspects.

The following is a chart of these preconditions and aesthetic traits which so often combine into music.

Proto-musical Traits
preconditions:
ability to make sounds at will
ability to control sound production
ability for vocal learning
ability to imitate
ability to create new sound combinations
ability to connect sounds to physical activity
ability to connect sounds to emotional state
ability to use sounds for communication
ability to coordinate sounds with external rhythm
aesthetic signs:
cultural transmission
cultural change over time
regional differences
awakening senses/ extra attention given to the way something will be perceived
more attention given to form than content
functional identity with stylistic change
multiple levels of interpretation possible
abstraction of sounds
play with pattern and noise
play with expected and unexpected
intensification of experience
creation of a transcendent or trance-like state
suspension of self-awareness
intent that something be perceived as aesthetic/musical

Fig. 10. Some of the proto-musical preconditions and aesthetic traits which make up human music.

This list is by no means exhaustive. I've included what seem to me the most salient features of music but, as Boilès reminds us, each individual perceives music according to his or her own set of particulars.[353] I'm explaining here my own perception of the ingredients of music, not what music "is" or must be to everyone.

Other aspects of music previously discussed, such as the universals and near-universals, and music's proposed origins and functions, would for the most part relate to these preconditions and aesthetic patterns which can combine to create music. Many of the universals, such as the use of discrete pitches, scales, tonal centres, and rhythmic patterns, for example, facilitate play with patterns and noise, or with the expected and the

[353] Boilès, 51.

unexpected. The complete involvement of the physical body with music-making, as described by Philip Tagg's universals, allows for intensification of experience and loss of self-awareness.

Many of the proposed origins and functions of music make sense as simply being conditions which are conducive to the development of music. The biological activities so often suggested as the basis for human music (as well as animal song), such as mating, territorial defense, individual identification, and group bonding for example, all provide fertile ground for the emergence of music. It makes sense that these are situations in which music might arise, since people might want to show off what "cool," aesthetic things they can do with their basic vocal abilities, whether to show their sexiness, their strength and power, their uniqueness, or their belongingness to a group.

Different kinds of human music would engage different combinations of the proto-musical traits, and the traits would be engaged differently by the various kinds of participants in a musical event. Composers, performers, audience members, and participants, though individually capable of engaging all of the proto-musical traits (and generally capable of trading roles), would be employing different of these traits while making or listening to music.[354] A composer, for example, would almost always be relying heavily on his or her ability to create new sound combinations, while a later performer of the same piece might be more involved with vocal learning, imitation, and cultural transmission.

The following chart compares how these proto-musical traits might be engaged in four examples of human music. I've chosen concert performances of Mozart's "Requiem" and the Beatles' "Love, Love Me Do" as fairly mainstream, easily recognizable examples of music within the context of the Western, academic music culture which is my home.

[354] The differing roles of performers, composers, participants, and audience members (in humans and animals both) is something that would certainly merit further study, but that is beyond the scope of this dissertation.

Singing in the shower is an example of something most of us would recognize as music of a sort, but would seldom include in discussion of music. John Cage's 4'33," also in live performance, is an example of music which is particularly far from the mainstream, though still commonly recognized as music, at least by Western academics. In this comparison I include the proto-musical traits engaged by everyone involved in these musical events, whether as a composer, a performer, an audience member, or a participant.

Proto-musical Traits	Mozart Requiem	Beatles "Love, love me do"	Shower singing	Cage 4'33"
preconditions:				
make sounds at will	yes	yes	yes	no (conspicuous for absence)
control sound production	yes	yes	yes	no (conspicuous for absence)
vocal learning	yes	yes	yes	no (conspicuous for absence)
imitation	yes	yes	maybe	no (conspicuous for absence)
new sound combinations	yes	yes	yes	yes (by chance)
connect to physical activity	no	yes	yes	no
connect to emotional state	yes	yes	yes	maybe
use sounds for communication	yes	yes	yes (to self)	maybe
coordinate with external rhythm	yes	yes	probably not	no
aesthetic signs:				
cultural transmission	yes	yes	yes	yes
cultural change over time	yes (reflects it)	yes (reflects it)	yes (reflects it)	yes (reflects it)
regional differences	yes (reflects it)	yes (reflects it)	yes (reflects it)	yes (reflects it)
awakening senses	yes	yes	yes	yes
form over content	yes	yes	yes	yes
functional identity/stylistic change	yes (reflects it)	yes (reflects it)	yes (reflects it)	yes (reflects it)
multiple levels of interpretation	yes	yes	yes	yes
abstraction of sounds	yes	yes	yes	yes
play with pattern and noise	yes	yes	yes	yes (in relation to other music)
play with expected/unexpected	yes	yes	yes	yes (in relation to other music)
intensification of experience	possibly	possibly	possibly	possibly
transcendent or trance-like state	possibly	possibly	possibly	possibly
suspension of self-awareness	possibly	possibly	possibly	possibly
intent to be perceived as aesthetic	yes	yes	maybe	yes

Fig. 11. Comparison of proto-musical traits engaged in performances of Mozart's Requiem, the Beatles' "Love, love me do," someone singing in the shower, and a performance of Cage's "4'33""

In most cases, it is pretty easy to tell if something is a piece of music (just as we can usually tell if something is a game). The Mozart and the Beatles pieces, though from quite different times and genres, share many proto-musical traits. The shower singer is somewhat removed, but still shows a similar profile. For a piece like the Cage, which

lacks many of the proto-musical traits which are usually essential to music, our knowledge that Cage is a composer (and therefore that he presumably intended to create an aesthetic experience) would certainly help us identify it as music. It's interesting to note that 4'33" engages some of the proto-musical traits in relation to other pieces of music, rather than internally. While there is no play with the expected and the unexpected within the piece, for example, since there are no expectations set up within it, the whole piece is a play on what is expected in a piece of music.

A piece like 4'33" could possibly be taken to mean that music is whatever the listener perceives it to be. There is no object which is inherently musical: rather, everything is potentially music. This is not a helpful notion in the context of this dissertation, since I believe that there is a difference between the musical and the non-musical -- and that some animals are capable of creating the musical. If everything were potentially music, there'd be no reason to write this dissertation. However, 4'33" could also be taken to mean that music lies in the intents of the creator, independently of the object created, and this idea is very relevant to the topic at hand. Though I do think that animals create musical objects, what the objects mean to them is more important than either what they sound like on the surface or what they mean to us.

Of course people may draw the line between what is and isn't music in different places. Some might say the Cage "isn't really music" in the same sense that the other pieces are, and others might hesitate to include the shower singing. That the Cage and the shower singer employ fewer of the proto-musical traits and are less universally recognized as music than the Mozart and the Beatles doesn't mean that they are any less music to someone who considers them to be music, however. They are simply less common, or less commonly recognized varieties.

Poetry, in its spoken form, is perhaps the art form most closely related to music in

that it, too, involves the aesthetic arrangement of sound.[355] Indeed, it shares with music many of the proto-musical traits. There are, however, some traits which typically distinguish the two. Music usually uses notes and sounds, independently of words. Even in a song with words, the melody can generally be recognized without them. Poetry, on the other hand, is intimately tied with words and their meaning. When poetry relies more on vocal sounds themselves than on the meaning of words, its distinction from music becomes blurred.[356] Works by poets such as Kurt Schwitters, Jackson Mac Low, and Anne-James Chaton might fall into this category. Likewise, when music is made up primarily of spoken words, it is less easy to distinguish from poetry. "Recitations" by Georges Aperghis, for example, occupies this middle ground. It is nonetheless usually fairly easy to distinguish between poetry and music, and we can accept that some works might lie in between without feeling that "poetry" and "music" are meaningless categories.

This family resemblance type definition of music makes it much easier to consider including animal songs within the realm of the musical. We would not need an animal song to be exactly the same as any particular human music to be considered a type of music: it would just need to fit a similar general musical profile. No one trait would guarantee the inclusion of an animal song in the musical, nor would any single trait keep it out. Just as with human sounds, people would have different thresholds for which, if any animal songs they would consider to be music. For me, for example, music is fundamentally a cultural activity: I consider it essential that "music" rely at least to some extent on vocal learning. Even though gibbon songs sound very much like music, and I might say that they are almost music, I don't consider them to actually be music, since they are almost entirely innate. Not everyone would consider this a basis for exclusion, however. Some would easily include in the musical the songs of not only gibbons but also frogs, some insects, non-passerine birds, and other animals which produce prominent and elaborate, though innate, sounds.

[355] Dance, of course, is also closely associated with music, but it is usually easy to distinguish because it does not primarily deal with sound.

[356] For an excellent resource on sound art, see <www.ubu.com>. (Accessed 23 May, 2006).

As a starting point for looking at the potential musicality of some animal songs it makes sense to see which of the human proto-musical traits they engage. Though this is a human-centered approach, it is appropriate here because what we are trying to investigate is whether some animals sing songs that could be considered music within our own understanding of the term, not whether we make songs that would be accepted in the aesthetic sound world of some other species. Each musical species would, of course, also have its own set of proto-musical traits. Once we have seen whether a particular species' song falls in the general ballpark of the musical by comparing it with human music, we could then add any species-specific proto-musical traits it might bring to an eventual, comprehensive interspecies list of proto-musical traits.

Let us now take a look at how the songs of some specific non-human species might compare with our own, in terms of their music-ness. I will start with the song of the European blackbird, since it is the song that first started me thinking about the relationship between human music and animal songs. For the purpose of interspecies comparison, I will be comparing, as much as is possible, all human music with all blackbird song, rather than two specific instances of song. The chart of human proto-musical traits will thus have "yes" marked for all traits in the "human" column, since at least some human music would contain them.

Proto-musical Traits	Humans	European Blackbirds
preconditions:		
make sounds at will	yes	yes
control sound production	yes	yes
vocal learning	yes	yes
imitation	yes	**yes**
new sound combinations	yes	yes
connect to physical activity	yes	yes
connect to emotional state	yes	yes
use sounds for communication	yes	yes
coordinate with external rhythm	yes	(no)
aesthetic signs:		
cultural transmission	yes	yes
cultural change over time	yes	yes
regional differences	yes	yes
awakening senses	yes	yes
form over content	yes	(yes)
functional identity/stylistic change	yes	yes
multiple levels of interpretation	yes	unknown
abstraction of sounds	yes	yes
play with pattern and noise	yes	yes
play with expected/unexpected	yes	yes
intensification of experience	yes	unknown
transcendent or trance-like state	yes	unknown
suspension of self-awareness	yes	unknown
intent to be perceived as aesthetic	yes	unknown

Fig. 12. Comparison of human and European blackbird songs. In the blackbird column, traits marked in bold are those which seem to me to be even more important to blackbirds than to humans. Traits in parentheses are those which seem to me to be present or not present in blackbird song, but which we don't currently know for sure.

As we can see, there is considerable overlap between the music of the human and the European blackbird. The birds rely on most of the same preconditions, and show many similar signs of the aesthetic. The only of the listed proto-musical traits present in human music but definitely not present, as far as we can tell, in European blackbird song would be the ability to coordinate the song with an external rhythm. We can't know for sure whether some traits, such as the intent to create aesthetic experience, or the creation of a transcendent state are present when the bird sings. In these cases, assuming that there was an intent or the creation of a transcendent state would be as unfounded as assuming there wasn't, since we know little about how the bird is experiencing its own song. We can hear what sounds like play with pattern and noise, and with expectation and thwarted expectation in the blackbird song, and we may assume that at some level the bird hears this also, but of course this too we don't know for sure. Imitation is even more pronounced in blackbirds than in humans. Overall, however, the profile is remarkably similar. The

blackbird and the human song differ no more from each other than any two instances of human music might.

Other songbird species might differ more from humans in their musicianship than do the European blackbirds. Zebra finches, for example, do not imitate, and seem to play much less with patterns and expectations than do either humans or blackbirds. They also bring some proto-musical traits for their own songs that do not apply to human music. Only the male zebra finches sing, for example, and they have just a short window of opportunity during which they can learn their songs. Despite these differences, however, the overall proto-musical profile of the zebra finch song overlaps sufficiently with that of our own music that it seems to me to be a music as well. (See fig. 13 for a comparison which includes zebra finch song.)

Humpback whale songs, too, share many proto-musical traits with our own music. The only proto-musical traits that do not seem as present in humpback whale song as in human music are, as with the blackbird, the ability to coordinate with external rhythms. The humpback whale song of course has some of its own proto-musical traits as well. Their conception of song in fact seems more restrictive than our own. Marine biologist Peter Frumhoff, after comparing typical and atypical humpback song and finding what remains constant, writes what he imagines to be the humpback whale song aesthetic essentials:

> Their concept of song, if indeed they have one, must include the fact that it should last a specific length of time. Its themes are never to be given in a random order and units are rarely, if ever, to be introduced *de novo*. Rather, new material should be derived from elements already present in current or previous songs. The phrase is presumably the most fundamental block of which songs are composed.[357]

As well, the whales sing only during breeding season and, it is believed, it is primarily the males who sing.

[357] Frumhoff in R. Payne, *Communication and behavior of whales*, 111.

The following chart compares the songs of humans, European blackbirds, zebra finches, and humpback whales. Again, I am comparing all songs of each species, rather than specific instances of each song. The traits I introduce to the chart as zebra finch traits and humpback traits are not necessarily present only in those species. I just list them as such because that is the species that led me to add that trait to the list. (In both zebra finches and humpback whales it is only, or primarily, the males who sing. Obviously that doesn't mean that humpback whales and zebra finches are closer to each other than are whales and humans or zebra finches and European blackbirds!)

Proto-musical Traits	Humans	European Blackbirds	Zebra finches	Humpback whales
preconditions:				
make sounds at will	yes	yes	yes	yes
control sound production	yes	yes	yes	yes
vocal learning	yes	yes	yes	yes
imitation	yes	**yes**	no	yes
new sound combinations	yes	yes	yes	yes
physical activity	yes	yes	yes	yes
connect to emotional state	yes	yes	yes	yes
communication	yes	yes	yes	yes
coordinate with external rhythm	yes	no	no	no
aesthetic signs:				
cultural transmission	yes	yes	yes	yes
cultural change over time	yes	yes	no	**yes**
regional differences	yes	yes	no	**yes**
awakening senses	yes	yes	yes	yes
form over content	yes	(yes)	(yes)	(yes)
functional identity/stylistic change	yes	yes	no	yes
multiple levels of interpretation	yes	unknown	unknown	unknown
abstraction of sounds	yes	yes	no	unknown
play with pattern and noise	yes	yes	yes	yes
play with expected/unexpected	yes	yes	less	yes
intensification of experience	yes	unknown	unknown	unknown
transcendent or trance-like state	yes	unknown	unknown	unknown
suspension of self-awareness	yes	unknown	unknown	unknown
intent to be perceived as aesthetic	yes	unknown	unknown	unknown
Zebra finch specifics				
only males sing	no	no	yes	yes
short learning window	no	somewhat	yes	unknown
Humpback whale specifics				
given length of time	somewhat	yes	yes	yes
themes in specific order	sometimes	maybe	maybe	yes
phrases as building blocks	sometimes	no	no	yes
new themes derived from old	sometimes	no	no	yes
only during breeding season	no	no	no	yes

Fig. 13. A comparison of human, European blackbird, zebra finch, and humpback whale song.

Animals whose sounds are less closely related to our own music would of course share fewer proto-musical traits. Wolves, for example, engage some but not all of our proto-musical traits in their howling. Their howls are flexible, controlled, connected with emotional and physical activity, and used for for communication. Though howling is innate, wolves must learn auditorily where to place their song within the group howl. They do not engage in imitation or deep level vocal learning, however. Fewer aesthetic traits seem to be present in their howls than in most music, though some may be. We don't know, for example, if wolves experience howls as transcendent or whether they intend them to be aesthetic. They do not appear to play with pattern and noise or with expectation and thwarted expectation. Different packs have different sounding howls, but this may be due to differences between the individuals who make up the packs rather than any culturally transmitted regional differences, and there is no known cultural change over time.

Wolves bring some proto-musical (or perhaps proto-howling would be more accurate) essentials of their own to their aesthetic sounds, however. Primary among these would be that the vocal arrangement of a group howl reflects the hierarchy of pack members, and that the howl will change to reflect any changes in hierarchy. Human musical arrangements may also represent social hierarchies, as when a conductor is given more status than the musicians he or she conducts, or when a leader initiates a call-and-response type of song, but this aspect seems to be less important to humans than it is to wolves, as there are also many human musical ensembles which do not represent a social hierarchy. The following chart compares the human proto-musical traits engaged in human music with those present in wolf howls.

Proto-musical Traits	Humans	Wolves
preconditions:		
make sounds at will	yes	yes
control sound production	yes	yes
vocal learning	yes	no
imitation	yes	**no**
new sound combinations	yes	(by chance)
connect to physical activity	yes	yes
connect to emotional state	yes	yes
use sounds for communication	yes	yes
coordinate with external rhythm	yes	(no)
aesthetic signs:		
cultural transmission	yes	slight
cultural change over time	yes	no
regional differences	yes	slight
awakening senses	yes	yes
form over content	yes	unknown
functional identity/stylistic change	yes	no
multiple levels of interpretation	yes	unknown
abstraction of sounds	yes	no
play with pattern and noise	yes	no
play with expected/unexpected	yes	no
intensification of experience	yes	unknown
transcendent or trance-like state	yes	unknown
suspension of self-awareness	yes	unknown
intent to be perceived as aesthetic	yes	unknown

Fig. 14. A comparison of the proto-musical traits engaged in human music and wolf howls.

Just as from my perspective, wolf aesthetic sound shares much with human music but is different in some significant ways, from a wolf's perspective, human music might overlap significantly but imperfectly with the proto-conditions of wolf aesthetic sound. Their howling might seem to us almost like music, while our music might seem to them almost like howling. The fairly distant wolf and human aesthetic *Umwelts* overlap sufficiently that we may participate in each other's world from time to time -- wolves may respond to human howling, and humans may use wolves in their music. Nonetheless, wolf howls lack some traits that I consider essential for music, such as deep level vocal learning, cultural transmission, and play with patterns. Wolf howls seem far enough from the musical that I would usually not consider them a music in the same sense that we make music.

One could imagine compiling a pan-zoological list of proto-musical and proto-aesthetic traits, one which would include all the traits of all musical and somewhat musical

species. Different species would engage different subsets of these conditions, and their profiles would overlap with those of other species to varying degrees. In a few species, such as humpback whales and a number of passerine birds, the essential proto-musical conditions of their songs would map so well on to those of our own that the aesthetic sound they produce could be considered essentially music in our own understanding. It would be hard to make the case that these songs aren't music without also excluding lots of human music. In other species there may be a partial overlap -- enough that many people would consider their aesthetic sounds to be musically interesting, but not enough that most of us would consider them to be "music."

With my new understanding of music, I feel that I can finally answer the question which has been at the root of this dissertation: "Do animals make music?" When I began my research, I had had an intuitive sense that they did, but had felt that I didn't know enough to say unequivocally that this was the case. But now I feel that I have the tools and knowledge to answer this question with confidence and good conscience. There is no one music, only lots of musics. If music is only an evening performance of Mozart or the Beatles in concert, then no, animals don't make music, but most of us don't either. But if music is those things, as well as a performance of Cage's 4'33", me singing in the shower, a group of friends playing old-time music on the back porch, a toddler singing to herself as she plays, and the downstairs neighbour practicing drums loud and late into the night, then yes, many animals, too, make music, or a music. Certainly not all animals make a music, and people will have different ideas of which species do, but the fact that any animal at all makes music means that we cannot consider it solely a human phenomenon.

CONCLUSION

When I started this research, I was trying to find out if I could say that some animals make music. I had always suspected that this might be the case, but needed more evidence to be able to say so with confidence and a clear conscience. I feel that I now have sufficient evidence to do so. Though the scope of this dissertation mostly ends here, I do want to address briefly the question of what it might mean if we can say that some animals do, indeed, make music. The goal of this essay is, of course, a musical one, not a moral one, but I do think that if the links between animal and human musics are indeed as strong as my research has led me to believe, this does suggest, at the very least, the need to reexamine some of our thinking both about the relationship between humans and other species and about our own relationship with music.

I wish here primarily to raise questions and to stimulate thought, not to make prescriptive advice about how we should interact with other species. The relationship between human and non-human animals is complex, and I'm certain that there is no one "right" way for us to regard other animals. If we recognize creativity, and the ability to create and appreciate aesthetic experience in some non-human animals, however, we may need to become willing to recognize animals as individuals to a greater extent than most of us do. In this culture, we tend to regard animals as a class rather than as a group made up of unique individuals.[358] Typically a whole species is regarded as equivalent to an individual person. This is revealed in common ways of talking about animals: a person likes cats as a class, rather than an individual cat, and eats "chicken," rather than a specific chicken. We are more likely to say that say someone is wise as an owl, shy as a mouse, or

[358] Martinelli, 64-65.

fierce like a lion, than to compare them with an individual animal. People may approve of using mice in research, rather than a particular mouse in a particular experiment.

As we come to regard each animal as a unique individual, with needs, desires, and creative ability -- traits that mark also human individuals -- we may come to be more cautious in our interactions with the animal world. We may start to think of the family of birds living in a tree before we cut it down, or the complex interactions among the members of a pack of coyotes before shooting one as a nuisance. This is not to say that a tree will never be cut, or that a coyote will never be killed, but the decision to do so might become a more nuanced one. Perhaps on some occasions we might decide that our own individual wants or needs do not outweigh the needs of an individual member of another species. Perhaps we could come to realize that extending empathy to other species is not simply a moral exercise, the ultimate goal of which is to practise for extending empathy to other humans, but is in itself morally necessary. Perhaps we could finally rid ourselves of the long-standing notion, upheld by Greek philosophers, early church fathers, and reductionist scientists alike, that non-human animals are here for the use of "man," and recognize instead that all animals, ourselves included, are here to live and enjoy our own lives, in the context of our species-specifc Umwelts.

Much of the experimental research which I have used to support my arguments comes out of research methods I do not think are appropriate to enact upon any individual, of whatever species. I am referring here especially to research which involves injuring, isolating, and killing animals, but I also have strong misgivings about any research which involves keeping animals captive, particularly in conditions that differ considerably from their natural habitat. I include information gathered from this research, however, because it is there, and for me to ignore it would benefit no one. I hope the fact that I and others have used data collected by this research will not encourage scientists to do more of it. Ironically, it is sometimes through this kind of reductionist research that people gather some of the information about the animals under study that makes it clear that such research is ethically questionable. I hope we can allow this information to prompt a move to less

invasive methods of observation. Not only would it be ethically better to do non-invasive field research, but we would ultimately learn far more about animals by seeing what they do in their rich native environment than we do by watching them in the impoverished setting of a laboratory, or a zoo.

Recognizing music-making in non-human animals might also suggest a need to reframe the way we think about our own music. If we regard sonic creativity as something not only common to many animals, but essential to their complete development as members of their species, then perhaps this might affect how we value music within human society. A situation I deplore is the increasing professionalization of music in the Western world. For the most part, people are either professionals or they make no music at all. Certainly there are many amateurs of all levels, but there are even more people who don't make any music, who consider themselves tone-deaf, and who say "I would have loved to learn to play music, but I had no talent" or "no opportunity." In fact, ability to make satisfactory music is present in all people in cultures where music is considered a normal part of life. If music-making were all around us, we wouldn't need special opportunities to be able to learn. This culture, too, used to have a much larger amateur tradition. Pianos used to be found in every home which could afford one, and in every elementary school classroom. Coal miners and other labourers used to have choruses and bands. Most regions used to have a vital folk music tradition, in which all participated. In a few places this remains. But this is being eroded as the car and other technological devices replace the piano as a status symbol, as demands on our time increasingly fragment us, and as recorded music and a variety of options for passive entertainment replace at-home and community music-making.

I want to believe that if we come to recognize that a life without music-making is a life of incomplete manifestation of our basic humanity, this will change. We need to stop considering music a "frill" in the schools and "entertainment" in the evening. We need to eliminate the financial and social barriers that prevent all people from having equal access to all music. We need to recognize music's central importance in the life and well-being of

all. I hope that the day will come when all are engaging in music, not just as listeners but as participants. We may not all be able to write like Mozart or play like Jimi Hendrix, but we can all, each in our own way, sing like the birds.

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