Is music the most important thing we ever did ?

Music, development and evolution

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Introduction

According to Steve Pinker (1997) "As far as biological cause and effect is concerned, music is useless". In fact, as Steven Feld notes (Feld, 1982), music can be downright dangerous; in the Kaluli longhouse ceremonies that he describes, music could result in severe burns for the performers, inflicted by listeners as punishment for having been moved to tears by the music. And yet, to move the listeners to tears was precisely the intent of the performers. Why did they do it? More generally, why do we do it? For music appears to be humanly universal - according to Blacking (1995) all human societies of which we have knowledge appear to have music - yet the practice of music, even if not as physically hazardous as it can be amongst the Kaluli appears on the surface to offer no benefits to our continued survival. But we started doing it and we continue to do it. From an evolutionary perspective the question must be: "Why?".

In trying to answer the question why, it is also necessary to ask the question *what*. For music can take very many forms. John Blacking, noting the universality of music, was careful to point out (1995, p224) that "every known human society has what *trained musicologists* [my emphasis] would recognise as 'music'"; music can serve quite different functions - can <u>mean</u> or <u>be</u> quite different things - in different societies. For the Kaluli people of Papua, music can provide access to the domain of the birds, which is that of the dead. For the Venda of Southern Africa music can map and mark the changing roles of individuals in society. Even Western tonal music may be experienced in many ways and as many things. It can be sensed as movement of self or of others, emotionally or even physically[1]. It can be encountered as the action of bodies in the world, the movement of the sea, the flight of birds. It can be felt as having social attributes or expressing social relations, as in A. B. Marx's gendering of first and second subjects of sonatas as *male* and *female*[2]. This diversity of forms of what music is and what music may signify or do means that any answer to the question *why* has to be broad and robust to accommodate all these whats.

Posing the evolutionary question about music may seem a luxury when there are so many other interesting questions that can be asked, but it does seem to be necessary at the present moment. Over the last decade a number of increasingly sophisticated theories of the evolution of mind and society have been formulated in the context of an ever-closer convergence between the concerns of human evolutionary theory and those of cognitive science. Music has begun to receive attention from an evolutionary perspective[3], and some of the conclusions reached appear to me to pose more questions than they answer. Pinker's assertion that music is "auditory cheesecake", Sperber's declaration that music is "parasitic", even Kogan's endorsement of McNeill's proposal that music is efficacious on account of the opportunities it affords to a culture for "muscular bonding" - all these suggestions seem at best partial, at worst plain wrong.

In this chapter I shall attempt to offer an alternative account of the role of music in human evolution. At the outset I must admit that it is in part motivated by a personal desire to defend the value of music as a human activity - as a musician, the notion of music as "parasitic cheesecake" is somewhat unpalatable. But it is also motivated by a desire to try to make sense of the varieties of music, of the multiplicities of roles that music plays in human lives and of the myriad and divergent meanings that have been attributed to music. In this attempt I shall be putting forward a view of music as rooted in human biology and its evolution, but one that is not intended to be reductionist or simply sociobiological. I shall not be arguing that there is a "gene for music", but rather that our musicality is grounded in human biology as expressed in the evolution and development of our cognitive capacities and of our social and environmental interactions. Music is a product of, and a process in, our individual development, the cultures that enfold our "lifelines"[4] and the evolution of our species.

I shall start by examining two comprehensive recent theories of cognitive evolution, those of Donald and of Mithen, neither of which make much mention of music, before examining three recent accounts that do purport to give accounts of music in evolution: a review by Kogan of theories explicitly addressing music, and two further comprehensive theories advanced by Sperber and by Pinker. I shall suggest that while Kogan's conclusions appear to provide part of the picture, Sperber's and Pinker's theories of music fail adequately to address music to the extent that they should not be taken as serious proposals[5]. I shall put forward an alternative account rooted in a broad definition of music and in considerations of cognitive development.

The evolution of the mind

Merlin Donald, in *Origins of the modern mind* (1991), puts forward a theory of cognitive evolution that links different modes of representing information to different and progressively more complex forms of culture. He postulates three principal modes of representation: the episodic, the mimetic, and the mythic/linguistic (this last shading into the theoretic) and suggests that these characterise, respectively, primate and australopithecine, early human (*Homo erectus*), and archaic and modern human modes of cognitive construal, and hence culture. Episodic thinking, for him, characteristic of primates, of apes, depends on representing discrete events; mimetic thinking, characteristic of *Homo erectus*, generalises across types of events. Communication in episodic - primate - cultures is thus limited to indication of events in the immediate environment, while communication in a mimetic culture can indicate more abstract, but pre-linguistic, relations between events and their implications. Mythic culture, that originating with early humans, is tied to the development of language by means of whose symbolic powers the world can be carved unambiguously at its joints, and leads, through the development of visuographic and later ideographic means of external symbolic representation, to contemporary human theoretic culture. Donald's passing references to music suggest that he locates its origins in mimetic modes of representation, arising with *Homo erectus* some 1.5 million years BP.

This is an extremely over-concise account of a very complex theory that draws on neuropsychological, archaeological, anthropological and ethological evidence in tracking the course of human cognitive evolution, but Donald's theory does require mention as one of the few attempts to present a unified and comprehensive account of cognitive evolution. Nevertheless it has been much criticised, particularly for its lack of fit to the archaeological record[6].

And despite its complexity and sophistication, Donald's theory is quite out of step with most current theories of cognitive evolution which are largely based on Fodor's proposal that the mind is effectively modular. In this view minds are wholly explicable in terms of general and homogeneous properties but are constituted at least in part of discrete and specialised modules, each dedicated to a particular task. The theories of Tooby and Cosmides, of Plotkin (1997), of Pinker (1997) and of Sperber (1996) all concur with this view of human mental architecture and seek to explain cognitive evolution within a modular framework. Tooby & Cosmides' (1992) approach, perhaps the most influential within archaeological circles, claims support from the archaeological record in proposing a large battery of mental modules, each subserving particular cognitive functions that can be inferred from the archaeological traces of human behaviours. Thus in their theory there exists a tool-use module, a face recognition module, a rigid objects mechanics module, a social inference module, a friendship module, etc. The criteria for deciding what constitutes a module of mind vary from theory to theory, but all four of the above-mentioned theories agree that the criteria must be predicated on the adaptive value of the module for human evolution; adaptive value is determined by evaluating the evolutionary benefits that would accrue from being able to perform particular cognitive tasks rapidly and efficiently.

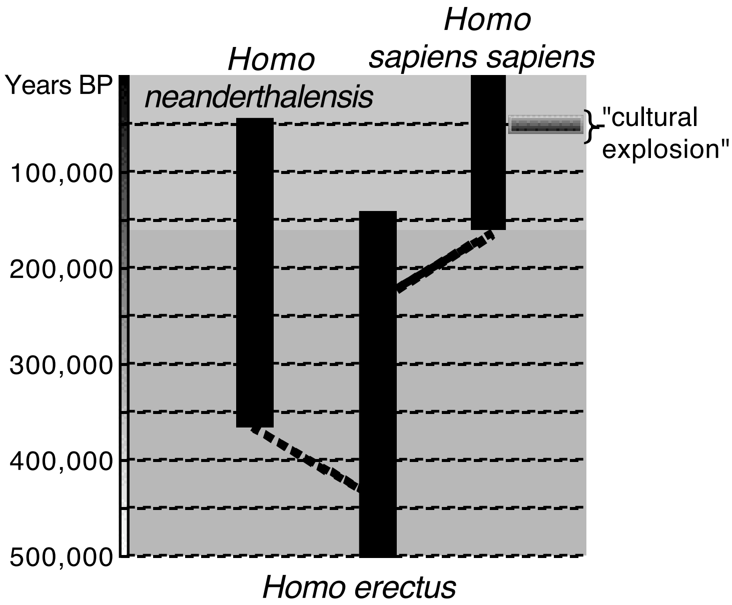


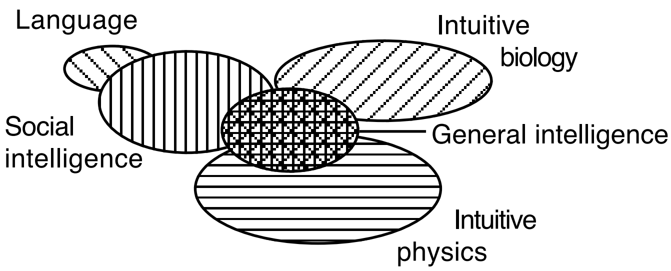
Figure 1 - A schematic account of recent human evolution (after Figure 18 of Stringer, C. & McKie, R. (1996) African exodus: the origins of modern humanity. London: Cape)

Steve Mithen (1996) presents a theory that is compatible with the idea of modularity and is tied to a close analysis of what the archaeological record tells us about human origins (a chart indiciating the current view of recent Homo lineage is given in Figure 1 above). He postulates a radical discontinuity of cognitive architecture between our predecessors and ourselves, *Homo sapiens sapiens*, basing much of his argument on an interpretation of Karmiloff-Smith's theory of cognitive development (Karmiloff-Smith, 1992). Mithen's ideas follow Fodor's in postulating a division between innate, specialised cognitive competences and a general, central, intelligence, although he prefers to speak of broad innate domains rather than of the narrowly defined modules of Tooby and Cosmides. However, like modules these domains can be informationally encapsulated; information in the mind in any particular domain may neither be accessible from within another domain nor be directly available to general, central intelligence. For Mithen the principal domains are intuitive biology, intuitive physics, social relations and language, in which he mirrors Keil's hypothesis of basic and innate modes of construal[7]. He suggests that early hominid minds can be characterised as possessing innate competences in these different domains. His analysis of the archaeological record indicates that, for early humans, different skills subserved by these different domain-specific basic competences do not seem to have been transferable across domains. For example, the degree of sophistication in technical competence revealed in the manufacture of stone hand-axes does not pertain in other domains nor does it alter much for a million years after hand-axes first appear in the record, some 1.4 million years ago[8].

Mithen suggests that the course of human cognitive evolution is marked by an increase in the capacity to integrate information across domains and to transfer information or skills between domains. The mechanics of this process of integration, processes that result in the formation of explicitised representations that may integrate information across domains, are derived from those operational in the theory of Karmiloff-Smith (1992). In her account of children's cognitive development she proposes that a limited number of innate domain-specific predispositions constrain interactions with both the external environment and the child's own internal environment that sustain the progressive development of cognitive representations. Within each domain infants form or exploit representations that are initially **Implicit** or procedural (and hence informationally encapsulated); as a child achieves behavioural mastery in a domain[9], these implicit representations may be iteratively re-described in successively more **Explicit** - and hence domain-general - terms. In this process of Representational Redescription (ibid., p17) "implicit information *in* the mind subsequently becomes explicit information *to* the mind, first within a domain and then sometimes across domains...". Karmiloff-Smith postulates three levels of Explicit representations that can result from and be operated on by redescriptive processes: those that are not consciously accessible or verbally reportable (E1), those that are consciously accessible but not verbally reportable (E2) and those that can be subjects of both conscious awareness and verbal report (E3). Representational redescription leads to the emergence of flexible intra- and inter-domain representations and may also underlie processes of increasing automaticisation and specialisation within domains as an individual develops which result in the instantiation of module-like competences, or sets of skilled behaviours and cognitive capacities.

Mithen employs Karmiloff-Smith's framework in suggesting that it is only in the last 100,000 years or so, with the emergence of modern *Homo sapiens sapiens*, that human cognitive systems have come to exhibit capacities for representational redescription. He suggests that prior to the emergence of modern humans, hominid and early human cognitive systems appear to have exhibited developed competences within the domains of social relations, language, "intuitive biology" and "intuitive physics" together with some general intelligence, but show little sign of the flexibility associable with between-domain representations (see Figure 2 below). That flexibility, which he argues characterises the modern human mind, becomes most evident in the archaeological record with the "cultural explosion" that occurred some 30,000 to 60,000 years ago.

The mind of homo erectus



The modern hunter-gatherer mind

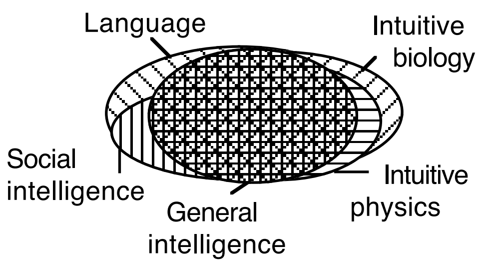


Figure 2 - The putatively "unintegrated" cognitive structures of early hominids (here, *Homo erectus*) compared to the "integrated" cognitive structures of modern humans. (after Figures 16 and 17 of Mithen, S. (1996) Prehistory of the mind. London: Thames & Hudson)

Again, this is a very over-concise resumé of a complex and sophisticated theory (in fact, two theories); I can only justify its brevity by noting that Mithen does not refer at all to music[10], and its inclusion by noting that this is a theory closely bound to what archaeology can tell us and one which has, in fact, much to offer in considering music's evolutionary role. For explicit consideration of music, however, one must turn to the theories of Kogan, Sperber and Pinker.

Music in evolution

Kogan (1997, p194) suggests that there is "a body of rigorous experimental work on the musical perception of human infants… [that] clearly demonstrates that prior to one year of age, infants have almost all of the skills of musical perception present in musically unsophisticated adults", and that this indicates that music is a domain-specific and innate human competence. He reviews the theories of Donald and of Mithen in the light of this suggestion, and proposes that of the two it is Donald's theory that can offer a more congenial place for music in cognitive evolution. He suggests that music is evolutionarily adaptive, endorsing the theory of group selection (see, e.g., Wilson and Sober, 1994) in proposing that it is so primarily because of its positive effects in promoting group morale and identity through the activities that it facilitates and subserves. In suggesting this he concurs in particular with the theory of McNeill (1995) that music's efficaciousness derives from the "muscular bonding" that arises from "the emotional response that ensues when people move together rhythmically in dance and drill", further proposing (p199) that music's adaptiveness at the group level might also be accounted for in terms of its capacity to "serve an adaptive tension-releasing function for individuals without exerting a destructive influence on group solidarity". He endorses Donald's theory in postulating that music's origins can be traced back to the rise of "mimetic" culture, that is, to the evolution of *Homo erectus* (from about 1.8 million years BP to about 300,000 years BP).

A very different view of music's evolutionary significance is provided by Sperber (1996) in the context of his theory of the interaction of mind and culture, which he develops as an "epidemiology of representations"[11]. Sperber explicitly follows Keil (1994) in proposing that the modular nature of human cognitive capacities is evidenced in our use of a limited number of distinct modes of construal[12], which provide the entirety of the structure of specialised cognitive modules that operate on different inputs. Sperber differentiates between the *proper* domain of a module, (ibid., p138) that class of "information that it is the module's biological function to process" - and the *actual* domain of the module, "all the information in the organism's environment that satisfies the module's input conditions". Environmental or evolutionary change can eliminate the proper domain of a module, and some novel feature of the environment may take over as its actual domain. This process of displacement is likely to occur, amongst other reasons, because "humans are massive producers, transmitters and consumers of information", to the extent that the actual domain of a module will come to include much information that meets its input conditions as a result of the "social distribution of information". Such information can come to constitute the module's *cultural* domain. The output from such basic modules may give rise to another type of module, the reflective, "meta-representational module" (ibid., p147), which constitutes a "theory of mind" module of which the proper domain is that of the "beliefs, desires and intentions that cause human behaviour." This meta-representational module is what underlies human communicational capacities.

Sperber proposes (ibid., p141) that "cultural transmission causes, in the actual domain of any cognitive module, a proliferation of parasitic information that mimics the module's proper domain". And it is in this context that he suggests that music is in effect parasitic; he hypothesises the existence of a module of which the proper domain is the processing of "complex sound patterns discriminable by pitch variation and rhythm", sound patterns that arise in course of early human communication occasioned by the impoverished vocal capacities of early humans, and attended to because of the pleasure that they offered to a listener. As a consequence of improvements in the human vocal tract the module's proper domain became empty; however, the pleasure that the exercise of the module offered stimulated humans to produce, artificially, other sounds which came over time to constitute music. Hence Sperber's conclusion (ibid., p142): "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".

A judgment that seems to concurs with Sperber's, and one that is perhaps the most widely disseminated recent account of music in evolution, is that of Steve Pinker (1997). He states that links can be identified between music and at least five different domains or aspects of human experience that he suggests are directly concerned with survival and so are likely to have played a functional role - to have had adaptive value - in human evolution. These are language, auditory scene analysis, habitat selection, emotion, and motor control. Despite these links Pinker suggests that music is a technology rather than an innate and adaptive predisposition. By technology, he means something that humans have invented to exercise or stimulate capacities in particular domains - such as those that underlie language, auditory scene analysis, habitat selectional skills, etc. - that have arisen because of their adaptive value in evolution. Hence his description of music as "auditory cheesecake"; music is not functional, but parasitic on the domains to which it has links, a technology that humans have invented and that we employ because it's pleasurable.

According to the theories reviewed so far, music does not seem to have much in its favour. At best, it would appear to be marginally adaptive in evolution through helping to promote group solidarity through "muscular bonding". At worst, it seems "useless", something that we do to pass the time in a pleasurable way because we have the spare cognitive capacity. It seems, in evolutionary terms, that music is either nice or Nazi.

The problem of ethnocentricity

However, there are significant problems with the specific theories of music and evolution presented here. Sperber appears to treat music purely as an aural phenomenon, almost as "noise from nowhere"; while music may indeed take this form, only for late twentieth-century Western consumer culture does an identification of music solely with sound seems feasible. Kogan adheres to Donald's theory, which seems at odds with the archaeological record. And while Pinker's view of music seems broader than that of Sperber in his suggestion that music is linked to more than just linguistic, communicative, competence, this is one of the few incontestable elements of his account. There is not time here to detail the deficiencies of the premises from which he draws his conclusions, but one common factor underlies, and **undermines**, them all, that common factor being ethnocentricity. Despite protestations to the contrary, all the evidence that Pinker presents and the assertions that he makes as to the nature of music in human experience are again most directly applicable to what music has become over the last hundred years within technologised and capitalistic Western society: an aural commodity to be consumed, dispensable on demand. Prior to that, and in almost every other society of which we have knowledge, the relation between music and action - between the auditory and the motoric - was or is much more evident and explicit.

Almost from its inception ethnomusicology has interpreted "music" as both sound **and** movement. Hornbostel (1928)[13] described musical melody as "an act of motility", proposing that "Song, like speech, is sounding gesture, originally not detached from that of the limbs". More recently, John Blacking (1995) has asserted that music and dance are simply not separable domains of human experience, while Gerhard Kubik has proposed that for some African music, "the auditory complexes may even be an, albeit important, by-product of the motional process" (Kubik, 1979, p.227). Indeed, Gelman and Brenneman (1994) implicitly endorse a close relation between music and movement in the expression of innate musical competence in suggesting that the range of activities found in Nigerian (Anang) musical enculturation - which includes not just singing and listening, but also playing instruments and dancing - contributes positively to the development of specifically musical competences.

Accepting a broad definition of music that embraces action, a re-reading of Pinker's theory produces conclusions somewhat at odds with his. He suggests that music stimulates the adaptive faculties or domains that have evolved under evolutionary pressure. But a music that embraces action may exercise rather than just "tickle" these faculties. Thus the existence of these links can be interpreted as conferring adaptive status on music in evolution. If the faculties that it exercises are necessary for survival, then the availability of a competence such as music that gives them a periodic workout **and** is fun into the bargain would seem to be highly adaptive. Thus music - from the perspective of a reworked version of Pinker's account - might well be evolutionarily adaptive for the *individual*, nicely complementing Kogan's proposal that music has adaptive value for the *group*.

Music in evolution: archaeology, development, mind & culture

At this point it seems appropriate to take stock of where we have arrived. Kogan suggests that music may have adaptive value for the group through reinforcing group identity and promoting group morale and by virtue of its capacity to release individual tensions while not destroying group morale. A re-reading of Pinker's theory suggests that music may have (secondary) adaptive value in exercising faculties that have themselves arisen under adaptive pressures[14]. And Mithen, whose theory of cognitive evolution is tied most closely to the archaeological record suggests that the course of cognitive evolution reflects increasing integration of information across cognitive domains.

I shall build on these theories by suggesting that Pinker is partly right in linking music to different domains, but that music not only links to but integrates information across the different domains. This integrative function fits well with Mithen's view of cross-domain integration as fundamental in cognitive evolution, while the multiplicity of domains that music integrates can be seen as endowing it with a diversity of reference that fits with Kogan's prescription for music as adaptive within the group in affording the possibility of non-threatening interaction. And I shall suggest that this view of music in human evolution is in accord with the archaeological evidence.

Music in archaeology

The archaeological evidence that specifically bears on music is best characterised by its sparsity; in fact there is little definite in the archaeological record[15] other than an indication that musical instruments only make an appearance linked to *Homo sapiens sapiens*, our own species. None of our hominid precursors left instruments that are identifiable as such[16]; conversely, almost as soon as we humans start leaving any particularly complex artefacts lying around for archaeologists to find, they turn out to be musical instruments. In other words, more or less the first thing we did when we developed the capacity and desire to produce diverse and technologically complex objects (probably between 40,000 and 30,000 years BP) was to produce musical instruments (bone pipes).

The fact that instruments appear some 40,000 years BP does not mean that music has only been around since then; self-evidently, it is likely that a music based on vocal sound production, or one using perishable materials or found objects[17], would have long preceded any music requiring the production of complex artefacts. But the appearance of musical instruments early in **our** archaeological record does indicate that *Homo sapiens sapiens* attached considerable importance to it and that it might constitute a competence specific to our species rather than to our precursors such as *Homo erectus* or *Homo neanderthalensis*. It could be suggested that a straightforward difference in general technological expertise between us and them could account for the lack of musical artefacts associable with earlier species of humans than ourselves. However, one can suggest that the human capacity for music constitutes a marker of the radical discontinuity in cognitive architecture suggested by Mithen as differentiating us - *Homo sapiens sapiens* - from our predecessors.

Music in development

If music is a species-specific capacity then, on the analogy of language, one might expect to find common **predispositions** for the acquisition of music across all human societies. And despite the variability in musical competence that is evident in many cultures, an increasing amount of evidence indicates that this is indeed the case for human infants and children. Trehub and her collaborators[18] have provided a wealth of evidence to support the claim that infants "may be rather capable listeners" (Trehub, 1991, p161). And M. Papousek notes (1996, p92) that "our studies…demonstrate striking cross-cultural universalities in the forms and functions of musical elements included in preverbal parent-infant interchanges". Not only the Papouseks' research but also recent work of Trevarthen (Trevarthen, 1998) support the claim that cross-cultural characteristics of early infant-caregiver interactions may exhibit and underpin the development of musicality; he conceives of *primary intersubjectivity* as being based in interactions that effectuate the "sharing of emotional states" between caregiver and child[19] and as exhibiting features that can be interpreted as involved in the acquisition of musical competence. H. Papousek (1996) suggests that musical elements are evident very early in the "processes of communicative development" and that their use precedes that of pre-linguistic phonetic elements. These elements are particularly evident in infant-directed speech and appear as (ibid., p48) "strongly accentuated prosodic elements, intonational contours, stress and rhythmicity". M. Papousek (1996, p90) notes that these musical elements are embedded in "multimodal patterns of preverbal communication, including tactile, kinaesthetic and vestibular forms", and that this embedding may be actuated by such means as the regular synchronization of vocal and kinaesthetic patterns in rhythmic interactions. H Papousek (1996, pp46-48) points up the significance of the early elements of music in facilitating the development of the child's exploratory competence that is manifested in infant play, suggesting that infants' playfulness constitutes a particular capacity that is "*supplementary* [my emphasis] to the fundamental integrative processes of learning and cognition".

So infancy research appears to reveal a common predisposition for the acquisition of musical competence that is manifested in early interactions and that can be functional, through play, in the development of exploratory competences. It can be further suggested that the **undirected** and **multimodal**[20] attributes of these precursors of musical competence, or **proto-musical behaviours**, together allow them to fulfil rather more than a *supplementary* role in general cognitive development. If infants possess not only a general intelligence (after Greenfield, 1991) but also innate domain-specific competences, then the multi-modal or *multi-domain* attributes of musical interactions and early musical play could act to reinforce the "fundamental integrative processes of learning and cognition". In other words, if innate domain-specific principles constrain even part of the infant's early experiences, music, or proto-musical behaviours in the form of interactions and play, may help to *instantiate processes that integrate and redescribe information across domains* (recall that Mithen proposes that these cross-domain processes of integration and redescription are of critical significance in our cognitive evolution). The domains active in proto-musical behaviours could include those subserved by Keil's different modes of construal - the mechanical, the intentional and the teleological (in Mithen's terms, "intuitive physics", "intuitive psychology" and "intuitive biology") - as well as those attributes of linguistic communication functional at the prelinguistic stage. The undirectedness of proto-musical behaviours would arise from the fact that they draw on so many different domains simultaneously, can occur in highly diverse interactive and exploratory contexts, and are unlikely to be <u>consistently</u> employed in a declarative manner so as to denote specific states of affairs in the world; in other words, their significance for the infant is transposable across many types of situation and many types of internal state. Cognitive representations involved in proto-musical behaviours would thus possess what can be termed "*floating intentionality*",[21] a multiplicity of "aboutnesses" that would facilitate the use of proto-musical behaviours as foci of social interactions. Forms of music and of musical behaviour available within a culture would support the emergence of, and sustain the production of, proto-musical behaviours by providing a range of possible structural and functional models. However, processes of enculturation or even of formal musical training can differentiate and progressively *modularise* these behaviours and their underlying representations into mature musical competences.

Music in mind - (i)

To summarise: I am suggesting that proto-musical behaviours may play a functional role in general development - and by implication, in cognitive evolution - by virtue of their multi-domain properties and their floating intentionalities. These attributes allow proto-musical behaviours to be employed flexibly and generically in play and in interaction so as to integrate and redescribe information across domains, thus instantiating and reinforcing the operation of cross-domain redescriptive processes. Social practices support proto-musical behaviours and the representations associated with them, and may particularise them into forms identifiable within a culture as something analogous to "music".

An account of how proto-musical behaviours might function in cognitive development can be articulated within Karmiloff-Smith's theory. In her theory the infant can be considered as having innate domain-specific biases which lead to the formation of implicit (I-level) representations in each domain. A complex event with global properties that can be regarded as proto-musical, such as a caregiver directing speech to an infant while holding or rocking it, may cue for the infant multiple implicit representations in different domains simultaneously, though innate domain-specific biases may to direct attention towards one of the domains[22]. Alternatively, attention could be directed towards that domain most relevant (after Sperber & Wilson, 1986) to the context of the interaction. In other words, a complex event with global proto-musical properties is likely to be tracked by the infant in terms of the information present in one of its constituent domains.

The I-level representations cued in the non-attended domains would constitute “noise” from the perspective of the attended domain[23], but if the complex event-**type** (having some consistent proto-musical characteristics over all **tokens** of its occurrence) recurs with sufficient frequency, that “noise” is likely to begin to acquire coherence in respect of the representation formed in the particular domain being attended, although, of course, from one instance of the event-type to the next a different domain might be attended. The repeated co-occurrence facilitates the development of cross-domain links, particularly between the linguistic microdomain of prosody, the social domain (in terms of the emotion-states experienced in respect of, inferred from, or associated with, the infant's recognition and mimesis of facial states and expressions) and the motoric or somatosensory domain through periodicity of movement.

The regular co-occurrence of events across domains in the context of the repeated proto-musical event-type could thus assist in establishing something like a representation at the E1 level, not accessible to consciousness or verbally reportable, embodying cross-domain information that is not in itself instrumental in that it is not unambiguously or explicitly intentional. However, there is a form of "multiple intentionality" embodied in the E1-level representation by virtue of its incorporation of features *resembling* those of explicitly intentional phenomena (such as speech and directed movement) **and** by virtue of its origins in multiple and disparate I-level representations that may each possess different explicit intentionalities, or that are not pointing to or significative of anything beyond themselves yet are sufficiently similar to explicitly intentional I-level representations in their proper domains to be construable as "symbolic". That very lack of explicit and unambiguous signification - or, from another perspective, surplus of intentionality - may facilitate the formation of E1-level representations by rendering behavioural mastery[24] relatively easy to achieve in respect of each behaviour subserved by an I-level representation in a relevant domain as there may be no objective criteria of success - no objective standard of instrumental behaviour - in respect of these domains.

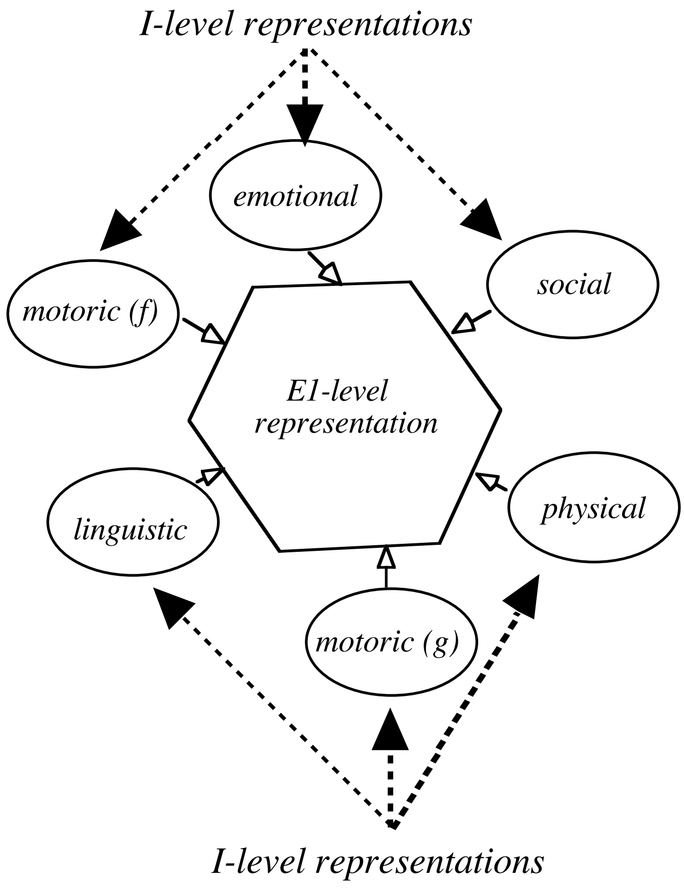


Figure 3 - Implicit representations in different domains (motoric (f)=fine motoric, motoric (g)=gross motoric) that might contribute to E1 representations subserving proto-musical behaviours

Thus processes of representational redescription may be precipitated in infancy by the proto-musical attributes of caregiver-infant interaction. They are likely to be further extended across more and different domains in later infancy as the child's competences develop. If one postulates a situation where an infant possesses multiple co-existing procedural and implicit representations in different domains, all or any of which might be evoked or required by the circumstances of a particular event:

(a) the physical (in terms of the ballistics of a body travelling through space);

(b) gross motoric (in terms of the pendular movement of a limb);

(c) linguistic (in terms of the prosodic contours of an utterance);

(d) fine motoric (in terms of the pattern of muscular control involved in the vocal folds required in production/mimesis of such an utterance);

(e) social (in terms of the assessment of the relevance and consequence of the actions or utterances);

(f) emotional (in terms of situational evaluation and dispositional response resulting in an emotional body state);

then some commonality of feature or features of all these I-level representation (perhaps the time-track of the representations considered as events, or their successivity, or as suggested earlier, simply their co-occurrence) enables the emergence of an E1-level representation that embodies - that is linked to - all these discrete, concrete, impermeable I-level representations.

According to circumstances, the E1 representation might then integrate some or all of:

(a) visual perception of the upward movement of a thrown ball;

(b) the proprioceptive experience of movement of a limb upward from resting position;

(c) auditory perception of the rising pitch contour of a prosodic inflection;

(d) the proprioceptive experience of the increase in vocal fold tension impelled by the production of that prosodic inflection;

(e) an increase in uncertainty about the social import of the increased vocal pitch;

(f) and an increased arousal associated with that uncertainty.

Conversely, the experience of the fall of the ball, the loosening of the muscle tension as the limb returns to resting position, a falling prosodic contour, the slackening of the vocal folds accompanying the fall in pitch, the realisation of the social import of the descent and a resulting decrease in arousal could also be integrated within an E1-type representation. In this way E1-level representations might underlie a generalised sense of either **tension** or **relaxation**.

The E1-level representation is neither verbally reportable nor consciously accessible, but constitutes something that might be conceived of as a temporal pattern of tension and relaxation, or perhaps as a time-track of "rate of change". It is endowed with "surplus intentionality" by virtue of its embodiment of a feature or features linked to, or summarising characteristics of, all these disparate I-level representations of experience, and may thus be employed so as to serve a variety of functions, among which are (i) to <u>make coherent</u> phenomena (tokens) that are susceptible to absorption within the representation (type) and in so doing to link phenomena across domains in a form that involves the least expenditure of cognitive effort for the greatest effect, (after Sperber & Wilson, 1986) and (ii) to <u>test</u> the generalisability - the limits of applicability - of the representation itself. The latter function can be thought of as operational within play[25], which will thus have amongst its foundations an integrated cross-domain representation that is at one and the same time free of any specific intentionality but loaded with multiple potential significances.

Music in mind - (ii)

It has to be said that Karmiloff-Smith's theory as she outlines it displays significant lacunae when considered from a music-developmental perspective. She makes no mention of how the processes that she describes may be related to the evocation or experience of **affect**, and she does not indicate how the **embodied** nature of the child's experience may impact on cognitive development. As noted earlier, the evocation of affect and the experience of movement appear intimately bound to music in many cultures and any theory of musical development must take this into account. An alternative exposition of the emergence of the explicitised yet consciously inaccessible cognitive representations that I suggest subserve proto-musical behaviours can be expressed in terms of Jackendoff's (1987) theory of cognition. This theory does not specifically consider general trajectories or processes of development but presents a unified account of the processes subserving cognition that offers intriguing hints about the relations between the body, affect and music that I shall exploit to provide a brief alternative version of musical development and functionality.

Rather than postulating the emergence of an explicitised and abstract representation at the E1 level that integrates aspects of multiple implicit representations across domains, one could postulate a developmental process that consists in the emergence of affective links between direct awareness and abstract representations that incorporate temporal features of sound structure and of somatosensory states (after Damasio, 1995) and are expressed in and receive feedback from muscular tension and relaxation as evoked by movement. These abstract representations do not originate in separate domains but emerge as an integrated domain through the temporal co-articulation of sound structure and dynamic somatosensory state, but one that would be embedded in or tied to broader auditory and somatosensory domains. Music in this view would still be explicitly functional, fulfilling integrative and redescriptive processes; it would afford to the individual opportunities for exploratory behaviours involving the planning of and production of temporal patterning, and the coordination over time of motoric, auditory and emotional structure. The "multiple intentionalities" inherent in its multi-domain embedding would again afford the possibility of exploratory behaviour in the field of social interaction as well as the exploration of the limits of relations between the elements of dynamic somatosensory states - movement patterns, experienced affect[26] and multi-modal representations of aspects of environmental and social stimuli that elicit particular somatosensory states.[27]

Music in culture

Returning to the framework outlined by Karmiloff-Smith, if this process of formulation of E1-level representations is accepted as part of the general developmental process of representational redescription (i.e., accepted as an element in the “natural” repertoire of human developmental behaviours), one can hypothesise that the activities and processes we can describe as “music” - or at least, as proto-musical - in any given culture have, amongst their other roles, the job of “amplifying” (or perhaps even kick-starting) the processes involved in representational redescription.

Music (and probably also dance) as a cultural activity thus affords a basis for rehearsing processes of representational redescription. As an intra-individual phenomenon, it also affords the basis for exploratory behaviours that, by virtue of the “floating intentionality” of the underlying representations, are more-or-less consequence-free in terms of their implications for the individual's relations with their environment (their impact on it and its reciprocal impact on them). This feature of proto-musical behaviours may also facilitate the exploration of social behaviours by affording a means for inter-individual interaction that is more-or-less consequence-free;

although it may be possible to identify a consistent and single focus of the proto-musical behaviours of several interacting individuals, a unitary musical behaviour with multiple participants, the manifold meanings available to each participant permit engagement in co-ordinated interaction in time while minimising possible inter-individual conflict. In other words, music enables **risk-free** action and facilitates **risky** interaction.[28]

These developmental precursors of musicality can be thought of as underlying the mature music of any particular culture, which for any member of that culture may draw on multiply-referenced cognitive representations that are neither consciously accessible nor verbally-reportable (but which could, in part, become so by virtue of enculturation or formal training). One can thus conceive of any given piece of music or discrete musical act as capable of embodying various simultaneously co-existing referential frameworks for each participant, and it becomes possible for multiple individuals to share in a common musical act without any intersubjective assignment of **specific** and **fixed** intentionality to that musical act. From the perspective of an observer, a single musical act is occurring; from the perspective of the participants, their separate yet simultaneous musical behaviours may bear different meanings for each participant yet no conflict need emerge from these co-extant but diverging significances. In this respect music has a unique social functionality; it has the capacity to afford conditions for social interaction that do not necessarily require the unique and fixed attribution of meaning or intentionality to any of the actions or productions of the participants, and hence can constitute a focus for co-ordinated social activity that is unlikely to give rise to grounds for discord or to situations that are potentially interpretable as threatening, as Kogan (1997, p199) in fact proposes. Such an interpretation is supported by a quotation from Steven Feld's beautiful account (Feld, 1982, pp222-223) of his time amongst the Kaluli people of Papua (recall that for the Kaluli, music offers access to the domain of the birds, which is that of the dead, and for them mourning or weeping and song are intimately bound together): "In settings for weeping and song, nothing true or false is at stake, no controversy over how things should be done, no question of who is right or wrong or what course of action individuals or groups should take…these expressive codes reference items and events to the lived world of actual people, places, events and behaviours. At the same time they reference the same items to abstract qualities and values…".

None of this is intended to imply that the **meaning** of music, whether conceived of as cognitive process or social act, is reducible to the diverse and multiple representations (or their referents) that function within the precursors of music in infant cognitive development, or to the redescriptive processes that sustain that development. The meaning of a musical piece or act for a mature individual will necessarily depend at any given moment on that person's own history and narratives[29], and on the situational significances that cultural processes confer on that piece or act through the instantiation of intersubjective modes of construal. It is, rather, proposed that the **indeterminacy** which has its genesis in the representations and processes that are active in cognitive development is what underlies the social functionality of music and contributes to - but does not itself decide - music's meaning.

Conclusion

To summarise: I have briefly reviewed two general theories of cognitive evolution, those of Donald and of Mithen, and three accounts of the place of music in human evolution, those of Kogan, Sperber and Pinker. I have discussed accounts of music in cognitive development, and have proposed that an account of music as functional in cognitive evolution can be expressed in terms of a framework related to those provided by the theories of Mithen and of Karmiloff-Smith. I have claimed that music is neither "auditory cheesecake", as Pinker would have it, nor "parasitic", as it is in Sperber's account. If music is a "technology", to use Pinker's term, it is one that is rooted in our individual and in our evolutionary development.

Casting back to music's evolutionary role, if music can be viewed as having its origins in the modern human capacities for the processes of representational redescription that Mithen suggests are crucial in the cognitive architecture of our species, it can also be thought of as having contributed to the emergence of those processes. In this view music is a cognitive capacity arising from an infant's propensities to search for "relevance" in, and mastery over, itself and its world and from early elements in that search, particularly the interactions with the primary caregiver. The development of proto-musical capacities is propelled by internal dynamics - largely concerned with behavioural mastery and with relevance - that lead to re-representation across domains, and by external, social, dynamics that act to amplify, stabilise, structure and direct these proto-musical capacities. Music appears as a direct and necessary correlate of the architecture of the modern human mind, facilitating the development of individual minds and affording structures for their interactions in society. It can thus be argued that "music" as an identifiable human pursuit, emerges from its developmental precursors as a distinct and socially-conditioned activity in the particular processes of human evolution that gave rise to *Homo sapiens sapiens*, our own species. Music is integrally bound up with those processes, and can be considered to have been either evolutionarily adaptive or what Stephen Jay Gould would term "exaptive"[30]. In other words, music propels the development, and propelled the evolution, of mind by enabling consequence-free representational redescription across domains; music also facilitates the development, and facilitated the evolution, of social behaviours by enabling risk-free action and risky interaction. At the very least it may have contributed to the emergence of one of our most distinguishing features, our cognitive flexibility; at most, it may have been the single most important factor enabling the capacities of representational redescription to evolve. It may be that music is the most important thing that we humans ever did.[31]

Notes

[1] See, e.g., Sloboda (1998).

[2] For rather broader expansion and exploration of a frame of reference based around gender, see McClary (1991). See also Watt & Ash (1998) and Dempster (1998) for music as having "person" attributes.

[3] Although music's evolutionary origins have been theorised since Darwin first framed his theory of evolution, not least by Darwin himself.

[4] To employ Rose's (1996) term.

[5] In fact, Sperber explicitly claims that he is **not** offering a serious theory (see Sperber, 1996, p141).

[6] See, for example, Arbib et al (1993).

[7] Keil (1994, p251) suggests that these modes of construal are few in number - "the mechanical, the intentional and the teleological (and perhaps half a dozen more)" - and subserve the organisation of knowledge into different domains.

[8] See Mithen (1996), chapters 2 and 7.

[9] See note 24.

[10] In fact, Mithen has admitted (personal communication) that on the morning after the book went to press he woke up in a cold sweat with the sudden realisation that he'd forgotten to discuss music!

[11] But see note 5 for Sperber's disclaimer of serious intent concerning music.

[12] According to Sperber (1996, p136) modes of construal constitute "dispositions to organise information in certain manners and to perform computations of a certain form." - see also note 7.

[13] Quoted in Blum (1991), p11.

[14] The issue of whether or not the principle of adaptation can account for **all** evolutionary change has been challenged, particularly by Gould & Lewontin (1979). They argue that features may arise in the course of evolution as a consequence of structural characteristics of a genotype rather than of immediate adaptive pressures; these features are thus occurring as secondary and non-adaptive consequences of changes that are themselves adaptive and constitute, in their terms, "spandrels" or "exaptations" (Gould having suggested the latter term as a replacement for the wholly misleading - but prevalent - "preadaptation").

[15] Lawson, Cross, Scarre and Hills (1998) provides a recent overview of sound and music in the archaeological record.

[16] For disposal of the much-discussed "Neanderthal flute" see D'Errico & Villa, (1997).

[17] See, for example, the suggestions in Dauvois (1989) that stalactitic structures may have been used as naturally occurring lithophones in the Upper Paleolithic period.

[18] See, e.g., Trehub, Schellenberg and Hill (1997).

[19] These interactions typically occur prior to eight months of age, and are evidenced in infant-caregiver mimesis, particularly of facial expression which is often linked to movement occasioned by or co-occurring with exaggerated prosodic utterances by the caregiver - see Trevarthen (1980).

[20] Or "multimedia", as Kogan (1997, p195) puts it.

[21] Which appears in many respects analogous to the notion of "deictic intentionality" proposed by Agre (1997).

[22] See Trehub & Trainor, 1993, p280: "patterns that are processed readily in early life could be considered to have special status (i.e. as good patterns) and to involve innate attentional predispositions (Locke, 1990: Marler, 1990)". As an instance of these innate attentional predispositions, Trehub & Trainor state (ibid.) that "We have suggested repeatedly that

pitch-contour processing is prominent among [early and innate] processing dispositions, with infants extracting the pitch contours of simple speech and musical passages".

23 I am grateful to Jonathan Impett for suggesting this formulation.

24 Which Karmiloff-Smith suggests (1992, pp17-25) is essential in precipitating the production of more explicitised representations through processes of redescription.

25 After Papousek (1996, pp44-48).

26 Perhaps along the lines of Damasio's **feelings**, which he defines as follows (1995, p147): "A feeling about a particular object [or event] is based on the subjectivity of the perception of the object, the perception of the body state it engenders and the perception of modified style and efficiency of the thought process as all of the above happens."

27 Though it has to noted that Jackendoff himself (Jackendoff, 1997, p218, note 6) sees music as a "spandrel", that is, as not directly adaptive.

28 My thanks to Annabel Cohen for suggesting that music can subserve both risk-free and **risky** activities.

29 See Bruner (1986, 1990).

30 See also note 14.

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