

MELODIC CONTOURS AS A CONNECTING LINK BETWEEN PRIMATE COMMUNICATION AND HUMAN SINGING

Inge Cordes

Universität Bremen, Germany

ABSTRACT

Background. Any probing of the question of whether music, which is exclusive to humans, is an entirely new phenomenon or whether there exist unknown connections with forms of vocal communication typical of previous stages in phylogenesis requires searching for early musical signs in human development. Universally parents use distinct, simple pitch contours in order to transmit emotional messages to the preverbal child. Their spontaneous appearance, triggered by the presence of an infant, indicates genetic predisposition.

Aims. As the melodic element plays an important part in singing, the melodic contours used in motherese were investigated as possible starting point for the melodies of songs. Additionally, possible connections to animal acoustic communication were sought.

Methods. Different forms of melodic contour in motherese serve different purposes, and their composition depends on social context. In order to establish possible similarities between melodic contours and the pitch contours of human melodies, songs were grouped into four categories by social situation: Praise Songs, Warriors' Songs, Songs to Arouse Attention and Lullabies. Corresponding ethnic songs from different cultures were analysed with regard to whether they contain pitch contours which correspond with those used in motherese.

On the basis of ethological findings, the characteristic features and functions of primate calls and those of the different forms of melodic contours were compared.

Results. Correspondence between pitch contours in songs and the melodic contours of motherese was established.

Primate ethological literature has shown parallels to exist between essential kinds of calls which are also at humans' disposal. This has given rise to the theory that in humans' prolonged period of progeny care the melodic contours must have evolved from the corresponding call classes of the modern human's ancestors. This requires further corroboration.

Conclusions. Music, especially singing, can be assumed to have developed from earlier forms of vocal communication with melodic contours as a connecting link.

1. BACKGROUND

Today it is taken for granted that humans and nonhuman primates have developed from a common ancestor. This shows in a large number of similarities in physique, physiology and behaviour. However, the faculties of speech and making music mark humans

off as unique. This gives rise to the question of whether the faculty of making music is an entirely new phenomenon specific to modern humans or whether there exist hidden connections with forms of vocal communication typical of previous stages in the evolution of humankind, or even with animal vocal production. The search for possible answers requires one to look for musical signs which are rooted in an early stage of human development. The melodic contours of motherese appear to be uniquely suited to this purpose. These are distinct, simple pitch contours, which are produced by marked modulation of the fundamental frequency. They are used universally by carers regardless of sex and age to influence the emotional state of the preverbal child. Their spontaneous appearance, triggered by the presence of an infant, indicates genetic predisposition on the one hand, while on the other they are considered antecedents of language. Therefore they appear to be a connecting link between biologically determined and culturally developed signs.

2. AIMS

This study examines whether there is a connection between original vocal expressions and culturally developed ones in music. This examination subdivides into two parts:

1. As the melodic element plays an important part in singing, the melodic contours used in motherese were investigated as possible starting point for the melodies of songs.
2. Possible connections to animal acoustic communication were sought.

3. METHODS

3.1. Investigation Of Melodic Contours In Songs

First, possible similarities of form and function between the pitch contours of human melodies and melodic contours of motherese were established by means of contrast and comparison. This is possible because of the context specific use of melodic contours in motherese. Thus:

- Parents increase the use of rising melodic contours for catching an infant's attention and encouraging it to imitate or to take its turn in dialogue.
- Gently falling contours are used to soothe an excited infant.

- Bell-shaped melodic contours prevail in approval of desired behaviour like smiling; they incline gently.
- Steeply falling- and steeply inclining bell-shaped melodic contours occur to discourage unwanted behaviour.

(Stern et al. 1982; Papoušek, M., Papoušek, H. & Symmes 1991; Papoušek, M. 1994)

Four song categories were chosen which are connected to social contexts which are comparable to those that have been investigated in language studies. Two of them are always linked to contrasting contexts. The categories are:

- Songs to Arouse Attention Lullabies (as soothing songs)
- Praise Songs Warriors' Songs

Songs belonging to any of these categories were collected from more than 60 cultures, such as Indian tribes of North and South America, African tribes, e.g. Zulu and Xhosa, Maori from New Zealand, songs from Borneo, Cambodia and Japan in Asia and a number of European countries. Their melodies were analysed with regard to pitch contour. A comparison with results from language development research was made in order to establish possible correspondences regarding shape and emotional meaning.

3.2. Investigating the Results Of Ethological Research

On the basis of ethological findings, the characteristic features and functions of primate calls and those of the different forms of melodic contour in motherese were compared in order to establish possible connections.

4. RESULTS

4.1. Proof Of Melodic Contours In Songs

Analysis of 185 songs has shown their melodies to be composed of pitch contours which display strong similarities with the different forms of melodic contour in motherese. They have thus been named in accordance with the language studies mentioned above. But in contrast to the glissando like movement of the melodic contours in motherese those in songs mostly progress in distinct steps.

The calculation of X-square from the sum toto of the frequency values of the different forms of melodic contour shows significant differences in their composition between song categories. This is illustrated by the diagrammes in Figure 2.

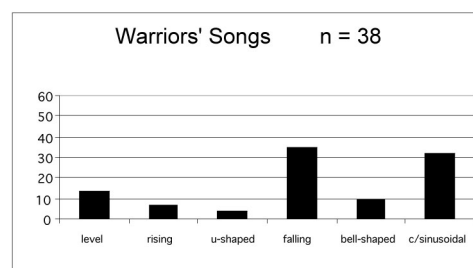
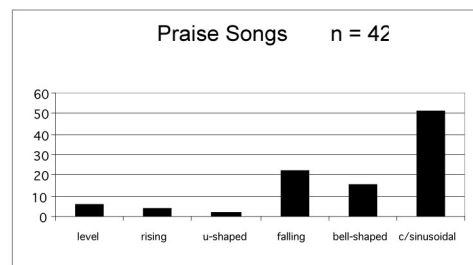
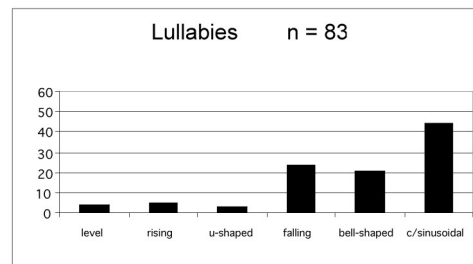
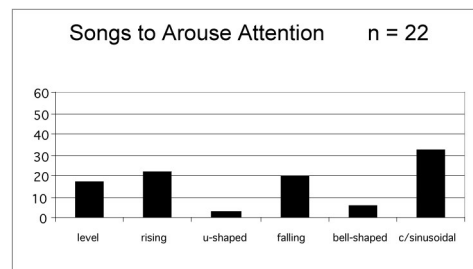


Figure 1: Proportional percentage of forms of melodic contour in Songs to Arouse Attention, Lullabies, Praise Songs and Warriors' Songs

Melodic contours were arranged so that all contours used to influence vigilance were ranged on the left of the x-axis. These are level, rising and u-shaped contours. They are followed by falling, bell-shaped and complex/sinusoidal contours. It is obvious that level and rising contours prevail in Songs to Arouse Attention. In Lullabies their use is limited, where falling, bell-shaped and sinusoidal contours prevail instead. In Praise Songs the distribution of melodic contours looks rather similar to that of Lullabies. The main difference is in the outstanding number of sinusoidal contours. In Warriors' Songs, the incidence of all forms of melodic contour useful for raising vigilance is higher than in those of Lullabies and Praise Songs. This makes sense, because this increases the effectiveness of other contours. These are sinusoidal and mainly falling contours.

Complexity is increased, because melodic contours may ascend or incline steeply or gently. Thus:

- In Songs to Arouse Attention steeply rising contours clearly prevail.
- In Warriors' Songs steeply falling contours predominate and of the bell-shaped contours those that incline steeply also prevail.
- In Praise Songs, by contrast, the gently falling contours predominate, and with bell-shaped contours both endings balance each other.
- In Lullabies it is the gentle variance of most forms of melodic contour that predominates.

In all song categories the number of sinusoidal contours is high, with Praise Songs taking the lead. Their shape is highly variable and depends i.a. things on category. In motherese, by contrast, they are not used much.

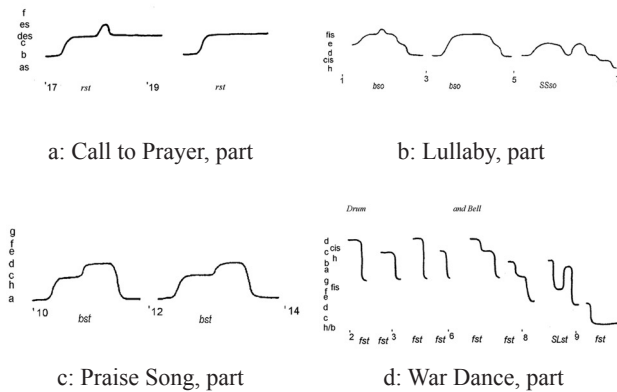


Figure 2: The parts of analytic graphs show a: steeply rising contours in a Song to Arouse Attention, b: gently ascending and likewise declining bell-shaped contours and a sinusoidal contour in a Lullaby, c: bell-shaped contours with high frequency range and steep decline in a Praise Song, d: steeply falling contours and a steeply inclining sinusoidal contour in a Warriors' Song.

[\[FIGURE2A.WAV\]](#)
[\[FIGURE2C.WAV\]](#)

[\[FIGURE2B.WAV\]](#)
[\[FIGURE2D.WAV\]](#)

The marked differences in the composition of melodic contours between categories point to different functions. These results concur with the findings of research into motherese. This correspondence confirms the initial hypothesis that melodic contours of motherese continue in song melodies.

4.2. Explaining The Origin Of Melodic Contours In Motherese - A Hypothesis

There is another finding which is of importance. The average duration of melodic contours differs between categories. This is of special interest in relation to ethological research findings. Following Tembrock (Tembrock 1966, 1971; Marler 1968) the main function of the acoustic system is the regulation of distance between individuals. He gives exact criteria defining the difference between distance enlarging- and distance reducing calls, thus attractive calls have a long rise time to full amplitude and are temporally stretched. For vertebrates they are characterised by dominating frequencies. By contrast, calls which have a repelling effect rise quickly to full amplitude and are short. They are noisy.

Precisely the same criteria are to be found in the melodic contours of the songs of different categories:

- Stretched contours which often rise or fall gently are typical of songs which are sung in social situations marked by closeness, such as Praise Songs and especially Lullabies. This is shown in Figure 2b and 2c.
- Short melodic contours which often start at the pitch climax and incline steeply or which rise and incline steeply predominate in Warriors' Songs, of which Figure 2d gives an example.
- Melodic contours which can be extremely long are found in Songs to Arouse Attention. They are comparable to animal alarm calls or calls for help, which are also stretched out long and very redundant in order to cover long distances, Figure 2a.

The existence of these common factors, which have a bearing on whether an utterance has an attracting or repelling effect and which also apply to melodic contours of motherese, reveal connections between the acoustic systems of humans and animals.

How can these connections be accounted for? Some researchers have looked for "motherese" in primates. But only Biben et al. (1989) and Lawick-Goodall (1967) report a special call which squirrel monkey- or chimpanzee mothers use in the first months when dealing with their offspring. Tembrock (1967) believes that attracting calls have evolved from aggressive ones through ritualisation. Because the latter had to bear more and different information they were expanded and became less noisy, or more melodious. Furthermore, sound signals of special structures have been found, which are used in similar situations by various species of primates (Marler 1965). One may suppose that they are also at humans' disposal. The calls of one particular species have been assigned to five classes, within which they are ranged according to degree of aggressiveness (Jürgens 1979), Figure 3. These findings have engendered the theory that in humans' prolonged period of progeny care this development has been continued. Accordingly, the melodic contours of motherese must have evolved from the corresponding call classes of the modern humans' ancestors as the emotionally positive pole as affectionate

responses to the infant's needs. The enormous brain growth, the increased volitional control of emotional vocalisation and the changes of the supralaryngeal tract are important conditions (Ploog 1992).

exist, the strong and immediate emotional effect of melody will become clear as well as the persistent human need for musical expression.

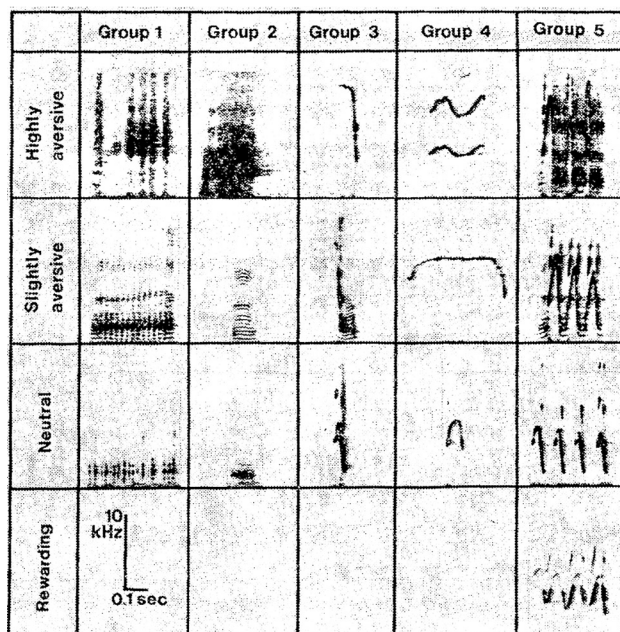


Figure 3: Schematic summary of the relationships between call type and emotional state as determined by the self-stimulation procedure of the squirrel monkey. In Jürgens 1979, p. 112

Thus soft, low frequency sinusoidal contours may have evolved from the first call group, soft bell-shaped contours from the second, softly falling contours from the third, the attention arousing contours from the fourth, and those sinusoidal contours which contain large leaps from the fifth call group, by which self-assertiveness, protest, agitation, a state of social unease and bellicosity or joy are expressed. This requires further corroboration. Should this assumption prove correct, several questions can be resolved. The high number of sinusoidal contours with large leaps in Warriors' and Praise Songs e.g. becomes understandable, for the corresponding calls of the squirrel monkey, being very contagious, are uttered while mobbing against enemies or expressing joy at the detection of food. Furthermore, the existence of so many different forms of contour which have an influence on vigilance would become understandable. In contrast to others, the calls of this group are not represented in a continuous system but in separate areas of the brain (Jürgens & Ploog 1970).

5. CONCLUSIONS

Pitch contours in ethnic songs have been shown to be similar to the melodic contours of motherese in form and function. The same factors as in animal calls control their effect on distance regulation. Taken together these findings allow the deduction to be made that music, especially singing, has developed from earlier forms of vocal communication. Should the relationship of melodic contours to special call groups of primates be proved to

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