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ANTECEDENTS OF MUSICAL MEANING IN THE MOTHER-INFANT DYAD

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The universality and cultural prominence of music suggest that it contributes something essential, not simply ornamental, to human existence. Its mysterious and apparently unique capacity to move listeners emotionally has led people in all societies to find it profoundly meaningful, even though this meaning may be difficult if not impossible to describe. In earlier times and other places, music was assumed to be of supernatural origin; in the more rational scientific and philosophic climate following the Enlightenment, a number of naturalistic explanations have been advanced (see Section I). It remains the case, however, that there is no accepted systematic and plausible account proposed for music's evolutionary origin and function; indeed, most biological thinkers, like Darwin (1871), view music as a "mystery." Yet if one takes an evolutionary view of human behavior, it seems clear that there must have been a time in our remote past when music, like language, did not exist. Its centrality and persistence in human experience indicate that it must have been adaptive. Why then did it arise, and when, and from what antecedents? The enjoyment that people everywhere take in music, the time, energy, and material resources they often expend in making or listening to

it, and its ubiquity all suggest that it has, or had, evolutionary importance.

A new look at music's evolutionary antecedents seems relevant in light of new findings and possibilities for synthesis in a number of current disciplines. Ideas in human ethology and sociobiology offer new theoretical approaches to the evolution of human behavior. Theory and information in new areas of psycholinguistics provide fertile departures for understanding human music. The field of neuroscience contributes relevant new knowledge about brain organization, function, and development to music as to other branches of human mentation. Studies in ethnomusicology reveal a multiplicity of notions about and uses of music in other societies, and stimulate a widening of our concept of music as a human behavior.

In the present paper, I will utilize ideas from the above fields in order to take a fresh look at the question of music's evolutionary origin and function. I view this as being a necessary first step toward understanding the sources and some of the reasons for its emotional power in human experience, i.e., its "meaning" as humanists and philosophers have traditionally conceived it.

The paper summarizes a larger study-in-progress and therefore is subject to the inevitable shortcomings of a complex synthesis presented in abridged and preliminary form. Additionally, it should be clear that I do not address the

genesis or function or meaning of a particular work or type, or of an individual experience, creation or performance of music.

The paper has three parts: (I) a critical overview of earlier biological or quasi-biological accounts of music's origin and function; (II) a description and analysis of universal "musical" features in mother-infant engagement ("babytalk"); (III) a proposal that human music, like many "derived" or ritualized behaviors of affiliation and appeasement in other animals, originated in parental behavior -- specifically in mother-infant engagement.

I. Inadequacies of Earlier Evolutionary Views

Previous speculative accounts of the evolutionary origin and function of music are inadequate for several reasons. Explanations proposed by nonbiologists may be based on outdated or naive views of evolution, while those proposed by biologists are often ad hoc, adopted uncritically and simplistically from analogies with other animals. Moreover, what is meant by "music" is too often based on unexamined ideas that are specific to Western culture, leading to oversimplification or overgeneralization.

Although Wallaschek (1893) posited that the origin of music must be sought in a fundamental rhythmical impulse that arises from a general "appetite for exercise" (similar to the idea of "surplus vigor" suggested by Spencer (1880-82) as the origin of play and art), the most frequent suggestions about the biological origin and function of music have begun with human

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vocal expression and communication, e.g., emotional outcries that inherently are strongly moving or alarming -- weeping, sobbing, calls for help, excited speech, shouts of joy, and so forth (North, 1959, Hutcheson 1725, Lacépède 1785, Spencer 1857, Rowbotham 1885), e.g., what today might be called "acoustical innate releasing mechanisms" (Eibl-Eibesfeldt 1975:498-99; 1989).

Music has also been traced to other vocal sounds from human activity -- e.g., hunting calls that imitate animal cries and birdcalls (Geist 1978); synchronizing sounds for rhythmic work such as pulling nets or pounding grain (Bücher 1896; Hornbostel, in Sachs 1977); lullabies; accompaniments to dance and festal excitement (Stumpf 1911) -- these sounds gradually acquiring refinement and social purpose (Sachs 1977).

Other theories have looked to human speech itself -- to the babbling of babies (McLaughlin 1970), to tone languages where different pitches of the same syllable are semantically significant (Kuttner 1951 and Schneider 1957, in Sachs 1977), to chanting, or even to signalling across valleys and distances -- hoots and hollers (Stumpf 1911; Hall-Craggs 1969).

Charles Darwin (1871) noting that animal sounds are functional, ultimately contributing to procreative fitness, suggested that music derived from mating calls that may have preceded language in human evolution.

It appears promising to seek the origins of music in human expressive utterance, since music, like speech, alarm calls, weeping, and so forth, expresses and elicits emotion. At the

same time, however, earlier suggestions in this vein do not go far enough.

To begin with, it is limiting to seek the origin of music in specific sounds with specific emotional content or purpose (e.g., the need for attention and care, or alarm, or sexual desire, or high spirits, or grief). While some music may be intended to express a specific emotion, it does this less with specific sounds than by organizing these into an affecting pattern. In any case, music need not, and usually does not, convey or arouse specific emotions at all. Hence, it seems more promising to look for music's origin in a human expressive vocal behavior where emotions are in some measure formalized -- structured in time -- rather than in one where emotions are simply expressed.

Additionally, the notion that music originated from emotional outcries (or anything else) requires explaining why musical treatment was given and what it added. What would be the motivation for -- that is, what would be accomplished by -- making music out of shouts of joy or grief? They are quite effective and communicative as is, and people who might choose to musicalize their specific emotions would not appear to receive demonstrable benefits over those who don't.

Finally, suggestions about the individual evolutionary functions or selective benefits of musicmaking are all too often commandeered from the accepted benefits of analogous or superficially similar behavior in other animals: these include

signalling an individual's mood or intent; indicating recreation or enjoyment; generating contagion; regulating movement; or displaying an individual's skill or prowess. Although any of these may be accomplished by one or another specific instance of music, it seems unwise to generalize one adaptive benefit to explain the entire phenomenon. For example, once anything has evolved it can be used culturally for display or message enhancement -- say the length of one's hair, or the impeccability of one's accent -- but this need not imply that hair or the articulatory organs of speech evolved originally for such a purpose. Thus I suggest that although it may be that in specific instances a particular type of music may serve a specific evolutionary function or secondary function (such as synchronizing movement in work, or allowing people to show off their talent so that they are more attractive to and successful with the opposite sex), I believe that we must consider whether musical behavior in general may have initially arisen to serve a more general and overarching function.

II. Universal Musical Features in Mother-Infant Engagement

A. The Importance of Prosody in Human Speech

Prosody refers to the nonverbal or expressive features of spoken language -- its intonational and rhythmic characteristics (e.g., patterns of pitch and stress, the use of pauses and timing). In human speech, prosodic features give both emotive and expressive coloring --importance of the utterance, mood of the speaker -- and also may affect actual lexical meaning.

"Greenhouse" is inflected differently from "green house"; moreover, I can say "Yes, do that," and convey the ironic opposite of these words by my use of such things as pitch, volume, elongation of vowels, tone of voice, pauses between words, and forcefulness of articulation. Such meaning is social as much as substantive, conveying who is speaking, who is to take the next turn, how the utterance is to be understood, and what the speaker's intentions toward and relationship to the listener are (Bolinger 1986, 338). Depending on one's prosody, the words "You will not go" may convey threat, challenge, taunt, or question (Beauquier 1865).

Most people would agree that spoken language usually has a not always hidden agenda: e.g., to persuade, dominate, convince, impress, deceive, entreat, appease, and simply to maintain amiable association. As these aims are accomplished as much by prosody as by words and grammar, it is clear that the expressive component of speech has been of great importance to our species.

Yet this fact requires emphasis. Our neglect of the emotive components of speech is evident when we assign "language" to the left cerebral hemisphere. Granted, the left hemisphere is generally dominant for the syntactical or lexico-grammatical aspects of language: injuries to speech areas in the left hemisphere result in impaired ability to produce or understand grammatically appropriate or correct utterances.

It is less widely known or appreciated that in the right cerebral hemisphere, there are areas corresponding to those in

the left that are critical for producing, processing, and responding to the affective prosodic components of speech (Ross 1983; Simonds and Scheibel 1989 in Schore 1994, 483). Thus, injuries here also interfere with correct use of "language" (Ross and Mesulam, 1979, Ross 1981). (FN 1)

In infants the two hemispheres are not as specialized as they later become, and it seems reasonable to assume that persons in preliterate societies (including our remote human ancestors) who do not have years of schooling in sequential analytic skills of reading and writing will depend more on right hemisphere capabilities than many of us in modernized societies.

No matter how important lexico-grammatical meaning eventually becomes, the human brain is first organized or programmed to respond to emotional/intonational aspects of the human voice. (Locke 1993,369, 416; Schore 1994). Newborns, even premature infants, will visibly take notice of a human voice and quieten to attend to gentle talking, lulling, or singing. They can respond to variations in frequency, intensity, duration, and temporal or spatial patterning of sounds (Papousek and Papousek 1981:171). Babies only a few days old will synchronize movements of their bodies with the sounds of human speech or with adult head movements, exhibiting rudimentary entrainment (Condon and Sander 1974; Peery 1980; Condon 1984). It is of course the prosodic and emotion-conveying features of the utterances to which they respond, not to their lexical or linguistic meanings.

B. Babytalk

1. Background

In all cultures, most people, not only mothers, commonly behave differently with infants than with adults, or even older children. The rhythms and melody of their utterances display a special clarity and appeal. They use exaggerated facial expressions, movements, and vocalizations in a way that invites a dyadic interaction, the features and patterns of which resemble dyadic ritualized behaviors in other animals. Why do they do this? What is accomplished by this striking yet commonplace communicative interaction that we tend to call, dismissively, babytalk?

Studies of the effects of maternal deprivation in nonhuman primates indicate that the mother-infant bond extends well back into our prehominid past. In the 1960s, John Bowlby, a child psychiatrist acquainted with the reactions of young children who for various reasons had been separated from their mothers, postulated that there is a positive need for infants to form what he called "attachment" with caretakers (Bowlby 1969, 1973). He described attachment as a complex of behaviors that serve to maintain proximity between the pair. He hypothesized that the evolutionary value of this proximity seeking to the helpless hunter-gatherer's baby was that it would not wander far away, and when frightened, or alone, it would cry, reach out, move toward, or otherwise try to resume contact with a specific protective figure, rather than remain vulnerable to predators or accidents.

We see comparable behaviors in many helpless young birds or mammals.

In the years since Bowlby's formulation, research with much younger infants has shown unexpected and quite remarkable inborn abilities and proclivities for interaction and intimacy, which suggest that attachment -- concerned primarily with the infant's physical safety -- should be viewed as a late-appearing consequence of a prior, equally innate and adaptive predisposition to engage in relationship and emotional communion. A few minutes after birth, for example, a neonate shows a preference for its mother's voice, which it has heard from within the womb. It can imitate facial expressions, like protruding the lips or tongue or opening the mouth, and hand opening and closing (Meltzoff and Moore 1977). Far from being passive recipients, responding reflexively to a stimulus, babies come into the world actively ready to communicate their needs, feelings, and motives to other persons, who themselves will respond by presenting the world to the child in precisely regulated ways. In numerous papers, Trevarthen (e.g., 1974, 1977, 1979a, 1979b, 1987, 1990, 1994) has described this "with-the-other-awareness," which he calls innate intersubjectivity (1979a, 1992), an inherent biological foundation not only for "attaching" but for eliciting and responding to emotional communication with an other.

Thus the inborn need for attachment that Bowlby described is separate from (MacDonald 1992) or built upon an even more fundamental inborn readiness of the baby to seek, respond to and

affect the mother's provision of not only physical protection and care but of emotional regulation and support (Dore 1983; Stern et al. 1983; Trevarthen 1984; Fernald 1984, 1985, 1989; M. Papousek et al. 1991; Schore 1994). In most cases, the pair practice and perfect their attunement of motivation and affect by engaging in a mutually-improvised interaction based on innate competencies and sensitivities that are at the same time emotional and musical. Long before classically-described attachment takes place, babytalk is providing enjoyment and intimacy for both participants and significant developmental benefits for the infant.

2. Characteristic Features

While the term "babytalk" (also called "motherese" or "infant directed speech") refers narrowly to the mother's utterances, these, and their accompanying gestures and facial expressions, are inseparable from the responses of the baby to whom they are addressed. With facial expressions, vocalizations, and movements of head, body, and limbs, infants solicit, participate in, and influence the behavior and sounds that are directed to them. Babytalk then is a sort of duet, a multimedia dialogic performance. [LIAM RECORDING & TRANSCRIPT]

The typical characteristics of babytalk have been described and analyzed by many researchers (e.g., Stern 1977, 1985; Fernald 1984; Trevarthen 1984; M.Papousek et al. 1985; Beebe 1986; Greiser and Kuhl 1988; Trehub, Trainor and Unyk 1993; Locke 1993). Such studies show a complex but describable

structure and development, universal features, and demonstrable adaptive benefits.

From birth to between three and four months, a mother's babytalk utterances universally tend to be spoken in a high, soft breathy voice. They are short and repetitive, with clear interposed pauses. They have distinctive, well-controlled pitch contours, and as one researcher has described it, are "vowel drenched," thus allowing for the contour to be sustained and emphasized. Regular stresses set up a steady rhythm that is soothing and reassuring. The subject matter comes from moment-to-moment occurrences -- comments on the baby's looks, actions, on events in the vicinity, and so forth. As the weeks pass, the mother subtly adjusts her sounds and movements to what the baby seems to want (or not want), and to its changing needs and abilities. She gradually moves from gentle cooing reassurance to trying to engage the baby in increasingly animated mutual play, as if she is assisting it to arrive at a mutually-negotiated optimal level of interest and sociability. To these ends, utterances and facial expressions become even more exaggerated, both in time and space -- i.e., they are formed more slowly, held longer, and punctuated with behavioral rests or silences.

What is said and how it is said also change gradually. Vocal pitch frequency remains raised, but utterances become longer with longer pauses between them, and utilize a greater range of pitch contours. The pair interact to a "beat" set up mutually and supported by the mother's movements and

vocalizations, and she will react to a baby's gesture (even a hiccup) as if it were a vocal reply. Yet there is increasing variation on the underlying rhythm in the form of dramatic crescendos, diminuendos, accelerandos, ritardandos, and glissandos. A mother will systematically modulate tempo to influence the infant's level of arousal, either increasing or decreasing it according to how she perceives the baby's present state. Imitation of each other's vocalizations and facial expressions, both involuntary and deliberate, contribute to mutual enjoyment and attunement. In 3 to 4-month-old infants at play with their mothers, there is a remarkable simultaneity of vocalizations.

As babies grow older, they desire more stimulation so that there is a gradual movement from delicate to more vigorous play. Mothers use dramatic and exciting games and songs, interspersed with excited vocalizations that induce or reinforce the baby's readiness to play. [MEGAN RECORDING AND TRANSCRIPT] At 5-8 months, they respond vigorously to teasing and structured routines where their expectations are manipulated by pregnant pauses or unanticipated diversions, often building to a climax (see also Papousek et al. 1984).

Toward the end of the first year, babytalk wanes. The mother's task, led by changes in the infant's needs, becomes more instructional (i.e., more lexical). The baby finds excitement in exploring and learning about a larger world, and the mother-child

interaction begins to contain more referential content and to sound more like adult conversation.

3. Benefits to Infants

"Babytalk" routines vary culturally, but mothers seem to find them "natural" -- they do not deliberately set out to act in some outlandish way or to "teach" their babies. As far as mothers and babies are concerned, they are simply "having fun," or enjoying each other's company. Yet we can posit a number of benefits contributing to the baby's emotional, intellectual, linguistic, psychosocial, and cultural development.

(a) There is the establishment of physiological and emotional attunement and reciprocity, contributing to the bond between mother and child.(FN 2) Both simultaneous and dialogic vocal matching and motor mimicry convey the message "I can feel as you do. I am like you" (Bavelas et al. 1987; Beebe and Lachmann 1988), and provide nonverbal emotional information about each other and oneself. By negotiating shared meanings, the pair will learn to regulate the other persons' stimulation, and to anticipate and adjust to each other's individual natures.

(b) The baby learns emotional "coping". In the babytalk interaction, a mother offers the infant emotional regulation and support by assisting it to identify and discriminate different dynamic states as they are expressed vocally and gesturally. The baby gains acquaintance with its own shifting levels of excitation and positive or negative feelings, developing some degree of self-regulation of these levels and feelings.

(c) Through emotional interchange, the infant also receives cognitive and intellectual benefits. By "anticipating," the baby hypothesizes what will come next and learns how to evaluate discrepancies from the expected; based on what is given, it judges how fast or slow a "climax" will occur and through experience tests and perfects these expectations or predictions.

(d) Students of language learning report how these early babytalk routines prepare the way for eventually making and being able to understand the prototypical and meaningful sounds of the language one will speak.

(e) Social (and psychosocial) benefits are enormous. The vocalizations that infants hear in babytalk help them to recognize individuals and to interpret and predict their behavior (Locke 1995). What is more, neuroscientists describe that "socioemotional interchange between an adult and a developing brain" (Schore 1994, 537) critically and indelibly shapes and influences the development of neural structures responsible for the infant's socioemotional functioning for the rest of the lifespan (Schore 1994; Trevarthen and Aitken, in press).

(f) Finally, in mother-infant interaction, what is considered appropriate in the culture is first learned and assessed. Different cultures instill their own norms of proper behavior.

4. Cross-Cultural Variants

There is not time in a paper of this length to discuss the many variations in babytalk from other societies described in

the literature, although it is obvious that in order to substantiate my claim that mother-infant interaction is a plausible evolutionary origin for the behavior of music, it is necessary to take these into account. In the dozen or so societies in which mother-infant engagement has been studied (see, e.g., Leiderman et al. 1977; Field et al. 1981; Hamilton 1981; Schieffelin and Ochs 1986), the earliest phases seem most similar. Mothers and infants everywhere engage in mutual gaze, smiling, touching, holding (including rocking and patting), vocalizing (the mother in "motherese"), and the infant looking at the mother's face (Lewis and Ban, 1977). These six components may vary in relative importance in different societies, but all occur. There is also a widely-found "caretaker greeting" where with visual contact the caretaker makes a slight retroflexion of the head, raises the eyebrows, opens the eyes wide, slightly opens the mouth, and gives a verbal greeting and/or a smile.

In one example, young Arnhemland Aboriginal infants are rocked and cuddled by their mothers, who deliberately and systematically evoke smiling responses with conventionalized noises (hisses, tongue clicks, grunts, lipsmacking) and especially by looking at the baby, moving the head toward it, and saying "Nhhhh-Nhhhh" with the tip of the tongue curled behind the lower teeth and the tongue protruded (Hamilton 1981, 30). This smile-eliciting device is frequently used by others as well, who also pinch, tickle, rock, joggle, and kiss (p. 44) others' babies, while making nonverbal sounds and repetitive

vocalizations. However, no one says very much to babies (p. 41), and verbal proficiency is not encouraged. Between 6-18 months, they receive as many gestural messages as verbal ones (p. 63). According to Hamilton, the culture makes much use of subtle nonverbal gestures of intention and emotion and children learn to perceive these as an intrinsic part of their society's communication system.

It is in the later stages of babytalk where the most variation exists, and where individual cultural norms of appropriate social behavior are instilled and reinforced. For example, American English mothers tend to have more extreme and dramatic intonational elements than British English, French, Italian, German, and Japanese speaking mothers (Fernald 1989). Japanese mothers use more repetitive nonsense syllables, onomatopoeia, invented words, and imitations of their infant's sounds than do American mothers (Morikawa et al. 1988; Toda et al. 1990), and spend more time soothing and less time arousing them than do American mothers.

In some societies, mother-infant vocal and behavioral interaction is greatly subdued and might seem initially to invalidate the claim that babytalk is based on innate species-wide proclivities. For example, Navaho mothers are reported to do little to actively encourage vocalizations or smiling, although during removal from the cradleboard there is face-to-face contact, smiling, and caretaking, and the infants spend the same amount of time looking at their mothers as infants in other

societies do whose mothers make vocalizations (Chisholm, 1983). Researchers report that Mayans in Mexico had no playful mother-infant interaction at all, no elicitation by mothers of social responses (Brazelton, 1977). These same infants also showed little curiosity or response to novel items shown to them by investigators. Yet Mayan villagers in Guatemala, like many mothers in traditional societies, allow infants and toddlers to sleep with them for several years, out of a reported commitment to forge a close bond with their offspring. (Morelli 199_). Mexican Mayan mothers may well also sleep with their children, and one would like to witness their interaction before falling asleep or upon waking. In other words, I take reports of no mother-infant interaction with a skeptical grain of salt.

Certainly, as studies of the Gusii of Kenya (Dixon et al., 1981) suggest, the "musical" components of mother-infant interaction need not be shown only or even primarily in vocalization or dramatic buildups. They have what appear to be monotonous mother-infant interactions with little eye contact and play. However, film analyses show a noticeable cyclic modulation of activity, controlled by the mother with gaze aversion (the converse of classically-described mother-infant interaction where the baby breaks contact by looking away).

Daniel Stern's (1985) notion of "attunement" indicates that the salient elements of babytalk, even in Western mothers, need not be strictly verbal. He describes how behaviors may be matched in different modalities rather than directly mirrored or

imitated. (FN 3). Infants can perceive such features of experience as intensity, contour, time, shape, rhythm, and duration intermodally or analogically -- e.g., loudness matched by strong movement, dots on a screen matched to a rhythmic beat (Eimas 1984; Stern 1985, 153). Crown et al (1988) have shown mothers and six-week infants to interact dialogically in a cross-modal (mother vocalize/infant gaze) interaction. Microanalyses of mother-infant engagement in the United States have shown reciprocal adjustments of behavior completed within seconds or fractions of seconds with a discernible structure or "rules" of mutual regulation (Beebe 1986, 29; Beebe and Gerstman 1984). I suspect that rigorous investigation and analysis would reveal in other less vocal and dramatic cultures where stimulation and intensity are not developed, or in energetic but nonverbal interactions as in Arnhemland, that mothers and infants are nevertheless temporally and dynamically adjusting their behavior to one another, in ways that escape direct observation in real time, and achieving the individual and social benefits described by investigators in the "typical" babytalk of Western mothers.

It is interesting that when the experimenters instructed the Gusii mothers to talk and smile to their infants, the latter responded with cooing vocalizations, big kicks, and large smiles. Vocalization in babies is most effectively elicited and most joyfully produced if rewarded with parental response and turntaking (Papousek and Papousek, 1979), so it is reasonable to assume that without encouragement a potential will gradually

fade. The competence for the full range of behaviors seems demonstrably to be there and wanes -- as in the Mayans, Gusii, and Navahos -- if not reinforced. The observation that caretaker-infant association is vocally, visually, and physically stimulating in modern hunter-gatherer groups (e.g., Hamilton 1981, Konner 1977) -- whose cultural behaviors are presumably closer than those in other kinds of societies to early human groups -- indicates that active, arousing interaction may well be more ancestral, having become subdued in some cultures.

5. Musical Elements

Even though semantically-meaningful words are used in babytalk, they are presumably heard by the baby as combinations of sounds with particular features and relations, not as verbal messages. These combinations, features, and relations of sounds can plausibly be described as, fundamentally, musical (Papousek and Papousek 1981b), suggesting the possibility of an evolutionary relationship between mother-infant interaction and music:

(a) The prosody of babytalk, like music, has intonational contour ("melody"), rhythmic regularity and variety, pauses or rests, and dynamic variation in intensity (stress and accent), in volume (crescendo and diminuendo), in speed (accelerando and decelerando), and in alterations of vocal timbre.

(b) Mother-infant engagement and music are temporal structures, making similar use of framed episodes, or "bouts," each with a clear beginning or introduction and final felt

closure, sometimes with a refrain or coda. The utterances also appear to be organized primarily into what can be transcribed as lines (or phrases), judged either by number of words, or by timed length which is generally 3 to 4 seconds, as demonstrated by Turner (1985) and Pöppel (1985) to universally characterize lines of verse -- and which Lynch et al.(1995) find to characterize phrases of prelinguistic vocalization, adult speech, oral poetry, and music (see also Krumhansl, C. L., in press). Often the episodes contain a theme or themes that are varied, thereby creating, manipulating, delaying, and ultimately satisfying expectation.

(c) Of particular interest is the importance of bodily movement in mother-infant interaction, whether in eliciting interactive behavior, in sustaining intensity, coordinating synchrony, or in recognizing each other's participation in the "beat" of the encounter. Indeed there seem to be a number of cultures where movement takes precedence over vocalization.

As theorists have tended to neglect the importance of gesture to language and thought (McNeill 1992) and the importance of prosody to spoken langauge, so has the integral importance of bodily movement in musical behavior been overlooked in the way we define "music" in Western culture. Yet ethnomusicologists have pointed out how "music" in most cultures generally includes both words and/or movement -- dancing, clapping, or otherwise marking time. It is also the case that children until the age of four or five cannot distinguish the rhythm of a piece from accompanying

movements, and find it difficult to sing without moving their hands and feet (Suliteanu, 1979). Infants 9-13 months of age moved differently to a lively and to a slow recorded segment of music, indicating that they can respond appropriately to temporal patterning of complex auditory sequences (Trehub 1993). It seems clear that music as a human behavior typically includes physical movement (although in the modern "concert" context this is usually suppressed).

(d) Both mother-infant engagement and music are social behaviors, a resemblance we might overlook without the ethnomusicological observation that people generally make music for and with other people (Feld 1974, 207).

(e) And finally, the results are similar:

(i) both are pleasurable and emotional, giving enjoyment through nonverbal means with much involvement of known right hemisphere competencies -- e.g., facial and intonational processing, whole pattern recognition, and somatosensory input (Borod et al. 1983); processing prosodic contours, facial expressions, and gestures (Blonder et al. 1991); the processing, expression and regulation of emotional information (Schore 1994); and crossmodal perception or analogy (Tucker 1992).

(ii) One often hears it said that one's responses to music are inexpressible -- they "cannot be put into words" -- and infant experience of course is nonverbal.

(iii) Both attune or synchronize participants.

(iv) Both are means of social-emotional regulation and control.

(v) Attunement or synchronization leads to emotional bonding or "self-transcendence."

III. Music as a "Derived Activity"

The fact that the human infant is exquisitely prepared to respond to the prosodic or musical features of human speech argues for their importance to babies' subsequent development, as is borne out by the many studies that indicate the emotional, intellectual, linguistic, psychosocial and cultural benefits attendant upon the highly musical babytalk dialogue.

Yet, any suggestion about the evolutionary origin of a behavior ultimately rests on the plausibility of the case made for the further development of that capacity. How could a complex behavior like music have evolved from anything -- in the present case, babytalk? And why?

My argument uses an ethological perspective, making use of studies of both play and ritual (behaviors that exist in other animals) in order to suggest intervening "steps" between mother-infant interaction and music. Specifically, I propose that in vocal play, ancestral human children elaborated the already important and appealing "musical" elements of babytalk -- keeping them going, as it were. Ancestral human adults, who of course were once children and then parents, spontaneously used and elaborated these elements as they created ritual ceremonies.

A. Ritualization and Ritual

Tinbergen (1952) introduced the concept of "derived" activities that during evolution arise and become emancipated from earlier functional attributes, acquiring new communicative meaning as social signals. More recently, Eibl-Eibesfeldt (1989, 439-40) has outlined the general changes that occur in this process that ethologists call ritualization. The ultimate result is to make the signal -- the derived behavior in its new communicative context -- prominent, unequivocal,and unmistakable to the perceiver.

These changes include the following: (a) movements (including vocalizations) are simplified, often repeated rhythmically, and their amplitude exaggerated; (b) variations in the intensity of the signal now convey information; (c) the releasing threshold is lowered, making elicitation more likely; (d) there is often a concomitant development of supporting organic structures (in animals, such things as manes, crests, tails; in humans, these are often accomplished by clothing, cosmetics, and so forth); (e) the motivation for producing the original signal often changes as it acquires a new meaning.

Using these characteristics, I believe that it is warranted -- despite cultural variations -- to consider certain general features of the dyadic behavior of babytalk to comprise a biologically-endowed ritualized behavior, one that both partners are predisposed to elicit and respond to.

In humans, unlike other animals, culturally-created ritual ceremonies of varying degress of complexity are also highly developed. They too manifest the regularization, exaggeration, formalization and perceptual salience of biologically-evolved ritualized behaviors in animals, and are concerned with similar abiding concerns of social life -- display of resources, threat, defense, and (conspicuously in humans) affirmations of affiliation.

It is well known that in many mammals, birds, and insects, elements of infant or caretaking behavior are the origin of biologically-endowed ritualized expressive sounds or actions ("releasers") that promote social contact, appeasement, and affiliation in adults. (FN 4) For example, in courtship, male sparrows shake their wings like a juvenile asking for food (Eibl-Eibesfeldt 1989, 146) and male ravens make a silent coughing motion of the head that resembles parental feeding behavior (Morton and Page 1992, 96). A courting male hamster utters contact calls like those of hamster babies (Eibl-Eibesfeldt 1989, 146). Even in our own species' billing and cooing, fondling of the female breast and kissing appear to derive from suckling and from parent-infant "kiss feeding": (Eibl-Eibesfeldt 1989, 138). Chimpanzees are especially likely to kiss -- a signal that observably calms and reassures -- during reconciliations (Trivers 1985). Mutual gaze is a feature of lovemaking in humans (Stern 1977), as it is in bonobos (Savage-Rumbaugh and Wilkerson 1978). In humans, love songs and courtship speech use childish words and

refer to childish things to create and display intimacy: e.g., the "tu" form of discourse; popular songs that express sentiments like "Cuddle up a little closer," or "You're my baby." Smiling, which is first developed ontogenetically between infant and mother, becomes in adult social interactions a universally-used means of appeasement and affiliation, along with other facial expressions and movements common in mother-infant interchange -- looking at the other, eyebrow raising and flashing, and bobbing the head up and down (see also the discussion in Schelde and Hertz 1994). Many adult mammals assume infantile postures and make infantile sounds to deflect aggression.

I would like to suggest that the biologically-endowed temporal and other prosodic sensitivities and competencies of mother-infant interaction (described in II-B-2 and II-B-5) were found by evolving human groups to be emotionally affecting and functionally effective when used (and when further shaped and elaborated) in culturally-created ceremonial rituals where they served a similar purpose -- to attune or synchronize, emotionally conjoin, and enculturate the participants. These unifying and pleasurable elements of babytalk comprised a sort of behavioral reservoir from which human cultures could appropriate appealing and compelling components for communal ceremonial rituals that similarly promoted affiliation and congruence in adult social life. These features were then developed, culturally codified (and, in some societies, even emancipated) as "music," as satisfactions in their own right, apart from ceremonial contexts.

B. Vocal Play and Imitation

There is convincing evidence in studies of infant and child development that the motivation to appropriate and elaborate prosodic (as well as lexical) features of language exists universally in humans -- in children's vocal play. The earliest vocal play in infants, after eight weeks when there is some control of respiration and the vocal tract, consists of prolonging sounds (Papousek et al. 1984); between 4-6 months, there are more substantial vowel-like sounds, bilabial trills, squealing, and growling (Locke 1993,176). True babbling begins between 6-10 months of age (Oller and Eilers 1988), and occurs more when alone than with others.

Children spontaneously initiate speech activities -- sound play, word play, distorting speech, and monologues -- that are unlike any shown to them by their parents. Even Kaluli children in the Southern Highlands of Papua New Guinea, where parents consider such activity to interfere with proper development of language and terminate it whenever they hear it, manipulate pitch, prosody, and timing in their sound play, and invite turntaking (Schieffelin 1990, 99) -- like children everywhere.

Such sound play is surely "musical." Indeed one could argue that the differences between music and the prosody of spoken language are only in degree of elaboration (including sustaining, repeating, and patterning tones -- i.e., exaggeration and regularization reminiscent of the ritualization process).

Kartomi (1991) has studied the spontaneous improvised musical phrases uttered by children while they concentrate on their play, and claims that this "play song" is distinct from the lullabies and nursery rhymes or songs created by adults for children. Rather, she says, it is created by children for use in their own adultless play world (p. 53).

Such "musical doodling" is ephemeral. The few improvised songs that are remembered and adapted into the corpus of established children's songs tend to be those whose texts express a memorable experience of pleasure, pain, fear, solidarity, or derision, and these songs are normally sung when playing games, eating together, teasing each other, and on occasions demanding solidarity with each other (p. 62). Even these more stable songs include an element of improvisation. While rhythm and metre are usually primary and fixed, the melody and form are secondary and variable. Such a propensity in children suggests that ancestral adults could well have followed a similar course in ritualizing "natural" vocalizations at times of strong emotions and when solidarity was displayed or required.

The readiness of children to imitate adults and each other is of course well known as an attribute of sociability and ultimately, educability (Bruner 1972). Imitation in adults also has a bonding effect (Bavelas et al. 1987); inviting a partner to imitative behavior by starting some action oneself or using imitation to express accord and thus a readiness for group play

is a principle of many bonding rituals. Doing things together confirms a sense of unity (Eibl-Eibesfeldt 1989, 510).

C. Ceremonies, Music, and Babytalk

There are, of course, countless examples in premodern and modern societies of the use of musical means (e.g., singing, chanting, drumming, instrumental playing, rhythmic movement) in ritual ceremonies. These may be dyadic like mother-infant engagement, using alternation and imitation as a way to create or express understanding and unity, or they may be concurrent, with all individuals performing actions together and thereby creating and confirming unity (e.g., Basso 1985). I have found examples too numerous to mention here of culturally-derived ceremonies whose structural and expressive elements resemble those of mother-infant engagement and which also acculturate and unify. Even societies that are poor in material culture or the visual arts still engage in musical behavior.(FN 5)

As well as using musical elements, many human rituals of appeasement or social solidarity come directly from infant-like behavior. The Bedouin ghinnawa ("little song") is an improvised poem that employs metaphorical terms evocative of childhood to reveal in a socially-acceptable way sentiments that are otherwise prohibited (Abu-Lughod 1986). The song voice used in the gisalo ceremony of the Kaluli uses sounds associated with a child whining for food to make listeners feel sorrow and pity, and thereby reinforces cultural themes of reciprocity and obligation (Feld 1982).

The many structural and functional resemblances to be seen in babytalk, ceremonial ritual, and music are, I believe, neither accidental or spurious. They suggest not only an evolutionary relationship, as I have outlined, but argue for the existence of an underlying amodal neural propensity in the human species to respond -- cognitively and emotionally -- to certain kinds of dynamic temporal patterns produced by other humans in contexts of affiliation. A propensity for relationship is thus at least as deep-dyed as the "self-interest" that has to date been the primary focus of sociobiological concern.

Notes

1. Interestingly, too, the right hemisphere processes vowels and the left consonants, which mark the semantically meaningful separations of morphemes and words. It is the vowels that are sustained and otherwise elaborated dynamically in music.

2. Affect contagion is a basic biological tendency among highly-evolved social species (Malatesta and Izard 1982), and has understandable evolutionary importance. The mother-infant bond can be viewed as the prototype for intense emotional unity.

3. Stern (1985) has refined his earlier analyses of mother-infant interaction to indicate the importance of attuning by "matching" -- e.g., (a) in intensity (as when loudness of the mother's voice matches an abrupt movement of the baby's arm or leg); (b) in contour (accelerating effort by the baby is matched by accelerating vocalization by the mother); (c) in temporal beat (nodding the head in rhythm with the baby's kicking); (d) in shape (moving the head up and down as the baby moves its arm); (e) rhythm; and (f) duration.

4. Eibl-Eibesfeldt (1989, 144) points out that wherever brood care exists, there is also affective behavior between adults; where it does not -- even where the creature is gregarious (as in iguanas) -- there is no affiliative or contact behavior in adults, and communication is restricted to display.

5. E.g., the Tikopia in the South Seas have relatively undeveloped plastic arts, but their music, poetry, and dance display a range of variation and elaborate articulation with many

nuances of form and expression (Firth 1973). The people of Alor pay little attention to material objects but have dances with versification; older men play gongs of different sizes in an "orchestra" where new rhythms or set patterns may be experimented with (Dubois 1944). Hunter-gatherer groups like Australian Aborigines and the Kalahari Bushmen have highly-developed musical traditions: song, dance, and poetry are an integral part of their lives (Anderson, 1990); the Aborigines, of course, have a rich tradition of visual elaboration of artifacts and themselves.

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