

Music, mind and evolution.

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Abstract:

The re-emergence of an evolutionary perspective on the human mind over the last decade has resulted in the production of a range of different theories about music's evolutionary origins. Some writers have suggested that music has its evolutionary roots in animal 'song', while others have proposed that music is a uniquely human behaviour. Some have argued that music is an evolutionary 'by-product', an accident of nature that is inessential to human survival, while others envisage music as central in the evolution of the modern human mind. This paper briefly surveys these competing views and suggests that a proper consideration of the relation between music and evolution can only emerge from an understanding of music's identity in cultural context and its manifestations in early childhood and development; it concludes by reflecting on the nature of evidence for musical behaviours in the archaeological record.

Key words: Evolution, development, ethnomusicology, archaeology.

Music as human behaviour

Music is a complex and universal social behaviour. Every society that we know of has something we can recognise as "music" (Blacking, 1995, p224), and every member of those societies is musical. Granted, in contemporary western culture there is a sharp distinction between those few who "produce" music and the majority who "consume" it; but the fact that the majority can "consume" music – listen to it, dance to it, and develop very strong preferences about it – suggests that even the silent majority are musical in having the capacity to understand music.

Research in cognitive science has revealed just how complex and special are the mental processes involved even in an act as simple as listening to music, and the discipline of ethnomusicology has shown just how diverse but how central music is in the different cultures of the world. Yet music, for many people, seems to be no more than a pleasing pastime, something enjoyable yet inessential.

However, the emergence of evolutionary psychology over the last decade has prompted an increasing number of researchers to consider why it is that humans have come to be musical. Some have proposed that music is just a contingent by-product of evolution, something enjoyable but unimportant. Others have come to the conclusion that music could have played a major role in human evolution.

Behind human behaviours lie human minds, and behind human minds lie embodied human brains. Accepting a materialist basis for human behaviours, consideration of evolution's role in those behaviours seems inescapable. But how just how much explanatory power has evolution in respect of such a complex human behaviour as music?

It is generally agreed (outside Kansas) that our bodies are products of evolutionary processes; humans share common – and quite recent, at around 5 million years – ancestry with the African great apes, and modern humans stand at the end of a twig on the bush of primate evolution. We have come about through the operation of the evolutionary processes of (i) random variation, (ii) natural selection and (iii) differential reproduction. Random variation leads to the emergence of organisms with a range of different capacities; natural selection, operating through ecological pressures, leads to the preferred survival of those types of organisms whose capacities are best adapted to prevailing sets of circumstances, as these organisms that are best adapted have a better chance of reproducing and passing on their genes than do less well adapted organisms. These processes have left us as the only species of human being presently to inhabit the earth.

Most people would accept that our brains, being part of our bodies, are also understandable as products of evolution. However, many take exception to the idea that our minds – even accepting that they have a material basis in our brains – should be understood in terms of evolution, preferring to think of the mind as being formed on the basis of our individual experiences within our culture of origin. They reject the idea that our minds and our behaviours are selected in and determined by our genes. In some ways this is not surprising. The idea that our behaviours are "in" our genes appears to remove the notion of free will, and it also seems very unlikely that we could ever account for the complexity of all the interactions and shared ways of understanding that make up human cultures in terms of genetic predispositions. However, the idea that we can understand mind as a product of evolution does not force us

to accept an all-embracing "genetic determinism". Nevertheless, over the last couple of decades many researchers have proposed a genetic basis for complex behaviours such as music. Some have proposed that music is of ancient evolutionary provenance: musicality is a capacity we share, in part, with our primate relatives or even with birds.

The "ancient provenance" of music

Marler (2000), for example, uses the idea of "phonocoding" - the capacity to "create new sound patterns by recombination simply to generate signal diversity" - to argue that human music and birdsong share significant general features that signal an evolutionary linkage. But though there is complex sound pattern in birdsong and in human music, in traversing the evolutionary space that separates birds and humans the incidence of the use of complexly patterned sound diminishes vastly. When we reach our closest evolutionary neighbours, the primates, we find a very limited stock of complex sound patterns being produced and employed. Most researchers into birdsong acknowledge that the relation between human music and birdsong is one of analogy, not homology, a surface resemblance.

However, origins for aspects of music in the primate use of sound can be envisaged; Merker (2000) suggests that a behaviour like chimpanzee fruit-carnivalling, where chimps appear to signal the presence of abundant fruit resources by loud but unsynchronised hooting, might have become modified by the imposition of synchrony on the cries; by increasing the intensity of the signal this would be an effective means of flagging the presence of rich food supplies to exogamous females in the vicinity. Such a behaviour, Merker suggests, might have been pursued in the hominid lineage, leading to the establishment of synchronised sound-making as an evolutionarily adaptive behaviour that could have been the basis for human music. Alternatively, Miller (1997, 2001) has proposed that the musical behaviours involved in performing are simply human manifestations of a capacity inherited from our (male) primate ancestors for displays of "protean" - unpredictable - behaviour, intended to attract mates; for Miller, music is operational in evolutionary processes of sexual selection. Here musicality is a genetically conditioned behaviour, and degrees of musicality are expressions of different genetic endowments for protean behaviour.

In both these theories music is seen as an adaptive behaviour, one that has played a significant role in human evolution. Others, such as Pinker (1997), suggest that music is a pleasant but unnecessary by-product of evolution, an activity that exploits human capacities - such as sensitivity to patterns in pitch - which have arisen for adaptive reasons. However, Miller's and Pinker's views - though not Merker's - can both be criticised for their ethnocentricity; they treat "music" solely as patterned sound, or as the perception of patterned sound, by mature individuals within western culture over the last century. This type of "music" - commodified, technologised, and alienated from the body - is not at all representative of what music is and has been at other times and in other cultures, as we shall see.

Other researchers - including myself - prefer to interpret mature adult behaviours as shaped by both biology and culture. The interactions with other human beings, and with the products of those others, that we are involved in throughout our infancy, childhood and adolescence, constitute a major component of the ecology of the human mind, and while the types of

interactions might be constrained by evolutionary forces they are not solely determined by them. Interaction with other humans leads to shared ways of understanding, and those shared ways of understanding – those cultures – play a significant role in shaping mature perceptions and cognitions.

The development of musical behaviour

In fact, the clearest traces of the impact of evolutionary processes on the mind are evident not in encultured adult behaviours but in the capacities of the infant mind. There is a vast amount of evidence (see, e.g., Keil, 1994; Spelke, 1999) that very young infants develop certain competences too quickly to be explained as the outcome of learning processes that involve interaction with the environment. Very young infants quickly cue in to behaviour that can be interpreted as "goal-directed"; they react with surprise to events that they experience as violating the laws of physics; and they respond appropriately to different facial expressions. All this suggests that they are primed for a sort of intuitive biology, physics, and psychology. And all human infants acquire language quickly and expertly; they seem to come into the world "primed" for language, though they require continuous linguistic interaction with other humans in order for their language capacity to be fully expressed (see Pinker, 1994).

So evolution can be thought of as acting on the mind in terms of shaping infant predispositions; infants and children are primed to deal with certain types of information rapidly and expertly without being taught to do so. Culture, in the form of human interactions that are shaped by common ways of understanding, particularises the developmental trajectory of those predispositions; so, for example, in the case of language, human interactions lead to the acquisition of mature competence in a particular language with a specific syntactic structure, lexicon, etc. If evolution has shaped the human mind, it has probably selected at the level of infant predispositions, and culture can be thought of as particularising – shaping into specific and distinct forms - the expression of those predispositions.

Interestingly, infants appear to be primed for music. Sandra Trehub and her collaborators (see, e.g., Trehub, Schellenberg & Hill, 1997) have demonstrated that at six months infants are "rather capable listeners"; for example, they are sensitive to melodic contour constancy, experiencing as "the same" melodies that share the same contour or pattern of ups-and-downs, even though the pitches might have changed. Even younger infants show a capacity for music; Colwyn Trevarthen (1999), and Hanus and Mechthild Papousek (1996), have shown that infants display a range of "proto-musical behaviours" in their interactions with their caregivers, using rhythm and pitch in a musical way. These proto-musical behaviours consist not only of listening to sounds but also of producing them and actively moving while doing so; as Mechthild Papousek puts it (1996, p100), "regular synchronization of vocal and kinaesthetic patterns provides the infant with multimodal sensory information including tactile, kinaesthetic and visual information".

So it would appear more appropriate to understand the human predisposition to be musical, rather than the expressions of that musicality shown by mature individuals in particular cultures, as being a product of evolutionary forces. And that predisposition to be musical is more than just a tendency to be a competent listener; infant proto-musicality, as we have seen,

involves not just listening to but also producing patterns of sound in time, and incorporates not just sound but action.

Music beyond the west

The fact that music is more than just patterned sound becomes obvious when we look at and listen to musics that are beyond the bounds of contemporary western culture; it seems that for most of the times and cultures that we know of, their mature musics overtly involve not just sound, but action (Blacking, 1995, p241). Any attempt to find universal features in music must acknowledge the embodied nature of music, the indivisibility of movement and sound in characterising music across histories and societies.

But a cross-cultural perspective on music reveals that it also involves multiplicity of reference and meaning; a piece or performance is simultaneously capable of bearing many different meanings. Music can function as a medium for communication with the dead for the Kaluli of Papua New Guinea (Feld, 1982), binding birds, souls, places and people at a time of transformation; music can be a mechanism for restructuring social relations, as in the *domba* initiation of the Venda (Blacking, 1976); and music binds the complex social, ritual and sexual dialogues that make up the "flower songs" – *hua'er* – of northwest China (Yang, 1994; Tuohy, 1999). In all these very different circumstances, music's meaning is rarely if ever explicit. Music is about something, but its aboutness can vary from context to context, within a context, and from individual to individual.

And music appears to have no immediate specifiable effects. Music neither ploughs, sows, weaves nor feeds; in itself, music does not seem capable of being a material cause of anything other than a transient hedonic encounter. It seems to be inefficacious.

Music, then, has some "universal" characteristics - roots in sound and movement, heterogeneity of meaning, a grounding in social interaction and a personalised significance, together with an apparent inefficacy. So for present purposes we can define "music" as follows:

Musics are 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.

Why musicality ?

If this is what music is, then why should evolution have endowed us with the capacity to do it? It seems pleasing, but not exactly essential for survival; in some ways similar to language in using patterned sound in time, and possibly sharing origins with language in some early hominid system that used both sound and gesture for the communication of social information, but unlike language in being unable to express unambiguous meaning. Nevertheless, a good case can be made for music, or proto-musical behaviours, as being not only useful but essential in individual cognitive development and in the development of capacities for flexible social interaction (for a fuller account see Cross, 1999 and Cross, in press). Music can be both a consequence-free means of exploring social interaction and a "play-space" for rehearsing processes necessary to achieve cognitive flexibility.

Music is specifically suited to the exploration of social interaction because of its non-efficaciousness and its multiple potential meanings. For example, each child in a group involved in a co-operative musical activity may interpret that activity as something different yet the collective musical activity is not threatened by the existence of 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.

The fact that music's significances can shift from situation to situation and may even be simultaneously manifold also makes it helpful in the development of a child's individual cognitive capacities. If music is about anything, it exhibits a "transposable aboutness". And music's "transposable aboutness" may be exploited in infancy as a means of forming connections between different domains of infant competence such as the psychological, the biological and the mechanical. Music, or proto-musical activity, can sustain the emergence of a *metaphorical* domain, acting to create and to maintain the cognitive flexibility that marks off humans from all other species.

Of course, what music is for infants and children is not necessarily what music is for mature members of a culture. Culture shapes and particularises proto-musical behaviours and propensities into specific forms for specific functions, as Tolbert (this issue) makes clear. The capacity for multiple meanings that characterises proto-musical activity is likely to underpin the social functionality of music and to contribute to, but not to determine, music's meaning.

Music as evolutionary engine

The mature musics of different cultures may vary widely; but underlying them are the attributes of infant proto-musicality. And it could be that the potential of those attributes for individual cognitive development and social interaction was significant in the very emergence of our species, *Homo sapiens sapiens*. The principal feature that seems to mark us out is flexibility in confronting the problems of survival; as a species, we appear to have been much more versatile than our predecessors in dealing with habitat selection, tool manufacture and choice, exploitation of natural resources, and management of complex social relations.

For cognitive archaeologists such as Steven Mithen (Mithen, 1996) this suggests that a fundamental change in the nature of the hominid mind occurred in the transition to *Homo sapiens sapiens*; while some of our predecessor species had very highly developed skills in discrete domains of life (such as tool manufacture), we appear able to transfer expertise between domains, or to develop expertise that is independent of any particular domain. In other words, the modern human mind is characterised by immense cognitive flexibility, and modern cultures can involve extremely complex social structures. And given that it seems feasible that music plays a role in the development of cognitive and social flexibility for modern human infants, it could be that the emergence of proto-musical behaviours and their cultural actualisation as music were crucial in precipitating the emergence of the cognitive and social flexibility that marks the appearance of *Homo sapiens sapiens* (for alternative and complementary accounts of music's efficacy in

evolution see H. Papousek, 1996, Brown, 2000; Dissanayake, 2000; Tolbert, this issue).

This proposal is not a statement of fact; it is a hypothesis, but one that seems to fit well with the facts as known at present in psychology, biological anthropology and archaeology. Indeed, archaeology tells us that the earliest unambiguously musical artefact identified to date is a bone pipe found near Württemberg in southern Germany; this is dated to around 36,000 BP¹, and was uncovered in a context that associates it with modern *Homo sapiens sapiens*. Its date lies at the farther end of what has been called the "cultural explosion" (Pfeiffer, 1985), the sudden efflorescence of visual art and symbolic artefacts that marks the undoubted emergence of modern human cognitive capacities. The archaeological record would suggest that musicality is human and ancient; it is notable that the pipe predates almost all known visual art, and in any case, a capacity for musicality (most likely, vocally expressed) must predate the construction of a musical artefact, most likely by a considerable period.

The origins of music

So music appears early in the prehistory of our species. Given the preceding arguments for music's likely importance in human evolution, it would be helpful have a better indication than at present of just when traces of musical behaviour appear. But consideration of the role of music, or indeed of sound, in our prehistory is still at an early stage; only lately have archaeologists begun to explore the sound worlds of prehistory in any great detail (see, e.g., Dauvois, 1989; Waller, 1993; Lawson, Cross, Scarre, and Hills, 1998).

Much recent work in the archaeology of music involves experimental archaeology: examining the processes involved in the production and use of material artefacts, or the constraints afforded by particular prehistoric environments (Watson and Keating, 1999) by empirical means in order to provide a more secure context for the interpretation of human interaction with artefacts and environments. Along with two archaeologists, Ezra Zubrow and Frank Cowan, the present author is undertaking a project in the experimental archaeology of music cognition. Knowing that humans in Europe from Upper Palaeolithic cultures (from around 40,000 BP until about 14,000 BP) used stalagmitic rock formations in caves to produce "musical" sounds (Dams, 1985), we reasoned that they might have used those types of stone with which they were most familiar, flint tools, to make musical sounds. The project is ongoing but already some intriguing results have been produced. Upper Palaeolithic-type flint tools can be used almost like chime bars; some produce extraordinarily clearly pitched and resonant notes, and using these reconstructed stone-age tools to produce sounds resulted in unique use-wear patterns². In other words, if our ancestors were using flint tools as musical sound-producing objects, we may now have a means of

¹ The "Neanderthal flute" from Divje Babe (see Kunej and Turk, 2000) would predate this by some 9,000 years, having been dated to around 45,000 BP. But the identity of the Divje Babe bone(s) as musical is debated; it has been proposed by D'Errico and Villa (1997) that the wear on the bone(s) resulted from carnivore activity rather than human action. Moreover, were this to be a musical artefact, it would be almost the only evidence from a Neanderthal context for the production of a "symbolising" artefact; the weight of evidence suggests that it is unlikely – though possible – that this was a musical instrument.

² For a preliminary report, see <http://www.mus.cam.ac.uk/~cross/lithoacoustics/>

identifying these. The next stage in the research is to look for 'tools' bearing these patterns of use-wear in the archaeological record; they have not been found before, but that may well be because no-one knew what to look for. The usefulness of having a means of identifying musical use of stone – over bone, wood etc. – is that stone goes much further back in the archaeological record; if 'flint tools' were indeed being used to produce musical sound it might be possible to track such artefacts back into the depths of prehistory in an attempt to make out just when the production of musical sound might have begun.

One thing we know for certain is that music leaves few traces – except in the minds of those who engage with it. It is quite likely that the traces that it left in our ancestors' minds still resonate in our contemporary, everyday world, in the agility of our thought and in the complexity of our social interactions. Without music, it could be that we would never have become human.

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