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# Music and Human Evolution: Philosophical Aspects

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Music today is ubiquitous, highly valued, multifaceted, and plays many different roles in many different social contexts. Unsurprisingly, then, an increasing number of researchers studying human cognition and evolution have raised questions about the evolutionary role and nature of music. Why did our ancestors spend time, energy, and resources on music, when they could have been performing activities more obviously linked to increases in fitness such as hunting, gathering, or stone tool production? Are music's origins intertwined with the evolution of language, or mother–infant communication, or group vocal "grooming," or sexual selection? Is music a biological adaptation? Is music innate? This chapter reflects on some of this fascinating interdisciplinary research from a philosophical perspective.

In the first section I discuss traces of musical activity that date back to 40 kya (40,000 years ago), connecting them with ideas about human behavioral modernity. I argue that the oldest known flutes do not represent the earliest expressions of our lineage's musicality, and suggest that music may be very ancient indeed. In the second section I reflect on the so-called "music instinct." I query the innate/acquired framework, utilized by many music cognition researchers, for conceptualizing development. In the third section, the heart of this chapter, I outline the debate surrounding the evolutionary status of music. Researchers have conceptualized music as an adaptation, by-product, exaptation, and technology—and debate surrounding music's evolutionary status is heated. I survey leading hypotheses and argue that taking dynamic gene-culture co-evolution and niche construction seriously calls into question the usefulness of those distinctions, making a case for a co-evolutionary perspective of music. (So while the second and third sections adopt a critical stance, my aim here is not to imply that the various empirical research agendas that target the cognition and evolution of music are unreliable or wrong-headed: the intention is to acknowledge methodological and theoretical difficulties and challenges that are priorities for future progress.) In the final section, I briefly outline a socio-cognitive niche construction perspective, drawing on examples from the ethnomusicological literature.

## MUSIC IN PREHISTORY

Musical instruments have a deep past. Archaeologists have unearthed an enormous sample of Upper Paleolithic flutes made from bird bone and mammoth ivory—over 100 uncontroversial specimens—dating back to 40 kya.[1] Besides flutes, the prehistoric record contains whistles made from deer phalanges and (alleged) bullroarers and rasps. (For review, see Morley 2013.)

Most of these ancient flutes are made from vulture ulna or radius bones. The proximal ends of these bones have been shaped into concave mouth pieces, the lengths of the bones have been scraped smooth for easier handling, and finger holes have been carefully created. Engraved slits along the body of some flute-bones suggest that the placing of the finger holes was measured, perhaps for practical or pedagogical reasons, perhaps reflecting some scale, mode, or pitch standards. Reconstruction experiments exhibit a wide range of tones and establish them as "fully developed musical instruments" (Conard & Malina 2008: 14).

Mammoth ivory flutes required much more precision work, and the procurement of the raw material would have been a more significant activity than birding. Presumably, obtaining mammoth ivory was a side-effect of hunting or scavenging mammoths—not in itself a primary investment in music—yet making flutes *from* ivory is a serious investment of time and energy:

> Ivory grows in layers (somewhat similar to tree rings), and in order to make it hollow these lamellae (layers) must be separated. To do this, a section of ivory must be sawn to the correct length, it must then be sawn in half along its length, the core lamellae must be removed, and then the two halves of the flute must be refitted and bound together with a bonding substance which must create an airtight seal in order for the pipe to produce a sound . . . This is a technically complex and challenging procedure. (Morley 2013: 50)

It is intriguing that our ancestors spent so much time, energy, and resources on crafting musical instruments.

The sophistication of these flutes' design and construction suggests complex communication and coordination, including teaching and learning, skilled manipulation of raw materials, good episodic and working memory skills, task specialization, and some degree of division of labor: the full gamut of behavioral modernity evident in each flute. Making musical instruments such as these requires an extended learning period, with presumably little to no payoff until the skill is more or less mastered, pointing to advanced mental time travel capabilities, increased forward planning, focus, and impulse control given the future utility of the item under construction (unlike, say, opportunistically knapped stone choppers or flakes). In short, musical instruments epitomize the advanced, modern minds of Upper Paleolithic hominins.[2]

What's more, although these ancient flutes are the earliest musical instruments that we currently have, they could not have been among the first musical technologies. Their sophistication implies a longer musical-technological tradition concealed—perhaps forever—from the material record. The European caves provided excellent preservation houses: if there were much earlier bird-bone flutes, for instance on the expedition into Europe from Africa, we cannot expect them to have lasted unsheltered from the elements. Bird bones typically preserve poorly due to their light structure.[3] And long-standing traditions of music, deeply entrenched in their respective cultures, appear in all known human societies (Nettl 2000). This suggests that music (or at least proto-music) appeared before modern humans left Africa, otherwise music would have had to evolve independently many times over, in populations geographically isolated from each other (Davies 2015).[4] At the very least, the strong possibility that the earliest full-fledged expressions of musicality are (and will remain) invisible to the archaeological record requires theorists to extend the estimate to well before the first traces at 40 kya. Yet the jury is out on how far back it should be extended (see Davies, Chapter 26 this volume).

Indeed, the absence of earlier musical-technological evidence is not evidence of absence. After all, the material source for ancient flutes need not be limited to bone and ivory. The ethnomusicological record details numerous musical traditions that utilize bamboo, wooden, or cane flutes (Titon 1996). Ancient flutes made from these easily worked and easily procured ephemeral materials may well have pre-dated (and co-existed with) those of the material record (Epsi-Sanchis & Bannan 2012). And other musical instruments may have been made from bark, reeds, shells, logs, horns, taut animal skins, stone.[5] Not to mention the human body—singing, humming, sighing, crooning, stomping, slapping, clapping, thwacking—surely the focus of much ancient musical production. Iain Morley's recent review of the paleoanthropological literature (2013) reveals that the biological preconditions for these, including complex vocalization, may have been in place since *Homo erectus/ergaster*, and that by the appearance of *Homo heidelbergensis* around 600 kya, we see cues of a modern vocal tract and auditory system. It is certainly not implausible that archaic sapiens at 200–300 kya, or even their heidelbergensian predecessors, were (proto-)musically active in some respect.

So although the timing of music's origin is unknown, that music has a deep history foregrounds its importance in ancient social life. (Indeed selection may have made this so, building on existing sensory biases.) One upshot is that complete models of hominin evolution and cognition need to say something about music. It cannot be assumed straight off the bat that music is a newcomer to relatively modern human social life and thus superfluous to an explanation of hominin evolution and cognition.

## MUSIC AND INNATENESS

Neuroscience has shown that engaging with music, whether through listening or performing, utilizes a broad cartography of the contemporary human brain (see, e.g., Alluri et al. 2012)—unlike reading or doing arithmetic, say, which have more localized neural correlates. Our skulls do not house a unitary music *module*; there is no evolved musical center in the brain. So development of the cognitive capacities that enable music's production and appreciation, and the nature of those capacities, have become hotly contested topics. Several related "music instinct" research agendas have emerged from this debate (Marcus 2012), of which one will be my focus: whether music is innate or acquired.

Dividing an organism's characteristics into those explained by its intrinsic nature and those explained by external influence is a standard move, part of folk-philosophical wisdom. And it is commonplace for especially talented musicians to be described colloquially as "born that way," innately musical—that the talent is for example "in the genes." This kind of talk presupposes an innate/acquired distinction, which has come to form an influential framework for conceptualizing development. One study reports that three-quarters of informally surveyed music educators believe children require innate talent in order to do well (Davis 1994).

Many researchers have famously rejected such an admittedly naïve nativist position (Howe et al. 1998). Musical expertise takes an enormous amount of deliberate practice: it has been estimated that top-level expert violinists clock up an average of over 10,000 hours of individual practice by age 20 (Ericsson et al. 1993). Nonetheless, debate is live concerning the innateness (or otherwise) of various underlying musical capacities; that is, capacities distributed among the general population, such as beat and tone perception.

Consider beat perception (detection of a regular, underlying pulse in music). István Winkler and colleagues (2009) privilege a nativist explanation given the very early stage in ontogeny—two to three days old—that this capacity has been evidenced. Jessica Grahn (2012), though, points out that experience of beat perception might begin prenatally, so the inference to innateness may be premature. Prenatal infants are exposed to a variety of external rhythms, such as the pulse and heartbeat of their mother. So while beat perception presumably relies on the infant's motor networks, it may also rely on her experience of auditory environment.

Consider also tone perception. Very young infants show a preference for consonant over dissonant tones in music, and this has led researchers to suggest that such a preference is innate (see Marcus 2012; Trainor et al. 2002). Interestingly, however, studies have established that neonates show preferences for music that was played to them whilst in the womb (see Sloboda 2005; also Parncutt 2009; Hepper 1991), so prenatal musical exposure influences infant preferences. And Josh McDermott and colleagues suggest that preference for consonance over dissonance is not universal: it appears that the Tsimané people lack this preference (McDermott et al. 2016). As with beat perception, presumably both inborn networks and auditory environment matter in tone perception.

Not only are innate ascriptions of musical capacities too quick, they conceal a deeper issue. There are general reasons to query the usefulness of the innate/acquired framework. First, the concept of innateness is subject to much philosophical scrutiny and debate. Rounding up twenty-six different definitions of "innate," Matteo Mameli and Patrick Bateson (2006) distinguish at least eight distinct concepts of innateness put to use by scientists. This suggests that there are numerous properties (and roles targeted and best played by those properties) that scientists are interested in when investigating innate traits. Mameli (2008) dubs the conflation of these distinct properties the clutter hypothesis of innateness. Paul Griffiths (2002) argues that attempts to operationalize "innateness" might elucidate some property or properties picked out by the broader (i.e., cluttered) concept, which might result in a construct useful for scientific investigation, but will fail to capture innateness *simpliciter*, undermining the general innate/acquired distinction.

Second, the great plasticity of the human brain makes distinguishing innate and acquired neural circuits—even on some "innateness" operationalization—something of a challenge (McDermott & Hauser 2005).

Third (and as the musical examples show), developmental interaction between genotypes and environments is ubiquitous and complex. There is widespread consensus that, apart from perhaps DNA processing's direct molecular products (proteins), a phenotypic trait's development in any individual depends on both genes and environment. This is known as the *interactionist consensus* (Sterelny & Griffiths 1999). So although the literature has moved past false and unhelpful caricatures of "irreconcilable" nature versus nurture perspectives, and although researchers might agree that the concepts are now "a matter of degree," the innate/acquired distinction is misguiding in practice at least for the reason that it focuses attention away from the interaction of developmental resources key to understanding human cognition. In my view, the innate/acquired distinction is an unhelpful framework for conceptualizing development of cognitive traits both generally and applied to music.

Nonetheless, music researchers can avoid the pitfalls of innateness by specifying their research targets explicitly, distinguishing the properties they are interested in from other ("uncluttered") candidates; for example, how developmentally robust a capacity is, whether a capacity can be modified down the line by learning (or other mechanisms for adaptive plasticity), whether it is environmentally canalized relative to some variation range, whether it is highly heritable (or otherwise) relative to some population, whether or not it is statistically universal in some population of normally developed individuals, and so on. There is no reason to prevent the debate over beat perception and tone perception side-stepping the innate/acquired distinction and proceeding along these lines.

We should prefer debate about detailed causal stories of musical development to rough innate/acquired ascriptions. The subsequent development through ontogeny of musical capacities (building on that of beat and pitch perception and so on) presumably relies on a very complex interaction of developmental resources. Consider that identical twins raised in different musical environments are likely to exhibit variation in musical abilities. Twin studies reveal that musical capacities are in part genetically influenced, yet that genetic effects on musical capacities are more pronounced among those in more musical environments (Hambrick & Tucker-Drob 2015). The developmental landscape metaphor may be useful here: causes from a variety of resources (genetic, epigenetic, behavioral, symbolic; Jablonka & Lamb 2005) shape the pathway one takes as one navigates the hills and canals of development from conception to death (Ariew 2007; Waddington [1957] 2014). And as André Ariew suggests, perhaps replacing attributions of innateness with environmental canalization—that is, the degree to which the end-state of a phenotype's development is buffered against environmental effects—will prove to be more useful for scientific modeling and debate than standard innate/acquired theorizing, true of musical capacities as much as any other.

## MUSIC AND EVOLUTIONARY THEORY

Debate about music's evolutionary status can be traced back to an exchange between Charles Darwin and Herbert Spencer. Spencer (1857) suggests that music's origins are in the prosodic/emotional elements of language, while Darwin (1871) suggests that music's origins are in sexual selection (see below) and that language emerged from its musical predecessor. (For a lucid historical background, beyond the scope of this chapter, see Cross 2007.) One of the questions dominating the contemporary philosophical literature on the evolution of music is whether or not music is an evolutionary *adaptation* (see Davies, Chapter 26 this volume). That is, does music have a proper function, having evolved due to its fitness benefits in our ancestral environments? Briefly, on Darwin's proposal, music's evolutionary origins might be functional in this sense—an adaptation for courtship/sexual advertising.[6] Spencer's view is different: it conceptualizes music as a by-product of language. There is no shortage of adaptationist hypotheses, and non-adaptationist alternatives, of music's evolution.

I will first consider adaptationist hypotheses. Following Darwin's lead, Geoffrey Miller (2000a), Denis Dutton (2009), and others argue that music evolved primarily through sexual selection, functioning as a courtship signal/fitness indicator. Darwin's own, oft-quoted conjecture is that:

> primeval man, or rather some early progenitor of man, probably used his voice largely, as does one of the gibbon-apes at the present day, in producing true musical cadences, that is in singing; we may conclude from a widely-spread analogy that this power would have been especially exerted during the courtship of the sexes, serving to express various emotions, as love, jealousy, triumph, and serving as a challenge to their rivals. (Darwin 1871: 54)

Darwin's idea is that our ancestors used vocal displays in their successful attempts to "woo" sexual partners—and to distinguish themselves from (and even challenge) their rivals.[7] Miller has been a strong advocate of a neo-Darwinian sexual selection hypothesis not only for music, but for many other aspects of human life (Miller 2000b).

Other adaptationist hypotheses of music's evolution stress aspects of cooperation and sociality rather than competition or sexual display. Some suggest that music reinforced "groupishness," appealing to the notion of multilevel selection (Brown 2000); others suggest that music functioned as a coalitional signaling system (Hagen & Bryant 2003). Robin Dunbar (1993, 1996) argues that "vocal grooming"—affective vocalizations from individuals to members of the group—took hold in our deep past. The idea: once hominin group size increased beyond a threshold, an upgrade from the one-on-one grooming social strategy observable in extant primates was called for (i.e., vocal grooming), which functioned as social glue. Dunbar first applied this hypothesis to proto-language, but arguably it is more plausible as a theory of proto-music (Dunbar 2012; see also Sterelny, Chapter 9 this volume). Ian Cross (2012a, 2012b) suggests that music functioned as a medium for the management of unclear or ambiguous social situations. Ellen Dissanayake (1982) argues that the arts (in which one might lump music) impart "specialness," which enhanced ritual and reinforced social cohesion. In later work (2008, 2009), Dissanayake suggests that music evolved through mother–infant communication, such as lullaby and play song that produces affective changes and arousal in infants and strengthens mother–infant bonds (see also Trehub 2003; Trehub & Trainor 1998). Steven Mithen (2005) postulates a "musilanguage"—a holistic (non-compositional), mimetic, multimodal, and manipulative (affective) communicative system—that he suggests precedes both music and language.

Participants in the debate freely admit that there is some speculation involved here. However, good hypotheses can generate testable predictions, and assessment of the evidence can help adjudicate between rival hypotheses. To illustrate, I briefly focus on and critique the sexual-selection adaptationist hypothesis about music. The following facts seem at odds with the predictions that we would make in order to test that hypothesis: (i) children are capable of demonstrating musical play and even good musical competence well before sexual maturity; (ii) it has not been established that musicians are any more successful at reproducing than other people (despite the sex-god escapades of a few rock stars and music celebrities)—conversely, *non*-musicians are not thereby less successful reproducers; (iii) cooperative, group-based—rather than individually focused—music is ubiquitous in the ethnomusicological record; (iv) the same goes for lullaby and play song between mothers and children, hardly acts of sexual display; (v) experimental findings suggest there is no correlation between female preference for higher levels of complexity in music (as a proxy for male quality) and occurrent fertility (ovulation), which would be consistent with the sexual selection hypothesis (Charlton et al. 2012); and, finally, (vi) findings from a recent twin study, boasting a huge sample of over ten thousand twins, show that "genetic correlations between musical aptitude and the measures of mating success were all nonsignificant . . . findings show that higher musical aptitude or achievement does not lead to increased sexual success (quantitatively) . . . there was no significant association between musical aptitude and number of children" (Mosing et al. 2015: 364).

My point is not that musical skill is ignored in our assessments of—or our attraction to—potential sexual partners, whether long term or one-night stands. It is extremely plausible that once music emerged, the demonstration of fine musical skills and musical creativity played a role in mate selection, and that music continues to be harnessed by some individuals as a means to attract sexual partners. Rather, my point is that an exclusively sexual-selection adaptation hypothesis for the evolution of music is unpersuasive. Even if important, sexual selection cannot be the whole story.

I'll now turn to non-adaptationist hypotheses of music.

First I will rather schematically introduce the additional terms for the uninitiated (Table 27.1). A *by-product* is a non-adaptive consequence of selection for some other adaptation or set of adaptations (Gould & Lewontin 1979). The redness of mammalian blood, for example, is a by-product of blood's biochemistry and function (internal, iron-based oxygen transport); it is not that selection conferred adaptive fitness on red-blooded ancestors versus their (say) green- or blue-blooded competitors. Blood's redness is merely an *indirect* result of selection. Traits that take on some new adaptive role—that is, "features that now enhance fitness but were not built by natural selection for their current role" (Gould & Vrba 1982: 4)—are *exaptations*. For example, bird feathers initially evolved for thermodynamic regulation, and were later

**Table 27.1** Explanation of terms

| Taxonomy | Description |
|---|---|
| Adaptation | Product of selection with proper function(s) |
| By-product (spandrel) | Incidental consequence of selection |
| Exaptation (adaptive offshoot) | Product of selection with adaptive effect(s) |
| Technology | Cultural invention; not a product of Darwinian selection/biology |

co-opted for use in flight (although many subsequent structural changes in feathers are, adaptations for flight). Finally, a *technology* is a cultural, rather than biological, innovation, though one that can have significant upshots. Technologies are conceived as not caused by biology, at least not in the same sense as blood's redness. Hominin fire behaviors have been conceived as a technology in this sense: a cultural product rather than a biological one (Patel 2010; Davies 2012). Music has been conceptualized as each of these options. To this I now turn.

Many researchers argue that music is a non-adaptive by-product of other long-established cognitive capacities. Steven Pinker has called music an "auditory cheesecake": "a cocktail of recreational drugs that we ingest through the ear to stimulate a mass of pleasure circuits at once" (Pinker 1997: 528); "music is . . . an exquisite confection crafted to tickle the sensitive spots of at least six of our mental faculties" (534).[8] On this view, music merely generates pleasure rewards, the underlying mechanisms of which were originally selected for in other contexts. Similarly, for Dan Sperber, "music . . . is parasitic on a cognitive module the proper domain of which pre-existed music and had nothing to do with it" (1996: 142).

Davies (2012) argues that even if music first emerged as a by-product, it would have taken on a clear adaptive role in due course. Although he does not use the term "exaptation," the idea is captured by his slogan "*form becomes norm*" (Davies 2012: 144). In the context of art behaviors generally speaking, Davies suggests:

> If art behaviors came to us as ancillary evolutionary by-products, they would not remain merely incidental. Their occurrence in the usual manner would become normative because they provide honest, because costly, signals of fitness. As a result, not only the absence of art behaviors but also the degrees to which they are represented can be informationally significant in assessing someone's fitness. (2012: 145)

Another example of an exaptation may be literacy. The ability to read and write is presumably a by-product of adaptations for language, pattern recognition, and social learning, not some de novo cognitive adaptation—yet once individuals develop proficient literacy skills, being able to read and write might increase their adaptive fitness.[9] Importantly, however, music is ancient enough for its fitness effects to have caused further evolutionary changes through positive feedback. (I return to this thought below.) This would be so *even if* music were as recent as the earliest known flutes at 40 kya. Writing systems, on the other hand, only date back to roughly 5 kya (Houston 2004)—and general literacy competence, broadly distributed through populations, is a strikingly recent phenomenon.

Pinker's by-product view leads him to call music a "technology." Reclaiming this term, Aniruddh Patel (2010) argues that music is a *transformative* technology, although a cultural invention, somewhat akin to the discovery and production of fire. On Patel's view, music is "transformative" because it is not a mere hedonistic, parasitic pleasure device, as per Pinker's by-product hypothesis: it can shape the neural structures of individuals during their lives and have real effects on their development, largely through the effects of neuroendocrine hormone-release and the brain's great plasticity. To be sure, music has been used to some effect in therapy, for instance in aiding stroke rehabilitation (Thaut et al. 1997) and reducing the desire for self-administered pain medication during locally anesthetized surgery (Ayoub et al. 2005); lullabies have a positive influence on the feeding patterns and development of prematurely born neonates (Standley 2003); music learning is correlated with increased general intelligence in children (Schellenberg 2006) as well as mathematical competency and emotion detection (Gardiner 2008; Thompson et al. 2004). Nonetheless, Patel thinks that music has not been targeted by selection so it is neither an adaptation nor an exaptation.

One problem with the debate is that theorists are not always clear on what they mean by "music." Adaptationist hypotheses might target music conceived as a trait or series of traits of individual phenotypes, rather than, say, the acoustic *product* of a collective, social practice, which might be the target of by-product or technology hypotheses. So it could be supposed that several views are compatible. They are about different *explananda* so we just have to disambiguate "music" appropriately. I argue elsewhere that there are multiple, legitimate, non-equivalent concepts of music (Currie & Killin 2016); knowing whether individual phenotypes or social products are being theorized about is important for disambiguating the target of hypotheses. However, *gene-culture co-evolution* undermines distinguishing between sharp biological and cultural conceptions of music, at least with respect to evolutionary theorizing. Music, on either disambiguation noted above, is a bio-cultural phenomenon; theorists who blackbox one in attempting to explain the other do so at their peril. In my view, this undermines couching music in the adaptation/non-adaptation framework. I will explain first with an analogy to hominin fire behavior.

Material evidence of sustained fire control appears around 790 kya (Goren-Inbar et al. 2004), becoming more continuous (and archaeologically visible) from around 400 kya. Fire contributed to our ancestors' increase in brain size, it enabled the cooking and softening of foods such as meat and tubers (chimpanzees spend hours every day chewing and digesting their uncooked foods), and it extended the light of the day, enabling opportunities for social and other pursuits. Crucially, fire control fed back into hominin anatomy (Wrangham 2009). Softening food through cooking enabled the reduction of tooth and gut size of our ancestors by lowering the demand on chewing and digestion, which in turn allowed developmental-energy reallocation to brain size increase. Fire culture had biological consequences, generating positive feedback loops. So (contra Patel) it is unhelpful to conceive of fire control as a purely cultural "technology," artificially splitting biological and cultural evolution, because doing so undermines the dynamic, intertwined evolutionary forces here.

Fire is not a one-off. Other examples include the dynamic co-evolution of cattle farming and the increased adult-age tolerance to lactose (Beja-Pereira et al. 2003), and the co-evolution of the hominin hand and tools (Marzke 2013). Crucially, co-evolution does not render it false to say that hands are, say, "exapted for toolmaking and use" versus "adapted for toolmaking and use" or vice versa—the important point is that this is not a productive framework: it does not focus attention on the co-evolutionary dynamics and feedback loops that were key in shaping (say) the hominin hand and its executive control. The same *mutatis mutandis* is true of music.

Recent research suggests that music is very likely to be a result of gene-culture co-evolution. Steven Brown and colleagues (2013) examine the correlations between genes (via mitochondrial DNA haplotype analysis) and music (via musicological analysis of recordings of traditional vocal songs sung in a group performance context) in nine geographically distinct indigenous populations of Taiwan. Their research indicates that musical diversity and genetic diversity are indeed significantly correlated, with musical overlap between that of nearby regions reflecting shared ancestry (genes) and not just inter-group cultural diffusion. (This is evidence of indirect co-evolution of course, not "genes for music.") From the results of their study, Brown and colleagues conclude: "The correlations we observed between musical and genetic diversity support the contention that music and genes may have been coevolving for a significant time period and that music might possess the capacity to track population changes" (Brown et al. 2013: 5). Similarly striking results are found by Patrick Savage and colleagues in examining the correlations between Ainu music and genes (Savage et al. 2015).

Music's co-evolutionary dynamics are important in assessing the adaptation debate's framework. And in my view, human musicality is a co-evolving patchwork of anatomic, cognitive, behavioral, and socio-cultural features. In cases of complex co-evolution, such as fire control and music, the explanatory usefulness of the standard set of distinctions is undermined, and boundaries are blurred.

## MUSIC, ETHNOMUSICOLOGY, AND NICHE CONSTRUCTION

In the previous section I emphasized gene-culture co-evolution. In this section I draw on examples from the ethnographic record in order to illustrate some of the myriad ways in which musicality is expressed in hunter-gatherer life, taking a broader niche construction perspective.

Living organisms alter their environments through their activities, shaping the living conditions of themselves, their offspring, and other affected organisms. Beavers, for example, drastically alter their environments, and the local ecosystem at large, by building dams. (For an introduction to niche construction theory, see Odling-Smee et al. 2003.) Through feedback loops, changing living conditions affect the development, actions, and selection of organisms down the evolutionary trail.

Human populations in particular flourish because humans construct the environments that humans experience (Kendal et al. 2011). Human children grow and develop in a world of innovations, norms, and conventions; their *socio-cultural*, *informational* environments shaped by previous generations:

> [Humans develop through] interaction with family, friends, collaborators, strangers, and domesticated animals, and an environment loaded with human artifacts. . . . All of this social and material infrastructure *scaffolds* the development of human cognitive phenotypes in every culture today and has for many thousands of years. (Trestman 2015: 92)

Humans are niche constructers par excellence. Turning to the ethnographic record can help explore the ways in which music plays a role in such processes of cultural niche construction (leading to fitness differences), and its roles in the social group and wider context. Take, for example, Australian Aboriginal society that traditionally maintained a highly symbolic, lyrically driven song tradition tied closely to concepts of geography, land ownership, story, and ritual (*Tjukurrpa*, "The Dreaming"), and which maps their vast, barren, homogenous desert environment, on one hand, and preserves creation mythology and traditional folklore through song, on another. Children that grow up in a social environment such as this, in which much information is expressed through traditional song, develop in a context that is *scaffolded* by these songs and their role in informational and cultural transmission and social learning. In the 1950s, Richard Waterman noted that:

> Throughout his life, the Aboriginal is surrounded by musical events that instruct him about his natural environment and its utilization by man, that teach him his world-view and shape his system of values, and that reinforce his understanding of Aboriginal concepts of status and his own role. More specifically, songs function as emblems of membership in his moiety and lineage, as validation of his system of religious belief, and as symbols of status in the age-grading continuum. They serve on some occasions the purpose of releasing tensions, while other types are used for heightening the emotionalism of a ritual climax. They provide a method of controlling, by supernatural means, sequences of natural events otherwise uncontrollable. Further, some types of songs provide an outlet for individual creativity while many may be used simply to conquer personal dysphoria. (Waterman 1956: 41)

Daou Joiris (1996) has carried out fieldwork on the semi-nomadic Baka Pygmy hunter-gatherers of southeastern Cameroon. Joiris describes their big-game hunting rituals, in which musical performance plays a crucial part. Music performed on "the female musical bow (*ngbiti*) with which women charm spirits in order to make them direct animals towards hunters" (1996: 273), in addition to whole-group song-dances and the (solo) yodeling songs of ritual specialists, are intended to entreat the spirits. These ritual musical performances, if performed successfully, are thought to be partially responsible for the hunters' locating and capturing/killing of game, deciphering of animal trackways, and so on. This cultural niche may very well co-evolve with a psychological one. The music and ensuing hype may raise the affect and emotional profile of the hunters, imbuing them with a heightened sense of awareness, confidence, and camaraderie—leading to a cooperative and bountiful hunt.

Traditionally, the Blackfoot and Sioux tribes of the North American plains, nomadic hunter-gatherers, utilized music daily, in ritual activities and puberty rites, social activities (promoting in-group cohesion), and war dances (promoting out-group dissonance). Their traditional music is primarily vocal, comprising "vocables" rather than words—contributing to activities emotionally rather than symbolically (McAllester 1996)—with percussion made from gourds, turtle shells, wood, cocoons, deer hoofs, and the like. Some songs, however, were iconic: a mimetic, "bleating-calf" song was used in a characteristic musical hunting strategy (Kehoe 1999; Morley 2013). The song lured bison towards the top of a cliff face, to be spooked and forced over:

> By skillfully mimicking a lost calf in his actions and by bleating pitifully, the caller attempted to make the bulls that led the herd follow him. Taking a zig-zag course so as not to make them suspicious, he would gradually lure them into the funnel [of an impoundment], quickening his pace all the while. Once the herd was well into the chute, tribes-men concealed behind the stone and brush piles stood up, shouted, and waved their robes to stampede the bison at the rear end of the herd.

> These frightened beasts would surge forward, impelling the leaders of the herd into the pound, willing or not. The buffalo caller quickly dodged to one side to save himself from being trampled to death, and made his escape. Sometimes a convenient steep bluff or gully was substituted for the pound, the bison breaking their legs as they fell over the precipice or being trampled by those behind as they crowded into the narrow gully. (Howard 1984: 61)

Notice that here I am looking to the musics of various societies, not because ethnographically recorded foragers are living replicas of our Pleistocene ancestors, but to provide illustrations of music's part in the niche construction of human lifeways. The Blackfoot "bleating calf" musical hunting strategy, for instance, obviously has ecological and cultural consequences. Moreover, looking to the musics of various historic traditions helps us "to examine and illustrate a wider diversity of the musical behaviors that exist" (Morley 2013: 12), allowing us to better understand the ways in which our ancestors could have been musical that are actually instantiated in groups living under some similar conditions. It reveals some similarities in material resources used, predominant use of the voice (rather than musical instruments), and the social/communal/affective nature of much music.

Although many open questions about music and human evolution remain, ethnomusicological research can bolster theories of music's evolution, fuel phylogenetic modeling methods, and allow researchers to test predictions generated from evolutionary hypotheses (for further discussion, see Killin 2016). One task for future research is elucidating how ethnographic research can feed into a niche construction perspective of human musicality, and hominin socio-cognitive evolution generally.

## NOTES

1. All from confirmed *sapiens* sites, the oldest from Germany's Swabian Jura ranges. The earlier Divje Babe I "Neanderthal flute" (a femur bone of a juvenile cave bear, dated to 60 kya) turns out not to be a flute at all (Diedrich 2015). There is, as yet, no confirmed evidence of Neanderthal musical technology.
2. For an extended discussion of behavioral modernity in general see, e.g., Sterelny 2011.
3. Instruments made from ivory may have a greater chance at preservation—if regularly made in pre-exodus Africa we might expect to find some and excavations may yet uncover them—though for now the complex processes required for the construction of ivory flutes (discussed above) perhaps suggests that they were a more recent extension of the prehistoric wind section.
4. The latter is not impossible. There may have been some novel feature of more recent human environments to which music was a response by convergence.
5. Ancient, intentional striking of stalactites and stalagmites has been evidenced (Montelle 2004), suggesting a lithic musical culture.
6. Stephen Davies (Chapter 26 this volume) characterizes Darwin's account of music as a by-product view, appealing to Darwin's reflection that music faculties are "mysterious." I think this characterization is too quick. Darwin's sexual selection conjecture aims to take that mystery out of music, which Darwin thought was perhaps not explained by *natural* selection. (For a closer look at Darwin's view on music, see Bannan 2017.)
7. Sexual selection is also the standard explanation for the evolution of birdsong; see, e.g., Catchpole 1987.
8. For objections to the cheesecake analogy, see, e.g., Carroll 1998; Dutton 2009; Davies 2012.
9. Writing systems allow the literate to "offload" information and ease constraints on semantic memory, problem solving, attention, and focus.

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