

# Music and cognitive evolution

Chapter for the  
*OUP Handbook of Evolutionary Psychology*,  
ed Louise Barrett and Robin Dunbar  
(to appear in 2007)

Ian Cross  
Centre for Music & Science  
Faculty of Music  
University of Cambridge  
West Road  
Cambridge  
CB3 9DP  
UK  
ic108@cam.ac.uk  
<http://www.mus.cam.ac.uk/~cross>

### ***Introduction and historical background***

In 1858 Herbert Spencer sent Charles Darwin a collection of essays which set out Spencer's thinking on a range of issues (Spencer, 1858), including the "origin and function of music". Darwin responded, thanking Spencer for the present; he congratulated him on the "admirable" nature of his "remarks on the so-called Development Theory", admitting that he himself was presently engaged on "an abstract of a larger work on the change of species", though treating the subject "simply as a naturalist & not from a general point of view; otherwise, in my opinion, your argument could not have been improved on & might have been quoted by me with great advantage". Darwin continued, declaring that "Your article on Music has also interested me much, for I had often thought on the subject & had come to nearly the same conclusion with you, though unable to support the notion in any detail"(Darwin, 1858).

By the time Darwin came to set out his thoughts on music in *The descent of man and selection in relation to sex* of 1871 (Darwin, 2004), however, something of a divergence of view had emerged, perhaps partly accelerated by Darwin's increasing exasperation with the extent to which his concept of evolution as founded in natural selection had been confounded in the public mind with the teleological theories propounded by Spencer. In *The descent* Darwin suggests that music arose as a functional component of processes of sexual selection; it should be regarded as having been analogous in its utility to the sounds produced by the males of a wide variety of species to attract mates (Darwin instances, *inter alia*, insects, fish, birds, mice and apes). While music is incapable

of functioning in the ways that "articulate speech" may do, its powers of representation being vague, it has great powers to arouse in us "various emotions". Music's affective powers arise through its association with processes of sexual selection, being employed "during the season of courtship, when animals of all kinds are excited not only by love, but by the strong passions of jealousy, rivalry, and triumph". Indeed, impassioned speech exhibits profoundly musical characteristics; as Darwin puts it, the powers of music are reflected in the "cadences of oratory". Music constitutes a basis for the emergence of language, being a capacity widely shared with other animals and constituting a medium ideally suited for the communication of affect rather than representation. Darwin thus viewed music as a precursor of language, its ultimate roots lying in its adaptive value in sexual selection.

Darwin contrasted his views with the position of Spencer that he had praised in 1858. Spencer had proposed that the prosodic features of emotional speech constituted the basis for music; Darwin claimed that in asserting this basis for the origin of music Spencer is largely following Diderot (an intellectual predecessor certainly not acknowledged in Spencer's essay). Darwin felt that while he had defensible reasons for claiming that music preceded language in evolutionary terms, Spencer had no good grounds to argue for a genesis of music in "the cadences used in emotional speech"; Spencer, for Darwin, is unable to offer "any satisfactory explanation... why high or deep notes should be expressive, both with man and the lower animals, of certain emotions.". In other words, Darwin claimed that Spencer had not put forward a cogent rationale for the emergence of music from speech; he simply observed that it appears to have done so without

providing an account of the mechanism that motivated it, which for Darwin lies in the utility of music in sexual selection processes and its concomitant association with contexts of high arousal.

Notwithstanding their differences, for both Spencer and Darwin music was conceived of as integrally expressive of affect. In *The expression of the emotions in man and animals* of, 1872, Darwin expands somewhat on the notion that music's affective potency reflects an ancient lineage for musical capacities and fits it for a role as the foundation of language. (The second, revised edition of *The expression...* appeared in 1889, and the psychologist Paul Ekman edited a third edition, incorporating a commentary on Darwin's text, which appeared in 1998; page numbers given in subsequent quotes refer to this last edition.) Music mirrors or captures the relationships between affective state and sound that are found across a wide range of species, particularly in respect of vocal music, which Darwin (1998, p94) suggests "must be taken as the primary type of all music.". Interestingly, Darwin suggests that the effects of music do not lie in its sounds alone but also in the actions which produce these. He notes that a melody transposed from one pitch range to another may lose much of its effectiveness, and suggests (ibid.) that "The effect is thus seen to depend not merely on the actual sounds but also in part on the nature of the actions which produces the sounds." As will be seen, this hint concerning an association between the powers of musical sound and action is one which resurfaces in evolutionary thinking about music only in recent years.

For Darwin, then, music was explicable in evolutionary terms; it arose as an integral component in processes of sexual selection, its affective powers explained by the context in which it had originated. But while the scientific prestige of Darwin's theory certainly helped to secure a place for evolution in thinking about music for the next forty years or so, it was Spencer's ideas, and particularly the governing principle that he had adduced in explaining the emergence of music from articulate speech, that shaped the ways in which a role for evolution was conceived in the study of music around end of the nineteenth century. This governing principle was likely to have been one of the principal factors underlying Darwin's dismissal of Spencer's ideas on music. For Spencer (1858) "certain general law[s] of progress" could account for the development of human civilizations, and indeed, Spencer imbued his own writings on evolution with just such a teleological bias. Evolution was, for Spencer, a scientific manifestation of such laws and in 1893 he published an essay entitled "The inadequacy of natural selection", propounding a sort of "folk-Lamarckian" notion of evolution as guided development. Such views would have been anathema to Darwin; they harked back to the immanent principles of design that his theory of natural selection with random variation had expressly sought to refute.

Nevertheless, the Spencerian view prevailed within evolutionary thinking about music across the transition between the nineteenth and twentieth centuries and beyond. For those involved in exploring music in its own right or as an adjunct to the study of culture or of mind, Spencerian teleological evolutionism appeared to provide a helpful framework within which to formulate an understanding of two of the most evident features of music: its cultural diversity and historical

mutability. Particularly in continental Europe, historical and comparative musicologists both exploited this framework in exploring and explaining the ways in which music differed from culture to culture and over historical time within western culture (see Rehding, 2000).

For historical musicologists such as Guido Adler and music theorists such as Hugo Riemann, Spencer's evolutionary teleology pervaded their preferred narratives of directed historical change in western musical practice and theory. Adler could claim that contemporary harmonic usages could be traced to a "natural" predisposition to sing in harmony, a practice that was subject to a process of increasing refinement through to the present day. Riemann, the most influential music theorist of his day, could claim that a principal difference between the "Cello-Germanic-Slavic" peoples and other races was that the former were more naturally predisposed to employ harmony in their music, hence more likely to give rise, over historical time, to music that conformed to the highest, most developed, principles of organisation (i.e., that conformed to his theoretical prescriptions).

The teleological thinking of Spencer combined with a reification of racial difference in much of the work of both historical and comparative musicologists of the time. The egregious Willi Pastor is noted by Redhing (2000, p358) as claiming in respect of "primitive" peoples (*Naturvölker*) that "When shown melodic instruments, for example, *Naturvölker* did not learn what melody is from using them but rather misunderstood their function and degraded them to produce mere sounds, the only form of music that they were capable of

understanding". In 1893 Richard Wallaschek published *Primitive music* (published in Germany in 1902 as *The origins of music*), an attempt to make sense of what was then known about non-literate musical cultures from the perspective of their inevitable evolutionary end-point: late nineteenth century western music based on complex harmonic structures and relationships.

Wallaschek's work was followed by others such as Alexander Ellis (the English translator of Helmholtz), Carl Stumpf, and Erich von Hornbostel, a student of Stumpf (see Nettl, 1956). While the principal focus of these comparative musicologists was on the ways in which different types of pitch systems could be regarded as underlying the melodic practices of different cultures, much of their thinking subscribed to the notion that racial differences determined ways in which music manifested itself in different cultures. In particular, it was held that a member of a 'primitive' culture was likely to privilege an acuity of sensory faculties over the use of reason. The consequences of such views can be seen in the statement of Charles Myers (1905), in his study of rhythm in the music of Sarawak, when he notes that while "the Malays enjoy the faculty of combining successive dissimilar [rhythmic] periods and of regarding them as members of a complex unity", these were "carried to such lengths... that their aesthetic effect may neither be appreciated nor reproducible by more advanced peoples". An unbridgeable gulf appeared to exist between the musics - indeed, the mentality of the members - of different cultures, and teleological evolutionary thinking appeared to underpin these cultural differences (for a review of the relationships between evolutionary and anthropological thinking in the early twentieth century see (Shore, 1996, Chapter, 1). Myers continued to speculate about music

from an evolutionary perspective, suggesting in an essay of 1913 that "We may be disposed to conclude that the beginnings of music have been derived from speech. It would be safer, however, to conclude that both have been evolved from a mechanism designed for the vocal 'expression of meaning'."

This essay, however, represents not a beginning but an end. Several different factors converged to suggest that evolutionary thinking about music was likely to be unfruitful. Over much of the twentieth century consideration of origins in the study of music moved away from any exploration of music's relationship to biology to re-focus on the historical relationships between contemporary western musical theory and practice, and western musical history (see, e.g., Kerman, 1985), or on music's relationships with abstract domains such as mathematics (the latter exemplified in works such as Schillinger (1941) and Forte (1973). For both strands of thought, evolution was simply irrelevant to their concerns which were viewed as primarily musicological, concerned with the explication of the historical and ontological roots of western music.

Within anthropology, the increasing tendency to focus on the cultural specificities of societies rather than on pan-cultural universalities diminished the apparent explanatory role of any biological foundation for culture and mind (see, e.g., Plotkin, 1997, Chapter 2). This anthropological tendency increasingly to focus on cultural diversity seems likely to have arisen partly through a change in the relative importance accorded to the notion of psychic unity (see Shore, 1996), and partly through a change in explanatory focus within the discipline away from mind towards culture or society. From early in the twentieth century,

exploration of music beyond the bounds of western societies came to concentrate on detailed ethnographic description and on attempts to understand the structures and functions of music in terms derived from the societies' own understandings of their music - in other words, in emic rather than etic terms (see, e.g., Nettl, 1956). While lip service is occasionally paid to evolution in this literature (see, e.g., Kunst, 1955, pp46-48), there is little evidence of evolutionary thinking as having had any significant impact on understanding music within societies or across cultures. Nevertheless, a vital feature of these ethnomusicological studies is the evidence they provide concerning the heterogeneity of music across different societies, a heterogeneity that has come to cast the western conception of music in a new light and to problematise the very notion of 'music' (see Blacking, 1976; Titon & Slobin, 1996; Clayton et al, 2003; Nettl, 2005). And any evolutionary approach to understanding music requires at least an operational definition of what might constitute 'music'.

### ***Issues in the definition of music***

Music varies from society to society to the extent that one culture's music may not be recognisable as music by members of another culture. This applies both to the structural features of the music and to the functions that it may fulfil. What any non-western culture conceives of and practices as music may have features that do not map onto western musical practices in any straightforward way. For example, western music exploits a dynamic and binary perceptual distinction between sounds that are consonant and those that are dissonant so as to articulate musical structures in time. This usage may have no evident relation to practices in other cultures that conceptualise and exploit the consonance-

dissonance distinction in other ways, as in the music of the *campesino* culture of Northern Potosí (Stobart, 1996; Cross, 2006, in press), or which do not appear to employ or even exploit the binary distinction in the first place (as in Indonesian gamelan music, see Perlman, 2004). And societies may severely circumscribe the functions of music in ways that would seem extraordinary in western cultures, as has been the case in certain Islamic societies (Nettl, 2005), or they may use music to fulfil functions that, in contemporary western cultures, would be fulfilled by means of formal linguistic interaction within institutionalised frameworks of legal process (as appears to be the case in at least some traditional Australian aboriginal societies, see Marrett, 2005). At the same time, one might find oneself responding to another culture's music in terms that would be appropriate in respect of the music of one's own society. The criteria that determine what is experienced as music' evidently vary between cultures. This can be the case even within a society that thinks of itself as sharing a common culture (as witness the periodic rejection by older generations of the preferred 'music' of younger people in recent western society - a rejection that tends to be mutual).

Nevertheless, ethnomusicologists insist that this cultural diversity exists in conjunction with what appears to be a universal musicality. Nettl (2005, p23) states that "All cultures regard music as at least minimally valuable"; Titon and Slobin, (1996, p1) assert that "So far as we know, every human society has music" but append the caveat that "Music is universal, but its meaning is not.". And John Blacking (1995, p224) states that "Although every known human society has what trained musicologists would recognise as 'music', there are some that have no word for music or whose concept of music has a significance quite different

from that generally associated with the word 'music'.". Indeed, there are many societies whose languages do not distinguish a set of phenomena that are cognate with those identified by the English word 'music'. The notion of 'music' itself is problematised by such findings, and the issue of its relationship to evolutionary thinking cannot be addressed unless attention is paid to defining what is intended by the term 'music'.

On the whole, ethnomusicologists have given surprisingly little consideration to this question. Amongst the few significant exceptions are Bruno Nettl, Alan Merriam and John Blacking, who adopt somewhat different perspectives. Nettl (2005) takes a pragmatic approach, suggesting that etic (western) and emic accounts should each feed in to determine what it is that ethnomusicologists should focus on as 'music'. Merriam (1964) suggests that 'music' can best be explored in terms of a tripartite model that embraces music as *sound* (what might conventionally be thought of as constituting music from a western perspective), as *behavior* (which embraces the musical - and "non-musical" - acts of musicians, and the activities in which the production of music is embedded) and as *concept* (how people think about music in terms of its powers and its relations to other domains of human life). Blacking (1995, p223), on the basis of his extensive field-work with the Venda peoples of southern Africa, and in particular, on his study of Venda children's music (Blacking, 1967) claims that "'Music' is a primary modelling system of human thought and a part of the infrastructure of human life. 'Music'-making is a special kind of social action which can have important consequences for other kinds of social action."

Blacking's claims appear to locate music as central to, and in some ways indissociable from, other domains of human behaviour. While the claim for music's centrality is not widely echoed in the ethnomusicological literature, the conception of music as embedded in broader suites of behaviour is more general; as Bohlman (2000, p293) puts it, "... expressive practices do not divide into those that produce music and those that produce something else, say ritual or dance. Music accumulates its identities... from the ways in which it participates in other activities...". For those engaged in understanding music as it manifests itself across different cultures and historical times, 'music' appears to be protean, and its identification in any consistent manner seems to be particularly intractable.

Certainly, music cannot be defined in the terms in which it is conventionally conceived of in contemporary western societies, as a consumable commodity constituted of complexly patterned sound that is produced by a class of specialists and engaged with through listening for primarily hedonic reasons. In many, perhaps most, non-western cultures it involves overt action and active group engagement (see Arom, 1991). It is often indistinguishable from dance in emic conceptions (see, e.g., Gbeho, quoted in Merriam, 1964, p273; Gourlay, 1984). The specialised roles of performer and audience are by no means universal, and in some respects might almost be considered a minority practice, music being something that is collectively performed rather than passively consumed. In almost all known cultures music is employed not only in caregiver-infant interaction (see Trehub et al., 1993; Trehub, 2003), entertainment and courtship but also in ritual, particularly at times of significant life transitions (such as the passage from adolescence to adulthood, from season to season, or

from life to death). And more often than not, music is frequently bound up with individual and group identity and is an integral part of a wider range of everyday activities. If a category of behaviours that can be termed 'music' has any generality across cultures, it seems that it can best be characterised as active, as founded in interaction, and as permeating most other aspects of social life.

Given that in the ethnomusicological view, music and other human activities are interfused, are there any features that would serve to distinguish 'music' as a discrete category of human thought and behaviour? At first sight, music seems to possess few characteristics that are not shared with other domains of behaviour, notably dance and language. Music involves patterned action in time, as does dance. Music appears communicative, complex, generative and representational, as does language.

The concept of music is amalgamated with that of dance in many - perhaps the majority of - cultures (see Arom, 1991). This fact, together with the stress on music as action in much of the ethnomusicological literature (Merriam, 1964; Blacking, 1976) suggests that it would be parsimonious to treat music and dance either as intrinsically related or simply as different manifestations of the same phenomenon. Relationships between music and language are more difficult to disentangle, but perhaps the most significant factors that differentiate them are the types of structured interactions that they allow and their contexts of use. While ethnomusicologists might debate whether or not a particular cultural phenomenon is or is not music, it is unlikely that such a difficulty would be encountered by comparative linguists. Linguistic interactions are typically

structured in time so as to co-ordinate the temporal succession of participants' contributions (Condon, 1982; Kendon, 2004). Language possesses a generative complexity that allows for the production and reception of a potentially unlimited set of utterances (Hauser et al, 2002). And language - whether verbal, gestural, signed or written - is evidently directed towards the communication of ideas, states of affairs, attitudes and affects that have relevance (see Sperber & Wilson, 1986) to their contexts of production and reception.

While music seems to share some of these characteristics with language, at least three significant differences are apparent:

- Music may allow participants to act simultaneously rather than asynchronously as in language; for music, this property appears to have positive effects, while for language the effect would be reduce its communicative functionality.
- Music can certainly be conceptualised as possessing generativity (Lerdahl & Jackendoff, 1983; Jackendoff, 1987; Temperley, 2001); however, that generativity has been postulated principally in respect of western tonal music and its generality remains to be rigorously tested.
- Music may be experienced as having quite specific meanings (see, e.g., Koelsch et al, 2004); however, the extent to which those meanings are necessarily stable or shared with other participants in a musical act is much less specifiable than is the case for language (Langer, 1942; Meyer, 1956).

Music's capacity to enable participants to act and to contribute to music-making simultaneously exploits the capacity of entrainment (see Clayton et al, 2004), a

capacity that may be unique within the hominid lineage. Entrainment has received minimal attention in the ethological literature, particularly that concerned with primates; while several species of arthropods and aneurans do appear to entrain (Merker, 2000, provides an overview), they do so in ways that appear different from those implicated in human entrainment and the issue of the origins of entrainment in the hominid or hominin lineage remain to be explored (Bispham, 2006, submitted).

Entrainment here refers to the co-ordination in time of one participant's behaviours with those of another and involves the organisation of the perception and behaviour of participants around temporal regularities that are inferred (generally non-consciously) from musical sounds and actions in the form of a periodic pulse or beat that is sensed by all participants. It is evidenced in continual processes of correction of errors in both period and phase by participants and appears to be more or less automatic, not seeming to require conscious intervention (see Thaut, 2005). Even engagement with music in apparently passive listening appears to rely on such entrainment processes, evidenced in periodic modulation of attentional load (Jones, 1976; Jones & Boltz, 1989). (It should be noted that Condon (1982) suggests that processes that appear similar to entrainment underpin linguistic interaction, though his claims remains to be validated empirically.)

The issue of the extent to which music exhibits generativity of a type similar to that of language remains at present unclear. A generative foundation for musical structures has often been claimed but has not as yet been demonstrated, even for

western tonal music. While music certainly can possess considerable structural complexity, it may be more appropriate to conceive of this complexity as operating on a local level, perhaps in a manner analogous to phonological grammar (Peperkamp, 2003), rather than as possessing the complex combinatoriality of linguistic syntax.

Language has an indisputable efficacy in human interaction in the achievement of immediate and deferred goals, in large part by virtue of its capacities to mean. It is often supposed that music's meanings can be reduced to the emotions it represents, expresses or elicits, which would suggest that meaning in music is a poor or natural cousin of meaning in language (which certainly incorporates affective values in its semantic content). However, while it is undoubtedly the case that music is valued for its affective powers in all societies, often being used to regulate and co-regulate individual and group moods and emotional states (see Juslin & Sloboda, 2001), music's meanings extend beyond its affective value; as Tolbert (2001) notes, music's meanings are equally embodied, natural or affective, and artificial or symbolic. Indeed, studies indicate that music can elicit meanings quite as precise as those of language, seemingly based on a common neural substrate (Koelsch et al, 2004); in general, however, meaning in music appears to be less susceptible to consensual determination than is meaning in language. Music certainly bears meaning, but the meanings that it can bear are more impenetrable and susceptible to change according to the context in which they are experienced than are those of language. As Blacking (1995, p237) notes, "Not only can the 'same' patterns of sound have different meanings in different societies; they can also have different meanings within the same society because

of different social contexts.", an attribute of music characterised by Cross, 2003a; 2005) as 'floating intentionality'. Cross goes further in suggesting (after Langer, 1942), that the meanings of any particular musical act or event are susceptible to different, and perhaps even conflicting, interpretations, by participants (a feature that certainly characterises the critical literature on music).

So music is differentiable from language in its exploitation of the human capacity to entrain, in the probable scope of its generativity and in ways in which it can mean. In some ways, this comparison could appear to objectify music as an impoverished version of language. However, music and language co-exist in all societies and fulfil different (though perhaps complementary) functions in those societies. While language is capable of expressing semantically decomposable propositions that have unambiguous reference, music cannot. Nevertheless, there are numerous social situations in which unambiguous reference in communicative acts is not a desideratum as it may precipitate conflict in attitudes or actions. Music's exploitation of the human capacity for entrainment allows participants to experience a sense of 'shared intentionality' (Tomasello et al, 2005) whilst under-specifying goals in ways that permit individuals to interact even while holding to personal interpretations of goals and meanings that may actually be in conflict, in particular, in situations that are on the edge, situations in respect of which outcomes are neither clear beforehand nor retrospectively identifiable by reference to particular outputs or products (Cross, 2006, in press). Music appears to have a profoundly social efficacy, and it appears possible to delineate music as a medium that is interactive, entraining, and that exhibits floating intentionality. Such a definition seems almost to exclude western

listening, which may often be passive and solitary rather than social. However, the object of listening - the music - can be conceived of as constituting a trace of human activity with which a listener 'virtually' interacts (as indeed can the musical score, which provides prescriptions for activity and is itself a trace of human musical activity).

### ***Music in evolutionary thinking since 1984***

Over the last decade a revival of evolutionary thinking about music has taken place, at least partly in the light of the ethnomusicological re-conceptualisations of music outlined above but largely motivated by the generic applicability to every aspect of human life of ideas emerging from evolutionary psychology. However, two slightly earlier contributions to the debate appear to have arisen from somewhat different roots: a paper published in 1984 by Juan Roederer, a physicist and psychoacoustician, and one of 1992 by Bryan Levman, published in the journal *Ethnomusicology*.

Roederer's brief paper (1984) makes a number of suggestions which were to re-surface in more recent literature. He focuses mainly on the complex structures of pitch and timbre characteristic of musical sound, suggesting that learning to deal with - to perceive and to produce - these complex structures could play a significant role in the development of infant linguistic capacities. Roederer is effectively following Spencer's notion that language preceded the emergence of music, and appears to be conceiving of music as a purely sonic phenomenon (perhaps unsurprising given his psychoacoustical background). Roederer suggests that the competences acquired by the infant in 'proto-musical'

exchanges with the mother are crucial in learning to deal with the prosodic aspects of language that are sometimes described as musical (interestingly, a recent study (Schön, Magne & Besson, 2004) appears to support some such link, finding evidence linking an enhanced capacity to make judgments about prosodic structure in language to early musical training). However, he also lays stress on the apparent utility of these early musical interactions between mother and infant in strengthening affective bonds. He expands on this notion in suggesting that the affective dimension of music could serve important functions in group bonding, as participants in a musical act would be more likely than not to be influenced in similar ways by music's affective powers. Roederer's paper had little immediate impact; it is only with the efflorescence of interest in music from an evolutionary perspective over the last few years that certain of his ideas have come to be re-appraised and their innovativeness acknowledged.

Levman's (1992) paper adopts a quite specific perspective on the evolution of music, summarised in his opening sentence (p146) which states that "This article proposes to evince evidence in support of the hypothesis that language and music evolved out of a common 'proto-faculty' which was primarily musical in nature.". In pursuit of this aim Levman aligns himself with Darwin rather than Spencer in suggesting that music preceded language in evolutionary terms. He draws on a range of literatures, including ethology, phonology and ethnomusicology, in claiming a primacy for 'musical' features of speech - essentially, pitch and timbre - over other linguistic features in the development of linguistic competence and in the evolution of language. While many of the ethnomusicological sources that he adduces appear to uphold his argument, it is

undermined by the narrowness of the linguistic references that he employs as well as a failure to acknowledge the provisional status of many of the empirical findings that he cites. Moreover, in spite of relying heavily on ethnomusicological evidence, Levman appears to view the communicative use of sound in non-human animals as continuous with the human faculty for music. This view is highlighted in his assertions that (p158) "most ethologists would agree that they [animals] have a form of song or music" and that (p164) "the music faculty is... non-symbolic". In respect of the first claim, song is certainly a capacity of non-human species, according to the criteria given in Holy and Guo (2005, citing Broughton, 1963); but most ethologists (see, e.g., the chapters by Slater and by Marler in Wallin, Merker & Brown, 2000) concur in claiming that non-human animals do *not* produce music. In respect of the second claim, ethnomusicologists (see, e.g., Tolbert, 1992, 2001; Feld & Fox, 1994) have suggested that the notion of music as 'natural' and hence non-symbolic, as Levman's thesis would suggest, is itself a cultural construct (though found in many different cultures); music is as symbolic as it is natural. In addition, Levman undermines his arguments by the vagueness of his account of the selection mechanisms that may have precipitated the emergence of a musical communication system, as well as by his reliance on the notion that ontogeny recapitulates phylogeny to substantiate his claims. Nevertheless, this paper, together with that of Roederer, identifies and rehearses many points that have proven to be central in the more recent debates over music and evolution.

At the beginning of the last decade of the twentieth century (around the time Levman's article was published), evolutionary psychology was coalescing as an

identifiable and significant strand of thinking within both psychology and evolutionary theory. Little attention was devoted to music within the discipline at first, but by, 1996 and, 1997 two of its main protagonists, Dan Sperber and Steven Pinker, had produced distinctly different evolutionary treatments of music which nevertheless both relegated music to the status of evolutionary byproduct.

Sperber, in his 1996 book *Explaining culture*, uses music to exemplify a particular feature of his modular model of mind, the capacity of a mental module to have both *proper* and *actual* (in the case he describes, *cultural*) domains. He hypothesises that in hominin evolution a mental module arose to deal with the types of complex sound patterns varying in pitch and rhythm that were producible by early hominin vocal systems and were employed in communication. He suggests (p141) that "The proper domain of the module we are imagining is the acoustic properties of early human vocal communication", and that individuals would have been strongly motivated to develop its acuity (i.e., its development would have had hedonic value) so as to ensure that they were detecting appropriate signals. Over evolutionary time another module arises to deal with more finely structured and generative characteristics of hominin vocal signals, but the earlier module is still extant; it is no longer central to hominin communication but persists as a feature of the hominin mind because its use is associated with pleasure. Hence, music: or rather, a mental module that allows modern humans to experience pleasure in the complex patterns of pitch and rhythm that for Sperber, characterise music. The module has changed its functionality; its proper domain has been displaced, but it has gained a cultural

(actual) domain of application. He suggests (p142) that "humans have created a cultural domain, music, which is parasitic on a cognitive module, the proper domain of which pre-existed music and had nothing to do with it.". He does note (p141), however, that the hypothesis that he outlines is intended as "an example of a way of thinking suggested by the epidemiological approach [to the exploration of the relationships between mind and culture] rather than a serious scientific hypothesis, which I would not have the competence to develop."

Notwithstanding this disclaimer, Sperber's conclusions concerning the role of music in the evolutionary model of mind were echoed the following year in Steven Pinker's book *How the mind works*. Pinker devotes ten pages of his final chapter, entitled *The meaning of life*, to considering music, because, in his words, he wishes to consider a mental faculty which "shows the clearest signs of not being" [an evolutionary adaptation] to set against examples of mental faculties that are self-evidently adaptive, such as language. Pinker starts from the premise that (p528) "as far as biological cause and effect are concerned, music is useless", noting that music is variable in its complexity from culture to culture, that while all tend to enjoy listening to music only a small subset of the population are practitioners, and that music communicates nothing but formless emotion. Hence, he concludes, music shows clear signs of being a 'technology', a human capacity developed and exploited for its own sake and at best evolutionarily neutral, rather than an adaptation. He suggests that this technology developed to exploit capacities that had arisen for largely adaptive reasons, claiming (p534) that "music is auditory cheesecake, an exquisite confection crafted to tickle the sensitive spots of at least six of our mental faculties", these being language,

auditory scene analysis, emotional calls, habitat selection, motor control and 'something else'.

Irrespective of whether or not music is non-adaptive, the significance of Pinker's discussion of music is severely diminished by the lack of fit between his conception of music and that outlined in the first part of this chapter. In effect, Pinker appears to be subscribing to an over-simplistic notion of music as it tends to be overtly manifested within late twentieth century western culture, as a commodified set of complex sound patterns produced by the few and consumed by the many, rather than as the complexly and integrally social (and individual) actions and structures that it is and has been both in the west (see, e.g., Finnegan, 1989) and in other cultures, places and times. The conception of music that is treated here from the perspective of evolutionary psychology is fundamentally ethnocentric, and is not representative of music's range of manifestations and significances. It can also be suggested that Pinker's focus on traits as adaptive in wholly individualistic terms (less than two pages of a six-hundred page text are allotted to discussing - and dismissing - issues of selection at the group level) limits the potential of his chosen approach to deal with traits of which the principal impact may be on individual capacities to manage intra-and inter-group interaction (see, e. g., Boyd & Richerson, 1985; Sober & Wilson, 1998), and musicality can be regarded as one such trait. Overall, while Pinker's view of music has been widely disseminated, its ethnocentricity significantly limits its explanatory adequacy as does its commitment to the seductive simplicities of 'self-interest'.

A similar focus on the effects of music at the level of individual fitness is evident in the work of Geoffrey Miller, though here the conclusions reached are startlingly at variance with those of Pinker. Miller (1997; 2000; 2001) harks back to Darwin in suggesting that music's primary role is located in processes of sexual selection. For Miller, music constitutes a medium that is well-suited to demonstrate the 'protean', unpredictable and creative, properties of an individual, properties that are selectively advantageous (their exercise constitutes an evolutionarily stable strategy for achieving or maintaining social dominance) and hence desirable in the determination of mate-choice. Music is well-suited to make manifest such properties as it combines (1997, p322) "ritualised rules of tonality, rhythmicity, melody and harmony and protean intentions and variations". Hence protean individuals might well advertise their creative assets in musical display; for such individuals, music constitutes an excellent medium in which to exploit the impact of ritual and the power of innovation. Miller (2000) seeks to support this argument by reference to a range of western musical practices ; for example, he refers to Jimi Hendrix, claiming that the sexual opportunities afforded by rock-star status are in line with the predictions of his theory.

While Miller's theory that "tunes help you breed more easily" may have held for the post-contraceptive, pre-AIDS, world of 1970s rock, it seems likely that its scope is limited to this lost world. Although music is certainly used for courtship in most, if not all, societies, as the ethnomusicological evidence indicates its roles are always more multifarious. Moreover, Miller's theory would predict that musical ability should exhibit, or at least should have exhibited, a significant

sexual dimorphism. While this would be difficult to ascertain in our predecessor species, it does not appear to be the case with modern humans; while musical roles are often sexually differentiated, in most cultures musicality appears to be equally exhibited by both males and females; if anything, the manifestation of musicality that is perhaps most culturally widespread, in the form of the use of proto-musical and musical forms of interaction between caregiver and infant, is primarily evidenced by females. Moreover, as Fitch (2005) points out, the precocious capacities of human infants in music perception would suggest that musicality is a trait that is unlikely to have been sexually selected for, given that such traits tend to emerge only in sexual maturity in other species.

A different rationale for music playing an evolutionary role through its effects on individual fitness is proposed in Cross (1999). This chapter draws on the developmental theory of Karmiloff-Smith (1992) and Mithen's (1996) account of later hominin evolution as being marked by a shift from domain-specific to domain-general competences, suggesting a role for music in motivating this shift. Cross proposes that music's floating intentionality might have been a factor in the emergence of domain-general competence by virtue of the capacity of musical behaviours simultaneously to be embedded in, and to signify differently within, different domains of human mental life. Music is conceived of here as underpinning a capacity to integrate information across different cognitive domains by offering a means of bridging the gap between these domains by virtue of its semantic open-ness and its ability to be integrated into other activities. The implications of this proposal do appear to fit with findings that musical training can influence children's IQs positively (see Schellenberg, 2003;

2004). However, it has to be noted that musical training in western cultures (where all experimental studies of the effect of music on other domains in development have been conducted) involves procedures that are directly analogous to school tuition; hence, an impact on IQ is unsurprising. Indeed, before a claim for music as central to the establishment of domain-general competence can be made securely, much remains to be uncovered about the relations between musical and general (enculturative) development and training in cultures other than those of the west, ideally employing a more generalisable measure of integrative cognitive competence than IQ. As matters stand, only one significant study has explored in depth the dynamics of the development of musicality in a non-western context, that reported in Blacking (1967).

Blacking found that the principal effects of childhood engagement with music lay in the domain of sociality; as he states (1967, p31) "Knowledge of the children's songs is a social asset and in some cases a social necessity for a child who wishes to be an accepted member of his own age group.". It seems likely that any evolutionary account of music might be more appropriately rooted in consideration of music's role in managing social relations and in the formation of social skills than in its putative effects on individual fitness. As noted above, there is certainly evidence that music is embedded in social activities and can be considered to have a proximate efficacy in managing social interactions. Early approaches to understanding evolution in terms of group selection (such as that of Wynne-Edwards, 1962) have been discarded on the grounds that any effects of selection for benefits at the level of the group would be far weaker than, and would effectively be over-written by, the powerful effects of selection for

individual fitness. However, more recent theories such as those proposed by Sober & Wilson (1998) and surveyed by Shennan (2002) have tended to substantiate a role for relationships between social environment and individual fitness in profoundly social species such as humans. In a social species, the behaviours of conspecifics are likely to constitute a highly significant component of the environment that governs the viability of any individual's behaviours. In such species behaviours that contribute towards survival and reproductive success may be determined as much by relations between conspecifics (and by individual capacities to manage such relations) as by relations between individuals and their physical environments.

The majority of recent evolutionary treatments of music have focused on its effects at the level of the group, approaches tending to fall into one of two categories. In general, those in the first stress music's possible effects on *inter-group* interaction, regarding music as strengthening or as signalling within-group collaboration so as to benefit musical groups (who will appear strongly bonded and effective as a social unit) as against less musical groups (who will appear weakly bonded and hence less effective in inter-group interactions and conflicts). Those in the second adopt a focus on music's role in *intra-group* relations, highlighting music's possible effects within groups either in terms of its role in the formation of group identity (and hence the reinforcement of within-group cooperativity) or on its efficacy as a means of managing, and of learning to manage, social relations (and hence its positive impact on individual fitness, and on conflict minimisation, within groups).

Merker (2000) proposes a role for music in managing inter-group relations that has its origins in chimpanzee 'fruit-tree carnivalling', unsynchronised group calling and display that is characteristic of groups of (male) chimps on discovery of abundant fruit sources. He suggests that chimp carnivalling constitutes an index of chimpanzee within-territorial male co-operativity and of number of fruit-trees, and acts as audible markers of these for - and hence as potential attractors of - migrating (exogamous) females. He points out that were chimp carnivalling to involve *synchronous* cries the range over which they would be audible would be greatly increased and their efficacy as indexes of group resources would be enhanced. He hypothesises that a hominin descendant of the common hominin-chimp ancestor acquired the capacity to carnival synchronously (in effect, to entrain), this contributing positively to their evolutionary fitness and constituting an origin for music. Merker's theory does provide an evolutionary basis for the significance within musical behaviour of the capacity to entrain, but is perhaps too conjectural; moreover, the narrowly constrained (and sexually differentiated) bases for the origins of music that it proposes are difficult to square with the broad scope of musical behaviours evident in contemporary societies.

Hagen & Bryant (2003) adopt a similar evaluation of music's likely role in evolution as a signifier of group resources. They suggest, however, that those resources that are being exhibited in group musical display consist of the *appearance* of group cohesion and efficacy, music acting as an excellent indicator of group stability and of the capacity to engage in complex, collective and coordinated, action. They reach their position by claiming that, as musical

behaviours are not a good indicator of an individual's capacity to contribute to group survival, coalition signalling constitutes the only possible rationale for the utilisation of musical behaviours. However, this focus on the immediate instrumental utility of actions in social contexts as the sole criteria for evaluating their potential fitness benefits under-values the extent to which such actions may have affective and intersubjective consequences that are not presently and overtly evident, but that contribute positively to individual fitness within the group. It is certainly possible that the coalition-signalling function proposed by Hagen and Bryant played some role in instantiating music into the modern human repertoire, but one could equally well find other potential rationales that are founded in consideration of inter-group relationships; for example, it could be hypothesised that music emerged to function somewhat as does language in Nettle (1999), as a means of securing a group against infiltration by free-riders by virtue of inter-group variation in musical style. In general, however, approaches that seek to ground music in inter-group relations seem to focus too narrowly on the notion of music as display while neglecting the significance of music as a participatory behaviour.

Brown's (2000a, 2000b) treatment of music in evolution acknowledges its prospective role in inter-group relations but emphasises its functionality within groups. Brown (2000a) presents an account of structural similarities between music and language in terms of combinatorial syntax and intonational phrasing, positing a common evolutionary origin for both music and language. As noted above, the extent to which music possesses the syntactic combinatoriality of language remains in question; nevertheless, Brown makes a cogent case for

language and music to be conceived of as rooted in common mechanisms at the phonological level, a proposal that seems more parsimonious than the suggestion of Pinker & Jackendoff (2005) that these mechanisms are homologous but distinct for language and for music. Brown (2000b) develops the notion of music as efficacious at the level of the group, suggesting that music typically acts to influence behaviours at the group level. He suggests that music acts to reinforce co-operative behaviour within the group by means of group ritual activities, promoting a sense of 'groupishness' that is likely to enhance prospects of group survival in addition to being effective in situations of inter-group conflict.

This focus on music's significance in promoting co-operative, within-group, behaviours, is mirrored by others. Kogan (1997) and Vaneechoutte & Skoyles (1998) view music as significant in human evolution by virtue of its embeddedness in social interaction and its effect of the formation of group identity, as does Dunbar (2004), who suggests that its primary effect is in the consolidation of group bonds. Mithen's (2005) extensive treatment echoes Brown in presenting a view of music and language as having common origins and in suggesting that music had an evolutionary efficacy in the formation of social bonds (after McNeill, 1995).

(Cross, 2001; 2003a; 2003b; 2005; 2006, in press) also subscribes to the notion that music has a bonding effect, but suggest in addition that music, by virtue of its polyvalent significances, can contribute positively to individual fitness within the group by facilitating communicative interactions that, were they to be conducted

linguistically, might give rise to conflict, a view also presented in Morley (2002; 2003) and Cross & Morley (2006, in press). Whilst maintaining that music may have an impact on individual fitness outwith social contexts by virtue of its 'metaphorising' powers (see above), Cross suggests that music's powers of entrainment, together with its 'floating intentionality', fit it for use as a medium for communicative interactions in which meanings are under-determined to the extent that participants are free to develop their own interpretations of the significance of their own, and others', contributions to the collective musical behaviour. At the same time its potential for group entrainment provides a framework for co-ordinated action that guarantees the integrity and continuity of that collective musical behaviour. In effect, it allows participants to explore the prospective consequences of their actions and attitudes towards other participants within a framework that is likely to align participants' sense of goals. Hence music can be regarded as possessing attributes that complement those of language, music and language here being viewed as different components of the human communicative toolkit that differ primarily in the degree to which they are capable of specifying meaning unambiguously.

Most of the preceding accounts view music's efficacy in shaping individual or group fitness as deriving from its proximate effects; however, they do not, in general, offer clear rationales for music's assimilation into the human repertoire of behaviours. That is, they tend either to avoid considerations of the ultimate factors that would have led to the emergence of music or to conflate proximate effects with ultimate causes (see also Fitch, 2006). One approach that does explicitly consider ultimate causes is that of Dissanayake (2000), who suggests

that the use of music, or para-musical behaviours in the form of 'motherese', in affect regulation and co-regulation in mother-infant interactions provides a rationale for music's roles in (p398) "social regulation and emotional conjoinment" (see also, Trehub, 2003). She suggests (p399) that "dyadic behaviors of mothers and infants [are] a biologically endowed ritualized behavior" which is predicated on the exploitation of musical features in human communication, suggesting (p390) that these behaviours are precipitated by a need to accommodate to increasing altriciality in the hominin lineage, leading to longer periods of infant dependency and mother-infant interaction and hence to the consolidation of musical behaviours into the adult repertoire. Cross (2003b) adopts a similar position, starting from the premise that altriciality and social complexity appear directly related in primates; the more complex the social organisation of a species the longer the juvenile period Joffe (1997). This lengthened juvenile period assists acquisition of the skills required by the need to interact flexibly with conspecifics. It is evident that our predecessor species exhibited shorter juvenile periods that were less differentiable into discrete stages of maturation than is the case for modern humans Bogin (1999), and it can be hypothesised that with increases in hominin altriciality there would have been increasing selection pressures to accommodate to an increased prevalence of juvenile modes of thought and behaviour within populations. Music can be thought of as a way of extending into the adult repertoire of thought and behaviour the benefits of juvenile exploratory behaviours and cognitions and of regulating their expression, and hence as viewed as an adaptive consequence - an exaptation - which arises from processes of progressive altricialisation and stage-differentiation in the later hominin lineage.

### ***Ethological, cognitive scientific and archaeological evidence***

Dissanayake's argument is echoed in that of Falk (2004) for the importance of infant-directed speech in the evolution of human communication systems, including music. Falk suggests that features such as the continuous positively-valenced affective vocalisation that characterise mother-infant interactions in modern humans are absent in our nearest extant relatives, chimps and bonobos, and suggests that these arose in part to 'substitute' for the mother's proximity as hominin infants became more altricial and less able to cling to the mother. While Falk is here postulating a discontinuity between the behaviours of humans and of other species to account for the emergence of music-like behaviours in humans, others have explored the prospects of identifying behavioural continuities. Indeed, Darwin's (2004) suggestion that music originated as a mechanism for sexual selection was motivated in part by the correspondences that he felt existed between human music and bird song.

Several contributors to the volume by Wallin, Merker & Brown, (2000) explore the possibility that aspects of animal communication constitute evolutionary precursors of human musicality. Marler, Geissmann and Ujhelyi consider that music may be related to, respectively, bird song, the duetting calls of gibbons and the vocalisations of bonobos. Each author takes a somewhat different approach to delineating the nature of the relationship between the animal behaviours in question and music; however, all appear to conceive of human music as complex sonic pattern related to the expression of affect rather than as a socially situated complex of communicative and intentional sounds and actions

with symbolic potential, which limits the explanatory significance in respect of music of the features of animal vocal signals that they explore. Moreover, *pace* the suggestion of Hauser (2000, p97) that animal vocal communication may share significant features with human vocal communication (such as, at least social, referentiality), most current theories (see, e.g., Owings & Morton, 1998; Seyfarth & Cheney, 2003) suggest that non-human animal vocal signals are in general more limited in function, serving principally to manage behaviours of conspecifics - and of other species in the immediate environment - through direct expression of affective state.

A recent overview of comparative perspectives on music in evolution (Fitch, 2006a, forthcoming) suggests that whether or not animal vocal signals are considered synapomorphic or plesiomorphic in respect of music (or indeed any form of human communication), human musicality can be considered to be constituted of a suite of discrete behavioural capacities, each having prospectively different evolutionary roots. He notes that studies of avian song learning are beginning to disentangle their functional, behavioural, neural and developmental bases in ways that allow helpful parallels to be drawn with human vocal learning and behaviour. Moreover, he points out that key components of musicality such as entrainment, the use of periodic sounds and gestures in social interaction, have barely begun to be studied in non-human species. A small number of studies have been conducted (e.g., McDermott & Hauser, 2005) which seek to explore continuities and discontinuities between the capacities of non-human species and human musicality; however, these have tended to treat music solely as sonic pattern and have so far demonstrated only

that non-human primates seem insensitive to types of distinctions that appear structurally significant in music from western cultural contexts.

From the perspective of cognitive psychology and neuroscience, over the last fifty years significant advances have been made in our understanding of processes of music perception and production (see, e.g., Deutsch, 1999; Zatorre & Peretz, 2003). For example, several large-scale research programmes have demonstrated that many important features of music cognition can be accounted for in terms of generic cognitive processes. Associationistic processes of feature abstraction and schematicisation appear to explain aspects of our experience of pattern in musical pitch (see Krumhansl, 1990; 2003), while processes of auditory scene analysis (Bregman, 1990) have been shown to underlie many features of our experience of local form in musical structures (see Huron, 2001a). Both of these types of process appear likely to have a degree of phylogenetic generality (see Plotkin, 1997, Ch 4) which would suggest that aspects of human musicality are grounded on perceptual and neural processes that may be continuous with those of at least some other species.

However, many of these cognitive scientific advances are largely in respect of western musical systems and perceptions. There are, to date, few studies that have explicitly sought to investigate cognitive or neural processes that might be common in engagements with music across a range of cultural contexts, or in engagement with music outside the confines of the western 'concert hall simulation' that serves as the paradigm for most laboratory-based research in the cognition and neuroscience of music. There are, of course, significant exceptions,

including papers by Castellano et al, (1984), Drake & El Heni, (2003), Hannon & Trehub (2005) and Sloboda, O'Neill & Ivaldi (2001). Several commentators have noted the urgent need to extend the range of experimental methods and cultural contexts that should be explored (Stobart & Cross, 2000; Huron, 2001b; Stevens, 2004).

Nevertheless, certain features that are of prospective significance for an understanding of music in evolutionary terms have been clarified in addition to those mentioned above. The experience of music has been shown to be bound to periodic modulations of attention (Jones, 1976; Jones & Boltz, 1989) that appear to reflect constraints on, or at least common processes in, the timing of human action (Pöppel & Wittmann, 1999; Thaut, 2005). Several studies have demonstrated unequivocally that music is capable of eliciting affect (e.g., McCoy et al, 1996; Blood & Zatorre, 2001). Others have reinforced a view of music as necessarily involving action or the experience of action; a meta-review by Janata & Grafton (2003) indicates that ostensibly passive listening to music involves activation of brain areas associated with motor planning, while a study by Koelsch et al. (2006) found that listening to pleasant music implicates brain circuitry associated with pre-motor representations for vocal sound production. Notwithstanding these advances, research in the cognitive neurosciences of music has a tendency to reflect, in the models that it produces, the constraints imposed by experimental methodology and by a focus on musical structures and modes of engagement with music that are bound to western cultural contexts, pointing up the need for creative collaboration across disciplines in exploring human musicality.

This need for collaboration across disciplines is also evident in respect of other potentially significant sources of evidence about the relationships between music and processes of human evolution, in particular the theories and findings of archaeology and of biological anthropology. When Darwin considered material evidence for music in prehistory in *The Descent*, he could only adduce the findings of Lartet, who had (Darwin, 2004, p636) "described two flutes made out of the bones and horns of the reindeer, found in caves together with flint tools and the remains of extinct animals.". In some respects the situation has not advanced greatly since Darwin's time, as the issue of music - and indeed, of sound - in prehistory has received little attention in the archaeological literature (see Scarre & Lawson, 2006). However, a recent paper (D'Errico et al., 2003) summarises what is known in the context of a re-evaluation of current archaeological approaches, particularly in the light of recent finds in southern Africa (Henshilwood et al, 2002). It notes that the earliest unequivocally musical artefact found to date is a bone pipe from Geissenklösterle in southern Germany, dating to ca. 36,000 BP. A further sequence of bone pipes has been found at Isturitz in southern France (in contexts rich in parietal art), with dates ranging from 20,000 to 35,000 BP. The earliest of these dates more or less coincides with the arrival of modern humans in Europe and suggests that something like music was of high significance to those peoples. As D'Errico et al. (2003) comment, these artefacts are extremely sophisticated, exhibiting subtle design features that are analogous to those found in historic wind instruments; the time, effort and expertise devoted to their manufacture must have been considerable and suggests that music was likely to have been of considerable importance to a

people who had just come to inhabit a new and potentially threatening environment.

In this context it should be stressed that the 'Neandertal flute' found at Divje Babe in Slovenia, a femur of a juvenile cave bear that has been interpreted as a musical artefact, is shown in D'Errico & Villa (1997) and in D'Errico *et al.* (2003) to have arisen as a result of carnivore action. As D'Errico *et al.* (2003, p38) state, "Of course, this does not mean that Neandertals were unable to manufacture and play musical instruments. It simply means that we cannot use *this* object to support that hypothesis...". The status of the artefact is somewhat complicated by the ways in which representations of it have been employed since its discovery (for instance, a silver 'replica' was presented to the Pope); however, the evidence would suggest strongly that this is not a musical artefact.

It has been suggested that the use of musical instruments, and the use of the voice, derive from distinct and different evolutionary roots (Nettl, 2005; Fitch, 2006b, forthcoming). While contemporary societies often differentiate between vocal and instrumental musics in quite rigid ways (for example, in assigning specific gender roles to singers and to instrumentalists), there are perhaps as many instances where, in the pedagogical tradition of a culture, the sound of an instrument is taught as constituting an analogue of the human voice (as is the case in both western and North Indian cultures). It is perhaps more parsimonious to consider the use of instruments as extending the sound-producing capacities of the human body (in terms of frequency range, intensity and timbre), instruments in effect functioning as prosthetic devices. In any case,

the use of musical artefacts will have been preceded by the expression of musical capacities by voice and body, and would appear likely to have an ancient provenance. The ubiquity of music in native American and Australian societies in forms that are not directly relatable to historic Eurasian or African musics strongly suggests that modern humans brought musicality with them out of Africa. Indeed, vocal and auditory capacities characteristics of modern humans appear to have emerged around 500,000 BP; intriguingly, the findings of Martinez et al. (2004) in respect of the auditory capacities of *heidelbergensis* would suggest that by this point in hominin evolution, a co-adaptation of vocal and auditory systems had occurred that privileged human vocal, social, information over other environmental sounds. In other words, the vocal and auditory capacities that subserve the experience of music today were present in hominins half a million years ago; whatever its precursors, modern musicality is likely to have very ancient roots.

### ***Conclusion***

Music has had an intermittently audible, yet long-standing, resonance in thinking about human origins. It was viewed as functional by Darwin, as an offshoot of language by Spencer, as exemplifying (in the forms that it took in late nineteenth century Europe) the culmination of a process of guided development in human history and prehistory, and more recently as parasite, 'cheesecake', and as central to the consolidation of the human capacity for culture. However, many of the views adopted in evolutionary thinking about music have misread music's cultural specificities as universal attributes. The notion of music as expressing 'pure emotion' disregards the extent to which music is self-evidently

embedded in, and expressive of, symbolic systems, while the notion that the paradigmatic mode of engagement with music is listening neglects the extent to which music is manifested in active interaction. Nevertheless, conceptions of music are emerging from ethnomusicological, cognitive, neuroscientific, and philosophical contexts (for this last, see Robinson, 2005) which enable music's locations and functions within the modern human repertoire of thought and behaviour to be fixed with an increasing degree of certainty. Music appears to be a human universal in the form of communicative behaviour that under-specifies goals yet facilitates a sense of joint action, enabling participants to sustain interaction while holding to potentially conflicting personal interpretations of goals and meanings. The ways in which it achieves this remain to be identified in detail, but music seems likely to be central in any attempt to specify the dynamics of human minds in cultures and the evolutionary processes that set the parameters for those dynamics.

In some ways it appears that thinking about the origins of music has not developed greatly since the *philosophes* were discussing the question in the context of the origins of language, and of the relative merits of French and Italian music, in the eighteenth century, contributors to the debate including the composer Rameau and the philosopher (and composer) Rousseau. As Downing Thomas (1995, p105) notes, "For Rousseau, vocal sounds are not so much expressions of ideas as they are moments of identification and social bonding", leading him to the conclusion (ibid, p143) that "the focus of the verbal [and, by implication, musical] paradigm in Rousseau has shifted from representation as reproduction to representation as a form of communion". Such ideas seem to

prefigure the conceptions of music as a medium for, and motivator of, social interaction that have emerged through the twentieth century. Indeed, Thomas's suggestion that in the eighteenth century debates, music was conceived of as (p9) "the anthropological 'missing link' in the eighteenth-century attempt... to pinpoint the semiotic moment which separates culture from nature, and human beings from animals" seems increasingly applicable in present-day debates about the evolutionary roots of language, music, and the capacity for culture.

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