

The evolutionary nature of musical meaning

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The paper will draw on ethnomusicological, cognitive and neuroscientific evidence in suggesting that music and language constitute complementary components of the human communicative toolkit. It will start by outlining an operational definition of music as a mode of social interaction in terms of its generic, cross-cultural properties that facilitates comparison with language as a universal human faculty. It will argue that, despite the fact that music appears much more heterogeneous and differentiated in function from culture to culture than does language, music possesses common attributes across cultures: it exploits the human capacity to entrain to external (particularly social) stimuli, and presents a rich set of semantic fields while under-determining meaning. While language is held to possess both combinatoriality and semanticity, music is often claimed to be combinatorial but to lack semanticity. This paper will argue that music has semanticity, but that this semanticity is adapted for a different function from that of language. Music exploits the human capacity for entrainment, increasing the likelihood that participants will experience a sense of 'shared intentionality'. It presents the characteristics of an 'honest signal' while under-specifying goals in ways that permit individuals to interact even while holding to personal interpretations of goals and meanings that may actually be in conflict. Music allows participants to explore the prospective consequences of their actions and attitudes towards others within a temporal framework that promotes the alignment of participants' sense of goals. As a generic human faculty music thus provides a medium that is adapted to situations of social uncertainty, a medium by means of which a capacity for flexible social interaction can be explored and reinforced. It will be argued that a faculty for music is likely to have been exaptive in the evolution of the human capacity for complex social interaction.

Introduction

Let us consider the requirements on systems of animal and human communication. Survival prospects of individuals and groups are self-evidently enhanced by a capacity to communicate information about states of affairs in the physical and social world and to organise action in respect of those states of affairs: the availability and locations of resources can be specified and shared; understandings and behaviours can be identified and disseminated; perceptions and conceptions of dangers can be collectively identified, and situation-specific actions co-ordinated; and the explicit contexts of social relationships can be articulated and sustained.

Language enables all these capacities, in part because of its powers of referential specificity, and in part because of its ability to present semantically decomposable propositions. In effect, language enables users to transmit and interpret information about states of affairs in the physical and social world and to organise appropriate action, in respect of:

- 1) denoting resource location
- 2) disseminating resource availability
- 3) broadcasting perception of danger
- 4) sustaining social relationships
- 5) enhancing transmission of behaviour
- 6) sharing intentions and intentionality
- 7) articulating contexts of social relationships

While the first four functions are indubitably shared by other animal communication systems, the latter three appear to be unique to language users. A possible bridge exists

between these sets of functions in mimesis (after Donald, 1991: see also Arbib, 2005), in that transmission of behaviour by non-genetic means does appear in some non-human species but is most likely mediated by means of mimesis, which is also likely to underpin transmission of procedural knowledge in humans. The efficacy of mimetic processes is, of course, likely to be immeasurably enhanced by language use.

But the use of language, with its potential for specificity and singularity of meaning, may also pose problems. For example, in the absence of any sort of institutional framework for the resolution of dispute, language can transform encounter into conflict as each party articulates their own, personally-motivated, view of a situation. When social situations are on the edge - encounters with strangers, changes in social affiliations, disputed courses of action - when there is uncertainty of outcome, the specificity of language - the fact that it can unambiguously denote individual feelings, attitudes and intentions - can tip situations over into conflict, between groups, within groups or even perhaps at the level of the individual (this last particularly in respect of the paradoxicality arising from the simultaneous foregrounding of incompatible conceptual-intentional frameworks - see Sperber, 1996; Cross, 2001). Language can become socially (and perhaps individually) dysfunctional.

But let us hypothesise the possibility of access to a parallel system of communication, one that, by its nature, tends to promote the likelihood of a sense of affiliation and joint

action but that lacks language's potential for specificity of meaning. Such a system of communication could powerfully complement that provided by language; it could turbocharge human communicative capacities in managing the uncertainties of social interactions.

It would be a requirement on this system that it be accepted as capable of only honest signalling (in ethological research and game theory, an honest signal reveals qualities of a signaller to a receiver that are relevant to the communicative situation; see Számadó & Szathmáry, 2006; Searcy & Nowicki, 2005); in this system, signals that are produced and perceived would have to exhibit features of which the interpretative scope would necessarily be constrained by an unambiguous fit between signal characteristics (acoustical and motoric) and the costly and hard-to-fake motivational-intentional (mental) and bodily states inferable as underlying signal production. The sense of the honesty of its signals would be further enhanced were it to be rooted in mechanisms that would increase the likelihood that participants interacting in this communicative medium would experience each others' states and intentions as mutually manifest (perhaps by means of a sense of shared action or by means of the common experience of action, or of structure, in time). At the same time, it would be necessary that the interpretative scope of the communicative system be broad enough so as not to require precise alignment between the frameworks within which the participants each interpret their own and each others' motivations and intentional states. And finally, it would have to be available to all humans, just as is the case with language. I have recently been exploring a new approach to thinking about meaning and affect in music (Cross, 2006, submitted) and it seems that the resulting model could endow music with the attributes of the communicative system that has just been outlined.

Music and meaning as universal?

Perhaps the best evidence for the universality of music has been found in the universally musical qualities of caregiver-infant vocal interactions. The work of researchers such as Sandra Trehub (for an overview see Trehub, 2003a) has shown that caregiver-infant vocal interactions exhibit striking similarities across a wide range of cultures, that even very young infants are sensitive to significant features of musical structure, and that exploratory and musical vocal sound production appears as a constant in the behavioural repertoire of late infancy (Papousek, 1996). In general, the use of musical features in caregiver-infant interaction appears to be rooted in the co-

regulation of affect by parent and child (Gratier, 1999; Dissanayake, 2000) and to play a significant role in the development of linguistic capacity (Trehub, 2003b).

However, evidence for universal musicality is not limited to its manifestations in infancy. Titon and Slobin (1996, p1) note that "So far as we know, every human society has music", though Blacking (1995, p224) refines this view in stating that "...every known human society has what trained musicologists would recognise as 'music' ", although "there are some that have no word for music or whose concept of music has a significance quite different from that generally associated with the word 'music'.". Irrespective of the presence or absence of a term cognate with the western concept of 'music' within a culture's lexicon, as Nettl (2005, p23) notes "All cultures regard music as at least minimally valuable". Moreover, not only is something identifiable as music found in all cultures, but members of any given society tend to be expected to be able to engage with music in culturally appropriate ways; indeed, in many, if not most, traditional cultures, the ability to engage in interactive musical performance is expected of all. As Blacking (1995, p236) notes, "...the almost universal distribution of musical competence in African societies suggested that musical ability [is] a general characteristic of the human species rather than a rare talent."

The view of music that emerges from these universalist considerations requires a somewhat broader conception of music than that which is familiar within the western supercultural sphere. Within that sphere, in art and education, music is something produced by the few and consumed by the many, a phenomenon that may have real value as a commodity only for purposes of entertainment. In fact, this conception of music is far too narrow to apply even within western cultures, as the research of Finnegan (1989), and work by Sloboda, O'Neill and Ivaldi (2001), clearly demonstrates. Music has significant roles in public rituals, in the private self-regulation of emotions, and defining individual and group identities. Music outside western supercultural conceptions is active and interactive, typically embracing what might be termed separately 'music' and 'dance' in western societies. This conception of music can be referred both to Christopher Small's (1998) term 'musicking', referring to the notion of music as an active and interactive social behaviour, as well as to the Igbo term *nkwa*, encompassing instrumental music, singing and dancing (Gourlay, 1984). However, it is not intended as an alternative to western conceptions of music, but as an attempt to delineate a broad, probably universal sphere,

of human activity, that encompasses those western conceptions.

Despite music's human ubiquity, as Titon and Slobin (1996, p1) note, "Music is universal, but its meaning is not." The significances that participants attributed to any particular piece of music or musical behaviour may vary considerably. As Blacking, (1995, p237) observed, "Not only can the 'same' patterns of sound have different meanings in different societies; they can also have different meanings within the same society because of different social contexts." Moreover, as I have noted elsewhere (Cross, 2005), the meaning of a specific musical piece or act may be experienced quite differently by different participants at the same time without the integrity of the music being significantly compromised. This feature of music – what can be termed its *floating intentionality* (Cross, 2003a) – seems to relate to the fact that music's meanings appear intimately bound to the contexts in which it is experienced. As Bohlman (2000, p293) puts it, "... expressive practices do not divide into those that produce music and those that produce something else, say ritual or dance. Music accumulates its identities... from the ways in which it participates in other activities...".

This view of music and its meanings appears to fit well with a notion of music as an entirely culturally contingent phenomenon (a position that is generally prevalent within academic musicology), in line with ideas of cultural variability and individual diversity within cultures. As Blacking, (1969, p39) noted, "Music cannot make people act unless they are already socially and culturally disposed to act"; in other words, the meanings of music are embedded in the cultural contexts within which the music occurs and is experienced and cannot be addressed separately from those contexts. Meaning – and emotion – in music are **culturally-enactive**; their characteristics emerge from inter- and intra-personal processes that are shaped by – and that in turn may come to shape – the contingencies of their specific cultural matrix. These considerations would suggest that music may afford the semantic indeterminacy that is required of the communication system outlined above, but appear to outlaw the notion that music may possess the power to be accepted as an honest signal; how can a signal be accepted as honest if its meaning is unclear?

Music and natural meaning

The notion of music as an 'honest signal' – or at least, as a 'natural sign' – has a long provenance in western thought. As Downing Thomas notes (1995, p72) for the *philosophes* of

the French Enlightenment, "Musicality, in the guise of the natural cry, transmits the authority of a natural origin to the conventionalized language." Indeed, Elizabeth Tolbert has pointed out (pers. comm.) that the notion of music as somehow 'natural' and unmediated is widespread in many societies (see, e.g., Basso, 1985). In western cultures the notion of music as constituting (Thomas, 1995, p126) "signs of our affections, of our sentiments" has been a central theme of writing about music over the last three hundred years. Indeed, it has been a theme of evolutionary thinking about music since Darwin's (1871/1998) suggestion that music's affective powers arose through its use in processes of sexual selection. The idea that music has a direct route to the emotions appears to be confirmed in its use as a highly effective Mood Induction Procedure (MIP) in experiments that have explored the behavioural, cognitive, and neural underpinnings of affective states (e.g., Albersnagel, 1988), as well as in its centrality of music in manipulating the emotional responses of audiences in cinematic contexts (Cohen, 2001). It is notable that music tends to be used in Mood Induction Procedures (as well as in cinematic and multimedia contexts) simply on the grounds that it *works*; rarely is any compelling rationale advanced in the Mood Induction literature for why music might have such powers. However, as I have proposed elsewhere (Cross, 2006, submitted), recent theories of animal vocal communication might afford some clues as to music's efficacy in influencing the affective states of listeners.

Seyfarth & Cheney (2003), in their review of animal communication systems, suggest that for almost all non-human species the transfer of information through the production of sound is largely contingent. As they note (2003, p158), most animal "communication is – compared with human language – inadvertent, because signallers are unaware of the means by which vocalizations exert their effects." In their 1998 book, Owings and Morton seek to remove some of this contingency from animal acoustic interaction by dispensing with the notion of information transfer and adopting a pragmatic approach, suggesting that animals, in producing vocal and other sounds, are generally seeking to manage their physical and social environments rather than to transmit information. At the same time, other animals – conspecifics and members of other species – are seeking to assess the import of the signals emitted by others. This 'management-assessment' framework is largely governed by relationships between the acoustical structure of the signals produced and the biological consequences that can be inferred from the acoustical features of the signal, generally instantiated as changes in

motivational state. Processes operating over evolutionary timescales act to integrate sensitivities to those 'motivational-structural' relationships into the sensory and behavioural repertoires of animals. These sensitivities can then be brought to bear in the inferences made in assessment of prospective biological consequences associated with the signal characteristics as well as in the use of signals with particular features to manage the social or physical environment.

An example might help clarify this. In situations of potential threat or conflict, one strategy for managing the situation is simple reciprocity: to seek to pose a threat in response. A common means of achieving this is present oneself as larger and hence more powerful than a putative opponent. There is a straightforward physical correspondence between the pitches – frequencies – of sounds and the dimensions of the physical objects that can produce these. Lower frequency sounds can only be produced by relatively large objects or entities. Hence a good strategy for appearing larger than one is to produce sound that is as low in frequency as can be achieved. This is likely to be accompanied in birds and animals by erecting feathers or fur. But in situations where visibility is restricted, signalling resources are limited to the acoustic domain. Lower frequency sound signals denote larger animals: perceivers (assessors) will be selected to attend focally to the frequencies of sounds in making judgments about threat level; simultaneously, managers (sound producers) will be selected so as to be capable of producing the lowest frequency sounds possible so as to seem to constitute the greatest possible threat. Thus for Owings and Morton, Expressive Size Symbolism comes to constitute an Evolutionarily Stable Strategy.

They suggest that evolutionary processes will also operate on sensitivities of other acoustical parameters of the signal including bandwidth and intensity, noting that frequency, bandwidth and intensity tend to co-vary with the prospective significance of biological situation. Evolutionary processes act to inscribe in the genomes of many species predispositions towards particular motivational states according to different features of the acoustical signals they encounter and produce in the form of what Owings and Morton term a "motivational-structural" code. They are thus postulating a close relationship between the motivational states of organisms (governed by affective systems) and the global structural characteristics of acoustic signals.

It would be surprising if such motivational-structural principles did not account for significant aspects of the human response to

sound, given the extent to which we share appetitive, reproductive, sensory and limbic systems with many other species; the dynamics of at least the latter two are likely to have been profoundly shaped by the history of our predecessor species' interaction with the regularities of the environments they encountered and successfully navigated. Hence, in terms of music as sound, a close relationship can be postulated between the motivational states of listeners and the global structural characteristics of musical sound. To take an example, one of the most famous instances of the use of music in film is the sequence for violins and lower strings composed by Bernard Herrmann to accompany the 'shower scene' in Hitchcock's film *Psycho*, the violent stabbing of the morally ambiguous Marion Crane character with whose fortunes the audience has been induced to empathise by Hitchcock's skilful editing and story-telling. The sound is high in frequency and intensity, rapid in onset, broad in terms of spectral energy, and is repeated periodically. These acoustical characteristics, Owings and Morton suggest (1998, p115), are likely to characterise sounds produced by an animal in states of intense, terminal, fear and aggression, being largely consequent on the impact of the animal's motivational state on its sound-producing system (and having the functions either of startling a predator, inducing mobbing by conspecifics, or attracting a competing, larger, predator to attack the initial threat source). It is unsurprising, then, that the violin sounds act potently to intensify the audience's experience of the visual scene, precipitating shock and eliciting a motivational state appropriate to the perceived situation, that of fear. At the same time, it should be evident that the sound is **not** just shrieking violins; it is a structured musical phrase, with gradual extension of its pitch range downwards and periodic repetitions of its elements, which structure is itself repeated with a slightly 'wilder' type of bow-stroke (an upward glissando) before terminating in a 'falling', closural, musical motif that has occurred earlier in the film. In other words, while there is a dimension of the musical sound that can be interpreted in motivational-structural terms as appropriate to the context in which it is encountered, there is **also** a dimension to the sound that renders it 'musical' and hence symbolic (from the perspective of a western-encultured listener). And, of course, it is being experienced as a component of a complex cinematic narrative which will shape its meanings, and of which it will in turn reshape the meanings, for an audience.

One can thus think of motivational-structural principles as constituting a locus for natural meaning in music. However, it must be noted

that the instantiation of motivational-structural principles in listeners' responses to music does not mean that the meaning of any music that activates these principles is fixed. Roughly consistent motivational states may be elicited by a piece of music in listeners, but this is not sufficient unambiguously to specify meaning. However, the operation of motivational-structural processes is likely to set limits on the range of possible meanings that may be abstracted by listeners from a given musical stimulus; motivational-structural principles hold the experience of meaning in music on a leash.

Thus there appear to be at least two different dimensions to meaning in music: one that is grounded in cultural context and action and can be described as **culturally-enactive**, and one that has evolutionary roots in survival-critical relationships between sound structure and biological significance – the **motivational-structural**. The simultaneous operation of these two dimensions of meaning in music would appear to allow music to seem to constitute an honest signal yet maintain a semantic indeterminacy; in the light of its universality, it seems that music may indeed be a communicative medium of the type outlined at the outset of this paper.

This dichotomous account of the ways in which music may mean and impact upon our affective response appears to fit with the long-established idea of culture and nature as antithetical and as resting on different types of process. However, this antithesis has begun to break down over recent years, with developments in evolutionary theory and ethological research. It has become clear that while *cultures* may vary, the *human capacity for culture* appears to be a human universal, one that is not shared with other species but that is part of our biological heritage. As Sperber & Hirschfield (1999, pcv) put it, "...cultural variation is the effect, not of biological variation, but of a common biological, and more specifically cognitive endowment that, given different historical and ecological conditions, makes this variability possible". This common biological and cognitive endowment is particularly evident in the complexity and range of the ways in which human beings can interact socially, a range that permits human social structures and cultures to adopt a bewildering number of different forms that far exceeds the range found even in other species of primate (Foley, 1995). In other words, while human cultures can be profoundly different, all humans have a *capacity for culture*. It might be expected that such a capacity would leave an imprint on any aspect of human interaction as significant as a system of communication.

The human capacity for culture

Recent explorations of the human capacity for culture have focused on the nature of 'theory of mind' (see Gopnik, 1999): the ways in which humans - and possibly members of other species - attribute mental states to conspecifics (and others). It appears that only humans can be conceived of as possessing a full-blown 'theory of mind': as Call and Tomasello (2005, p261) note, even our nearest primate relatives, chimpanzees, "have the cognitive skills to recall, represent, categorize and reason about the behaviour and perception of others, but not about their intentional or mental states". In a series of recent papers Tomasello has sought to clarify the foundations of the human capacity for culture, suggesting (Tomasello, 1999) that it is based on the ability of humans to 'understand others as intentional agents with whom they can align themselves'. Subsequently, this notion has been refined (Tomasello et al., 2005) so as to propose that the human capacity for culture is rooted in a capacity for, and motivation towards, 'shared intentionality' which "refers to collaborative interactions in which participants have a shared goal (shared commitment) and co-ordinated [and mutually understood] action roles for pursuing that shared goal."

This notion clarifies the ways in which human interactions - and, consequently, communication systems - are likely to differ generically from those of other species. Human interactions and communication systems are grounded in inferences about the mental states of others, which requires that inferences implicated in a communicative act are concerned not only the physical and biological environment (as appears to be case for most instances of non-human animal communicative acts) but also the **cognitive** environment of participants in the act of communication (see Sperber & Wilson, 1986). Hence unlike signals in non-human animal communication systems, human communicative signals are likely to be as much concerned with establishing the context of communication as they are with imparting information (or, for that matter, with regulating the physical and biological environment). They will be concerned as much with making mutually manifest the assumptions that underlie the act of communication - with sharing intentionality - as they are with conveying specific information.

I would suggest that this humanly particular mode of interacting and communicating is likely to shape interpretations of music as a communicative system. In effect, the human capacity for culture can be conceived of as underlying a *third* dimension of meaning and affect in music, rooted in shared, generic, but

solely human, characteristics of our engagement with the world and particularly with each other (as members of a complexly social species, manifesting a capacity for shared intentionality). This dimension would be oriented towards attributions and interpretations of intention and intentionality in engagement with music, and can be described as **socio-intentional**. It would be rooted in performative actions and sound structures that afford cues about shared intentionality that direct attention in interaction rather than the sharing of attention *per se*: these may be, e.g., declarative and disclosural (making manifest), concerned with the direction of another's attention to an object or event distinct from the individuals involved in the interaction; they may even be dissimulative, concerned with the *misdirection* of another's attention.

Juslin (2001) has proposed that the communication of emotion in music is rooted in humanly universal mechanisms for the vocal expression, and recognition of the expression, of emotion by the voice, mediated by the specificities of cultural contexts. However, this approach appears to elide the putative role of motivational-structural and socio-intentional factors in the experience of music, in effect treating all aspects of the experience of emotion in music as motivated by ascriptions of intentionality. The three-dimension account allows for the operation in the motivational-structural dimension of low-level and ancient processes (evolutionarily speaking) that do not rest on such ascriptions, which may **co-occur** with processes that may be bound to the inferences of intentionality that would be correlates of the socio-intentional dimension.

The operation of the socio-intentional dimension would be most evident in musical acts that are live and interactive, involving participants in both sound production and perception (and usually, structured movement or dance), as is the case in many traditional societies; within the temporal flow of musical events, participants will necessarily display overtly performative stances to each other that are interpretable in terms of the socio-intentional features they exhibit. Signs of the socio-intentional dimension are likely to be somewhat less easily discernible when music is being experienced as a purely sonic phenomenon, as in listening to a recording; nevertheless, it seems more than likely that this dimension would be experienced in terms of the traces of human action and intention embodied in the temporal flow of the music's sonic surface. This is probably most evident in the ways in which that sonic surface will embody cues as to constituent segmentation (see Palmer & Hutchins, 2006) that may be

analogous to those of linguistic prosody; in a more complex example, the socio-intentional dimension can be thought of as providing the matrix for the experience of the demonstrative and disclosural functions that may be inferred from the typical antecedent-consequent structures of much European music from the later eighteenth and earlier nineteenth centuries.

While the culturally-enactive dimension of musical meaning underlies and highlights musical difference across cultures, the socio-intentional dimension is likely to underlie the capacity to respond - appropriately or inappropriately - to music of another culture in terms of its properties as humanly organised sound. While the meanings of music are bound to their cultural contexts, the apprehension of humanly organised sound as music allows it to appear comprehensible even outwith its immediate social context. As Blacking (1995, p238) notes we can, with little experience of a musical idiom or culture, 'make sense of' other musics (e.g., from a western perspective, while a listener may have no knowledge or understanding of the structural principles underlying Balinese music, the music can still be apprehended as music even in the absence of cultural knowledge). Hence, Blacking concludes (*ibid.*), "there must be supra-cultural cognitive resonance, and that there must be levels at which different composers, listeners and musical systems use the 'same' musical modes of thought." I would suggest that many of these cross-cultural resonances are located in the socio-intentional dimension of musical meaning.

The co-existence of these three dimensions of musical meaning endows music with a capacity for fluidity of meaning that, in the limit, is in stark contrast to language. If any musical act or utterance is capable of being interpreted in a multiplicity of ways, according to the relative prominence in listeners' perceptions of the music's motivational-structural, socio-intentional and culturally-enactive features, then it affords scope for its meaning to be co-opted to fit with personal circumstance and preference. At the same time, the operation of motivational-structural principles will act to circumscribe the range of possible meanings and to endow the music with the attributes of an 'honest signal'. Hence music can be viewed as complementing language in affording the means to explore and to sustain social interactions in ways that minimise the likelihood of conflict.

Music and a sense of shared action

But music possess one further feature that is likely to amplify its social efficacy. Musical interaction typically involves the entrainment

of action and attention to a commonly inferred, more-or-less regular and periodic, pulse. Participants in a musical activity will regulate the temporal alignment of their musical behaviours by engaging in continual processes of mutual adjustment of the timing of actions and sounds; even those who appear engaged in 'passive listening' to music will be modulating their attention according to the ways that the flow of the music affords scope for a regular pulse to be abstracted. The ability to produce and to entrain to a regular auditory stimulus through processes of mutual adjustment of period and phase may well constitute a species-specific capacity (Bispham, 2006) (there exist no rigorous tests of this capacity in non-human primates). It seems to underpin not only musical behaviours but a wide range of human communicative acts; recent work has shown that entrainment may be implicated in a wide range of communicative situations and be manifested in a variety of forms, from eye movements (Richardson, Dale & Kirkham, 2006) to postural changes (Shockley, Santana & Fowler, 2003).

When musical communication is understood as constituting a mode of social interaction that allows the co-creation of risk-free frameworks for interaction, an act of entrainment (identifiable by means of performance of constant and mutual error-correction) can be interpreted as constituting, at the least, a practical guarantee that those who are mutually engaged do not have aggressive intent in respect of each other; entrainment is a guarantee of cooperativity (not of cooperation *per se*, but of the likelihood that each entraining individual is prepared to cooperate). This view of the function of entrainment in musical contexts is quite different from that proposed by Merker (2000); he suggests that a capacity for entrainment may have emerged in the hominid lineage because of its signalling advantages for sexual selection at the level of the group. It is being suggested here that the function of entrainment (whether in musical or broader communicative contexts) is, simply, that of a guarantee of cooperativity; hence this view of entrainment locates its proximate efficacy in the management of intraspecific social relations. For a species within which the management of extremely complex social relations is at a premium such a simple signal of cooperative intent would be a very parsimonious means of managing the social environment. In an extremely social mammal such as ourselves we might even regard entrainment as an Evolutionarily Stable Strategy (ESS).

Indeed, one might view entrainment as the 'missing link' in theories of the human

capacity for culture (see Tomasello et al, 2005), where mechanisms that might have led to the emergence of positive motivations to 'share intentionality' do not seem to have been clearly identified. It seems feasible to suggest that the motivation to share psychological states could be precipitated - or at least sustained - by the guarantee of cooperativity implicit in inter-personal entrainment. Hence one proximate function of inter-personal entrainment would be the profoundly social one of providing conditions for inferences as to cooperativity. As a non-exclusive but foundational sub-component of the human capacities for both musicality and language, entrainment would seem to be an ideal candidate for a mechanism that expedites the emergence of motivations to act collaboratively, facilitating the appearance of the human capacity for culture. Hence, in this view, the human capacity to entrain is seen not as an aspect of the socio-intentional dimension of musical meaning but rather as a substrate that facilitates the emergence of that dimension.

Music in conflict

In summary, it appears that music has all the attributes of a communicative system that is highly adapted to facilitate the management of the uncertainties of social interaction. It can be postulated to have effects within or between groups, or even in the management of individual cognitions and affects. Certainly, there is ethnographic evidence to support the view that music may be uniquely efficacious at multiple levels in situations that are 'on the edge'. Alan Marett (2005) provides a fascinating instance of the use of music (and dance) to manage potentially violent social conflict amongst Australian Aboriginal groups from the 1950s to the present day in the form of a tripartite system of ceremonial reciprocity developed at Wadeye in the Northern Territory. As he notes, the impetus for the establishment of this system was the expansion of the resources available at the Port Keats (Wadeye) mission to a range of groups, some of which had long histories of conflict with each other. Indeed, the consequent expansion of the population at Port Keats led to inter-communal violence, and elders from some of the groups concerned devised a system of ceremonial reciprocity to establish and maintain a degree of social harmony. The system required each of the three main groups - differentiated by their language, by their Dreaming (or cultural history), by the song-types they possessed and by the territories that they currently used - to perform their song types for and about each of the other two groups. As Marett notes (*ibid.*, p59) "all the songs refer to local places and

articulate cosmological principles held in common by all three groups".

However, the songs performed by each group in each other's company refer to the country and Dreamings of **other** clans or language groups, thus celebrating the possession of those locales and connections to ancestors by the others while covertly permitting the expression of a sense that those places and those Dreamings may have been intimately linked to the ancestors of the performing group. Thus emerges an overt celebration of the other's possessions and ancestral heritage, and at the same time a covert avowal of historical ownership by virtue of the familiarity with which those possessions and heritage are overtly articulated in the songs. But, because song texts often contain elements of ambiguity, and because the music itself can be interpreted differently by the different participants, conflict is averted even while an overt acknowledgement of the other's gain is potentially combined with an expression of loss that may be cathartic. It is notable, as Marett (*ibid*, p23) notes, that "The tripartite ceremonial system established at that time [late 1950s] continues to function to the present day and is pointed to as a source of ongoing stability within the community."

Music can also mediate within the group in the form of a mechanisms for social bonding but perhaps more commonly at times of social and individual change that will have immediate social consequences. A now famous example can be found in the ethnomusicological research of Steven Feld (1982) on the music of the Kaluli peoples of Papua New Guinea. Feld focused on Kaluli music as displayed in the *gisalo* ceremony, a funerary ceremony which is rehearsed and 'composed' for performance by a medium, and can elicit very strong reactions on the part of the audience; in fact, the audience may, if moved too much to tears against their will, actually cause physical harm to the performer (a contingency that is accepted as very much part of the job by the performer). The melody that the performer uses derives from the call of the *muni* bird, one of the common birds of the Papuan rain-forest. In the Kaluli belief system those who die join the realm of the birds, and the *muni* bird is the central numinous entity in the main Kaluli myth of 'the boy who turned into a *muni* bird' and thus joined the departed spirits. The performer in the *gisalo* ceremony employs the song of the *muni* to re-tell the history of the person who has died, grounding this in the places that they knew by articulating the pathways that they walked, hence straddling and joining the two dimensions of the living and the dead. The ceremony thus makes space for the dead in the channelled grief of the mourners, acting

to mediate the social change that is consequent on the death. The musicality of the *gisalo* ceremony can be conceived of as inhering in the processes that are used to manage the multiplicity of the relationships involved in the liminal transactions that are the focus of the ceremony.

However, none of this is to suggest that the exercise of human musicality will inevitably underpin social harmony. Its expression is not inevitably altruistic, and can also facilitate violence and destruction. Richards (2006, in press), in presenting a powerful account of the dynamics of conflict in Sierra Leone in the 1990s, notes that music appears to have been used to facilitate the forced re-situation of individuals into new social orders. Music was also used explicitly to enhance social bonding between child or adolescent combatants (who had typically been abducted by, and inducted into, armed groups) prior to armed assaults on other groups or on the civilian population that all too often ended in atrocities. Hence the end-products of the exploitation of music's powers to facilitate social interaction will depend on the contexts in which it is used; to return to the earlier quote from Bohlman (2000, p293) "...Music accumulates its identities... from the ways in which it participates in other activities". If those other activities are chaotic, if norms of behaviour both within and between groups have ceased to have any force, then, as Richards notes, human musicality "can display its dark side".

Conclusion

Overall, music appears to possess all the attributes of the communication system outlined at the outset of this paper; it appears to be cross-culturally universal, to be acceptable as an honest signal, to be endowed with semantic indeterminacy, and to elicit a sense of shared action and intention. The simultaneous operation of different dimensions of meaning afford it semantic indeterminacy, while the operation of the motivational-structural dimension (and perhaps the socio-intentional) allow it to be admitted as an honest signal. Its rootedness in processes of entrainment permit it to constitute a guarantee of cooperativity and hence to elicit a sense of shared action and intention. Music is as much a part of the human communicative toolkit as is language. Many issues, however, remain to be resolved or even explored.

As outlined above the different dimensions would appear to overlap somewhat; in particular, it seems probable that it would be difficult to distinguish clearly between motivational-structural and socio-intentional factors in musical meaning. However, the motivational-structural dimension is

grounded in predispositions to use, and in responses to, sound that do not require any inferences about the intentionality of others. The socio-intentional dimension, in contrast, is rooted in just such inferences. The two dimensions can be interpreted as functioning at different pragmatic levels (see Cross, 2006, submitted). Motivational-structural processes are rooted in management-assessment systems, where the uses and interpretations of sound are consequent on the inferences that underpin them, or that they afford, about the nature of the physical and biological environment, requiring no 'theory of mind'. Socio-intentional processes are grounded in ostensive-inferential processes (see Sperber & Wilson, 1986), where consequences of the operation of 'theory of mind' - in the form of an awareness of the extent to which the context of a communicative act renders common assumptions mutually manifest - are central. Hence consideration of the explicit contexts of the production and reception of musical acts and events might enable the contributions of the different dimensions to musical meaning to be disarticulated.

It is also necessary to consider how empirical evidence for the functioning of these different dimensions in the experience of meaning and affect in music might be sought. While there is strong (if generally ethnographic rather than experimental) evidence for the operation of culturally-enactive features in musical experience, experimental work on the other two dimensions largely remains to be conducted. There is some suggestive evidence for the operation of motivational-structural factors in the experimental literature on music and affect, which can be interpreted as implying that certain global features of music will be experienced as consistently eliciting, or leading to attributions of, distinct types of emotion (see, e.g., Husain, Schellenberg & Thompson, 2002). At present experimental studies of the relationships between the global structural characteristics of musical signals and listeners' attributions of, or experience of elicited, affect are being conducted in Cambridge (Kronhaus & Cross, forthcoming), and results to date appear to support the notion that such relationships can best be explained in motivational-structural terms.

The present proposal has much in common with the 'teleofunctionalism' proposed by Millikan (2004), in which meaning-carrying internal states arise in biological systems in response to biologically-significant event-types through processes of evolution; it does not differentiate between motivational and conceptual-intentional states as loci of meaning. As a consequence, perhaps the most significant theoretical issue that the current model raises is to determine how these

different dimensions of meaning may function within music considered as a semiotic system. These dimensions constitute a decomposition of meaning in music; how might meaning be recomposed within the musical sign? The different dimensions are not being proposed as different levels on which meaning may exist within music, but as different dimensions that may be simultaneously operational at different semiotic levels, from the iconic through the indexical to the symbolic. Any single musical act or event will almost inevitably afford scope for being interpreted in terms of its motivational-structural, socio-intentional, and culturally-enactive significances, but an understanding of the ways in which that musical act comes to function semiotically within a culture requires that the three-dimension be located within a model of semiotic process. This problem is presently being explored by Elizabeth Tolbert and myself (see also Cross, 2006, submitted).

This is, fundamentally, an evolutionary model of meaning in music, where meaning is seen as arising from processes that are likely to have had different evolutionary roots. It suggests that some aspects of human musicality - and perhaps, of human communicative systems in general - show continuities with the capacities of other species, in positing the operation of motivational-structural principles in the experience of music. It also suggests that there are likely to be discontinuities between the capacities of other species and human musicality by postulating the operation of a socio-intentional dimension of musical meaning that is unique to humans, and it is conceivable that the human capacity to entrain is also a human-specific capacity.

Elsewhere (Cross, 2003b) I've suggested that musicality is an exaptation arising from processes of progressive altricialisation in the later hominin lineage, with musicality emerging as part of the mature human behavioural repertoire as a means of conserving, regulating and expressing the exploratory values of childhood modes of thought and behaviour. The view of musicality advanced here would suggest that music is complementary to, and co-extensive with, language.. Music is a foundational component of the human communicative toolkit, having powers in situations where language may be inefficacious; language and music are perhaps best conceived of as extending towards each other from opposite poles on a continuum of specificity of meaning (Cross, 2005). It is likely to have arisen, in a form that would be recognisable as musicality, together with language rather than itself constituting one of language's evolutionary precursors; any evolutionary precursor of this

powerful communicative toolkit would have expressed the functions of both language and music rather than those of one or the other.

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