Chapter 2

Root, leaf, blossom, or bole: Concerning the origin and adaptive function of music

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2.1 Introduction

In an earlier survey of ideas about the adaptive function of art (Dissanayake 1994), I invoked the old analogy of blind men examining an elephant to describe what kind of creature it is. The concept of art, I said, is similarly composed of a variety of features, some as different from one another as the elephant's trunk from its ear or tail. Yet to discuss the subject of art's function (or origin) cogently, we need to know what it is that we are referring to—we need to have an idea of the larger whole.

It is the same with 'music', which—like 'art'—is not a word or concept in many human societies, even ones that conspicuously engage in what *we* would call music or art. Like the editors and other contributors to the present volume, my subject here is music as a component of *communicative musicality*, a term that offers a new way of thinking about that complex, many-faceted entity that we call music. As the essays in this volume seek to demonstrate, musicality is a psychobiological capacity that underlies all human communication, including music. It has evolved to become a universal characteristic of human nature. As a component of human nature—part of what makes us human—musicality and music itself have an evolutionary origin and function. Like speech or toolmaking, there must have been a time when they did not exist. From what antecedent abilities did they arise, and why?

Non-evolutionary explanations for the origin of music have probably existed for thousands of years—we know, for example, that many cultures consider it to be a gift of the gods, or of a particular god. However, under the influence of the Enlightenment, and especially after the publication of Charles Darwin's ideas in the second half of the nineteenth century, more 'scientific', quasi-evolutionary sources and functions for music were proposed. It is useful to describe these and two recent specifically evolutionary proposals, before offering my own hypothesis on the origin and purpose of music.

To organize my discussion, I use an analogy from another large living thing, in the present case vegetable rather than animal. In his poem *Among school children*, William Butler Yeats asks,

> O chestnut-tree, great-rooted blossomer,
> Are you the leaf, the blossom or the bole?
>
> W B Yeats (1928)

In seeking to understand music as it emerged from the great-rooted whole of musicality, I consider the early quasi-evolutionary speculations as individual *leaves*, and a current influential theory from evolutionary psychology as *blossom* (music as ornament to attract sexual partners)

and—indulging in poetic license or interpolation for the purposes of my discussion—as *burl* (music as non-adaptive by-product of other adaptations). My own hypothesis about music I liken to the *bole* or trunk that supports the entire chestnut tree, which Yeats implies is more than the sum of its various parts. The *root*, which nourishes the entire tree, is communicative musicality, as described in other essays in the present volume. As with any illustrative analogy, I beg the reader's indulgence and ask that it not be taken further than I take it here.

2.2 **Leaf: early speculations**

In the second half of the nineteenth century, writings about music began to include speculations about its evolutionary origin and what we now call its adaptive function (although formulated more in terms of what music was observed to accomplish). These suggestions were not presented as scientific hypotheses, but instead were ideas derived in large measure from observations of musical behaviour in 'primitive' societies. As is well known, Darwin's theory of descent with modification by means of natural selection, had reverberating and not always beneficial effects on subsequent thought about humans. Ideas about 'progress' and 'improvement', based on misunderstandings and the misapplication of Darwin's theory, were used to support racialist 'explanations' for human social and intellectual differences, eventually tarring all of the subject of human evolution with the brush of racism and ethnocentrism (Degler 1991). A century later, few humanists or even social scientists seek to propose evolutionary origins and functions for human behaviour, and the concept of human nature itself is suspect.

Nevertheless, my colleagues and I, engaged in adaptationist studies of the various arts (e.g., Aiken 1998; Brown 2000a, b; Carroll 2004; Coe 2003; Dissanayake 1995/1992, 2000a, b; Miller 2000a, b; Mithen 2005), are concerned to propose plausible hypotheses about their evolutionary origin and, especially, their adaptive function(s). Considering what others before us have suggested is a useful starting point, even though early theorists did not feel obliged to address what would have caused or promoted the emergence of music in human individuals or societies in the first place. Here, on the chestnut tree of music, I place these and other such suggestions about the origin and function of music as leaves, which give nourishment and rustle pleasantly, but are to be replaced after their seasonal usefulness is past.

Most speculation about the biological origin and function of music, from the late eighteenth century to the present day, have looked to human vocal expression and communication: for example, emotional outcries that are inherently strongly moving or alarming—weeping, sobbing, calls for help, the ups and downs of excited speech, shouts of joy, and so forth (Combarieu 1894; Lacépède 1785; Spencer 1857)—what Eibl-Eibesfeldt (1975, pp. 498–499) later called 'innate releasing mechanisms' (and see Panksepp and Trevarthen, Chapter 7, this volume).

Additionally, some theorists traced the beginnings of music to rhythmic sound (Rowbotham 1880), or a rhythmic impulse, arising from the general appetite for exercise (Wallaschek 1893) and used to facilitate and promote work such as pulling nets or pounding grain (Bücher 1899). Other scholars thought that rhythm alone was not 'music', which required tones and intervals (Hornbostel 1975; Stumpf 1911).

Music also has been traced to sounds from human activity—hunting calls that may imitate animal cries and birdcalls (Lucretius 1937, in Rowbotham 1880, p. 661; Geist 1978); signalling (Révész 1941; Stumpf 1911), as across valleys and distances with hoots and hollers (Hall-Craggs 1969); play (Bücher 1910); and accompaniments to dance and festal excitement (Stumpf 1911)—these sounds gradually acquiring refinement and social purpose when used to ease and pace work and ritual.

Other theories have looked to human speech itself—to tone languages such as Chinese or Yoruba, where different pitches of the same syllable are semantically significant (Kuttner 1990; Schneider 1957), or to the preverbal babbling of babies (cited in McLaughlin 1970). There has been a lengthy debate, which still continues, about which came first in human evolution: music (Darwin 1874; Monboddo 1774; Rousseau 1761) or speech (e.g., Pole 1924/1879; Spencer 1857).

Although suggestions like these sprouted with some profusion, they were primarily arm-chair speculations, often influenced by unexamined Western presuppositions about aesthetic experience. For example, Max Weber (1958, p. 40), writing about the peculiar rational properties of developed Western music, contrasted it with 'primitive music', which was used for socially important and practical ends—apotropaic (protective) and exorcistic—rather than for accessing 'the sphere of pure aesthetic enjoyment'.

Most scholars today who address the adaptive function of the arts are concerned with the visual arts or literature, not music. Insofar as the earliest 'literature' (oral literature) was probably inseparable from song and movement, one can suggest shared evolutionary origins or adaptive functions for vocal music and the earliest recitation or oratory. I know only a handful of evolutionarily informed hypotheses about music's place in evolution—Brown (2000a, b), Cross (2003), Dissanayake (2000a, b), Hagen and Bryant (2003), Huron (2001), Merker (2000), Morley (2002), Miller (2000a, b), and Mithen (2005). Pinker (1997, 2002) contends that music is not an adaptation (Section 2.4, this chapter). This essay is not the place for comparison and evaluation of these hypotheses, except for those of Miller and Pinker, which have attracted popular attention and are discussed in the following two sections.

2.3 Blossom: music as sexual ornament and costly signal

A widely disseminated adaptationist hypothesis of the arts is that of Geoffrey Miller, who has specifically addressed the subject of music according to sexual selection theory (Miller 2000a, b). Because the flowers of a tree are essential for reproduction and are generally showy, I treat the sexual selection hypothesis as a 'blossom' of musicality.

Miller does not suggest a specific evolutionary origin for music or the other arts. He begins with Darwin's (1874) suggestion that human music might have evolved as a courtship display by invoking recent theoretical formulations in evolutionary psychology, notably 'costly signalling' theory and contemporary understanding of Darwin's own, now accepted, theory of 'sexual selection'. Restrictions of space prevent more than a brief outline of these ideas here.

Remarking on the apparently useless ornamental accoutrements of other species—especially the beautifully coloured, marked, and often enlarged crests, tails, wings, and other body parts of male birds—Darwin wondered whether human art, although different from culture to culture, was the same sort of thing. Yet why would either evolve? Features that are superfluous (as music and the other arts appeared to be) take time and energy from more obviously useful activities, such as finding food, mating, or resting. What is more, they draw attention to themselves, even attracting predators. Heavy antlers or luxurious tails impede locomotion and divert energy from vital activities. They would seem to reduce fitness, not contribute to it.

Miller applies 'costly signalling' theory (Zahavi and Zahavi 1997) to this apparent problem. The ornaments of birds and animals honestly advertise their fitness, because the strength and vigour required for their display cannot be 'faked' by less well-endowed males. Females who prefer (i.e., find beautiful or pleasing) such signals of genetic superiority and who choose their bearers as mates will produce similarly well-endowed male and female offspring with similar preferences. Through succeeding generations, these ornaments are 'selected for' and become established as species traits, despite their apparent liability. Similarly, Miller claims that human

music—song, dance, and the virtuosity to do them well—has evolved through sexual selection by females.

Competition is inherent in this model, since females choose the male with the most extravagant endowment—whether the brightest, tallest crest, the most vigorously quivered tail, the most splendidly ornamented bower, or the most complex and sonorous song. Sometimes male birds compete directly—for territories as well as mates—with their songs and displays; at other times they perform before a female who may, however, prefer another, better endowed suitor.

Miller's hypothesis of the competitive use of musical behaviour as male display, which I have only summarized here, has evidence in its favour. In many, if not all human societies, young males show their vigour, beauty, and sexual desirability through song and dance, and they achieve status through these and other accomplishments. About the time Miller was born, Curt Sachs (1962) described competitive uses of music in 'primitive societies': the Chippewa admire a singer's 'expanded range'; in Hawaii, deep and powerful chest resonance is noticed; Kikuyu women give a good flautist food and drink as signs of appreciation (1962, p. 134). In the Trobriand Islands, a good male singer is a success with women: 'The throat is a long passage like the *wila* [*cunnus*] and the two attract each other. A man who has a beautiful voice will like women very much and they will like him' (Malinowski 1929, p. 478). Other such examples can be easily found.

I suggest, however, that male competitive display for females is not the origin of music, nor its primary function. To begin with, 'musicality' in the animal world is used not only by competing males, but notably by monogamous pairs for bonding and territory maintenance—for example, duetting in gibbons (Geissmann 2000; Merker, Chapter 4, this volume) or courtship 'dances' in birds such as cranes, where both partners participate. As Sugiyama and Scalise Sugiyama (2003, p. 182) assert, costly signals may operate 'on several frequencies, capable of sending a variety of messages', not only mate value. Costly ceremonial arts, which include music and dance, may display kinship, generosity and sociality—as well as skill and male competence (Ottenberg 1989, p. 180) or group prestige (van Damme 1996, p. 270), since groups as well as individuals engage in costly signalling. Excess and cost are not only signals that say 'Look at me, I can afford this extravagance'. They can also signal 'I [or we as a group] really care about this message, and I am [we are] putting my money where my mouth is.' Expenditure of time, materials, and resources—in ceremonial performances composed of expensive, rare, or labour-intensive artefacts, costumes, structures, and performances—indicate to members of the group its zeal and strength of purpose for achieving the outcome that the ceremony is intended to provide. Thus art-filled ceremonies may appear luxurious, superfluous and pathological—as do male costly displays for mates—but they have fitness benefits other than mating advantage that are arguably as important (Section 2.5, this chapter).

Miller's hypothesis emphasizes creativity and virtuosity as unfakable endowments of which music and dance are evidence. However, although originality is valued for its own sake in some societies, human art is typically conservative, not idiosyncratic (Coe 2003). Its manifestations derive from the ancestors or supernatural spirits and must be reproduced accurately so that they will work as intended. Skill, too, is usually admired, but may also incite envy. Cole and Aniakor (1984) report that an Umunze Igbo slit-drum artist was so skilled that he was sacrificed so that he would not carve a bigger drum for another village (in van Damme 1996, p. 348). Among the Baule, carvers were usually cripples—those who were unable to farm (van Damme 1996, p. 232). These are perhaps exceptional cases, and may be interpreted as proving the rule that music is a sign of male fitness; however, they indicate that at least in the visual arts, male display may be only one—and not the most important—function of the arts.

Music and other arts in premodern societies have many contexts and uses that belie a sexual selection function. They are frequently displayed and performed in single-sex groups. Older males or females may be considered the best artists or performers. A glance at the artefacts on display in any ethnographic museum suggests that they and their accompanying music are frequently used for occasions that are as likely to create fear or awe as sexual interest.

Steven Brown (2000b, 2002) has pointed out other problems with a strict sexual selection argument for music. Darwin's theory was meant to explain sexually dimorphic traits—it is male birds who attract attention to their skilful song and who have costly ornaments. Yet human musical ability is possessed equally by females—as Miller notes, though he emphasizes male music-making—and both sexes typically produce music. In some East Asian societies, girls are the primary singers during courtship—e.g., the Moso (Namu and Mathieu 2003)—and in many others, the courting pair together engage in antiphonal love dialogues that allow them to coordinate body rhythms and otherwise assess their physical and emotional compatibility, e.g, Hmong (Catlin 1992), Kmhmu (Proschan 1992), Maranao (Cadar 1975), and Moso (Namu and Mathieu 2003).

Miller's hypothesis addresses extreme talent, but musicality is a general human capacity that benefits all, not only a few virtuosos. The entire hypothesis is concerned less with music than with virtuosic capacity and the benefits of having a large brain. By treating all products of the human brain as a form of sexual signalling, Miller (2000b) offers no cognitive function that is primary to music (or any other art)—no need that is fulfilled by its specific character that is not equally fulfilled by any other skill or display behaviour (Carroll 2004, p. xxi).

Another serious difficulty with the sexual selection argument is that it leaves no room for cooperative uses of music, which are by far the most noticeable in the world's musics—as the pioneer ethnomusicologist John Blacking emphasized (e.g., Blacking 1995, p. 31; see also Pavlicevic and Ansdell, Chapter 15, and Dissanayake, Chapter 22, this volume). Steven Brown makes the important point that 'the two most salient features of music, compared to any other form of vocal communication in nature, are its use of *pitch-blending* and *temporal synchronization*' (Brown 2000b, p. 297). These features facilitate coordination and cooperation among individuals, and it is difficult to see how they could have arisen through competitive interactions. Brown speculates that these two cognitive capacities may have evolved specifically for coordination and emotional unification among individuals in a group.

2.4 **Burl: music as functionless by-product**

William James (1890, p. 419) considered music to be 'a mere incidental peculiarity of the nervous system, with no teleological significance'. A century later, Steven Pinker (1997) echoes James and others like him who consider the arts to be superfluous by-products of other adaptations—rather like the hemispherical woody outgrowths or burls that sometimes form, like a wen or tumour, on the trunks of trees. The canonical example of this view is Pinker's analogy with strawberry cheesecake, which humans evolved to like because during the Pleistocene, when sugar and fat were rare, it was advantageous to prefer high-calorie, energy-rich foodstuffs when they were available, rather than to be satisfied with tubers or leaves. (Our atavistic liking for such foods today has little, if any adaptive function and indeed is maladaptive if overindulged). Like sugar, fat, alcohol, recreational drugs, masturbation and pornography, the arts—including music—exploit cravings that in other contexts are or were adaptive. Even though they are non-functional, we like these concentrated doses of sensory and mental delight because they allow us '[to press] our pleasure buttons' (Pinker 1997, p. 525).

Pinker's analogy is clever and amusing. Sometimes music, like eating, *is* an indulgence. However, familiarity with the range of uses of arts in small-scale subsistence societies—and apparently by our Paleolithic ancestors in what is now France and Spain, who have left evidence of artful behaviour in remote parts of deep caves—disposes of any suggestion that making and experiencing the arts are simply for pressing pleasure buttons. Laments, funerary arts, crawling through a kilometre of narrow, wet, dark tunnels to paint (or view and perform ceremonies before) bison and other animals on cave walls—these are not things people do for entertainment and fun. The sheer amount of time, individual energy and material resources devoted to ceremonial behaviour—in which music, dance, visual decor and literary language all combine—indicates that pleasure is not the only or even greatest reason for its centrality and persistence in the overwhelming number of human societies for which we have historical (and sometimes prehistorical) evidence. Music engenders emotional states—fellow-feeling, affirmation, solemnity, tears, and intimations of transcendence—that are not reducible to self-gratifying pleasure.

2.5 Bole: from protomusic to music

My argument about the evolutionary origin and function of music has two parts: a protomusical and a musical stage. I present it here as the *bole* or trunk from which the entire chestnut tree, rooted in communicative musicality, spreads forth its many branches in space and time.

2.5.1 Protomusic in communicative musicality

The emergence of protomusical capacities in humans, I suggest, derives in part from the consequences of being a creature that showed two incompatible anatomical modifications during its evolution: walking upright and developing an enlarged brain. A bipedal stance requires changes in bones and muscles that were originally used for quadrupedal locomotion. Among these alterations is a narrowed pelvis, making for difficulties at parturition for both the mother and her large-brained infant—a trend that was well underway by 1.6 million years ago (Falk 2004, p. 499). The solution (or compromise) was that selection favoured infants who were born at an increasingly premature state. Over evolutionary time, hominid babies gradually became much more helpless at birth than those of other primates (Dunbar 1996, pp. 128–129).

At birth and with lactation, the release of hormones such as opioids and oxytocin ensures that mammalian mothers are devoted to caring for their infants (Miller and Rodgers 2001; Pederson *et al.* 1992). It appears, however, that hominid mothers of helpless, demanding offspring required additional insurance to guarantee that they would willingly devote constant attention and care to them for years. How else to explain why shortly after birth (and at least as early as four weeks), human mothers and infants universally engage in dyadic species-specific interactions that serve to coordinate their behaviour and emotions—what Malloch and Trevarthen call 'communicative musicality' (see Panksepp and Trevarthen, Chapter 7, this volume). This interaction is more than the lilting, simplified utterances of 'motherese' or 'infant-directed speech'. It includes concurrent special facial expressions and movements of the head and body as well.

'Musicality' is an appropriate label, in that the interactions are organized in bouts (phrases) over time and in time, using such musical features as melodic vocal contours, rhythmic and regularized vocalizations and body movements, and expressive dynamic contrasts and variations in space (large–small, up–down) and time (fast–slow, short–long), with behavioural 'rests' or silences between bouts. The interactions are a multimodal (or multichannelled) 'performance' of the mother, in which vocal, facial and bodily movement occur all together, temporally organized according to a common pulse.

Although mother–infant interaction is well-studied, my hypothesis about its relevance to the evolution of music emphasizes three intertwined points that invite further investigation: (a) the noteworthy nature of the signals presented by the mother; (b) the infant's strong and untaught receptivity to the signals; and (c) the infant's active contribution to the communication. The visual, vocal and kinesic elements used multimodally in 'packages' by mothers are *simplified, repeated, exaggerated and elaborated versions of adult communicative signals*—what one might assume is necessary for attracting and holding the interest of an immature baby who requires stimulation and emphasis to pay attention. However, putting it this way diminishes the role of the baby in *eliciting and preferring precisely these kinds of signals* which, interestingly, are all similar to, and possibly derived from, *affiliative expressions* that adults use with each other in normal positive social interchange: open mouth, eyebrow flash, smile, looking at, head bob backward, body leaning toward, head nodding, soft high-pitched undulant vocalizations, touches, pats and kisses—many of which, incidentally, are present in some form in affiliative or submissive contexts in primate societies (Dissanayake 2000b, p. 41; King 2004).

Far from adults 'teaching' babies to like these sorts of signals, babies encourage *us* to interact with them in a way that we would never think of using with other adults or even older children. It seems reasonable to assume that a mother's simplifications, repetitions, exaggerations and elaborations of common affiliative communicative signals would have reinforced—through proprioceptive feedback (Scherer and Zentner 2001, pp. 371–372)—affiliative neural circuits in her own brain at the same time as she was communicating her feelings of love and attachment to her infant. (See Panskepp and Trevarthen, Chapter 7, and Turner and Ioannides, Chapter 8, this volume, for a description of the neurobiology of both partners in the mother–infant interchange, and a fuller account of its ontogeny.) Such reinforcement would have been adaptive both for maternal reproductive success and infant survival. In a book about the origins of music that appeared after the present chapter was prepared, Steven Mithen (2005) also suggests that evolved interactions between mothers and infants provided abilities that were used for communal singing and dancing in early human societies (*Homo ergaster* [1.8 million years ago] and *Homo heidelbergensis* [0.5 million years ago]). This chapter is not the place to discuss the points of similarity and difference in our hypotheses.

I suggest that the elements or operations of communicative musicality as they developed phylogenetically in interactions between ancestral mothers and infants—simplification or formalization, repetition, exaggeration, elaboration (and, for older infants, manipulation of their expectation, or surprise) of simultaneous vocal, visual, and kinesic expressions—are the origins of the capacities later used by humans in making and responding to music. Long before adult individuals themselves intentionally began to make what we call music (and the other temporal arts, which in small-scale societies are generally performed all together), these operations were adaptive between caretakers and infants, serving to coordinate behaviour and emotion and, by so doing, to conjoin or bond the pair. (Many other adaptive benefits to infants of the behaviour have been described by a large number of scholars, some of which are listed in Dissanayake [2000a, p. 393]).

In this scheme, the capacities for eventual music originate not in sex (i.e., sexual display), but in *love* or 'mutuality' (Dissanayake 2000b): the behavioural and emotional coordination between two individuals who need each other for their own individual reasons—for the baby, survival and, for the mother, reproductive success. In other words, as communication richly endowed with communicative musicality, the original function of simplified, repeated, exaggerated and elaborated signals presented multimodally by mothers to infants would have been to reinforce concord, not to compete for or seduce mates.

2.5.2 Music as interpersonal coordination and conjoinment

The second part of my argument—how our ancestors distilled music from protomusic—arises from observing the most common context in which music occurs in 'societies of intimates' (Givón and Young 2002)—traditional foraging (hunting and gathering) societies that were the sole institutional form of human society until six to eight thousand years ago. In these and more recent small-scale groups, music and the other arts are an integral part of human ritual ceremonies (see also Merker, Chapter 4, and Dissanayake, Chapter 24, this volume).

I have described ceremonies as 'collections of arts', without which a ceremony would not exist (Dissanayake 2000b). As in mother–infant interaction, where vocalization does not take place apart from facial expression and bodily movement, the collection of arts in ceremonies (singing, chanting, intoning, playing an instrument, dancing, keeping time by striking or moving to a beat) occurs and has its effects simultaneously. Early ethnographers of the arts (e.g., Boas 1925, p. 329; Hornbostel 1975/1905, p. 270), like countless subsequent ethnographers, noted the close relationship in small-scale societies between music, poetic language and expressive movement.

In proposing an evolutionary account of music, one need not posit a single origin in, say, emotional outcries or a predilection to rhythmic movement. In contrast to other evolutionary or quasi-evolutionary hypotheses of music's origin and function, mine considers the first music to have consisted of simultaneously presented vocal, visual and kinesic ordinary behaviours that were to some degree altered—simplified or formalized, repeated, exaggerated, elaborated, and sometimes manipulated to delay (or otherwise confound) expectation—making them non-ordinary (Section 2.6 of this chapter).

These emotionally powerful alterations of ordinary behaviours—first developed and performed spontaneously (that is, unintentionally, without being taught) as the communicative musicality of mother–infant interactions—can be called aesthetic or protoaesthetic (i.e., musical or protomusical). They are, additionally, what artists in every medium intentionally do to attract attention and to create and shape emotion. It remains, however, to suggest how and why early human adults began to use and expand their protoaesthetic or protomusical capacities and sensitivities—originally evolved from communicative musicality in mother–infant mutuality—in religious ceremonies.

Earlier I described the hominid trend towards developing an enlarged brain with increasingly complex neuronal connections. Among the sophisticated mental abilities that larger brains made possible in ancestral humans were the expansion of memory (remembering significant events, both desired and feared) and foresight (the ability to predict and plan). Rather than simply respond instinctively and contingently, like other animals, to current and changing conditions of hunger, danger, illness, and other important survival-related states, early humans—with memory and foresight—at some point would wish to *do something* about uncertainty (Malinowski 1948; Per Brandt, Chapter 3, this volume).

An expanded awareness of past and future, and a concomitant concern with cause and effect, provide the ground and motivation for what we call religion—in brief, the concern about why good and bad things happen, how they got that way, and what can be done about them. Such concerns and the arts appear to have developed together. One could say, in fact, that ceremonies composed of music and associated arts are the behavioural or expressive counterpart of religious doctrine and belief, providing something 'special' (shaped, embellished) to do for humans cognisant of and attempting to cope with the problems and uncertainties of mortal existence, whether past, present or future. In ceremonies, the temporal arts, based on the protoaesthetic operations of communicative musicality, could similarly coordinate and conjoin individuals,

providing emotional reassurance that the group's efforts would prevail (Dissanayake, Chapter 24, this volume).

2.6 Control of anxiety

Pace sexual selection arguments, the costly messages that groups and individuals transmit in ceremonies are less for attracting prospective mates than for attracting spirits, ancestors, and other forces that affect their lives and can bestow success in hunting, protection in warfare, prosperity, fertility, traversing important life stages, healing, and so forth. The question here is why fantastic religious beliefs and practices persist when they (to a modern scientific mind) do not attract spirits who can give assistance. That is, what is the ultimate function of costly ceremonial behaviours? I suggest that by joining with others in music and art-filled ceremonial behaviour, individuals may have felt more of a sense of coping with the uncertain circumstances addressed by the ceremony and thereby effects of the stress response were better ameliorated than for those who went their own isolated, anxious ways. Psychologists have found that the feeling of control has considerable positive effects on health and ageing (e.g., Maier and Seligman 1976; Peterson, Seligman and Vaillant 1988) as does the presence of social support (Uchino, Cacioppo and Kiecolt-Glaser 1996).

Hormones released during prolonged stress are debilitating to a wide range of somatic functions, including immune system activity, mental performance, growth and tissue repair, and reproductive physiology and behaviour (Sapolsky 1992). However, the physiological and neurological effects of entraining brain and body with others—through the vocal, visual, and kinesic behaviours and aesthetic operations that evolved to establish communicative musicality and ultimately music/art in ceremonial practice—require and establish a sense of behavioural control and actually *could* enable our ancestors to cope emotionally with uncertainty (Mithen 2005, p. 220).

Both infants and adults engage in repetitive kinesic and vocal behaviours for self-soothing, even to the point of pathological states such as rocking and head-banging (Perry and Pollard 1998). Even captive animals that perform pathological-appearing repetitive behaviours are found to have lower levels of stress than their counterparts that do not move stereotypically and repeatedly (Charmove and Anderson 1989). Mothers use the protomusical operations of communicative musicality to soothe and regularize emotional states in their infants. There is a large literature on music being used by individuals in modern societies to 'regulate, enhance, and change qualities and levels of emotion' (DeNora 2001, p. 169).

My suggestion here and elsewhere (Dissanayake 1995/1992) that the arts help individuals cope with anxiety antedates and resembles E.O. Wilson's suggestion that general intelligence enables behavioural flexibility, which has been adaptive, and at the same time produces confusion and uncertainty (Wilson 1998, p. 225). For Wilson, the arts are designed 'to create order and meaning from the chaos of daily existence [and to] nourish our craving for the mystical' (Wilson 1998, p. 232). We should not overlook *behavioral and emotional* contributions of the arts to stress reduction in ancestral ceremonial contexts, which derive from the protomusical operations (or mechanisms of communicative musicality) that originally facilitated conjoinment in mother–infant mutuality. That is, the adaptive benefit to humans of reassurance through behavioural and emotional coordination should be emphasized as much as cognitive ordering and understanding (e.g., Taylor 2002, pp. 48, 79, 133; Dissanayake, Chapter 24, this volume).

How might a temporally organized, ceremonialized response to uncertainty have originated? The human tendency to come together is especially great under stressful circumstances (Taylor 2002, p. 77). Both Malinowski (1922) and Mead (1976/1930) describe small groups in what is

now Papua New Guinea, huddling together and *chanting charms in a sing-song voice* to abate the violence of a storm. Having 'something to do' in a time of stress, such as moving and vocalizing rhythmically with one or more companions, would be more soothing—and safer—than going one's own isolated, anxious way. If the storm abated without mishap, one can imagine the chanting becoming more formalized and elaborated during subsequent storms. Another plausible model for an origin of early human music is *the lament*, a widespread performance by individuals or groups in which the natural behaviour of weeping and moaning in grief at the loss by death or separation from a loved one became formalized and elaborated in song/poetry/movement, and shared with others to relieve feelings of helplessness, individual isolation, despair, and the anxiety attendant on the interruption death makes to the life of an individual or group. Even the spontaneous reactions of individuals in the United States after the September 2001 attacks illustrates the therapeutic nature of participation in temporally organized and elaborated behaviour—listening with others to song, liturgy and poetry, walking solemnly and formally while holding candles, flowers and flags, or composing poetry to be placed with quiet ceremony in public places.

2.7 **Concluding remarks**

I have proposed that the primary adaptive function for mother–infant interaction in which communicative musicality is so evident—coordinating and reinforcing emotional coordination of the pair and promoting their mutual feelings of conjoinment—was similarly adaptive when additionally shaped and elaborated in ceremonial uses of music, although in a group rather than dyadic context. Such psychobiological cohesion makes it possible for individuals, dyads and groups to flourish.

My hypothesis fits in with stimulating ideas about music aiding group coordination offered by Brown (2000a, b), Freeman (2000), Benzon (2001) and Mithen (2005), and is a plausible antecedent of or alternative to other hypotheses about music's function. While developing my ideas, I discovered another scholar who in passing mentioned mother–infant interaction as a possible source of music (Hodges 1996, p. 46), and after preparing this chapter I found that Mithen (2005) expressly considered mother–infant interaction to be critical in the evolution of human music. He also considers the therapeutic effects of music for stress reduction and healing in Neanderthals and observes that modern humans make music under conditions of adversity (Mithen 2005, p. 236). Ian Cross (2003; Chapter 5, this volume) suggests that music may have originated in part as a result of processes concomitant with increasing neotenization (i.e., the persistence of juvenile traits into adulthood) during hominid evolution and Jaak Panksepp and Günther Bernatzky (2002) identify the evolution of song with the attachment/affiliation function of affection-seeking or affection-expressing vocalizations.

Merker (2000; Chapter 4, this volume) emphasizes unusually developed human abilities that antedate and contributed to the evolution of human music, including the unique ability to keep time to a common pulse. His account begins not with hominid mother–infant interaction, but with the synchronous chorusing and foot-stomping of late Miocene ancestors, which he suggests contributed to group coordination of males for the purpose of attracting females and for competing against other groups. Hagen and Bryant (2003), in a paper that is admirably illustrated with ethnographic examples, propose that music and dance may have evolved as a coalition-signalling system, perhaps originating from coordinated territorial defence signals. McNeill (1995) remarks on the 'muscular bonding' that occurs with 'keeping together in time' in dance and military drill. Although these scholars emphasize ancestral music as coordinating and strengthening bonds between males so they can compete with other groups, this function does

not belie a hypothesis of music's origin in the protomusical performances of mother–infant interaction.

Benzon (2001) suggests that music, by recruiting so many different parts of the brain, enables neural circuits to achieve coherent temporal form, and that this coherence is subjectively experienced as pleasurable and satisfying, relieving the anxiety of incoherence. Benzon examines several suggestions for evolutionary origin (although he does not consider the protomusical components and operations in mother–infant interaction) and concludes that although biological adaptation may have played a role in the evolution of the precursors to 'musicking' (his term for music behaviour), he finds the effects of culture on music to be more relevant (Benzon 2001, p. 190).

The phenomenon of human music is an ancient and mighty tree with many branches, leaves, flowers—and a burl or two. From its roots in communicative musicality, its bole, or trunk, rises as a thick compendium of mechanisms that foster emotional communion and conjoinment. In turn, these mechanisms support the superstructure of music with its variety of biological, social and cultural manifestations and purposes—some of them far from and even different from their source, as in the solitary rewards of listening to or making music alone (Kivy 1990). This view of human music as rooted in communicative musicality helps us to appreciate music's emotional and transformative power in human experience and to understand its antiquity and unique importance in our species.

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