

# Music, cognition, culture and evolution

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## Abstract:

We seem able to define the biological foundations for our musicality within a clear and unitary framework, yet music itself does not appear so clearly definable. Music is different things and does different things in different cultures; the bundles of elements and functions which are music for any given culture may overlap minimally with those of another culture, even for those cultures where "music" constitutes a discrete and identifiable category of human activity in its own right. The dynamics of culture, of music as cultural praxis, are neither necessarily reducible, nor easily relatable, to the dynamics of our biologies. Yet music appears to be a universal human competence. Recent evolutionary theory, however, affords a means for exploring things biological and cultural within a framework within in which they are at least commensurable. The adoption of this perspective shifts the focus of the search for the foundations of music away from the mature and particular expression of music within a specific culture or situation and on to the human capacity for musicality. This paper will survey recent research that examines that capacity and its evolutionary origins in the light of a definition of music that embraces music's multifariousness. It will be suggested that "music", like speech, is a product of both our biologies and our social interactions: that "music" is a necessary and integral dimension of human development: and that "music" may have played a central role in the evolution of the modern human mind.

We can express our understanding of biology within a framework that enables us to relate it, if not reduce it, to our understanding of the world in physical and material terms. Biological and physical understandings of the world are commensurable, in at least one of the senses that Lakoff<sup>1</sup> (p322) proposes. An understanding of ourselves as biological beings appears to be an understanding of "natural kinds"<sup>(a)</sup>. But is music a "natural kind", comprehensible within the generalised framework that is science?

Many argue that music is not a natural kind. Indeed, following a conventional dictionary definition of music - "The art of combining sounds of voices or instruments to achieve beauty of form and expression of emotion" - it would be difficult to do so. The consensual view from within the humanities appears to be that music is cultural rather than natural; music is viewed as constituted of practices, concepts and perceptions that are grounded in particular social interactions and constructions. Molino<sup>2</sup> (p169), in questioning the status of music as a natural kind, proposes that "Nothing guarantees that all the forms of human music contain a nucleus of common properties that would be invariant since the origination of music."

As Geertz<sup>3</sup> (p5) put it, in promoting a semiotic and interpretive approach to culture, "man is an animal suspended in webs of significance he himself has spun", and within Geertz's humano-centric web of culture there is little room for the "natural". For Treitler<sup>4</sup> (p203), "Meaning in music is a function of the engagement of codes or orders by the note-complexes of which the musical event is comprised", and musical phenomena are thus "intelligible only in the light of an interpretation which intuits the purpose or intention that they embody". Tomlinson, inciting musicologists to embrace Geertz's concept of culture, makes explicit the idea that scientific generalisation is incompatible with musicological method; he asserts<sup>5</sup> (p352) that the essence of cultural - and hence musicological - explanation is "not to codify abstract regularities but to make thick description possible, not to generalise across cases but to generalise within them". Indeed, Abbate<sup>6</sup> has suggested (pxv) that "There is nothing immanent in a musical work (beyond the material reality of its written and sonic traces) and our perceptions of forms, configurations, meanings, gestures and symbols are always mediated by verbal formulas, as on a broader scale by ideology and culture." And Garnett<sup>7</sup> proposes that "there is... no extra-cultural locus from which to observe music, nor extra-cultural meaning to observe". "Music" is seen as the expression of discrete, contingent, socially conditioned factors in respect of which a generalisable - and hence scientific - account is neither relevant nor possible.

Such an approach to understanding music appears justified in view of the heterogeneity of forms that music can take. What "nucleus of common properties" other, perhaps, than the very concept of the musical work<sup>8</sup> underlies such diverse products of western culture (or, as Slobin<sup>9</sup> has put it, musical microcultures) as (i) a performance of a Machaut motet; (ii) the autograph score of a Beethoven string quartet; (iii) the concept of Robert Ashley's "I am sitting in a room..."; (iv) a live broadcast of Brian Ferneyhough's "Transit"; (v) the grooves in the vinyl that constitute the recording of the Holy Modal Rounders' track "Half a mind to have a mind"; (vi) and the samples that make up part of the mastering materials of a Dr Dre CD? And indeed this last example undermines the very concept of the musical work itself. It might be suggested that "the art of combining sounds of voices or instruments..." provides such a common property (though the issue of "the achievement of beauty..." seems moot). But if we look beyond what Tomlinson<sup>5</sup> refers to as a "presentist"<sup>(b)</sup> view of our own culture, that common property evanesces.

Indeed, when we look to other cultures, the notion of music *per se* is called into question. For example, Malm<sup>10</sup> (p5) questions whether or not the sound of the bull-roarer used in some Arnhem Land aboriginal ceremonies constitutes "music", as "its sounds in secret rituals are not considered as independent sonic events but rather are thought to be the sounds of the supernatural itself". And a culture may be constituted such that it does not distinguish a discrete category of practices that map onto those that would comprise music from a western perspective. Gourlay<sup>11</sup> notes that some cultures employ terms far more inclusive than the western notion of music; for the Igbo of Nigeria, *nkwa* denotes "singing, playing instruments and dancing". Thus the anthropologist approaching Igbo culture with a view to examining its "music" is confronted by a dilemma; as Gourlay puts it (p35) "By forcing the Igbo concept into the Procrustean bed of western conceptualisation, she is in fact surrendering to the dominance of western ideas - or at least to the dominance of the English language. How



listeners, while one can learn to clap or tap at those points in the piece, it does not appear to *feel* - and I speak from long experience - as though one is tapping on the beat. It always feels as though one is tapping on an offbeat.

While certain features of this music's organisation can be accounted for by invoking the operation of perceptual processes underpinning the experience of time that appear genuinely universal, the fact that longer, more intense, notes do not mark out the tactus cannot be explained in this way. In fact it seems likely that prosodic features of the language of Northern Potosí, Quechua, relate to the way in which tactus is organised, projected and experienced in that culture's music.

That even such an apparently unreflective act as regularly tapping the foot in time to a piece of music is so susceptible to cultural differentiation appears to suggest either that tapping one's foot in time to music has a semantic component (if D'Andrade's proposal that culture impacts cognition primarily at the conceptual level is accepted) or that human cognitive capacities are so grounded in culture that any elementary commonalities are over-ridden, and that minds are only susceptible to explanation in terms specific to the particular cultures in which those specific minds are rooted - a return to the position of Geertz. In other words, culture is in the bones and science has no place in its understanding.

We appear to have reached an impasse; it seems that music is cultural, variable and particular, and not susceptible to explanation in general and scientific terms. Yet there are those who argue that music is, nevertheless, a human universal. Blacking<sup>14</sup> (p224) states that "every known human society has what trained musicologists would recognise as 'music'", while Merriam<sup>15</sup> (p227) bluntly asserts that music "is a universal behavior". How can these claims be squared with music's cultural particularity?

As a first step we must enquire what Blacking and Merriam mean by "music" in this universal manifestation. For both, music is not just sound. Indeed, the musical example given above is not "the music"; it was a recording of the sound of a musical activity in a particular cultural context. To experience "the music", you might have to undergo what has been called<sup>16</sup> the "Total Turing Test" of lifelong immersion in the culture; at the least you would have to get the feel of the instrument and of the movements involved. The "music" would involve embodied action as much as disembodied sound. Even in our own culture it is only in the last hundred years, with music becoming an increasingly commodified aural consumable, that the self-evident ties between musical sound and human movement have been rendered obscure. For John Blacking, the claim that music is a human universal explicitly involves acknowledgement of the embodied nature of music, the indivisibility of movement and sound in characterising music across times and cultures; he claims<sup>14</sup> (p241) that "'Music' as a human capability is a cognitive, and hence affective, activity of the body". For the greater number of cultures in the world, and for the greater part of the historical existence of our culture, "music" appears to have involved and to involve movement just as much as sound.

But music in its universal guise not only involves sound and movement, it involves multiplicity of reference and meaning; for Blacking and Merriam music is intrinsically polysemic. For example, music can function as a means of communication with the dead for the Kaluli of Papua New Guinea, binding birds, souls, places and people at a time of transformation; or music can function in the restructuring of social relations, as in the *domba* initiation of the Venda. In each of these two very different ceremonies, music is central, its meaning rarely if ever explicit but its fugitive significances essential. Blacking<sup>14</sup> notes (p237) "the 'same' sound patterns... can ...have different meanings within the same society because of different social contexts". And as Merriam<sup>15</sup> (p221) suggests, a defining characteristic of the musical utterance is its property of being "unrepudiable in form but repudiable as to content". In other words, music has the capacity to lack consensual reference; it can be about something, but its aboutness can vary from context to context and even within context.

Not only may music's significance vary according to social context, but the significances of a singular musical activity can vary from individual to individual. We know this from our experience of music in our own cultures and we can see it in others; for example, in the *gisalo* ceremonies of the Kaluli, some performers seek to dominate and direct while the performances of others appear to emerge from performer-audience interaction;<sup>17</sup> and in any particular performance some participants weep while others do not.<sup>18</sup>

And finally, music in general has a further, peculiarly negative, feature; it appears to have no immediate and evident efficacy. Music neither ploughs, sows, weaves nor feeds; in itself, if it can be considered to exist outwith its context of use, it does not seem to be capable of being a material cause of anything other than a transient hedonic encounter. It is inefficacious.

From these considerations of the "universal" characteristics of music we can return to the original question of whether music can be construed as a natural kind. We now appear to have a basis for proposing an operational definition of music that might afford the commonalities that would allow an instatement of the natural in the musical. It seems that a generalisable definition of music would refer to music's two roots in sound and movement, to music's heterogeneity of meaning, to its grounding in social interaction yet personalised significance, and to its inefficacy. Putting these four premises together yields the following operational definition:

*Musics can be defined as those temporally patterned human activities, individual and social, that involve the production and perception of sound and have no evident and immediate efficacy or fixed consensual reference.*

When applied to the mature expressions of music in particular cultures, this definition does no more than provide a conceptual umbrella for otherwise potentially heterogeneous ethnographies; in that context it is descriptive rather than explanatory. It constitutes a general proposition that applies to the universal presence of something like "music" in all human cultures. However, in claiming that music is universal Blacking goes further than this; he suggests that music is ubiquitous not only across human societies but across all members of those societies. As he states <sup>14</sup> (p236) "...the almost universal distribution of musical competence in African societies suggested that musical ability [is] a general characteristic of the human species rather than a rare talent." This suggestion squares with recent research into the precursors of musical ability in a western context, notwithstanding those such as Barrow <sup>19</sup> who assert (p194) that "musical ability is... limited in its distribution". While it is self-evidently true that the production of "music" in contemporary western society is in the hands of a specialised class of performers and composers (and lawyers), musical ability cannot be defined solely in terms of productive competence; (almost) every member even of our own, highly specialised, society is capable of listening to and hence of understanding music. Indeed, recent research <sup>20</sup> can be interpreted as suggesting that musical productive abilities in a western context, rather than being rare capacities that are evidence of some inborn "talent", are better explained in terms of the effects of motivation and of practice. In other words, music is not just universal across cultures; it appears that everyone has the capacity to be musical, though this capacity is likely to be realised to different degrees and in different ways in different cultural and social environments.

It is within this broader notion of music as a universal human attribute that the operational definition of music given above might be informative, as applied to the human capacity for musicality; if borne in mind in the exploration of the propensities for, and the functionalities of, music for infants and children, it might yield an understanding of the commonalities that appear necessary in order to relate music to our biologies. And as Sandra Trehub notes in this volume, investigations of infant and childhood musical capacities do appear to reveal cross-cultural invariants.

Sandra Trehub and her collaborators have shown that even young infants possess the capacities to perceive significant structural and affective features of musical sounds. <sup>21</sup> The real-world context in which such capacities are most evident is the typically affect-laden interaction of the infant with a care-giver (and it is notable that, irrespective of culture, even adults appear sensitive to features of infant directed song <sup>22</sup>). Other researchers such as the Papouseks and, more recently Colwyn Trevarthen and his collaborators have focused closely on the musicality of such interactions.

The Papouseks have been particularly concerned with infant vocal capacities and interactions. Hanus Papousek <sup>23</sup> (p43) has noted that "musical elements participate in the process of communicative development very early", suggesting that "they pave the way to linguistic capacities earlier than phonetic elements". He sees (p46-47) infant and early childhood musical behaviours as forms of play involving higher level integrative processes that act to nurture "exploratory competence" (a notion that seems to rely on the idea of musical

signification as transposable); these exploratory competences entail the participation of emotions and constitute precursors of artistic or scientific competencies.

Mechthild Papousek focuses on the musicality of infant-caregiver interactions, stressing the indivisibility in these of music and movement and the fact that they appear to involve patterns of infant **and** caregiver behaviour that are singularly invariant across cultures. She notes <sup>24</sup> (p100) that "parents' multimodal stimulation is tailored to infants' early competence for perceiving information through different senses as coordinated wholes", and that "regular synchronization of vocal and kinaesthetic patterns provides the infant with multimodal sensory information including tactile, kinaesthetic and visual information".

The work of Trevarthen and his colleagues has centred on these temporal characteristics of infant-caregiver interaction. Trevarthen <sup>25</sup> states that, from birth, central to our neuronal anatomy is a "body-imaging core system" that comes to act so as to integrate attention, learning and self-regulating physiology with actions of expression and execution; this he terms the Intrinsic Motive Formation (IMF). In operation, the IMF incorporates periodic timing mechanisms that give rise to a "hierarchy of motor rhythms"; these, governing movement and binding affect in rhythmic time, he calls the Intrinsic Motive Pulse. For Trevarthen (p160) "Musicality... is the aurally appreciated expression of the IMF with the Intrinsic Motive Pulse as its agent". From these premises, Trevarthen develops a conceptual framework to explore the expression and development of communication - of intersubjectivity, in his terms - through empirical observations and analyses of infant-caregiver interaction.

The rhythmicity of caregiver-infant interaction, in terms of the capacity of the infant to follow and respond in kind to temporal regularities in vocalisation and in movement, and in time to initiate temporally regular sets of vocalisations and movements, is seen here as central to the development of human significative and communicative capacities; its embodied nature enables the sharing of patterned time with others and facilitates harmonicity of affective state and interaction. For Trevarthen, that rhythmicity is also a manifestation of a fundamental musical competence. As he frames it (p194), "Musicality is part of a natural drive in human socio-cultural learning which begins in infancy".

There is, thus, an increasing amount of evidence that musicality is in our birthright; the capacity for music is an integral component of the infant mind. However, the notion of music as innate that emerges from the research just cited does not sit easily with current general theories of the infant mind. While these theories are increasingly nativist in suggesting that the infant mind, rather than being domain-general, is endowed with either modular or domain-specific competences, they tend to account for the existence of these competences on the basis of their adaptive value in evolution and most theorists see no adaptive role for human musicality in evolution. The present consensus <sup>26</sup> suggests that the infant mind is primed for the rapid emergence of competence in (at the least) interpreting social relations, physical and mechanical interactions and the behaviour of biological systems. This view is supported by a substantial quantity of empirical research, in particular by recent work <sup>27</sup> that supports the cross-cultural generality of some of these domains.

There have been some suggestions that musicality might constitute one of these "native domains". Gelman and Brenneman <sup>28</sup> propose that a domain-specific competence in music is evidenced by the results of Trehub and others, suggesting that sensitivities to harmonicity of tonal relations and to melodic contour formations constitute evidence of a music-specific competence. However, their conclusions are rather undermined by their focus on perceptual capacities of which the existence might equally well be accounted for by their utility in other cognitive domains; the tendency to link sounds that are perceived as harmonically related, and to differentiate between sequences of sounds that differ in their contour, appears more likely to derive from a general capacity for auditory scene analysis <sup>29</sup> than to testify to the existence of an early and specifically musical competence. In other words, the suite of perceptual capacities that Gelman and Brenneman identify as making up the domain of musical competence might be epiphenomenal; each capacity might be more securely considered as being proper to other domains that are more self-evidently and immediately functional than is music.

Indeed when music has been viewed from an evolutionary perspective it has often been viewed as contingent, at best exaptive, a view most clearly exemplified by Steven Pinker <sup>30</sup> and endorsed by others such as Barrow <sup>19</sup> and Sperber <sup>31</sup>. For Pinker, music is, famously "auditory

cheesecake"; while music in his view is bound to the domains of language, auditory scene analysis, habitat selection, emotion, and motor control, it does no more than exploit the capacities that have evolved to subservise each of these areas. Music is thus "exaptive", an evolutionary by-product of the emergence of other capacities that have direct adaptive value. Barrow<sup>19</sup> similarly suggests that human musicality has had no role in our survival as a species, suggesting that it derives from an "optimal instinctive sensitivity for certain sound patterns" that itself arose because it proved adaptive. Sperber<sup>31</sup> goes furthest in condemning music as an evolutionary "parasite", though he explicitly disavows serious intent in formulating that view. Nevertheless, he does suggest that music is a human activity that arose to exploit parasitically the operation of a cognitive capacity to "process complex sound patterns discriminable by pitch variation and rhythm" that was originally functional in primitive human communication but that fell into disuse with the emergence of the modern vocal tract and the finer shades of differentiation in sound pattern that it afforded. For Pinker, Sperber and Barrow, music exists simply because of the pleasure that it affords; its basis is purely hedonic, and, as Pinker puts it "Compared with language, vision, social reasoning, and physical know-how, music could vanish from our species and the rest of our lifestyle would be virtually unchanged."

These three views appear to constitute the beginnings of a consensus that would relegate music to the status of evolutionary footnote and would seem to vitiate the idea that its biological foundations deserve any attention. However, all three theories suffer from an attribute that disqualifies their conclusions from serious consideration, that of ethnocentricity. Theirs is a "culture-lite" view of music. They take no account in their conclusions of the indivisibility of movement and sound in music<sup>(c)</sup>, focusing on only one dimension of music as defined above, that of music's inefficacy in any domain other than the individually hedonistic. Despite lip-service paid to the notion that music might take other forms in other cultures, music appears in these theories largely as disembodied sound oriented towards individual hedonism, a notion quite untenable before the advent of recording technology. Indeed, over the last hundred years, recording technology together with the reification of intellectual property and the globalisation of its law has sanctioned the subsumption of music into the capitalist economy as a tradable and consumable commodity. It might well be that Pinker's view of music is an accurate reflection of what music is now for some within western culture, but that culture-specific "music" is scarcely representative of the complex and embodied set of activities and interpretations that are evident in most non-western "musics". To put it another way, what music is for some at present is not what music is for others, was for our predecessors or could be for our children.

Even when music has been viewed as adaptive in human evolution, the problem of ethnocentricity can remain. Miller<sup>32</sup>, in promoting the notion that "Machiavellian intelligence" played and still plays a significant role as an agent in processes of sexual selection, suggests that musicality constitutes a marker for possession of such intelligence; musical performance constitutes a display of protean behaviours and functions so as to advertise to prospective mates the possession of the "protean" capacity to be "unpredictable", a capacity that he suggests is of value in social interaction. The putative link between music and sex certainly motivates many adolescents in our society to engage in "musical" behaviours, but most will realise only too quickly that mere presence onstage is no guarantee of successful subsequent sexual interaction. If it could be demonstrated from a comprehensive cross-cultural survey that music's primary function is as a vehicle for the display of "protean behaviours", it would be reasonable to infer that this was music's *raison d'être*. However, the available evidence does not sustain this view; music is and has been employed for many different ends by different societies, and in most the role of music in courtship is positively subsidiary to its value in activities of healing, praying, mourning or instructing. Miller's view of music seems as bound to the peculiarities of current western practice as does that of Pinker,

For Pinker, Barrow, Sperber and Miller, the effects of music are at the level of the individual, whether in terms of affording hedonic experience or exhibiting protean attributes. It's notable that much of the research into infant musicality (particularly that of Trevarthen) suggests a different locus for music's functionality (if any), that of human interaction. Several recent theories of music as adaptive in human evolution have located its functionality at the level of the group, including the writings of Kogan and of Brown. Kogan<sup>33</sup> (p197) notes that current evolutionary theory suggests that "natural selection operates not only within groups but also between them". He follows McNeill's<sup>35</sup> notion of "muscular bonding" in proposing that the

communal experience of affect elicited by moving together rhythmically in music and dance could have enhanced co-operative survival strategies for early humans, for example, in hunting or in inter-group conflict. This efficacy of rhythmic synchronicity in promoting group identity can be related back to the "time-sharing" capacities exhibited in infant-caregiver interaction, though here it seems limited to its impact on affect, ignoring any broader functionality.

For Brown<sup>34</sup>, the adaptive features of music for the group go beyond those on which Kogan relies. Brown adduces the notion of music as reinforcing "groupishness", which he defines as a "suite of traits that favor the formation of coalitions, promote cooperative behavior towards group members and create the potential for hostility towards those outside the group". Music supports these traits through the opportunities that it offers for the formation and maintenance of *group identity*, for the conduct of *collective thinking* (as in the transmission of group history and planning for action), for *group synchronization* - the sharing of time - between members of a group, and for *group catharsis*, the collective expression and experience of emotion. Ultimately, Brown sees music as having become instantiated in human cultures through its role as "ritual's reward system"; music, for him, is a type of "modulatory system acting at the group level to convey the reinforcement value of these activities... for survival." And if Brown is correct in his portrayal of music's role in promoting "groupishness", music is likely to have been a major contributor to what Smith and Szathmáry<sup>36</sup> hold to have constituted one of the major transitions in evolution: the very emergence of human culture.

Dissanayake<sup>37</sup> see the mature expression of music in human culture as intimately linked to the characteristics of mother-infant interaction. She views music (p390) as "multimodal or multimedia activity of temporally patterned movements" that has "the capacity to coordinate the emotions of participants and thus promote conjoinment." She suggests that features of the musicality of mother-infant interaction might lay the foundations for a "grammar of the emotions" that can be expressed in mature musical (and other artistic) activities. For the developing child, the musical characteristics of mother-infant interaction are of critical importance in the acquisition of capacities for "social regulation and emotional bonding"; these characteristics also provide the elements in the "musical play" of later childhood that will equip the adult with the predisposition and capacity to engage in the structured interactions of ceremony and ritual as well as in specifically musical behaviours. However, other significant and functional roles have been proposed for music in individual development and in the development of capacities for social interaction; music can be both a consequence-free means of exploring social interaction and a "play-space" for rehearsing processes that may be necessary to achieve cognitive flexibility.<sup>38</sup>

Music is consequence-free in that it is not directly functional; it is non-efficacious. It is specifically suited to testing out aspects of social interaction by virtue of both its non-efficaciousness and its polysemic nature, its multiple potential meanings. For each child in a group ostensibly involved in a cooperative musical activity, that musical activity can mean something different yet the singularity of the collective musical activity is not threatened by the existence of multiple simultaneous and potentially conflicting meanings. Music provides for a child a medium for the gestation of a capacity for social interaction, a risk-free space for the exploration of social behaviour that can sustain otherwise potentially risky action and transaction.

Just as one can posit a role for music in the socialisation of the child, one can also postulate a role for music in the development of the child's individual cognitive capacities that is quite distinct from its efficacy in the child's acculturation. Again, this role is motivated by the intrinsically polysemic nature of music, the fact that its significances can modulate from situation to situation and can even be simultaneously multiple. If music is about anything, it exhibits a deictic intentionality, a "transposable aboutness". And it is conceivable that music's "transposable aboutness" is exploited in infancy and childhood as a means of forming connections and inter-relations between different domains of infant and childhood competence such as the social, biological and mechanical. To give a crude example; the arc of a ball thrown through the air, the prosodic contour of a comforting utterance, the trajectory of a swallow as it hawks an insect, the pendular ballistics of a limb swung in purposive movement, might, for a child, each underlie the significances of a single musical phrase or proto-musical behaviour on different occasions. Indeed, these heterogeneous incidents may be bound together simultaneously in the significance of that phrase or behaviour, the music thus exhibiting what I

have called elsewhere a "floating intentionality". The "floating intentionality" of the music can provide for the child a space within which she can explore the possible bindings of these multi-domain representations. Hence one and the same musical activity might, at one and the same time, be about the trajectory of a body in space, the dynamic emergence or signification of an affective state, the achievement of a goal and the unfolding of an embodied perspective. All these "aboutnesses" exist not in respect of objects but events, ongoing structures in time, and music or proto-musical behaviours afford the opportunity to explore the cross-domain mappings that the representation of temporal sequences of object-states as events makes available.

From this perspective one can advance a second definition of music, one that rests on the idea that what "music" is for any given culture may vary immensely but will derive from the same general human propensities:

*Musics are cultural particularisations of the human capacity to form multiply-intentional representations through integrating information across different functional domains of temporally extended or sequenced human experience and behaviour, generally expressed in sound.*

In this view, music, or proto-musical behaviours, subserve a metaphorical domain or perhaps more appropriately, underpin a metaphorical stance, acting to create and to maintain the cognitive flexibility that marks off humans from all other species. And it could be that the emergence of proto-musical behaviours and their cultural realisation as music (and, for the matter, dance) might themselves have been crucial in precipitating the emergence of the cognitive flexibility that marks the appearance of *Homo sapiens*. For if Smith and Szathmáry<sup>36</sup> are correct in maintaining that human culture constitutes one of the major transitions in evolution, and Mithen<sup>39</sup> is correct in claiming that the appearance of *Homo sapiens sapiens*, ourselves, is marked by the emergence of a flexible cross-domain cognitive capacity, then music is uniquely fitted to have played a significant role in facilitating the acquisition and maintenance of the skill of being a member of a culture - of interacting socially with others - as well as providing a vehicle for integrating our domain-specific competences so as to endow us with the multi-purpose and adaptive cognitive capacities that make us human.

Of course, what music, or more appropriately proto-music, is for infants and children and what it might have been in evolution, is not necessarily what music is for a mature culture or society. Culture shapes and particularises proto-musical behaviours and propensities into specific forms for specific functions, and those, as noted at the outset of this paper, can be so divergent that they do not appear to be mutually reducible - they do not appear to exhibit a "nucleus of common properties" (after Molino<sup>2</sup>). However, it is noteworthy that for most cultures, music - and here one might almost prefer to use the Igbo term *nkwa*, as it seems to capture the interlinking of sound and action that characterises music for most cultures - the functions that music fulfils, the contexts in which it appears most efficacious, often lie in the realm of ritual and of psychic healing. That is, music often functions in individual and group encounters with the numinous and in the modulation of affective state.

The affective functionality of music can certainly be referred to its embodiment in action and to the contexts within which proto-musical activities occur for infants and children,<sup>37</sup> as well as to a broad range of different circumstances in specific cultures.<sup>40</sup> But it seems that music's ubiquity and efficacy in encounters with the numinous are best accounted for by reference to proto-music's polysemy, its "floating intentionality". This property of proto-musical activities may facilitate the mature use of music in those cultural contexts that deal with what Sperber has called "relevant mysteries". Sperber applies this term to situations where beliefs or mental representations arise which are contradictory but are each separately related to (and hence relevant in respect of) other mental representations and beliefs. When simultaneously foregrounded by actions or circumstances, these contradictory beliefs then become "mysteries" and "achieve relevance because of their paradoxical character - that is because of the rich background of everyday empirical knowledge from which they systematically depart" (Sperber<sup>31</sup> p72). Within the framework of Sperber's theory, religious ideas are distinguished from everyday beliefs by their paradoxicality and their relevance, by their broad applicability and their ambiguity; and the view of music's functionality outlined above would suggest that music is also distinguished by just such a broad applicability and ambiguity. By virtue of these

attributes music may thus be particularly appropriate as a means of amplifying, exemplifying or reinforcing in the course of ongoing experience just these attributes of belief that are interpretable as religious; music's indeterminacy may suit it for use as a means of pursuing and perhaps even parsing the numinous.

But the factors that endow music with its efficacy for individual cognitive development and socialisation in infancy and childhood cannot by themselves determine the multiplicitous forms and functions that music takes and that music serves in mature cultural contexts. The meaning of a musical activity for a mature individual will necessarily depend at any given moment on that person's own history and narratives, and on the situational significances that culture's "shared system of meanings" confer on that activity. The polysemic potential that characterises proto-musical activity is likely to underpin the social functionality of music and to contribute to, but not determine, music's meaning. The functionalities and functions of music or proto-musical behaviours for the individual, whether in their own cognitive development or in their socialisation, must be set in the context of the functionalities and functions of music as a cultural phenomenon. Music, like language, cannot be wholly private; it is a property of communities, not individuals. And these different levels at which music may be efficacious must be integrated in any understanding of its foundations. Music's very existence is best evidenced in interaction. If music is of importance in human development, evolution and life, then an attempt to render commensurable our understanding of music as interaction with our understanding of music's biological foundations is crucial in coming to terms with what Henry Plotkin <sup>41</sup> (p222) calls "the most complicated thing in the universe - the collective of human brains and their psychological processes that make up human culture".

To return to the beginning; what are the implications for this view of music as something more than patterned sound, for an understanding of its biological foundations? We would expect its neurophysiology to be complex, reaching beyond the auditory pathways to the limbic system and to centres of motor behaviour. We would expect that the cultural context of music - the forces that shape music for any given culture - should condition its neurophysiological correlates. And we might expect music and language to share many, but not all, neurophysiological correlates.<sup>42</sup> While music and language might meet somewhere near poetry, music can never attain the unambiguous referentiality of language (which Deacon<sup>43</sup> holds to be language's primary defining characteristic), nor language the absolute ambiguity of music.

But at the limit, while music may be in our biologies, our culture is in our music. If the roots of human musicality are to be found in infancy, particularly in infant-caregiver interaction, its potency might be tied to the support provided by society for those interactions. In an intriguing study Maya Gratier <sup>44</sup> investigated the coherence of interactions between caregivers and infants in three different contexts: French mothers in France, Southern Indian mothers in South India, and Southern Indian mothers who were recent immigrants to France. She found a difference between the coherence of the immigrant mother-infant interactions and those of the other two culturally-embedded groups; interaction between the immigrant mothers and their infants was significantly less coherent than was interaction in the other two groups. She suggests that the cultural dislocation of the immigrant mothers had impacted directly on their capacities to interact "musically" with their infants. Something as individual and putatively innate as the capacity of a mother to interact coherently in time with her child seems to be dependent on the mother's rootedness in her cultural environment. In other words, if music is in our birthright, its inheritance appears to be a fragile gift that rests on the humaneness and sympathy of the culture that surrounds us.

## Notes

(a). This is not to endorse the idea that there are "natural kinds", that science provides an account of the essences of things in the world. The term "natural kind" is used here simply as a concise way of referring to the objects of scientific discourse. As Rose<sup>45</sup> (p42) points out, even a concept as seemingly "natural" and unambiguous as a "protein" is susceptible to multiple and differing levels of definition that are dependent on "the purposes for which we need to make the definition". There is an incontestably societal dimension to the make-up of what is taken to constitute science at any time. But the notion that scientific procedures and understandings are simply varieties of social practice definable by their particular vocabularies<sup>46</sup> or by their poverty and abstraction<sup>47</sup> is insufficient to account for the instrumentality of those procedures and for the commensurability of the understandings that they afford.

(b). Tomlinson<sup>5</sup> p358: "The presentist view of art works as transcendent entities fully comprehensible without reference to the conditions of their creation sacrifices Geertz's expansion of human discourse for a solipsistic and ultimately narcissistic aestheticism."

(c). Although Pinker explicitly addresses the link between music and movement he treats this simply in terms of music "tapping in" to systems of motor control.

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