Review Feature

The Singing Neanderthals: the Origins of Music, Language, Mind and Body
by Steven Mithen

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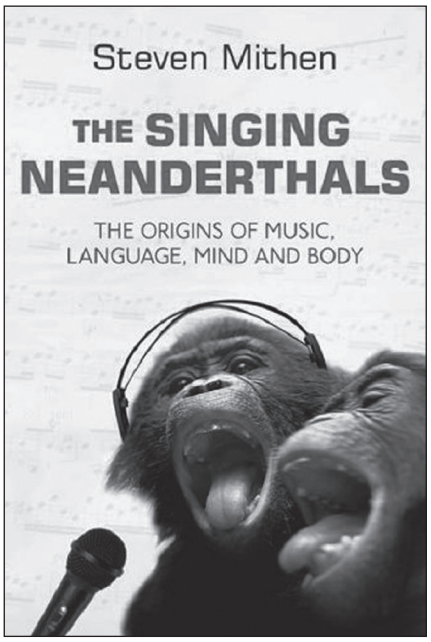

Why are humans musical? Why do people in all cultures sing or play instruments? Why do we appear to have specialized neurological apparatus for hearing and interpreting music as distinct from other sounds? And how does our musicality relate to language and to our evolutionary history?

Anthropologists and archaeologists have paid little attention to the origin of music and musicality — far less than for either language or 'art'. While art has been seen as an index of cognitive complexity and language as an essential tool of communication, music has suffered from our perception that it is an epiphenomenal 'leisure activity', and archaeologically inaccessible to boot. Nothing could be further from the truth, according to Steven Mithen; music is integral to human social life, he argues, and we can investigate its ancestry with the same rich range of analyses — neurological, physiological, ethnographic, linguistic, ethological and even archaeological — which have been deployed to study language.

In The Singing Neanderthals *Steven Mithen poses these questions and proposes a bold hypothesis to answer them. Mithen argues that musicality is a fundamental part of being human, that this capacity is of great antiquity, and that a holistic protolanguage of musical emotive expression predates language and was an essential precursor to it.*

This is an argument with implications which extend far beyond the mere origins of music itself into the very motives of human origins. Any argument of such range is bound to attract discussion and critique; we here present commentaries by archaeologists Clive Gamble and Iain Morley and linguists Alison Wray and Maggie Tallerman, along with Mithen's response to them. Whether right or wrong, Mithen has raised fascinating and important issues. And it adds a great deal of charm to the time-honoured, perhaps shopworn image of the Neanderthals shambling ineffectively through the pages of Pleistocene prehistory to imagine them humming, crooning or belting out a cappella harmonies as they went.

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Overview

Steven Mithen

While there has been considerable discussion and debate within palaeoanthropology regarding the origin and evolution of language and art, that of music and dance have been neglected. This is as surprising as it is unfortunate as these behaviours are universal amongst human communities today and in the historically documented past. We cannot understand the origin and nature of *Homo sapiens* without addressing why and how we are a musical species.

The Singing Neanderthals argues that while both language and art are most likely restricted to *Homo sapiens*, musicality has a significantly earlier appearance in human evolution and was utilized by a wide range of hominin ancestors and relatives. Indeed, the failure to appreciate this leaves us with a very restrictive understanding of past communication methods and lifestyles in general. Moreover, we remain constrained in our understanding of how not only music but also language originated in modern humans. To address these issues, *The Singing Neanderthals* draws on evidence and theories from a wide range of disciplines including neuroscience, psychology, linguistics, musicology and palaeoanthropology. By building a synthesis of material from these fields it seeks to not only understand how our capacities for language and music evolved but also to construct a more informed understanding of the past.

At present, there are two key approaches to the evolution of language with regard to the nature of proto-language. One of these can be called 'compositional' and is especially associated with the work of Derek Bickerton and Ray Jackendoff. In essence, this argues that words came before grammar, and it is the evolution of syntax that differentiates the vocal communication system of *Homo sapiens* from all of those that went before. An alternative approach is that developed by Alison Wray and Michael Arbib. They suggest that pre-modern communication was constituted by 'holistic' phrases, each of which had a unique meaning and which could not be broken down into meaningful constituent parts. As such, discrete words that can be combined to make new and unique utterances were a relatively late development in the evolutionary process that led to language. I favour the holistic approach and envisage such phrases as also making extensive use of variation in pitch, rhythm and melody to communicate information, express emotion and induce emotion in other individuals. As such, both language and music have a common origin in a communication system that I refer to as 'Hmmmmm' because it had the following characteristics: it was Holistic, manipulative, multi-modal, musical and mimetic (see Fig. 1).

Appreciating that human ancestors and relatives had a sophisticated vocal communication system of this type helps to explain numerous features of the archaeological and fossil record. The long-running debate about the linguistic capabilities of the Neanderthals arises from apparently contradictory lines of evidence that can now be resolved. That from their skeletal remains suggests a capability for vocal communication similar to that of modern humans (and which has, therefore, been assumed to be language) while the archaeological evidence provides few, if any, traces for linguistically mediated behaviour. This seeming paradox is resolved by appreciating that the Neanderthals did indeed have a complex vocal communication system, but it was a type of Hmmmmm rather than language. Another type of Hmmmmm was used by the immediate ancestors of *Homo sapiens* in Africa, both having originated from a 'proto-Hmmmmm' used by a common ancestor.

The Singing Neanderthals examines and interprets the fossil and archaeological records to provide a feasible scenario for how Hmmmmm would have originated and evolved into a sufficiently complex communication system to support the cultural achievements of the Neanderthals and other large-brained hominins.

It begins by arguing that the vocalizations, gestures and body postures used by non-human primates today are most likely analogous to those used by early hominins during the Pliocene. The vocalizations of apes and monkeys often have a musical nature to them, heard most dramatically in the rhythmic chattering of geladas and the 'duets' 'sung' by paired gibbons. Such non-human primate calls should be described as 'holistic' because they do not appear to be composed out of discrete 'words' with their own individual meanings and which can be recombined to make novel utterances. *The Singing Neanderthals* argues that the vocalizations of our Pliocene ancestors would have been similar and these directly evolved into human language and music during the course of hominin evolution.

With regard to evolution in the Plio-Pleistocene, the need for increased sociality arising from environmental and dietary change would have created pressures for enhanced communication, this being facilitated by the evolution of partial bipedalism and changes in the vocal tract. The evolution of full bipedalism by 1.6 mya would have provided further possibili-

ties for both vocal communication and body language, the latter arising from the new forms of muscle control that walking and running on two legs requires. Further selective pressures for enhanced communication would have arisen from the demands to exchange information about new environments, from changing life-history patterns, for mate attraction, for the planning of big game hunting and for the cultural transmission of technological knowledge. *The Singing Neanderthals* examines the fossil and archaeological evidence for each of these developments and considers their implications for the nature of hominin communication and expression.

There is no reason to expect that these selective pressures and opportunities for enhanced communication would have resulted in language as we know it today — a communication system with grammatical rules to compose a discrete number of words into a potentially infinite number of utterances. Moreover, there is no evidence for language-mediated behaviour in the archaeological record prior to several tens of thousands of year safter the first fossil traces of *Homo sapiens* in Africa. What we should expect, however, is for the communication systems of our ancestors and relatives to have had a degree of musicality as a means to express and induce emotions and to develop group identities, the latter being essential for the high degree of cooperation required by prehistoric communities. As Merlin Donald has previously argued, mimesis is likely to have been important in these communication systems of large-brained hominins. I extend his arguments to include 'sound synesthesia' — the phenomenon by which the physical size or type of movement of an entity is matched by the character of a vocal expression — in light of Brent Berlin's recent research on the prevalence of this in extant languages of traditional peoples.

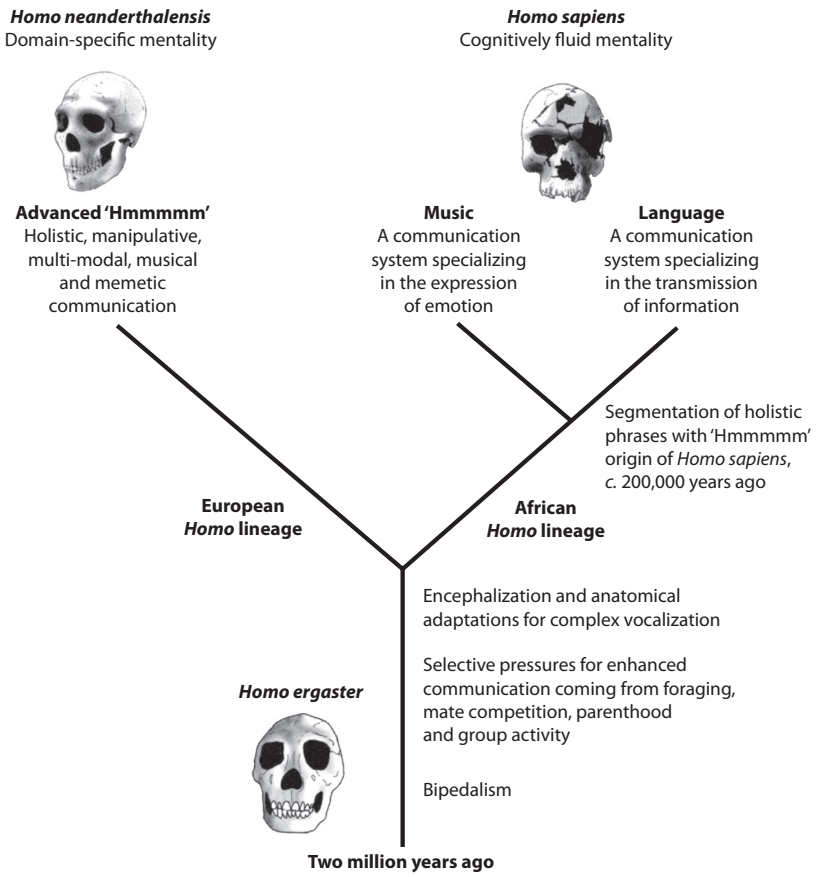

Figure 1. *The evolution of music and language.*

While the fossil and archaeological records provide substantial evidence for the co-evolution of music and language, further evidence can be found from examining ourselves today. *The Singing Neanderthals* reviews and interprets four areas of research within cognitive science. First, it examines the overlap between music and language, recognizing both profound similarities and differences between these modes of communication and expression. Second, it examines how music and language are constituted in the brain. To do so, it reviews case studies of people who have either suffered brain lesions or been born with a cognitive constraint, that has inhibited either their linguistic or musical ability. This fascinating evidence, along with the use of brain scans, shows that while music and language are not entirely separate from each other, neither of them has a cognitive priority in the adult brain — in other words our musical abilities do not appear to be simply a spin-off from language as has been proposed by Steven Pinker. *The Singing Neanderthals* follows the arguments of Isabelle Peretz, a distinguished neuroscientist who has made pioneering studies of amusia (the loss of musical ability). She argues that both language and music are constituted by a series of relatively discrete modules within the brain, some of which are most likely shared and some of which are dedicated to one of these alone.

Brains have to be understood from a developmental as well as an evolutionary perspective. Consequently, *The Singing Neanderthals* reviews what is currently understood about the maturation of the brain and the development of language and musical abilities in the child. It focuses on so-called 'motherese', the manner in which adults communicate with pre-linguistic infants and notes the highly musical nature of this which supports arguments that babies are born inherently musical. This appears to relate to the need for parents to ensure infants receive substantial emotional support during their development and so, as a fourth task, a review is made of how music expresses and induces emotion.

Music is frequently cited as the language of emotion, but is there any robust scientific evidence for this claim? *The Singing Neanderthals* describes a series of psychology experiments that demonstrate that music not only induces emotions, but by doing so changes behaviour. The relationship between music and emotion is of crucial importance because research during the last decade has recognized that emotion is a requirement for rational decision-making rather than being a constraint upon this. Hence, once we appreciate that our large-brained hominin ancestors had to continually make crucial decisions about survival in challenging Pleistocene landscapes, we must also recognize that they could only have done so by being highly emotional people — and by implication highly musical.

By reviewing the evidence and theories from primate studies, child development, neuroscience, psychology, and the archaeological and fossil records, *The Singing Neanderthals* aims to develop a more sophisticated understanding of pre-modern communication systems — and hence lifestyles — than currently exists. As the book title indicates, it is particularly concerned with gaining an improved understanding of the Neanderthals and hence presents them as not only highly intelligent but also highly emotional individuals who communicated with a particularly musical version of Hmmmmm. Nevertheless, as argued in my previous work, the Neanderthals had a domain-specific mentality which imposed a major constraint on their levels of creativity and symbolic thought.

The separation of a Hmmmmm into the two systems of communication that we now refer to as language and music (see Fig. 1) most likely occurred as part of the process by which modern *Homo sapiens* originated in Africa. In *The Singing Neanderthals* I follow Alison Wray's arguments for the process by which compositional language is likely to have evolved from holistic utterances, which she describes as 'segmentation'. Important evidence regarding the feasibility of this process has come from the computational work undertaken by Simon Kirby and his colleagues at Edinburgh. That work has also shown how the process of cultural transmission can play a key influence on the development of grammatical rules. Once 'words' had come into existence amongst early *Homo sapiens* or their immediate ancestors in Africa, the process of language evolution in terms of increasing grammatical complexity would have begun. This is the period for which Derek Bickerton's arguments about language evolution are applicable, rather than the much earlier Plio-Pleistocene as he himself has argued.

The evolution of compositional language from Hmmmmm would have had a profound cognitive impact. In a previous book, *The Prehistory of the Mind* (1996), I argued that this would have involved the transition from a domain-specific to a cognitively-fluid mentality and I now provide further support for that proposal coming from the recent arguments by the philosopher Peter Carruthers. Language effectively delivered the capacity for metaphor to the human mind that underlies art, science and religion. Cognitive fluidity also enabled the construction of complex artefacts and the extension of the mind and body into material culture. As such it provided the possibility of musical instruments and an immense elaboration of hominin musical abilities.

In summary, *The Singing Neanderthals* attempts to explain how the capacity for music evolved. To do so, it also has to address the evolution of language, the body and the mind. It attempts to draw on the latest research from a diverse range of fields to both understand the present and produce a more accurate picture of past communication and hominin lifestyles than currently exists. It shows how we became a musical species and how by continuing to make and listen to music today we reaffirm the fact that we are products of a long evolutionary past.

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'Name that tune'

Iain Morley

Steven Mithen's book represents a timely endeavour to address an area of research the importance of which is increasingly recognized in a diversity of academic fields. The book is principally concerned with elaborating the idea of a shared foundation for musical and linguistic vocal behaviours and situating it in the context of hominin evolution.

Mithen achieves this largely by incorporating into this evolutionary context the ideas of several other researchers. Principal is Alison Wray's idea of *holistic* and *manipulative* (*functional*, in Wray's terms) early linguistic behaviour; with this Mithen incorporates the important point that communication uses both vocal and corporeal media and is thus *multi-modal*, Merlin Donald's idea of *mimetic* communication, and the idea that such vocalizations would have exhibited *musical* qualities. From these components are derived the appropriately onomatopoeic acronym '*Hmmmmm*', which Mithen names the pre-linguistic communicative behaviour. The idea of a shared precursor to linguistic and musical behaviours is not a new one, but whilst several such observations have previously been made in an evolutionary context, there have been few attempts to model the manifestation of such behaviour within the human evolutionary record as a whole. Typically, Mithen writes in an easy style which is accessible to a broad readership, deals clearly with material from a diversity of academic fields, and describes archaeological sites and evidence evocatively. The content of the book has already been introduced by the author, so this review might be most usefully constituted by highlighting some issues and implications associated with the work.

First of these is a need to define the terminology used. Steven Mithen adopts Nettl's (1983) definition of music as 'human communication outside the scope of language' for the consideration of this issue, which, he professes, is 'perhaps as good a definition as we can get' (p. 11). Thankfully it is not. This definition has the potential to include many other behaviours, and is thus too broad to be useful here; some of these behaviours may indeed be part of those that constitute musical activities, others may not. Whilst defining 'music' is a notoriously thorny problem, it does not seem adequate to define it as what language isn't, and this is especially problematic when language isn't defined either. Finally, this seems an especially curious definition to choose when the chapter it introduces is concerned with commonalities between music and language.

We are left far from clear as to what Mithen considers 'music' to be, although it is a word which is used frequently and in diverse ways throughout the text. Cross's (2003) conception of music is particularly useful in this regard: 'Music embodies, entrains and transposably intentionalises time in sound and action'. This definition encompasses both the corporeal and auditory elements of musical performance and perception, and its potential to have multiple meanings — it means different things to different people in different contexts ('transposable intentionality'). It can also be applied to all experiences of music be they 'live' and participatory, or recorded and solitary. It deliberately avoids cultural specificity, and whilst it does not stipulate some of the properties of music which may be universals, the properties of music which it describes *are* universal. Whilst it is general enough to encompass any musical activity of any culture and era, it is precise enough such that any activity conforming to this definition would be considered musical.

This lack of definition is most explicit in the case of the 'musical' m in the 'Hmmmm/Hmmmmm' model. Curiously this is the only one of the initials that is not clearly defined. Having a 'musical' m as a constituent part of a type of vocalization which is supposed to be a precursor to musical behaviours seems somewhat tautological, though perhaps this is a product of its ambiguity. The 'musical' aspects of 'Hmmmm' and 'Hmmmmm' actually permeate various of the proposed components of the acronym. Music can itself be holistic, emotionally manipulative and multi-modal, and it is the fact that this is the case that forms the basis for the 'Hmmmm' model; music cannot be separated from the rest of 'Hmmmm'. As a consequence, when Mithen talks about 'the musical aspects of "Hmmmmm"' (p. 176; p. 150) it is not clear which elements he means — the elements of musical behaviour that permeate the other letters of the acronym, or whatever it is that he considers the 'musical' element of the acronym to be? Are they the same elements when talking about the benefits of bipedalism as when discussing 'Singing for sex?'. At some levels there is also a certain amount of circularity to the model: several of the proposed properties of 'Hmmmm'/'Hmmmmm' are justified by reference to the roles and properties of musical behaviours today, but then ultimately, modern musical traits are explained by the model as being derived from 'Hmmmmm'.

The lack of a clear conception of 'music' or 'musical ability' also leads to several points of ambiguity in the discussion of other research. For example, in the context of discussing brain pathologies, Mithen

states that '… all suffered lesions that led to loss of language-processing abilities but preservation of musical abilities' (p. 39), but in at least two of the four patients described rhythmic perception and reproduction were severely impaired too. Are we not to consider these abilities a part of musical ability? In this case it appears that what Mithen means by 'musical abilities' is in fact the 'perception and recognition of the melodic elements of music'. In the related studies, the terms 'musician' and 'non-musician' are frequently used (and repeated by Mithen). Does he agree with such categorizations? Typically they in fact refer to 'professional performers of Western music' and 'amateur performers' or 'non-performers of Western music'. Which elements of these categorizations does Mithen consider to be important in the context of discussing a trait which is, it is maintained, inherent in us all?

As noted, Mithen draws upon evidence from a wide range of fields of research in building up a picture of the extent to which musical capacities are innate, how music production and processing is organized in the brain, and identifying the presence of relevant capacities and selective pressures in the archaeological record. But in each of these cases, only a select portion of the relevant literature is cited. It is difficult, of course, to cover every area of evidence in as much detail as one might wish in a single book, but 150,000 words does give plenty of scope.

There is only the space here to mention a few examples. The investigation into the relationship(s) between music and emotion is a rather larger area than Mithen apparently believes. The section of chapter 7 entitled 'The language of music' (pp. 89–92), by which Mithen is referring to emotion, deals principally with music as *expressing* emotion — or, rather, as a vehicle for the intentional expression of emotion by a composer and/or performer, and the consequent response of the listener. There are many other ways in which music can communicate emotion and elicit emotional responses in listeners, which are highly relevant to this study, quite outwith the intention of the composer or performer (see, for example, Clynes 1977; Kivy 1989; Panksepp 1995; Gabrielsson & Juslin 1996; Addis 1999; Davies 2001; Lavy 2001; Panksepp & Bernatsky 2002; Morley 2003, 150–62).

In the case of the fossil record for vocal tract and auditory evolution, the body of literature available is also large, and many relevant analyses of fossil hominins, vocal-tract reconstructions, and evidence of vocal capabilities, are not cited (e.g. Laitman & Heimbuch 1982; Laitman 1984; Magriples & Laitman 1987; Laitman & Reidenberg 1988; Arensberg *et al.* 1990; Ross & Ravosa 1993; Budil 1994; Fitch 2000). Mithen does cite works relating to muscular innervation in the control of breathing (MacLarnon & Hewitt 1999) and the tongue (Kay *et al.* 1998). He does not, however, explore more recent papers published in response to those articles. The discussion of the thoracic canal dimensions of *Homo ergaster* (specifically, the Nariokotome boy KNM-WT 15000) would benefit from a consideration of the paper by Frayer & Nicolay (2000) in addition to that of MacLarnon & Hewitt (1999). Frayer and Nicolay (in Wallin *et al.*'s *The Origins of Music*) disagree with MacLarnon & Hewitt on several points of analysis and physiological capabilities; in fact, their views are artificially polarized (Morley 2002; 2003), but a full picture of the breathing and vocal-control capabilities of KNM-WT 15000 is only achievable through a consideration of both sets of findings. Similarly the findings of Kay *et al.* (1998) regarding the hypoglossal canal should be considered in light of the later research by DeGusta *et al.* (1999), which found that many non-human primates have hypoglossal canal dimensions within the range of modern humans, both in absolute terms and relative to the volume of the oral cavity, and that the same applied to several fossil species.

Although Mithen's work derives much from the comments of John Blacking (1973) regarding his work with the Venda people of South Africa, there is little other consideration of the manifestation of musical behaviours outside of the familiar modern Western context.

Such consideration would be useful in helping to ensure that a representative concept of 'musical behaviours' in modern humans is generated, and highlighting the roles which such behaviours can fulfil in modern hunter-gatherer subsistence contexts. Several general comments are made, such as 'Mimicking and performing mimes of animals are pervasive among all such [modern hunter-gatherer] societies as part of their hunting practices and religious rituals' (p. 168), but without citation. Similarly Mithen states that 'when living in conditions of adversity, [modern humans] make music' (p. 236); but the only citation made regarding the making of music in conditions of adversity relates to the Venda, and states that they did *not* make music 'when facing periods of hunger or stress. In fact, they did the reverse: they made communal music when food was plentiful' (p. 209). If there were references to back up the former assertion (e.g. Johnston 1989; Nettl 1992; Turino 1992; Locke 1996; McAllester 1996), the latter would seem less problematic.

But none of the preceding comments really constitute objections to the model itself, which includes several appealing ideas. There are a few areas of ambi-

guity, however (in addition to the conception of music itself), that seem to arise in Mithen's exposition of the ways his model would be manifest. There are several aspects which could be addressed; I shall focus on just one — the 'singing Neanderthals' themselves.

In the context of discussing Neanderthals ('Neanderthals in love'), Mithen attributes to them 'advanced "Hmmmmm"'; he explains this as being different from the 'Hmmmmm' of their predecessors in that 'they took this communication system to an extreme' (p. 221) — i.e. a *more* emotional, *more* tonal, *more* social version of what was done before. 'Advanced Hmmmmm' is also characterized by Mithen in terms of what we have apparently lost, which in his terms is an extreme sensitivity to the general auditory environment and emotional sensitivity to the vocal and physical actions of others. He suggests that we occasionally have flashes of the type of experience that would have been common for Neanderthals, at a ballet, for example. But I am not convinced that modern humans *per se* have demonstrably lost such sensitivities. What Mithen describes seems to me to be representative of some modern *western* human experience. As such, I can't help but feel that the nature of the 'singing' undertaken by the Neanderthals of the title of the book requires some more elaboration.

Mithen maintains that Neanderthals lacked symbolic language and behaviour (the one being taken as a proxy for the other). A lack of symbolizing capacity does not conflict with a capacity for holistic meaning in vocal sounds, according to Mithen, because the communication was holistic rather than compositional (p. 231). But then he proposes that Neanderthals 'had a larger number of holistic phrases than previous species of *Homo*, phrases with greater semantic complexity for use in a wider range of more specific situations. I think it is also likely that some of these were used in conjunction with each other to create simple narratives' (p. 234).

What is not clear is how it is possible to have a semantic element without this being in some way symbolic. Also, what would the content of such a *narrative* be, if not symbolic in some way? In any case, presumably any such narrative could only concern subject matter from a single 'cognitive domain' such as Natural History Intelligence, or Technological Intelligence, or Social Intelligence, because without 'cognitive fluidity' Neanderthals would only have been capable of using such holistic phrases in conjunction with each other if each drew upon the same cognitive intelligence domain. Or perhaps *all* 'Hmmmmm' utterances rely only on the Social Intelligence domain, as they are ultimately derived from emotive vocalizations mediating social relationships? But then, mime of animals relies on Natural History Intelligence, surely, as would the use of 'Hmmmmm' for the planning of hunts (p. 237)? How would the capacity for a form of 'Hmmmmm' utterance related to hunting activities develop from the 'Hmmmmm' utterances that are derived from social mediation, without some degree of cognitive fluidity? I am not seeking to suggest that these behaviours that Mithen describes were not possible, but only that it would be valuable to have a greater explication of how he sees these capabilities that he describes fitting within his existing ideas.

Incorporating as it does the great selling points of Neanderthals, sex and music (two of which feature in the title), this book is bound to reach a wide audience, and should stimulate debate and further research. It raises a number of interesting points, and some of the ideas suggested should prove to be testable with more in-depth investigation. It falls somewhat short, however, of the author's statement that it provides 'a complete account not only of how music and language evolved but also of how they relate to the evolution of the human mind, body and society' (p. 7), for a number of reasons.

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Joining the Dots: the Evolutionary Picture of Language and Music

Alison Wray

As an ex-professional musician, I read with particular interest Mithen's evolutionary account for the similarities and differences between language and music. He generously acknowledges the role that my proposals about how language evolved have played in the development of his own theory, but the scope of his endeavour is much, much broader than mine, and draws into the frame many observations and lines of evidence that I had not even considered in the context of evolution.

The evolutionary relationship between language and music is a worthy focus of attention, particularly within a framework of asking what, exactly, music

is *for*, and why it is not more similar in form and function to language. Like language, music serves as an emotional conduit, certainly, and the making of music is a hugely significant social activity. But its semantic potential, which is surely immense, is barely realized. At the periphery, music does carry meaning — TV themes and Leitmotifs can forge very strong associations, while the playing of a national anthem can have a speech-act-like force. Yet rarely, if ever, are arbitrary note sequences or chords paired with specific meanings in the way that phonemes are, and the scope for novelty in music, governed though it is by the grammars of melody and harmony, and able to feature embedding and recursion, does not extend to a hierarchical making of meaning.

There are a number of possible reasons why. Perhaps the harmonic relational properties of music render it incapable of carrying meaning with sufficient latitude: overriding constraints on what sounds belong together might interfere with the capacity to create novel configurations. However, one has to be careful neither to be *post hoc* nor culture-centric here: although harmonic relations are founded on the physics of sound waves, our sense of what sounds 'musical' is at least partially a product of cultural conditioning.

Another possible explanation is that music is not processed in the part(s) of the brain it would need to be, for it to link up with meaning. Research suggests otherwise (e.g. Maess *et al.* 2001), though whether processing locus determines functionality or vice versa is unclear (Wray 2002). Recent discussion about mirror neurons and language evolution (Arbib 2005) suggests that the locus of the neurons that control a function may be of considerable importance for understanding its aetiology. But we may have to wait for clear answers, for new technologies in cognitive neuroscience have raised doubts about how to measure neural activity in the processing of complex functions (Sidtis 2000).

Mithen's own explanation is different again: music does not carry meaning, because language does. And in that case, it is natural to ask what music might have been able to do had language not been there — in Neanderthals, for instance. Mithen's proposal is, I think, largely compatible with what we know about music, language and human evolution. Having said that, we know so little, that many different proposals would be equally compatible. I see little of concern in his belief that a lot can be achieved communicatively with a relatively inflexible system, for we see this in evidence in other animals. The challenge, of course, is that of establishing at what point in the evolution of humankind an inflexible system might have ceased to be sufficient. Mithen believes, as do I, that that point may have come surprisingly late in the story.

If there is any part of Mithen's story that I am not fully convinced by, it is the matter of just where taught musicality departs from something more 'natural'. That music of some description can be a natural vehicle for self-expression is not at issue, but how should we relate such a vehicle to the specific phenomenon that we more generally term 'music' — a product refined and augmented by manufactured cultural practice? As indicated by the evidence upon which he draws, Mithen implicitly depicts western music as a version, albeit formalized, of spontaneous, emotionally infused musical expression, and as a natural extension of the Hmmmm communication that he attributes to our pre-modern ancestors. To my taste, western classical music (as indeed most other musical traditions worldwide) is different in kind. Its production is, for a start, subject to a heavy burden of learning that few master. There is no naturally facilitated access to the comprehension (let alone creation) of the kinds of melodies, harmonies and rhythms found in the works of Bach or Schoenberg: no equivalent — for music of this kind — of first language acquisition. The interpretation of such music is also learned, if one moves beyond mere gut emotional reactions, into the spotting of styles, allusions and 'meanings'. The naive ear will not discern that in *The Magic Flute* the three flats in the home key of E♭ major possibly symbolize 'the threefold initiation rite and the three pillars of the "temple of humanity"' while C minor 'symbolizes an incomplete grasp of masonic ideals' (Hill & Cotte 2005). As a result, I am more in sympathy with Pinker than Mithen is, regarding the view that *this kind* of music is a late add-on that arises from, and must be sustained by, specific cultural impetus. Indeed, George Grace and myself propose that some of the 'fundamental' features of language itself are also secondary and culturally-supported (Wray & Grace in press), so there is no difficulty for us in seeing the same gradation in music.

However, within the Wray & Grace framework, the above objection is not terminal for Mithen's proposed scenario: we resolve the problem of how cultural augmentation relates to natural abilities not by separating them absolutely, but by challenging the assumption that there are any absolutes. No one is raised in a cultureless environment, and quite possibly no single culture ever accesses and maximizes all aspects of an individual's natural ability. In view of this, our model derives the natural-augmented con-

trast from a continuum of complexity supported to a lesser or greater extent by culture. Specifically, there is a conservative 'natural' default that can be modified, under certain kinds of cultural pressure, to create and sustain a secondary level of signal complexity, which will fall away again if the cultural pressure reduces (Wray & Grace in press). Although we offer this model in relation to language, there is no difficulty, I think, in extending it to music.

The key impact of all of this is that I would hesitate to develop an argument about the origins and characteristics of natural musicality on the basis of how people appear to use learned musical skills. These I would rather place on the far end of the cultural augmentation continuum that gives us writing, computer-mediated communication and, in Wray & Grace's proposal, also some features of syntax. Where would the accommodation of this objection leave Mithen's account? In assembling his evidence for how musical ability relates organically and functionally to linguistic ability, he would no longer be able to draw on certain of the neurological cases, such as the retention or loss of piano-playing abilities after brain damage, and the locus of the processing of music in professional musicians. Such studies should be separated from those that reveal the selective loss or retention of musical abilities that are closer to the 'natural' default. Classifying the evidence, however, would probably require more information than many of the original reports provide. In addition, one would need a robust model of just how musical education might affect the processing of music, to parallel the neurolinguist's interest in how literacy affects the processing of language. I know too little about the neurological processing of 'natural' musical skills to be sure, but my guess, on the basis of neurolinguistic evidence, is that there might in fact be stronger evidence of double dissociation between language and the more natural skills of music (sense of rhythm and pitch, the production of sung vocalisations, etc.) than there is for skills developed through prolonged and deliberate study and practice.

If so, it may be that all one needs to do is move the reference line: some of the kinds of music that Mithen sees as primary and central expressions of our evolutionary heritage are simply made secondary and more peripheral. Crucially, the continuum model means that they remain part of our potential, in the same way that 'universal' linguistic relations such as Subjacency, which cannot be observed in unwritten languages (because only written languages regularly provide grammatical configurations sufficiently complex to house them), seem to emerge naturally when the conditions finally pertain (Newmeyer 2002).

In evaluating *The Singing Neanderthals*, one has to consider what the book is aiming to achieve. Mithen's intention is to offer a coherent story, by taking a huge range of independent observations and claims from the literature, and weaving them into a narrative. Every time he makes an inferential leap about what some neurological observation or archaeological discovery might mean, there is opportunity for someone to object. But constructive critics of Mithen's book will not simply lunge iconoclastically at individual points and believe that, by challenging them, they have made a contribution to knowledge. Rather, they will assess the extent to which their observation affects Mithen's bigger picture, and suggest patches where they can, and a plausible alternative of equal scope where they cannot.

This is a bold book that develops just one scenario for what happened. We need narratives of this kind if our studies of human evolution are to get anywhere. Modern research is often piecemeal — investigations focus on some particular question with limited capacity for generalization, and are in danger of never being adequately related back to the bigger picture. Yet, as Popper noted, it is the bigger picture that provides the rationale for the underlying assumptions that infuse our work — for the predictions and hypotheses we make. There need to be big pictures, against which the various accumulated pieces of evidence can be measured, while the evidence, in turn, confirms, challenges or modifies the picture itself. In a research context like the evolution of human cognitive and communicative capacities, picture-builders need to be particularly bold, because there simply is not enough information for their endeavour to be other than a join-the-dots exercise. There is undoubtedly more than one way to make a picture out of the dots, but unless you get on with making one of them, nothing moves on. Steve Mithen is an expert picture-maker. He has the imagination and courage to ask the 'what if?' questions, follow a scenario through to a conclusion, and offer us something to think about and react to.

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Abracadabra! Early Hominin for 'I think my humming's out of tune with the rest of the world!'

Maggie Tallerman

One of the major tenets of this book is that Early Humans communicated — at least as long ago as 1.8 myr — by using a system that Mithen terms 'Hmmmmm', standing for Holistic, manipulative, multi-modal, musical and mimetic. Mithen's big idea is that there was 'a single precursor for both music and language' (p. 26), a communication system rather like a musical score, but comprising holistic vocalizations, hand and body gestures, mimesis, even song and dance. All of these features combine to what other people might call protolanguage, or pre-language.

But Mithen, as a non-linguist, has seized rather too eagerly on a lovely, simple idea: since the vocalizations of other primates are 'holistic' (not decomposable into any component parts, having nothing analogous to words or morphemes) then the earliest language-like hominin utterances must similarly have been holistic. Lovely, but to most linguists, clearly wrong. Mithen gives as an example of the possible content of a single holistic utterance 'Go and hunt the hare I saw five minutes ago behind the stone at the top of the hill' (p. 172).

Let's get this straight: we are talking about an era long before there's any syntax or clauses, nor (in Mithen's view) any words, so all of this hare story is supposedly represented by *one* utterance, perhaps supplemented by gestures or a tune. As Mithen puts it (p. 172) 'Each phrase would have been an indivisible unit that had to be learned, uttered and understood as a single acoustic sequence'. Problem number one: each utterance also has to be stored as a single concept in the hominin's mental lexicon, and retrieved from storage to be uttered. Now, it cannot conceivably be the case that the lexicon at any stage prior to the emergence of fully modern humans was more *complex* than it is today, yet nothing remotely as complex is stored as a single concept in any known languages. Mithen's 'hare' example is the conceptual equivalent of no less than three clauses. But modern speakers have been shown to engage in conceptual planning only at the level of a single clause — a mental proposition. So how could early hominins possibly have had the lexical capacity to store, retrieve and execute a single utterance which corresponds to several clauses' worth of semantic content? And if they could, why has this amazing capacity been lost?

Problem number two: like all linguistic or protolinguistic communication, holistic utterances must be culturally transmitted; in other words, they are unlike ape calls, which are essentially innate. So how did anyone ever learn the highly specific meanings that Mithen attributes to his holistic utterances? The idea that any bunch of hominins (then or now) could even agree on the meanings of a set of these hugely complex utterances, let alone learn them, just doesn't square with what we know about the brain. Mithen argues that Neanderthal children (amongst other hominins) could have acquired 'a large number of holistic phrases' (p. 241), but fails to address the fact that this is a far harder task than learning a set of protowords, where one word equals — and can be stored and retrieved as — a single lexical concept.

Problem number three. Assume with Mithen that words ultimately emerge from longer holistic utterances when chance similarities occur in the phonetic strings, and can be imbued with similar meanings. He gives an example of Alison Wray's: if a phrase *tebima* meant 'give that to her' and a phrase *kumapi* meant 'share this with her', then 'an individual might recognize that *ma* was a common phonetic segment in both phrases, and "her" a common aspect of their meaning' (p. 253). An obvious objection is that this is not at all how the development of pronouns and other *function* words proceeds: it is axiomatic in linguistics that they emerge from *content* words via well understood processes of *grammaticalization* (basically, this means losing lexical content and becoming merely grammatical). This aside, the major drawback with the proposal is that our hominins are supposed to be able to extract the common bit of sound/meaning no matter where the string *ma* occurs in the utterance (and presumably, that might be somewhere in the middle of a much longer string, such as *bupakagulodimaladopubogo* — after all, Mithen does note that 'the holistic phrases [...] of our human ancestors may have been of considerable length, having evolved over millenia and proliferated in number to provide ever greater semantic specificity': p. 254).

Why is the idea of such an ability a problem? Because once again, nothing remotely like it occurs in any known language in linguistically sophisticated *Homo sapiens*. In languages with agglutinating or polysynthetic morphology, each word contains a lexical stem which is preceded and followed by a number of other bound (inseparable, non-independent) morphemes; a single utterance may be very long, corresponding to an entire clause in a language like English. But the order of elements within words is fixed: each morpheme is allocated a position in a *morphemic template*, which

specifies an exact order for each verb or noun stem, and all the other classes of morphemes attached to it. We never find *random* ordering of chunks of meaning: this simply wouldn't be learnable. So Mithen's poor hominins, struggling towards Language, evidently possess superhuman analytical capabilities.

So far, then, we have seen that the nice, straightforward idea of holistic pre-language must be wrong, because at all levels (lexical storage, lexical access, lexical acquisition, speech processing) it requires *linguistic* abilities far beyond those of modern humans. (A number of other detailed arguments in this vein are outlined in Tallerman in press.)

Why, then, do proponents of holistic protolanguage like the idea? A big part of it, for Mithen at least, is because 'a holistic protolanguage of this type is evidently on an evolutionary continuity with ape-like vocalizations' (p. 149). The point is presumably that the more continuity we envisage between pre-hominin vocalizations and early hominin utterances, the less we have to explain about how Language emerged. I had thought that as a polarized debate, this had long gone extinct. Apparently not. Mithen seems to think that opponents of holistic protolanguage are just against the idea of continuity *per se* (p. 149). But this isn't the case. It is rather clear, for instance, that the motor function of speech 'draws on phylogenetically ancient mammalian oral capacities for sucking, licking, swallowing and chewing' (Studdert-Kennedy & Goldstein 2003, 239). From such actions, these authors suggest, comes the hominin protosyllable — and I am pleased to concur. At a basic level, it's obvious that the common ancestor of chimp and human at around 5–6 mya had a vocal tract, tongue and lips and glottis, ears, and much else besides that we've now co-opted for speaking and listening. But *speech* (production, perception, even neural mechanisms supporting) is not *language*, as Mithen himself concedes in a footnote (19, p. 312).

Moreover, there are a number of serious ways in which primate vocalization differs from language. Mithen even lists some of these (a subset of the points mentioned in Tallerman in press); see note 18, p. 312. But then he straightaway dismisses them. Doesn't it matter that different neuroanatomical structures are responsible for language than for primate vocalization; that in the main, primate vocalization is not under voluntary control; that primate calls are made on both the inbreath and the outbreath, whereas language vocalizations are made on the outbreath; that primate calls are essentially genetically transmitted (innate) while the vocalizations of language are learned? Most of all, doesn't it matter that primate calls differ radically from linguistic utterances in that the latter, and only the latter, dissociate sound and meaning? Only in Language do we see the finite set of speech sounds combined and re-combined to make up the infinite set of meanings that humans can conceptualize. This stuff is not trivia, and Language is not just a few easy steps away from the ancestral call system, which is how I think Mithen would like to portray things.

Still on continuity, Mithen actually *underestimates* the communicative importance of 'gesture-calls' (Burling 2005): non-linguistic and paralinguistic gestures and signals such as laughter, sobs, screams, frowns, smiles, snarls, shrugs and many more, all of which share crucial characteristics with the communication systems of other primates. Mithen assumes that Hmmmmm includes these features, and I wholeheartedly agree that they are essential to human communication. Where Mithen and I part company is over the need to postulate an additional layer of vocalized 'holistic utterances', primarily concerned with the manipulation of other individuals. He regards these as crucial for 'the type of subtle and sensitive communication that is required for the development and maintenance of social relationships' (p. 148). But why? We don't need holistic utterances in order to convey our feelings — this is exactly what gesture-calls do. Protolanguage (or, indeed, Language) of any kind barely even enhances — and certainly doesn't usurp — the role of the ancient non-verbal features in maintaining social relationships. Postulating a holistic protolanguage to do the social stuff is then an unnecessary evolutionary digression, and one from which we would have to backtrack to get words. Mithen leads us down a blind alley, and at the end we're no nearer to the origins of language.

In sum, a great bedtime read — but only for those who enjoy fiction.

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'Make your own music and liberate all of these hominids that still reside within you', is Steven Mithen's final exhortation in this richly textured, and engrossing account of why archaeology matters to the study of human evolution. Mithen sets himself a hard task; to provide an evolutionary account of music. Hard, because like most Palaeoanthropologists, archaeologists neither use nor understand evolutionary theory (Foley 2001, 5). Doubly hard, because most archaeological discussions revolve around a very few ancient musical instruments: I once examined a PhD that had amassed the entire corpus of less than a hundred pieces, most of them from one site, Isturitz. And trebly hard, because to venture into music is to question the hegemony of language as *the* human attribute to explain.

Mithen succeeds brilliantly on all three counts and I recommend you read the book to see exactly how. But as you might expect in such a wide-ranging and bold account there are some loose ends and unexplored areas that I want to pursue.

Let me start with the sub-title: *the origins of music, language, mind and body*. There is plenty in the book that deals with the first three but very little that addresses the body. Bodies, in Mithen's account, are physical containers that had to undergo evolution so that through bipedalism, that involved both walking and running, they developed the necessary apparatus and motor skills to produce sound. These same bodies are also vehicles that move the singer/speaker around the landscape, bringing them together to enjoy the rich emotions of communal living, those endorphin rushes that flow from healthy exercise and singing in unison. *The Singing Neanderthals* is therefore a brain: body book, a Cartesian statement about adaptation, so that what's good for the mind is good for the species. Some of this stems from the homunculus model of the modular mind that Mithen (1996a,b) favours and which over time, and through the process of cognitive fluidity, bootstrapped the various cognitive domains together. The homunculus is the bootstrapper writing those programmes to produce desired effects, the master builder who transformed the parish church into a Minster. Damasio (2000) sums up the effect as *extended consciousness* that distinguishes us from our primate cousins. Extended consciousness, like cognitive fluidity, produces 'the capacity to be aware of a large compass of entities and events, i.e. the ability to generate a sense of individual perspective, ownership and agency, over a larger compass of knowledge than that surveyed in core consciousness' (Damasio 2000, 198).

The Singing Neanderthals is therefore not a book for the phenomenologist. This is a pity because it teeters so often on the brink of treating the body properly rather than as a set of legs to move the brain around the environment. Mithen writes convincingly of the need to include emotions into our accounts of human evolution and encourages us all to see hominins whistling while they worked. Music enriches the experience of interaction, especially between mother and child and the passages on the significance of lullabies are especially good. Music is therefore, he argues, ancestral to language and not some later Pinker-ish exaptation of 'auditory cheesecake'.

However, we bond through music because of its embodied structure rather than its cognitive sense. We experience the world through our bodies and construct metaphorical concepts grounded on such experience. The shift from trying to construct artificial intelligence (AI) in robots, using cartesian models, to situating artificial life (AL) as an embodied activity that inhabits the world rather than simply adapting to it (Anderson 2003), provides a useful parallel that studies of human evolution might take to heart.

I would go further and say that before language or music there were objects and these were also used, as children do long before they can speak (Bloom 2004; Hespos & Spelke 2004), to construct embodied, metaphorical concepts about the world. In this respect I agree with Donald's (1998, 61) identification of mimesis, an implementable action metaphor, rather than language, as the key cognitive skill of hominins. Moreover, mimetic styles of thought and communication that 'model the whole body, including all its voluntary action-systems, in three dimensional space' (Donald 1998, 49) were the platform for music and language in whatever order they appeared. However, rather surprisingly, mimesis comes later in Mithen's chronology. He neatly sums up early hominin communication by the acronym Hmmmm (Holistic, multimodal, manipulative and musical). That further, all important fifth m, mimetic, is only added he believes with the Neanderthals. This seems to me to ignore the ancestry of artefacts and action metaphors and succumbs once again to the domination of language as the thing to explain during human evolution.

Which brings me to the performative question and how artefacts, that include bodies, interact. Mithen is quiet on the issue of performance, only talking of gestures and rhythms when they reinforce the rational task of adaptation. But performance is the thing, as Goffman (1959; 1967) argued with his notion

of the territories of the self, and where in face-to-face interaction a *front* is maintained and a *line* acted out. The dramaturgical metaphor is inescapable once music is considered because, as Lévi-Strauss famously said, music is 'at once intelligible and untranslatable' (Leach 1970, 115). A discussion of the evolutionary importance of music should be the forum where an embodied account of adaptation is emphasized. The question as AL has discovered is not how to get robots to think about the world but instead how do they perform who they are? As Mithen points out, music is seldom, if ever, heard or performed without accompanying movements that are integral to our enchainment in an extended consciousness.

The same applies to objects once we have challenged the hegemony of language as the only source of meaning. But we cannot divorce these acts from the performances that initiated them, for example the rhythmic chipping of stone (and its accompanying staccato sounds) or singing baby to sleep. Without performance, musicology is like museology; studying sounds and objects in isolation separated by the closed eyes and the glass case. The alternative is to return to those metaphorical connections that music and material culture make (Tilley 1999) and where, as Nick Cook reminds us, we run out of words just when we have something to say about them. The way back is through the body and the relational rather than simply rational view of our many-faceted hominin worlds. It is these relationships that a consideration of music liberates rather than a melody of hominins from within our heads.

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Reply

I am grateful to Clive, Maggie, Iain and Alison for their comments on *The Singing Neanderthals*. When reading their views, I realized that I am nothing if not an academic masochist by voluntarily subjecting my work to such critical evaluation. Various weaknesses and errors have been claimed in the work, some of which I agree with and some of which I will contest.

Iain takes me to task for not having defined music, while contradictorily and erroneously claiming that I adopted Nettl's definition. All I mean by music is human produced sound that has a rhythmic and/or melodic content — a minimalist definition that clearly encompasses many sounds which are not conventionally recognized as music in our own culture, such as spoken language, while also excluding some accepted pieces of music, such as John Cage's 4' 33". I am happy to accept the latter and its like as music, if that is what the composer wishes, just as I am prepared to accept Tracey Emin's unmade bed as art. In contrast to Iain, I don't find Cross's conception of music useful because its meaning is obscure to me. I also get rather tired of terminological debates about the definition of music, language or symbolism, as we all know that such definitions are culturally specific. So I am happy to leave such debates to Iain and others while I get on with more productive research.

The distinction I should have made explicit was between a 'natural biologically based musicality' and music as a culturally constructed phenomenon which builds upon that biological basis. So the musical 'm' in Hmmmmm ought to stand for the former — which had seemed quite obvious to me already — while the latter developed after Hmmmmm had bifurcated into music and language. Although I appreciate that the following have a culturally learnt component, I would describe bird song, whale song, primate vocalizations and baby babble as possessing musicality rather than being music.

This is the distinction that Alison emphasizes: natural musicality as a vehicle of self expression in contrast to the phenomenon that we more generally term 'music' which is refined and augmented by manufactured cultural practice. I had tried to draw this distinction in my final chapter when I considered the development of musical technology, expertise and elitism, but perhaps should have made the distinction more explicit far earlier on within the book, as I now appreciate it is of greater significance than I had previously considered. I concur with Alison that the brains of expert musicians, those who have invested much of their childhood and adult lives to practising instruments, may tell us little about the neurological basis of the 'natural default' — and I did indeed make precisely that point (p. 34). Unfortunately there are simply insufficient neurological studies available at present to make the separate studies of 'natural' and 'culturally enhanced' musical abilities that is evidently desirable. I did my best with the evidence I had available. Fortunately, the neuroscience of music is developing apace: within a few years we should

have far more sophisticated understanding of music and the brain.

Iain also berates me for not including a range of additional evidence and citations that would have further strengthened my arguments. There is always more than can be included in an academic study, especially one that draws on data and ideas from numerous disciplines. But I felt the book was long enough already and the works he mentions are of less significance than the ones I included.

I was deeply disappointed with Maggie Tallerman's comment. Not because of its predictable content, but because it illustrated how she, in common with too many linguists, struggle to think in evolutionary terms. Being familiar with some aspects of her work, I knew that Maggie would disagree with the notion of holistic proto-language as elaborated in *The Singing Neanderthals*. I suggested her as a commentator to the editor of *CAJ* because I assumed she would engage in a constructive fashion with the arguments. Alas, I was wrong: her criticisms are of little significance and she descends into rudeness when calling my work fiction. It is indeed that last statement — that my book is suitable only for those who enjoy fiction — which exposes her shameful refusal to engage with the fossil and archaeological evidence for human evolution. And when she claims that my hominins were 'struggling towards language' it is clear that she fundamentally misunderstands the nature of evolution and the arguments in my book: there is no teleology in my theory. Maggie seems to believe that because primate vocalizations and human language are different, then there cannot be any evolutionary relationship. I sense here a lingering desire not only to keep humans up on their creationist pedestal, unsullied by any evolutionary continuity with other animals, but linguists on their self-anointed academic pedestal — sadly isolating themselves from the inter-disciplinary studies and hindering the development of knowledge.

I find Maggie's criticisms of limited significance: while they may require a refinement of my ideas regarding holistic proto-language they do not seem to challenge it in any significant manner. All she seems to be saying is that modern language today is different from Hmmmmm. Well, yes, of course. I fully agree that there are issues to address regarding the potential semantic complexity of Hmmmmm utterances, the means by which these could have been acquired by children and the evolutionary process of segmentation. My book argued that the musicality of Hmmmmm played a key role in each of these processes, and the role of such musicality was entirely ignored by Maggie in her comments (indeed she ignored almost all the book). She seems to want to do no more than impose a watered-down version of modern-day language onto our human ancestors rather than recognizing that the complexity of their behaviour and cultural accomplishments demands something quite different.

The key issue is when did the transition from a holistic ancestral call system/proto-language to a composition language occur — or as Alison phrases this in her comment, when did an inflexible system of communication cease to be sufficient? Maggie appears to agree that the ancestral call system was holistic and seems to believe that this transition to a flexible compositional language occurred at an early stage, presumably with the emergence of the *Homo* genus (as with most evolutionary linguists there is no hint at any time-frame in her views). This is the standard argument about the evolution of language that has been proposed for more than a decade and led us nowhere. It is simply incompatible with the evidence from the archaeological and fossil record: *The Singing Neanderthals* argued that the transition was a late event and by so doing was able to explain the character of early human behaviour that had hitherto remained incongruous with theories of language evolution. Here I disagree with Alison when she claims that we know so little about the past that many different proposals would be compatible with the evidence. My view, inevitably, is that *The Singing Neanderthals* proposes the only scenario we have at present which is compatible with not only the archaeological and fossil evidence, but also that which we know about the brain, child development and the impact of music on our emotions. I would like to read some others.

Clive says that to 'venture into music is to question the hegemony of language as the human attribute to explain'. I sincerely hope he is correct, and I certainly began writing *The Singing Neanderthals* without any intention of addressing the evolution of language. I am unsure whether the fact that I was drawn to write about language as well as music is an indication that Clive is ultimately wrong — language is indeed the key human attribute to explain — or whether I simply lost my way. Neither did I begin the book with an intention to address the body, but the process of researching and writing took me on an intellectual journey that left me — according to Clive — 'teetering so often on the brink of treating the body properly rather than just as a set of legs to move the brain around the environment'. Well, I had hoped to have gone a little further than this as I believe, and had hoped to explain, that the body is far more than this. I am, however, still learning and finding Clive's recent

writings about the body and artefacts very stimulating. Similarly with regard to performance: having written and reflected on *The Singing Neanderthals* I now fully agree that 'performance is the thing' — but I did not have that view prior to completing the work.

As Alison notes, *The Singing Neanderthals* is a bold book, one that seeks to provide a 'big picture' for human evolution by integrating research from many diverse fields of study, extending way beyond my own expertise. From day to day, review to review, I alternate between thinking I was brave and stupid to attempt to write such a book. The reviews from Clive, Maggie, Iain and Alison have taught me a great deal, as indeed have the reviews that have appeared elsewhere and the responses to the talks I have given. None of these have led me to question the veracity of the key ideas in the book, but I would certainly write it now with a different emphasis and understanding. Or rather I now feel prepared to undertake new strands of research into the origin of music and the musicality of our human ancestors and relatives, building on the foundation I hope to have provided in *The Singing Neanderthals*. By doing so, I submit myself to nothing but years of academic frustration: the Neanderthals and their cousins have all left the stage, letting a few of their props drop to the floor. Like their bones, these will forever remain silent — not even a murmur or a twitch about how our ancestors may once have sang and danced long before they had words to speak.

References

Addis, L., 1999. *Of Mind and Music*. Ithaca (NY): Cornell University Press.

Anderson, M.L., 2003. Embodied cognition: a field guide. *Artificial Intelligence* 149, 91–130.

Arbib, M., 2005. From monkey-like action recognition to human language: an evolutionary framework for neurolinguistics. *Behavioral and Brain Sciences* 28, 105–67.

Arensberg, P., L.A. Schepartz, A.M. Tillier, B. van der Meersch & Y. Rak, 1990. A reappraisal of the anatomical basis for speech in middle Palaeolithic hominids. *American Journal of Physical Anthropology* 83, 137–46.

Blacking, J., 1973. *How Musical is Man?* Seattle (WA): University of Washington Press.

Bloom, P., 2004. Children think before they speak. *Nature* 430, 410–11.

Budil, I., 1994. A functional reconstruction of the supralaryngeal vocal tract of the fossil hominid from Petralona, in *Studies in Language Origins,* vol. 3, eds. J. Wind, A. Jonker, R. Allot & L. Rolfe. Amsterdam: Benjamins, 1–19.

Burling, R., 2005. *The Talking Ape: How Language Evolved*. Oxford: Oxford University Press.

Clynes, M., 1977. *Sentics: the Touch of Emotions*. New York (NY): Souvenir Press.

Cross, I., 2003. Music and biocultural evolution, in *The Cultural Study of Music: a Critical Introduction*, eds. M. Clayton, T. Herbert & R. Middleton. London: Routledge, 19–30.

Damasio, A., 2000. *The Feeling of What Happens: Body, Emotion and the Making of Consciousness*. London: Vintage.

Davies, S., 2001. Philosophical perspectives on music's expressiveness, in *Music and Emotion: Theory and Research*, eds. P. N. Juslin & J. A. Sloboda. Oxford: Oxford University Press, 23–44.

DeGusta, D., W.H. Gilbert & S.P. Turner, 1999. Hypoglossal canal size and hominid speech. *Proceedings of the National Academy of Sciences of the USA* 96, 1800–1804.

Donald, M., 1998. Mimesis and the executive suite: missing links in language evolution, in *Approaches to the Evolution of Language: Social and Cognitive Bases*, eds. J.R. Hurford, M. Studdert-Kennedy & C. Knight. Cambridge: Cambridge University Press, 44–67.

Fitch, W.T., 2000. The evolution of speech: a comparative review. *Trends in Cognitive Science* 4, 258–67.

Foley, R.A., 2001. In the shadow of the modern synthesis? Alternative perspectives on the last fifty years of palaeoanthropology. *Evolutionary Anthropology* 10, 5–15.

Frayer, D.W. & C. Nicolay, 2000. Fossil evidence for the origin of speech sounds, in *The Origins of Music*, eds. N.L. Wallin, B. Merker & S. Brown. London: MIT Press, 217–34.

Gabrielsson, A. & P.N. Juslin, 1996. Emotional expression in music performance: between the performer's intention and the listener's experience. *Psychology of Music* 24, 68–91.

Goffman, E., 1959. *The Presentation of Self in Everyday Life*. Garden City (NY): Anchor Books.

Goffman, E., 1967. *Interaction Ritual: Essays on Face to Face Behaviour*. London: Allen Lane.

Hespos, S.J. & E.S. Spelke, 2004. Conceptual precursors to language. *Nature* 430, 453–6.

Hill, C. & R. Cotte, 2005. 'Mozart's Masonic Music', in *Grove Music Online,* ed. L. Macy. http://www.grovemusic.com (Accessed 27.10.05).

Johnston, T.F., 1989. Song categories and musical style of the Yupik Eskimo. *Anthropos* 84, 423–31.

Kay, R.F., M. Cartmill & M. Balow, 1998. The hyperglossal canal and the origin of human vocal behaviour. *Proceedings of the National Academy of Science of the USA* 95, 5417–19.

Kivy, P., 1989. *Sound Sentiment*. Philadelphia (PA): Temple University Press.

Laitman, J.T., 1984. The anatomy of human speech. *Natural History* (Aug.), 20–27.

Laitman, J.T. & R.C. Heimbuch, 1982. The basicranium of Plio-Pleistocene hominids as an indicator of their upper respiratory systems. *American Journal of Physical Anthropology* 59, 323–44.

Laitman, J.T. & J.S. Reidenberg, 1988. Advances in understanding the relationship between the skull base and larynx with comments on the origins of speech. *Human Evolution* 3, 99–109.

Lavy, M.M., 2001. *Emotion and the Experience of Listening to*

Music: a Framework for Empirical Research, PhD thesis, University of Cambridge. Available online at http://www.scribblin.gs/miscellanea/thesis.html.

Leach, E.R., 1970. *Lévi-Strauss*. London: Fontana.

Locke, D., 1996. Africa: Ewe, Mande, Dagbamba, Shona and BaAka, in *Worlds of Music: an Introduction to the Music of the World's People*, ed. J.T. Titon. 3rd edition. New York (NY): Schirmer, 71–143.

MacLarnon, A.M. & G.P. Hewitt, 1999. The evolution of human speech: the role of enhanced breathing control. *American Journal of Physical Anthropology* 109, 341–63.

Maess, B., S. Koelsch, T.C. Gunter & A.D. Friederici, 2001. Musical syntax is processed in Broca's area: an MEG study. *Nature Neuroscience* 4 (5), 540–45.

Magriples, U. & J.T. Laitman, 1987. Developmental change in the position of the fetal human larynx. *American Journal of Physical Anthropology* 72, 463–72.

McAllester, D.P., 1996. North America/Native America, in *Worlds of Music: An Introduction to the Music of the World's People* (3rd edition), ed. J.T. Titon. New York (NY): Schirmer.

Mithen, S., 1996a. The early prehistory of human social behaviour: issues of archaeological inference and cognitive evolution, in *Evolution of Social Behaviour Patterns in Primates and Man*, eds. W.G. Runciman, J. Maynard-Smith & R.I.M. Dunbar. Oxford: Oxford University Press, 145–77.

Mithen, S., 1996b. *The Prehistory of the Mind*. London: Thames and Hudson.

Morley, I., 2002. Evolution of the physiological and neurological capacities for music. *Cambridge Archaeological Journal* 12(2), 195–216.

Morley, I., 2003. *The Evolutionary Origins and Archaeology of Music: an Investigation into the Prehistory of Human Musical Capacities and Behaviours.* PhD thesis, University of Cambridge. http://www.dar.cam.ac.uk/dcrr.

Nettl, B., 1983. *The Study of Ethnomusicology: Twenty-nine Issues and Concepts*. Urbana (IL): University of Illinois Press.

Nettl, B., 1992. North American Indian music, in *Excursions in World Music*, eds. B. Nettl, C. Capwell, P. Bohlman, I. Wong & T. Turino. Englewood Cliffs (NJ): Prentice Hall, 260–77.

Newmeyer, F.J., 2002. Uniformitarian assumptions and language evolution research, in *The Transition to Language,* ed. A. Wray. Oxford: Oxford University Press, 359–75.

Panksepp, J., 1995. The emotional sources of 'chills' induced by music. *Music Perception* 13, 171–208.

Panksepp, J. & G. Bernatsky, 2002. Emotional sounds and the brain: the neuro-affective foundations of musical appreciation. *Behavioural Processes* 60, 133–55.

Ross, C.F. & M.J. Ravosa, 1993. Basicranial flexion, relative brain size, and facial kyphosis in nonhuman primates. *American Journal of Physical Anthropology* 91, 305–24.

Sidtis, J.J., 2000. From chronograph to functional image: what's next? *Brain and Cognition* 42, 75–7.

Studdert-Kennedy, M. & L. Goldstein, 2003. Launching language: the gestural origin of discrete infinity, in *Language Evolution: the States of the Art*, eds. M.H. Christiansen & S. Kirby. Oxford: Oxford University Press, 235–54.

Tallerman, M., in press. Did our ancestors speak a holistic protolanguage? *Lingua*.

Tilley, C., 1999. *Metaphor and Material Culture*. Oxford: Blackwell.

Turino, T., 1992. The music of Sub-Saharan Africa, in *Excursions in World Music*, eds. B. Nettl, C. Capwell, P. Bohlman, I. Wong & T. Turino. Englewood Cliffs (NJ): Prentice Hall, 165–95.

Wallin, N.L., B. Merker & S. Brown, 2000. *The Origins of Music*. London: MIT Press.

Wray, A., 2002. *Formulaic Language and the Lexicon*. Cambridge: Cambridge University Press.

Wray, A. & G.W. Grace, in press. The consequences of talking to strangers: evolutionary corollaries of socio-cultural influences on linguistic form. *Lingua*.