

HOMO MUSICUS: Are Humans Biologically Predisposed to be Musical?

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Historically, Western European arts and aesthetics have been approached from what might be called the “top down.” From the time of Plato until about a century ago, concepts about these subjects have been the province of philosophy and religion, invoking abstract ideas such as Mind, Truth, Being, Pure Form, “spiritual” reality, and states of transcendence or transfiguration. Subsequent paradigms of modernism and post-modernism have refocused philosophical views among intellectuals, but for the most part retain their Western core.

The Multiple Modernities concept is a recent approach to understanding music in a culturally-decentered world—not as an abstraction or flaccid “anything goes” ideology—but as a broad, universal activity that can be found in multiple forms in multiple cultures. The approach treats music globally, appreciating that from earliest times, until the invention of written scores, musicians have been composers-performers-improvisers—and that it is possible in their own music-making to become cultural pluralists, able to deeply integrate (not just “borrow”) the aesthetic sensibilities of other and different cultures.

For over forty years my work has explored the fundamental elements of the arts as they arose and developed in human biology and evolution. I claim that underlying multiple modernities, multiple musical cultures, and the individual styles of every musician, there are even more basic (“bottom up”) musical principles that are inborn in all humans, no matter what cultural musical traditions they have absorbed from childhood or learned in later life. That is, these fundamental musical capacities arose during human evolution and are present in all music in our species, providing the capacity to absorb music from one’s own culture as well as that from other cultures.

My starting point has been the field of ethology, a biological science that is concerned with the behavior of animals in their natural environment. Aware that humans are an animal species and that every human culture practices what can be considered “music,” ethology provides a good place to understand the nature of music as an universal, inherent species-specific behavior, like language, cooperation, or pair-bonding—something that humans are “programmed” (born) to do. Ethologists claim that, like anatomy and physiology, behaviors have also evolved in order to contribute to an animal’s survival and reproductive success. Evolved behaviors have “selective value” (the evolutionary term now generally replaced by “adaptive”). Here it should be said that an evolutionary explanation is often automatically but mistakenly assumed to mean that something is “innate” or “genetically determined.” Calling music “adaptive” means that it is a behavioral *predisposition* that requires a facilitating environment to be expressed. Someone who never hears music (like one who never hears language) will at best emit or produce only rudimentary sounds and rhythms.

Although we cannot go back to the dawn of human evolution and observe our ancestors, there are at least five good reasons for presuming that music might be an adaptive behavior. It (1) occurs universally, in all cultures, (2) is “costly” in terms of time, energy, and material resources that are devoted to it, (3) is appealing--pleasurable, (4) is easily acquired—children, even babies, readily engage in musical behavior, with little or no teaching, and (5) is culturally important.

My “bottom up” hypothesis about music begins with a universal human behavior that every reader has witnessed and probably practiced. It is so commonplace that even Darwin, the father of ten children, did not remark on it. Yet recent studies show that this universal behavior—mother-infant interaction (sometimes called “baby talk”)—is quite complex, revealing surprising “protomusical” aptitudes in infants and even neonates. The hypothesis claims that building upon these elements to produce musical behavior is an evolutionary exaptation.¹ The hypothesis synthesizes six “strands” of scientifically-based knowledge, with plausible speculation scaffolded on this knowledge. It provides a foundation for claiming that a predisposition for musical behavior is inborn and can be accessed in everyone.

First Strand: The “Obstetric Dilemma”

The hypothesis begins with two momentous anatomical adaptations in ancestral hominids of the Early Pleistocene. These are bipedality (walking on two legs) and brain enlargement. The latter occurred between four and two million years ago, with brain size gradually expanding from 508cc in *Australopithecus*, the earliest hominid, to 973cc in *H. erectus*. An even more dramatic increase in size is evident between *H. erectus* (or contemporaneous species ancestral to *sapiens*) and modern humans, who have a brain size of about 1400cc.²

With regard to bipedality, numerous anatomical adaptations were necessary to convert a four-legged creature to one with that can stride fully upright. Among these requirements were restructuring the rib cage, reshaping the spine, relocating the opening of the spinal cord, altering the lower limbs and feet, reconfiguring surfaces of the joints, and resculpting body musculature.

In addition, and significantly, the pelvis also became gradually shortened from top to bottom and broadened from fore to rear in order to center the trunk over the hip joints and thereby reduce fatigue during upright locomotion.³ For females, this reconfiguration secondarily resulted in a serious obstetric problem⁴—giving birth to babies (whose head-size was gradually enlarging in order to accommodate a larger brain) through an increasingly narrowed birth canal.⁵ It was with hominin species like *H. erectus* or perhaps *H. ergaster* that the mismatch between upright posture and increasing brain size became an acute problem at childbirth, leading to further anatomical adaptations.

For example, the infant skull developed a fontanelle, thereby becoming compressible at birth; ligaments joining the frontal halves of the female pelvis were able to stretch at birth, making the pelvic ring slightly larger; and infant brain growth increasingly occurred outside the womb.⁶ Importantly, also, the period of gestation was reduced,⁷ thereby insuring a smaller neonate head. The extent of this

¹ While an adaptation emerges through a history of selection in order to solve an adaptive problem, an *exaptation* corresponds to an already present adaptation and gains a new function without subsequent selection (Seghers 2015: 338). Space does not allow a full description of the requirements for considering a behavior to be an adaptation, an exaptation, or a by-product. See also Gould and Vrba 1982; Jablonka and Lamb 2005; Gangestad 2008.

² Mithen 2005. See also Falk 2004, Flinn and Ward 2005

³ Klein and Edgar 2002: 52-53.

⁴ Sometimes called the “obstetric dilemma.” See Washburn 1960 and Trevathan 1987.

⁵ *H. ergaster* had a narrower pelvis than its predecessor, *H. habilis*, in which rapid brain expansion was occurring between 2 to 3 million years ago (Wade 2006: 18-22). “Turkana Lad,” a specimen of *H. erectus* of 1.6 million years ago, also has a narrow pelvis (Falk 2009: 51).

⁶ Taking body size into account, a neonate’s brain (350cc) is relatively the same size (proportion) as an infant chimpanzee (150cc). However, between birth and age 4, the human baby’s brain triples (the chimp’s doubles and remains that size) and by adulthood human brains are four times the size at birth (1400cc).

⁷ Selection did not so much “shorten” or “reduce” the period of gestation but prevent it from increasing as much as it otherwise would have been on track to do (Chisholm 2003: 148).

reduction can be appreciated once we know that if a human baby conformed to the general primate fetal developmental pattern, it would be born at around 18 months⁸ and weigh 25 pounds.⁹ This change resulted in highly “premature” infants who are extremely helpless at birth.

Second Strand: Mother-Infant Interaction is an Adaptive Behavior

Although archaeologists and evolutionary scientists are aware of the “obstetric dilemma” and its anatomical concomitants, they have not generally emphasized behavioral adaptations¹⁰ that were also essential to addressing the evolutionary problem of the survival of highly immature babies in the Early Pleistocene.¹¹

Despite their physical helplessness, newborn infants are socially precocious. They are alert at birth and respond to human voices and faces more than to any other sound or sight, allowing them to interact with the adults around them from the moment they are born. Caretakers everywhere behave to infants differently from the way they do to adults or even older children. Vocally, we speak slowly to babies in a high-pitched, undulant, soft voice (in some societies, with rhythmic tongue clicks or hisses). Visually, we make funny faces (widened eyes, raised eyebrows, open mouth, broad sustained smiles, and distinct head movements, such as a quick bob backward, and nods). Kinesically (i.e., using body movements), we touch, pat, stroke, hold the hand, embrace, groom, sway from side to side or forward and back, hug, and kiss. A significant feature of the interaction in many societies is “mutual gaze”—gazing for a sustained period into each other’s eyes, a behavior that is highly uncomfortable with anyone but a baby or a lover. It expresses deep trust and intimacy.

Babies respond with delight to these sounds, sights, and gestures. In their early weeks they need and like regularity and predictability—soothing gentle voices and movements. However, at around four months, they begin to appreciate fun, silliness and divergence from their expectations. Without conscious intent, maternal facial expressions, utterances, and movements become more exaggerated in space and time, more varied and modulated. The mother may tease, create anticipation, and manipulate the baby’s expectations—as in games of Peek-a-boo or This Little Piggy. For their part, infants gradually respond with larger smiles, more active movements, and sounds of pleasure.

These interactions occur in sequences that are multi-modal. That is, sound, movement, and visual expressions occur and are processed as one. In more developed engagements, one finds more interaction and more matching of sounds and expressions. Although their responses are not strictly synchronized, the pair closely and unconsciously coordinate their behavior in time, take turns, imitate, and perform joint actions (such as chorusing), leading eventually to a capacity to entrain. Such interactions do not occur between mothers and infants in other species.

⁹ Falk 2009, Gould 1977, Leakey 1994, Portmann 1941.

¹⁰ Including myself (Dissanayake 2000), these are Falk 2009 and Morgan 1995.

¹¹ Dissanayake 1999.

Third Strand: Mothers' Visual, Vocal, and Kinesic Signals to Infants Are Modifications of Ordinary Affinitive Communications of Adults

Although adults' behaviors with babies may seem peculiar, if not bizarre, they are derived from familiar expressive signals that adults use when they feel interested in, friendly toward, receptive to, and comfortable with each other:¹² Visually, they Look at, Gaze, Raise Eyebrows ("Flash"), Smile, Open Mouth, Bob, and Nod. Similarly, when adults indicate deference, non-dominance, and the emotion of "happiness," their vocalizations have Higher Pitch and are Soft, Slow, Undulant, and Breathily.¹³ Kinesic signals of affinity include Touching, Stroking, Patting, Holding the Hand, Embracing, Grooming, Hugging, and Kissing. In addition to being common adult human gestures of sympathy and affection, these physical movements are also seen in affinitive social contexts with wild and captive primates and presumably in early *Homo*,¹⁴ suggesting they are ancient cooperative signals in our genus.

It is important to recognize that babies are not taught to respond to these antics. If anything, they "teach" adults to perform for them. Infants come into the world wanting this kind of interaction and reward those who provide it with adorable kicks, wriggles, smiles, and coos. They don't wriggle and smile if presented with adult talk. Their ready responsiveness strongly suggests that their receptivity is inborn, just as is the mother's keenness to behave in this peculiar manner.

Fourth Strand: Mother-Infant Interaction Resembles "Ritualized" Behaviors

When engaging socially with other adults, as just described, people use spontaneous behavioral signals to indicate friendship or positive affinitive intent, but when interacting with infants, these signals are altered in specific ways. Similar alterations of behavior can be observed in other animals in an evolutionary process called "ritualization," first identified and described by ethologists.¹⁵

In ritualization, an unremarkable ordinary behavior from an instrumental context (e.g., gathering nest material, pecking the ground for food, self-grooming, or preparing for flight) is altered so that it communicates a new social message: "I'm angry: get out of my territory," "I'm feeling friendly, let's play," "I want to mate with you." Unlike the instrumental or "ordinary" precursor behavior, ritualized movements or sounds become "extra-ordinary" and thus attract attention. They typically become (a) *simplified* (formalized, patterned), and (b) *repeated rhythmically*, often with a "typical" intensity¹⁶—that is, with a characteristic regularity of pace. The signals are frequently (c) *exaggerated* in time and space, and often (d) further emphasized or *elaborated* by the development of special colors or anatomical features.

Mothers interacting with babies also use these same "operations" on the behaviors they typically use with other adults in ordinary social contexts to communicate friendliness, submission, or appeasement. When altered, or ritualized, these behaviors mean something else in the new context of bonding: "You can trust me," "I adore you," "This is what it is to be social." Examples include:

¹² Grant 1968, 1972; Schelde and Hertz 1994.

¹³ Frick 1985, Puts et al. 2006, Scherer and Oshinsky 1977.

¹⁴ deWaal 1989, King 2004, Nicolson 1977, Silk 1998.

¹⁵ Eibl-Eibesfeldt 1970, Huxley 1912, Smith 1977, Tinbergen 1952. Although anthropologists and others may use the word "ritualize" when they describe the creation of a cultural ritual, it has a different and specific meaning in ethology, referring to an evolutionary process that occurs gradually over many thousands of generations.

¹⁶ Morris 1957.

Simplification or formalization. Facial expressions are held (sustained), vocal utterances are simplified, and face and body movements are stereotyped.

Repetition. Sounds, words, pats, strokes, and nods are repeated, often metrically or rhythmically.

Exaggeration. Vocalizations may be dramatically loud or soft, with strong emphasis on certain sounds, words or movements; there are exaggerated vocal contours, even striking glissandi; facial expressions often show widened eyes, raised eyebrows, an open mouth, a wide smile.

Elaboration. Facial expressions, vocal sounds, and head and body movements may be dynamically varied (e.g., made large and small, fast and slow, long and short, high and low).

Manipulation of expectation. Games and songs allow mothers to play with the older infant's innate temporal sensitivity.

In other words, mother-infant interaction evolved as a ritualized behavior in humans, where ordinary signals of friendliness (used with other adults) are altered by the same features as those described by ethologists for other animals. Formalization, repetition, exaggeration, and elaboration of positive friendly signals have neurobiological effects in the mother's brain, reinforcing neural pathways and releasing brain chemicals that promote and strengthen her feelings of affinity.¹⁷ Important in this regard is oxytocin, an endogenous opioid popularly called “the love (or bonding) hormone.” Although it is an ancient hormone that is present in all vertebrates, its primary function is to foster caretaking in mammalian mothers: it is secreted during parturition and lactation. In humans, it is released at these times and also during mother-infant interactions, with the effect of promoting feelings of trust, pleasure, and “oneness.” The mother finds her baby lovable and interactive (even though it is also helpless and demanding) and is sufficiently rewarded to be willing to provide nurturance for months and years. By eliciting and responding positively to these signals, infants insure that they will attract care. The evolutionary result is that the baby is more likely to survive and the mother to ensure her own reproductive success.

Fifth Strand: The “Operations” Used in Mother-Infant Interaction and Ritualized Behaviors Are “(Proto)”-Musical.

The operations of ritualized mother-infant interaction also describe what musicians (composers, improvisers, or performers) do to tones, chords, motifs, timbres, rhythms, meters, and other components of music in order to attract attention, sustain interest, and evoke emotion—the same effects that mothers accomplish with infants and that animals accomplish with ritualized behaviors. The fact that babies are receptive to exactly these operations, in a multi-modal form, suggests that they are born with proto-musical capacities or sensitivities upon which later music can be built. Mother-infant interaction is the seedbed from which cultures later developed music (and other arts).¹⁸

There are further resemblances between mother-infant interaction and music that suggest a close evolutionary relationship. Notably, both take place in time and evoke emotion. Both have

¹⁷ For descriptions of biofeedback, see Ekman 1992, McIntosh 1996, Zajonc 1985, Zajonc and Ingelhard 1989.

¹⁸ This idea contrasts with the most popular hypothesis for the origin and evolution of music (and other arts), which traces these to competitive male display. The so-called “sexual selection hypothesis” extrapolates from song-like behaviors in male birds and cetaceans, as well as other art-like visual displays of male bower birds, peacocks, and birds of paradise, that attract females for mating. My own view does not discount the existence of male display but emphasizes an equally important though neglected component of reproductive success—the successful birth and subsequent survival of a child.

melodic, rhythmic, and dynamic change. Both have a similar temporal structure (clearly evident in written transcripts of baby talk and in notated musical scores): they are composed of lines or phrases constructed into larger “framed” episodes; episodes have a consistent expressive mood with an overall thematic and formal construction; themes may vary within or between episodes; expectations are set up and eventually satisfied. Importantly, physical movement is intrinsic to both.¹⁹ Both give pleasure and are “emotionally moving.” Reactions to each may be described as “wordless” or “inexpressible.” Both engender what can be called attunement, bonding, and even feelings of self-transcendence. Both are means of social regulation and enculturation.

Even recognizing these similarities, one might still wonder how the proto-music of mother-infant interaction as it evolved over more than a million years ago developed into actual musical behavior that we would recognize. How did we get from baby talk to Beethoven and beyond? Until this point, the argument has been anatomical and behavioral. To get to actual music, the important factors are cognitive (intention, deliberation) and cultural.

To begin with, of course, we should not think of Western classical music as the first music: it is part of a sophisticated and quite recent tradition that is dependent on written scores. Instead, let us consider music as it probably existed in Pleistocene societies, when people lived in small interdependent social groups in a subsistence way of life as nomadic foragers (hunter-gatherers). As we cannot observe such groups, we must extrapolate from what we know of the musical behavior in hunter-gatherer societies of the recent past, as described by anthropologists.

Music in traditional (or small-scale) societies has a number of universal (or near-universal) features. It is performative (often improvisatory), communal (everyone participates if only by moving in place and clapping or otherwise keeping time), and simultaneously auditory, visual, and kinesic (multimodal)—typically including dance or other movement, even body decoration, masks and costume, as well as sound. In such societies, music participation is considered to be culturally essential. Frequently it is “religious” by nature and intent, occurring prominently in ceremony/ritual in which group members become coordinated or unified in their behavior and emotions.

Sixth Strand: The Invention of Ceremonial Ritual and the Arts

Surveying small-scale societies of the recent past, it is reasonable to conclude that religious ritual and the arts evolved together.²⁰ At least they are so closely intertwined that one can accurately describe almost any ritual as a “collection of arts.” If one removes the arts—body decoration, song, instrumental music, coordinated movement and dance, poetic language, prescribed use of space—there is no ceremony, just people behaving in an ordinary way.

The earliest indication of visual arts in our species, from at least as far back as 250,000 to 200,000 years ago, are cupules (repeated and often patterned hemispherical indentations hammered into rock surfaces), perforated stone or bone pendants, and ostrich eggshell disc beads. Shaped pieces of ochre for coloring bodies and objects have been found from at least 120,000 years ago.²¹ Although music and dance are ephemeral and do not remain in the archaeological record, it is not unlikely that

¹⁹ British anthropologist A. R. Radcliffe-Brown (1948: 334) found that for the Andaman Islanders, singing and dancing were “two aspects of one and the same activity.” This is also the case in American pre-school children between the ages of three and five who do not sing without simultaneously moving their hands and feet (Suliteanu 1979).

²⁰ Suggested origins for music include lullabies, work coordination, excited speech, hoots and hollers, and imitating animal cries (see list in Dissanayake 2009: 18).

²¹ Bednarik 2003, Malotki and Dissanayake 2018.

they may well have preceded the making of material artifacts. Perhaps cupule sites marked ritual places and occasions for music, dance, and performance.

But what could have been the reason or justification for our ancestors to begin to alter stone surfaces, decorate bodies, or engage in music and dance? In small-scale societies, we find that arts-suffused rites occur at transitional times of unresolved uncertainty or anxiety about important biological matters such as subsistence, safety, prosperity, health, fertility, and traversing important life changes such as puberty, marriage, birth, and death.²² Ceremonies are intended to influence important outcomes—to have an effect. As members of ancestral societies became more and more aware of past and future, of the good and bad things that had happened and could happen again, they desired to influence the future. By taking time and trouble to make ordinary things extra-ordinary, they could display to spirits and other supernatural agents, as well as each other, the depth and intensity of their need and desire to affect for good the existential problems of hunter-gatherer life.

It is clear to us today that ritual behavior may not be the most reliable remedy to assure health, safety, and fertility. Because no successful biological creature spends great amounts of effort on useless endeavors, however, why did such activities persist? What could have been the evolutionary advantage of ceremonial art/ritual?

The neurobiology of emotion helps to answer these questions. The ritualized social signals of mothers to their infants, taking place in formalized, repeated, exaggerated, and elaborated sequences, serve to bond the pair as they coordinate their body rhythms and feel “in tune.” It has been discovered that the release of oxytocin not only enhances affiliative prosocial behaviors, producing feelings of trust, confidence, elation, and bondedness, but also reduces the pernicious effects of stress-induced cortisol.^{23, 24} An obvious adaptive benefit of participation with others in coordinated music-making, as in the songs and dances of ritual practice, would have been twofold: promoting cooperation within the group and relieving individual anxiety and emotional tensions.²⁵ As with mothers with infants, these same evolutionary advantages helped individuals (by reducing anxiety) and groups (by fostering feelings of oneheartedness), thereby insuring their survival better than individuals and groups that did not artify.

In other words, musical behaviors in ceremonies, associated with other arts, developed and were maintained as a way of demonstrating individual and group care and concern about biologically-important outcomes. In evolutionary terminology, the “*proximal*” (immediate) functions were, first, to have “something to do” that by its extravagance would persuade spirits, ancestors, and other supernatural powers to affect individual and group interests during uncertain circumstances. At the same time, arts behavior enticed people to engage in and be emotionally moved by and convinced of the truth of the ceremony. Religion appeals not only to the intellect in the form of beliefs or precepts but to senses and emotions. The earliest culturally created arts behaviors can be considered as behavioral/emotional mechanisms that instilled religious belief. Rituals work because their arts provide the emotional “oomph” that makes religious beliefs memorable and meaningful.²⁶

Two *ultimate* (adaptively beneficial over time) functions of arts/music-suffused rituals can be suggested. First, by providing something to do with others, in uncertain circumstances, they alleviate the deleterious effects of the stress response. The release of stress hormones like cortisol negatively affect growth, tissue repair, energy release, immune system activity, mental activity, digestive function,

²² van Gennep 1960; Turner 1969.

²³ Shaver et al.1988; Freeman 1995; Carter 1998; Nelson and Panksepp 1998; Uvnäs-Moberg 1999; Carter and Altemus 1999; Miller and Rodgers 2001; Heinrichs et al. 2003; Taylor et al. 2008; Zeifman and Hazan 2008; Dunbar et al. 2012.

²⁴ Uvnäs-Moberg 1999; Heinrichs et al. 2003; Taylor et al. 2008.

²⁵ Koelsch et al. 2010; Dunbar et al. 2012.

²⁶ Dissanayake 1992, Schiefenhövel 2009.

metabolism, and even reproductive physiology and behavior.²⁷ In this sense, ceremonial/arts behavior—compared to doing nothing—is adaptive.²⁸ Music and movement, in particular, are notably effective in regulating disturbing emotions like fear or anxiety and thereby contributing to the well-being of participants.²⁹

A second ultimate function of participation in ceremonies through their arts is the instilling of collective emotions such as trust and a feeling of belonging. Participating with others in formalized and rhythmically-repeated activities (as in mother-infant interaction) secretes oxytocin and other endorphinic substances that create pleasurable feelings of unity with others, strengthening their commitment to each other.³⁰

Conclusion: What Is “Music”?

The foregoing speculative reconstruction of the origin and evolution of musical behavior provides a biological foundation for the theory of multiple modernities. Although the musics of varying cultures may seem vastly different from each other, there are bottom-up proto-musical fundamentals that characterize the making and appreciation of music everywhere. The “operations” described above (formalization, repetition, exaggeration, elaboration, along with creating and manipulating expectation) describe what composer-performer-improvisers everywhere do to attract interest, sustain attention, and shape and mold emotion. Music then can be biologically described as the use of these operations on audible tones, intervals, beats, meters, and rhythmic and thematic motifs. A single musical event is not itself “music.” Whatever else music may be, it is *what is done* to its elements, in time, that creates what can be identified as music. Our sensitivity to these operations is inborn, then exercised in intimate human relationships and, as we grow into our surrounding culture, may lead to some of the most transcendent and supreme experiences that humans can know.

²⁷ Sapolsky 1992.

²⁸ Kaptchuk, Kerr & Zanger 2009.

²⁹ Taylor 1992.

³⁰ Freeman, 2000.

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