Routledge
Taylor & Francis Group

Journal of the Royal Musical Association

ISSN: 0269-0403 (Print) 1471-6933 (Online) Journal homepage: http://www.tandfonline.com/loi/rrma20

Music in the Deep History of Human Evolution

Shane McMahon

To cite this article: Shane McMahon (2018) Music in the Deep History of Human Evolution, Journal of the Royal Musical Association, 143:1, 233-242, DOI: 10.1080/02690403.2018.1434355

To link to this article: https://doi.org/10.1080/02690403.2018.1434355

Journal of the Royal Musical Association, 2018
Vol. 143, No. 1, 233–242, https://doi.org/10.1080/02690403.2018.1434355

Routledge
Taylor & Francis Group

Review Articles

Music in the Deep History of Human Evolution

SHANE McMAHON

Gary Tomlinson, *A Million Years of Music: The Emergence of Human Modernity*. New York: Zone Books, 2015. 362 pp. ISBN 978 19 35 40865 9.

Why did a tradition of learned instrumental polyphony emerge in Europe and not, for example, in Mesoamerica? Similarly, why has the music of Bach earned a status unrivalled within the context of global musical cultures while, for example, Aboriginal and other indigenous musical traditions worldwide face the possibility of extinction?[1]

Kindred questions were central to academic musical thought around the turn of the twentieth century, yet the kinds of answers proffered, emerging from the evolutionary-historicist framework of the time and advancing a social Darwinist perspective, are not ones which we might countenance today.[2] Such thinking was simple enough in its reasoning: European music, of which that of Bach is exemplary, evolved to ever more complex and sophisticated levels, while the music of native populations evolved little, if at all – a fact attributable perhaps to a stubborn or congenital primitivism on the part of the latter. While no musicologist would today profess such an opinion publicly, the problem of how to address such questions remains, and indeed it must be assumed that the perspectives of a century ago still operate in the background, akin to regulative 'ghost theories'. Indeed, it is unlikely that they do not so operate, given the tacit basis of musicology in evolutionary historicism.[3]

Such questions are at the core of Jared Diamond's popular and influential 1997 book *Guns, Germs and Steel*, the central preoccupation of which can be framed in the form of a question analogous to the ones I have posed above: why, for example, did Europeans sail the Atlantic and discover the Americas and not the other way round? 'Why did human development proceed at such different rates on different continents?' Diamond asks.[4]

Email: mcmahon.ks@gmail.com

[1] On the issue of musical extinction, see Allan Marett, 'Vanishing Songs: How Musical Extinctions Threaten the Planet', *Ethnomusicology Forum*, 19 (2009), 249–62, and Catherine Grant, *Music Endangerment: How Language Maintenance Can Help* (New York: Oxford University Press, 2014).

[2] See Alexander Rehding, 'The Quest for the Origins of Music in Germany circa 1900', *Journal of the American Musicological Society*, 53 (2000), 345–85.

[3] On the notion of 'ghost theories', see Daniel Lord Smail, *On Deep History and the Brain* (Berkeley, CA: University of California Press, 2008), 3 and 42.

[4] Jared Diamond, *Guns, Germs and Steel: The Fates of Human Societies* (New York: W. W. Norton, 1997); repr. as *Guns, Germs and Steel: A Short History of Everybody for the Last 13,000 Years* (London: Vintage, 2005), 16.

> It *seems* logical to suppose that history's pattern reflects innate differences among people themselves. Of course, we're taught that it's not polite to say so in public […]. We're assured that the seemingly transparent biological explanation for the world's inequalities as of A.D. 1500 is wrong, but we're not told what the correct explanation is.[5]

In *A Million Years of Music: The Emergence of Human Modernity*, Gary Tomlinson does not engage such topics directly, but the implications of his astonishing foray into the deep history of the emergence of sapient music-making, or 'musicking', are far-reaching and potentially transformative. To be clear, this is not a book about either the origin or the 'evolution' of music, though it punctures many assumptions surrounding these issues. It is, rather, a study of the emergence of human cognitive modernity, or the incremental attainment over millennia of those interrelated capacities which distinguish modern humans: musicking, language, symbolic thought and 'thinking-at-a-distance'. In its focus on the emergence of the capacity for musicking in the context of human biological and cognitive evolution, Tomlinson's work may initially appear remote from the everyday concerns of the musicologist. In fact, written in dialogue with evolutionary biology, cognitive science, palaeoarchaeology and palaeoanthropology, the book is hardly a work of musicology at all, and many of its central claims will demand careful consideration from a wide and diverse academic community. Nevertheless, *A Million Years of Music* may be the most important contribution to musicology in its short history: in his historical purview and methodological blend of hard science and historiography, Tomlinson sketches a map of the future terrain that every musicologist will one day be obliged to explore.

Deep history and the long chronology

A Million Years of Music is perhaps best considered in the context of a new mode of historiography which has emerged since around the turn of the present century. The most immediately striking feature of these new histories is the vertiginous historical depth they assume in the form of the 'long chronology', in some cases developing timelines so extensive as to encompass periods long before the emergence of anatomically modern humans.[6] The gathering momentum of deep historical research over the past decade perhaps signals a felt need among historians to reassess their basic terms of historiographical engagement, and

[5] Diamond, *Guns, Germs and Steel*, 25.

[6] In addition to Smail, *On Deep History and the Brain*, and Andrew Shryock and Daniel Lord Smail, *Deep History: The Architecture of Past and Present* (Berkeley, CA, and London: University of California Press, 2011), which elaborate upon the idea of deep history and associated methodological issues, some of the most striking examples, closely related to Tomlinson's work in their interdisciplinary methodology and chronological scope, are those of David Christian, *Maps of Time: An Introduction to Big History* (Berkeley, CA, and London: University of California Press, 2004); Robert N. Bellah, *Religion in Human Evolution: From the Paleolithic to the Axial Age* (Cambridge, MA, and London: Harvard University Press, 2011); E. J. Michael Witzel, *The Origins of the World's Mythologies* (New York and Oxford: Oxford University Press, 2012); and Clive Gamble, *Settling the Earth: The Archaeology of Deep Human History* (Cambridge and New York: Cambridge University Press, 2013).

this need for reassessment also presses upon musicology as it emerges from the postmodern conjuncture.

Historical musicology arguably has one of the shortest historical chronologies on record. The origin of Western music is essentially coterminous with the invention of notation and the spread of literacy after the ninth century. Although antiquity is briefly surveyed in any standard rendition of music history, music proper is assumed to begin in the second millennium: all the rest is 'prehistory', musically speaking, a long prelude to the birth of musical civilization. Even then the bulk of Western musical history is confined to *c.*1650 and after, with an increasing weight of importance given to the recent past.[7] Such a short chronology, together with the foundational tenet that the emergence of notation and literacy marks the boundary between musical history and prehistory, imposes severe restrictions on the nature of intellectual engagement with music as a human practice, and the deep historical perspective Tomlinson assumes has several important consequences for our reassessment of those basic terms of engagement.

One of the cumulative effects of *A Million Years of Music* is its erosion of claims or assumptions regarding the emergence of the human capacity for musicking which are implicitly grounded in teleology or in schemes of smooth progressivism. There was, in other words, no ultimate purpose to these incremental cognitive and behavioural attainments which coalesced in the human capacity for music-making, no historical destiny being played out, and no triumphal emergence of the modern from the savage. Likewise, Tomlinson also disavows any claims of a revolutionary break, of a sudden rupture somewhere over the course of human evolution which served to produce the great 'before' of prehistory and the 'after' of modernity; there is no watershed moment which secures the border between the primitive and the complex, or between nature and history.[8] Indeed, the very idea of prehistory, which itself has been significantly undermined in recent historiographical work, barely figures in Tomlinson's scheme.[9] 'If we look back 20,000 years,' he writes,

> we reach the lives of humans whose musical capacities were probably little different from our own. As we look farther back we reach horizons where this similarity can no longer hold – perhaps 40,000 years ago, perhaps 70,000, perhaps 100,000. But we never cross a line before which all the cognitive capacities recruited in modern musicking abruptly disappear. Unless we embrace the incredible notion that music sprang forth in full-blown glory, its emergence will have to be tracked in gradualist terms across a long period. (p. 24)

[7] In addition to implicit progressivism, contemporary musical historiography also strongly illustrates what Daniel Lord Smail refers to as the telescoping of history. See Smail, 'History and the Telescoping of Time: A Disciplinary Forum', *French Historical Studies*, 34 (2011), 1–6. Tomlinson has elsewhere referred to this historiographical phenomenon as 'Presentism'. See his 'Monumental Musicology', *Journal of the Royal Musical Association*, 132 (2007), 349–74 (pp. 361–2).

[8] The undermining of the historiographical plot-devices of revolution and rupture has gained significant ground over the past two decades. Influential here is the essay by Sally McBrearty and Alison S. Brooks, 'The Revolution that Wasn't: A New Interpretation of the Origin of Modern Human Behaviour', *Journal of Human Evolution*, 39 (2000), 453–563.

[9] See Andrew Shryock and Daniel Lord Smail, 'History and the "Pre"', *American Historical Review*, 118 (2013), 709–37.

Of course, both narrative strategies – the smooth progressivism of teleology and the revolutionary rupture – are standard to older models of historical writing, and both ultimately derive from sacred history. The revolutionary rupture or break, so fundamental to musical historiography, is a secular elaboration of the biblical deluge – the singular event which demarcates the boundary between history and prehistory, and consequently between those with history and those without.[10] Again, in musicological terms, this is coextensive with the emergence of notation: in the twentieth-century musicological imagination, it is writing which separates music that is properly historical from music that is not.

Tomlinson thus excludes much of what we assume to be normative for any discussion of music on a large scale, including its origin and purpose, specific musical traditions and the development of notation. What remains then is a carefully weighed, step-by-step tracing of the gradual, incremental and indeed haphazard emergence of the human capacity for musicking, embedded in a broader account of the emergence of human modernity. From the perspective of deep history, the latter connotes cognitive and behavioural modernity, and indeed in Tomlinson's narrative the spectre of discontinuity and extinction occasionally looms over those attainments as modern humans disperse and migrate across the globe, encountering new environmental affordances and constraints.

Nineteenth-century ghosts

Reading between the lines of this otherwise serenely written study, one senses an abiding impatience with historical and contemporary speculation on the origin and evolution of music, and with related speculation as to why music exists. These issues centre on the relationship between music and language, on the one hand, and the proposed adaptive functions of music, on the other. The intellectual legacy of Charles Darwin is central to both, and Darwin's thought on musical issues in turn owes much to earlier Romantic conjecture.[11] Indeed, as Tomlinson reviews the literature, such as it is, on music and human evolution, it is sobering to realize both how little and how gauchely these issues have been addressed. Darwin's speculations and his frequent recourse to musical terminology, as for example in his discussion of the 'true musical cadences' he detected in the 'singing' of gibbons, are easily yet magnanimously dismissed by Tomlinson.[12] On the other hand, two more-recent studies by Steven Brown and Steven Mithen receive special censure.[13] For Tomlinson, the former's 'musilanguage' hypothesis and

[10] On how modern historiography is informed by the plots and narrative devices of sacred history, see Smail, *On Deep History*, 12–39. See also Eviatar Zerubaval, *Time Maps: Collective Memory and the Social Shape of the Past* (Chicago, IL, and London: University of Chicago Press, 2003), 11–36.

[11] Tomlinson has previously broached some of these issues in 'Vico's Songs: Detours at the Origins of (Ethno)musicology', *Musical Quarterly*, 83 (1999), 344–77.

[12] From Darwin to Robin Dunbar, non-specialist commentary on music in human evolution has often been marred by an imprecision of language which, as Tomlinson notes, such eminent figures would not have not tolerated in their own specialized areas (p. 114).

[13] Steven Brown, 'The "Musilanguage" Model of Music Evolution', *The Origins of Music*, ed. Nils L. Wallin, Björn Merker and Steven Brown (Cambridge, MA: MIT Press, 2000), 271–300, and Steven Mithen, *The Singing Neanderthals: The Origin of Music, Language, Mind and Body* (London: Weidenfeld & Nicolson, 2005).

the latter's speculations on musical protolanguage both in different ways propose scenarios which neither cognitive science nor the archaeological and fossil record can sustain, and thereby fall into the trap of 'taking precise, complex musical capacities as first principles' (p. 116). Tomlinson's ability to take authoritative command of these issues is based on his formidable knowledge of current research in fields as diverse as evolutionary biology, cognitive science, palaeoanthropology and palaeoarchaeology, a knowledge lightly worn but impressively brought to bear in particular upon the vexed question of the purpose of music in the context of hominin evolution. The behaviours out of which some claim that music must have evolved, or provided an 'adaptive function', include the contexts of courtship and sexual selection, social bonding and the consolidation of group identities, and infant rearing. These are certainly contexts in which music operates, but none of them alone could possibly provide the context or the ultimate explanation for the emergence of musicking.[14] The issue for Tomlinson here is the 'futility of monocausal modelling of complex histories' (p. 268) which such adaptationist models betray. The coalescence of initially separate behaviours and capacities into modern musicking is not well described, he writes, 'by tracing linear causal pathways from before to after, simple to complex' (p. 24). Indeed, Tomlinson notes that 'evolutionary biologists deride such globally imprecise and teleological accounts as "just-so stories" – in this case, How the Human Got its Music' (pp. 33–4).

The principal issue underlying Tomlinson's critique both of adaptationist models and of hypotheses of musical origin and function such as those of Brown and Mithen is that the various individual cognitive capacities which underpin musicking are 'not domain-specific to it' (p. 31). This insight negates the validity of a search for an ultimate origin or an ultimate cause for music. Tomlinson instead separates the distinct capacities of entrainment, discrete pitch perception and hierarchical ordering fundamental to modern musicking – separate functions which did not emerge in tandem – and models their emergence in the hominin line. This necessitates a narrative beginning around a million years ago and some 800,000 years before the emergence of anatomically modern humans. As a result, it shows that the various capacities arrayed in modern musicking have very long developmental histories encompassing several hominin species. Tomlinson elaborates this complex, non-linear history through the broader framework of the interdependent evolution of biology and culture, or biocultural co-evolution. This ('post-Neo-Darwinian') insistence on the centrality of culture to evolutionary processes yields important perspectives for historical thinking, particularly around the kinds of issues raised at the outset of this review, which we will return to below.

Acheulean echoes

Tomlinson's model for the emergence of entrainment, and the specifically human capacity for rhythmic perception and coordinated rhythmic activity, requires us to abandon an understanding

[14] For recent examples illustrating the kind of deeply entrenched adaptationist view Tomlinson seeks to overturn (in this case, music as a mechanism of social bonding), see Robin Dunbar, 'On the Evolutionary Function of Song and Dance', *Music, Language, and Evolution*, ed. Nicholas Bannan (Oxford: Oxford University Press, 2012), 201–14, and the same author's *Human Evolution* (London: Pelican, 2014), 207–14.

of early hominin activities as the product of agency (Chapter 2). In the prelinguistic Acheulean landscape of around a million years ago, the significantly smaller brain size of early hominins such as *Homo ergaster* and *Homo erectus* make it a near certainty that it could not have been otherwise. At the same time, the biface stone tools from this period recovered by archaeologists testify to a capacity to learn and transmit information, otherwise the presence of such tools cannot be accounted for. From this apparent paradox, Tomlinson builds a 'bottom-up' model of the generation of behavioural complexity, one in which intentionality emerges from 'habituated biomechanical actions' (p. 67) and in which technologies emerge not from a preconceived mental template but 'from bodies and materials up' (p. 62).[15] The initial layers perhaps of a uniquely hominin cultural archive can be traced here, to the feedback loops created between early hominins and their environments and to the weakly synchronized and coordinated mimetic activities taking place among them, to which the Acheulean bifaces testify. Tomlinson's model of growing rhythmic perception and metric entrainment initially has nothing to do with music: 'Beat-based musical processing' is for Tomlinson 'the tip of a cognitive iceberg'. Metric entrainment is 'a relatively modern, specific exploitation of general capacities with a long history in the hominin line' (p. 81), and the emergence of that capacity cannot be separated out from more general questions of how early hominin species began to produce or enact patterned, sequenced and voluntary behaviours.

These questions elide with Tomlinson's later exploration (Chapter 4) of the gradual emergence of sequenced, hierarchical behaviours among later hominins, specifically Neanderthals. This time the archaeological record contains evidence of a nascent capacity for both functional and temporal hierarchization, as the surviving tools are evidence of 'an important advance toward processual, operational-sequence thinking' (p. 157). The point here is that hierarchic, sequential and combinatorial patterns are fundamental to modern musicking. Yet these are also embedded within the emergence of what Tomlinson calls protodiscourse, a kind of 'sequenced communicative behaviour' (p. 139) from whose prelinguistic, non-referential exchanges a generalized pattern of expectation and fulfilment or denial might have emerged, 'energies and exchanges structured in a very general way *like music*' (p. 140). Again, *pace* Mithen and Robin Dunbar, Neanderthals did not 'sing'. Instead, Tomlinson argues for the recognition of the emergence of those cognitive and behavioural capacities which would later aggregate or coalesce into the sapient capacity for musicking, a capacity fundamentally dependent upon hierarchy, sequenced action and the 'formal patterning of stimulus and response according to bifurcating operations' (p. 140).

Towards a deep history of absolute music

The emergence of discrete pitch perception is an issue of staggering complexity, and in many ways Tomlinson's treatment of the topic throughout the book converges in a superb

[15] Here, Tomlinson develops the ideas of the archaeologist Clive Gamble. The idea that such tools are a product of a mental template formed in advance implies a capacity for mental abstraction, thinking-at-a-distance and what Gamble calls a 'release from proximity' (p. 61). For Gamble, such a capacity is not otherwise attested in the archaeological record of the period under discussion.

discussion (Chapter 7) of the issues surrounding the musical pipes made of bone and ivory discovered by archaeologists in the Swabian Jura in south-west Germany. The pipes unearthed at Geissenklösterle, Hohle Fels and Vogelherd near Ulm are part of a series of important finds that have prompted many archaeologists to posit stronger or weaker versions of a thesis that the area was witness to the emergence of human modernity following the migration of *Homo sapiens* from the east, and indeed Tomlinson's discussion here is central to the cumulative concerns of the book. Such finds are taken as evidence of a 'revolution' in the Upper Palaeolithic, even though no fossil remains have yet been discovered which would prove beyond doubt that these finds can be attributed to modern humans. The pipes, with their fixed pitches, should not invite us to speculate about whether they represent the 'beginning' of (Western) music, but more importantly to recognize that the pipes provide evidence that by 30,000 years ago (the complicated issue of the precise dating of the pipes aside), hominins had attained the perception of discrete pitch. The pipes thus do not represent a beginning of any kind, but are instead a reflection of that complex cognitive attainment. More importantly, they reflect the attainment of the abstraction of pitch from meaning or signification: individual pitches had already undergone 'an absolution from signifying', and Tomlinson proposes that 'music was from the first, in this sense, *absolute*' (p. 258). Music has always been absolute in the sense that the very cognitive ability to perceive discrete pitch indicates the ability to abstract pitch from meaning (p. 203) and signals the emergence of a 'cultural investment in nonsemantic formations' (p. 206). This, from the evidence of the archaeological record, is an ancient attainment and one which cascades into previous attainments of cognitive and behavioural capacities for entrainment and coordinated (or even synchronized) rhythmic activity.

Tomlinson's perspective on the import of the Swabian pipes points more broadly to the nascent capacity of hominins for abstraction as such, for 'thinking-at-a-distance', a major part of the broader story Tomlinson relates of the pathways of hominin sociality over several hundred thousand years. 'The neurological coalescence that enabled discrete pitch and abstraction of pitch from signification seems to fall into the same cognitive developments that enable thinking-at-a-distance in general' (p. 259), and these attainments indeed point to 'a vast expansion of the human imaginarium'. In this way, Tomlinson brilliantly reorientates the nature of the discussion surrounding the historical, evolutionary and cultural import of the Swabian pipes: they are remarkable, he writes, not merely because they fix pitches, but because they 'visualize, spatialize, and finally materialize a ubiquitous human capacity for cognitive abstraction' (p. 259).

Tomlinson's cumulative picture of the emergence of the distinct capacities that coalesce in the modern human capacity for musicking – the 'falling out' of musicking from other domains, as he calls it – is thus at a deeper level an account of the emergence of hominin sociality. None of the capacities that collectively signal human modernity – musicking, language, symbolism and abstract thought – emerged magically or in isolation, but all are part of a wider panoply of cumulative behavioural and cognitive attainments spread across the hominin clade. As mentioned above, *A Million Years of Music* is not primarily written for a musicological audience, and many of its central claims demand close consideration by experts in the fields of cognitive science, evolutionary biology and anthropology. However, the book's historiographical principles demand close and sustained attention from musicologists.

Sameness, difference and the pathways of deep enculturation

Foundational to *A Million Years of Music* are principles of incrementalism, gradualism and non-linearity, yet the cogency of such principles is fully evident only in the context of the long chronology. So, too, is the evolutionary principle of conservatism which states that previous cognitive gains are retained within an emerging suite of cognitive capacities. The processes we can reconstruct from the archaeological and fossil records are not teleological but cumulative and cascading, yet at the same time are marked by 'microbursts' of cultural innovation (p. 247) and abrupt discontinuities, all of which feed into broader co-evolutionary cycles. Such perspectives, of course, bring about several casualties, not least the Eurocentric and Whiggish perspectives which have dominated musicological thinking since its inception and whose assumptions, from the perspective of deep time, are untenable. All the same, a methodology based upon principles of incrementalism, gradualism and non-linearity cannot be considered as simply another exercise in postmodern relativism: indeed, Tomlinson's study could also be understood as a return of narrative of the universal kind, albeit a narrative deeply informed by the lessons of the postmodern turn.[16]

Tomlinson's narrative ends around 20,000 years ago, when modern humans had certainly fully attained the capacity for musicking, the 'foundational sameness' which would give rise to 'limitless difference' (p. 234). This, however, is still around 10,000 years before *Homo sapiens* migrated across the Bering land bridge to populate the Americas, bringing with them musicking, language, ritual and religious practices and (according to Michael Witzel) fully developed mythological systems, elements of which today still govern both our sacred and our secular narrative patterns of thought.[17] While Tomlinson traces the incremental attainment of foundational (cognitive) sameness, consideration of the pathways of the ensuing dispersal and migration of modern humans is central to the historical imagination of musicology, as these pathways largely account for the 'limitless difference' which subsequently emerges. In the context of the deep worlds mapped by scholars like Tomlinson and Clive Gamble, Western music is a very recent and local affair – the music, essentially, of the Holy Roman Empire and its descendent Europe. Nevertheless, it holds a pre-eminence and a degree of deference unattained by the music of any other global culture. Indeed, Western art music has for many come to stand for 'music' as such, universal in its embrace and exemplary of the creative

[16] In this sense, Tomlinson's work could be grouped with that of scholars attempting to reinvigorate an older tradition of historiography; see David Christian, 'The Return of Universal History', *History and Theory: The Next Fifty Years*, special theme issue no. 49, *History and Theory,* 49/4 (December 2010), 6–27. Although Tomlinson is unlikely to claim that he has written a 'universal history' of the kind robustly advocated by Christian, *A Million Years of Music* certainly provides a conceptual framework in which such a history (or series of histories) might be conceived.

[17] The precise dating of the earliest migrations is still a matter of debate. The earliest date attested with certainty is *c.*11,000 BC. However, claims have been made that the earliest migrations may have occurred *c.*20,000 BC. For a convenient recent summary of these issues, see Marcel Kornfeld and Gustavo G. Politis, 'Into the Americas: The Earliest Hunter-Gatherers in an Empty Continent', *The Oxford Handbook of the Archaeology and Anthropology of Hunter-Gatherers*, ed. Vicki Cummings, Peter Jordan and Marek Zvelelbil (Oxford: Oxford University Press, 2014), 405–36. For the origins and development of mythological systems and their continued influence, see Witzel, *The Origins of the World's Mythologies*, esp. pp. 430–9.

capacities of the human species. The ultimate question remains of why and how the music of one group of local cultures could attain such global pre-eminence and significance.

To return to the issues posed at the outset of this review, central in different ways to both Diamond and Tomlinson, is the question of the lack of congruence often evident between human cognitive and physical capacity and potential on the one hand, and the record of human behaviours, material attainments and technological achievements in history on the other. If the cognitive capacities of all members of the species *Homo sapiens* are identical, and have been so for more than 20,000 years, what then can explain not merely the diversity of musical practices and traditions in the world and in history, but also the manifest inequality in material distribution and technological achievement which underpins those musical practices?

From the beginning, as Tomlinson writes, 'musicking was always technological' (p. 48). Musicking is deeply embedded in technologies and, for several centuries in the Western context at least, has been inconceivable in their absence. But as both Diamond and Tomlinson stress, technologies emerge as a consequence of the feedback loops established between hominins and their environments. Different environments and terrains provide different sets of affordances and limitations, thus different feedback loops (different in kind, not necessarily in quality). Here Tomlinson's model of the 'epicycle' is a compelling critical tool in addressing the kinds of questions posed at the beginning of this review article. The epicycle emerges from the basic co-evolutionary feedback loop between biology and culture. Over time, a 'cultural archive' – 'learned bodies of information and learned sequences of practices' (p. 225) – begins to sediment, and in turn this archive acquires an independence from the basic co-evolutionary feedback cycle (thus the designation epicycle). The cultural archive then assumes the capacity to act as a feed-forward element (p. 16), and indeed as such can act as a 'propulsive force' (p. 226) in that broader cycle. Central to Tomlinson's thesis is that such cultural epicycles were operative throughout the entire process of hominin evolution, and with this insistence he overturns a long-standing assumption that culture is a kind of 'outgrowth or aftereffect' of evolution (p. 41). Culture, the acquisition and transmission of learned behaviours,

> was an active force among our ancestors at least two million years ago, and no useful narrative of our evolution over that span can start from culture-free evolutionary patterns and point to cultural outcomes. Our narratives must instead attempt to analyze from the start biocultural reciprocities in which deep, multiplex cultural histories shaped noncultural dynamics of evolution at the same time as they were shaped by them. (p. 42)

By about 50,000 years ago, such cultural epicycles took on an increasingly central place given that the basic cognitive and genetic sameness of *Homo sapiens* had by then been established (p. 256). Cultural difference begins to proliferate exponentially after the dispersal of *Homo sapiens* from their centre of speciation in Africa, their displacement of earlier hominin populations in the Old World and their migration to new environments such as the palaeocontinent Sahul (New Guinea, Australia and Tasmania), Siberia and the Americas. From about 50,000 years ago we witness only microgenetic changes in human phenotype, but on the other hand also an astonishing diversification of cultural behaviours and practices.[18] For Tomlinson, the motor

[18] See Gamble, *Settling the Earth*. Indeed, with significant overlap between them, *A Million Years of Music* is very profitably read alongside Gamble's deep history of hominin migration and settlement.

of this diversification is the cultural epicycle and it also marks out *Homo sapiens* among all species as 'makers of difference' (p. 291). That said, the epicycle provides 'an impulsive but nonprogressive force' (p. 245) which is at root 'aimless' (p. 235), and the differences evident in history and the archaeological record testify to the fundamentally non-linear nature of human cultural innovation, a principle which still governs such innovation today. Tomlinson's epicycle model then impels a revision of our understandings of the dynamics of cultural and musical history. In the absence of linear trajectories of evolution or decline, we are confronted with a daunting and sobering picture of the haphazard and often contingent nature of cultural transmission (pp. 230–3), its pathways of continuity and its abrupt discontinuity; the ever deepening of cultural archives or their sudden erasure; and the propulsive nature of epicyclic mechanisms for which overlapping hominin migratory patterns, favourable climatic conditions and a diversity of environmental affordance seem to play central roles:

> Accumulations and transmissions of cultural knowledge may rush headlong at one scalar level or be short-circuited at another; sedimentations of population-wide behaviours may pile up in one locale while eroding elsewhere; epicyclic amplifications may take over or never gain a foothold. All these varying patterns will feed back or forward into the loops of biocultural coevolution. (p. 21)

These patterns likewise feed into the loops between technologies and musical practices, loops which perhaps shape in important ways subsequent channels of musical enculturation in any given society. Even so, there is no template for how such enculturation normatively ought to proceed in different societies on different continents, and if there is one basic point we should take from *A Million Years of Music* it is that no normative outcome to such millennia-long processes of enculturation should be assumed. 'It is not the case', writes Tomlinson,

> that every human society that hunts large birds will end up fashioning from their bones pipes for musicking. But the reasons why one group does so while another does not cannot be understood simply as a measure of genetic capacity or through the operations of singular invention and cultural transmission. (p. 247)

With Tomlinson's feedback loops and epicycles we have travelled far from conventional ideas of singular invention, of revolution or of genius, and closer to understanding the complexity of processes of musical enculturation over the *longue durée*. While perspectives derived from the short chronology may lead us to assume that present-day technological inequalities between musical cultures are natural or inevitable, deep history shows us that they are not, and cautions us, too, against considering them definitive.