

# A VALIDATION OF THE EMOTIONAL MEANING OF SINGLE INTERVALS ACCORDING TO CLASSICAL INDIAN MUSIC THEORY

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## ABSTRACT

According to ancient Indian music theory, intervals evoke specific emotional states. This study investigates whether a specific emotion is also attributed to a musical interval within Western culture and whether such meaning is in agreement with that proposed by Indian music theory. A high degree of agreement would support the existence of human universals in musical meaning.

Participants (N=29) assessed four natural intervals (major second, major third, fourth, and fifth) constituted by two sine waves. It was found that participants rated the meaning of each interval in a consistent and reliable manner both between-subjects and within-subjects. After grouping participants according to their musical expertise (i.e., 'Professionals', 'Amateurs' and musically-'Naïve' participants), statistical analyses revealed that each interval was rated differently. However, the groups of participants did not differ in their ratings. Moreover, 'Professionals' and 'Amateurs' were significantly less variable in their ratings than the 'Naïve' participants. Importantly, there was substantial agreement between the choice of adjectives given by our contemporary Norwegian participants and those attributed to the same interval according to classical Indian music theory.

These findings suggest that the meaning attributed to the natural intervals here examined might be universal, across cultures and time.

## 1. INTRODUCTION

The question whether people assign a specific emotional meaning to a single musical interval or not has not been answered yet. Indeed, "there is surprisingly little and fairly tentative research on intervals" (Gabrielsson & Lindström, 2001, p. 242). According to Nettl (2000), intervals are used in all cultures, but they can differ widely in their frequency ratios. In other words, what Europeans might recognize as a major second could be translated into another musical language with just  $\frac{3}{4}$  of the frequency ratio used in European classical tradition. However, after heated debate among ethnomusicologists (e.g., Husmann, 1952 versus Reinhard, 1952), it remains unclear whether specific scales and intervals are universals in music (cf. Burns & Ward, 1982; Nettl, 1980). We surmise that intervals might be universals in meaning but their specific organisation into scales or modes could still differ greatly among traditions.

In this study we have focussed on the emotional expression of single intervals. Specifically, we investigated whether 1) individuals within one culture (i.e., contemporary Norwegian) would agree with one another and themselves on an emotional

characterization of a specific interval; and 2) whether such attributions of emotional meaning to intervals would also be consistent with that of another tradition distant in both space and time (i.e., medieval Northern Indian), as described in historical musicological sources.

It would seem that, based on results of several studies, intervals do actually differ in meaning in a way that is rather consistent among Western raters (Costa et al., 2000; Maher et al., 1982; cf. De la Motte-Haber, 1982). Thus, it seems that people are able to provide in a coherent and reliable manner a specific meaning for a distinct interval. Nevertheless, these results are not without ambiguities, and a unanimous consensus on which intervals do distinctively differ in meaning and what meaning such intervals would have, has not been reached yet. This in itself might not invalidate the "universalistic" hypothesis because there are differences in methodology among the various studies. Most importantly, each study might have sampled different ranges of emotions that might be more or less appropriate for the stimuli that were used in each study (Costa et al., 2000). For example, several studies have used a sample of Cooke's (1959) descriptions of the emotional effect of intervals to construct so-called 'semantic scales' for questionnaires (Costa et al., 2000; Maher, 1980). However, Cooke's elements of musical expression often refer to phrases and motives (that is, interactions among intervals), which may not only mirror aesthetic attributions as comprehended in Central Europe (cf. Behne, 1997; Oelmann, 1993) but also exclude some basic emotional meanings that could best capture those of the individual intervals.

Although, as mentioned above, there is still ambiguity about the emotional attributions that Westerners give to single intervals, there is at least one non-Western tradition where such attributions have been clearly specified by the musicians themselves and music theorists. Specifically, we here consider the musicological theory as it has been developed in Northern India for, at least, the last thousand years. According to these ancient music theorists of Northern India (about 1200 - 1700 AD), musical intervals evoke specific emotional states, which Alain Daniélou (1968) has summarized in *The rāga-s of Northern Indian Music*. According to this analysis each interval, or *shruti* used in *rāga-s*, possesses a defined meaning often referring to a specific emotional atmosphere (Balkwill & Thompson, 1999); e.g. the 4<sup>th</sup> is described as contented, peaceful, and the 5<sup>th</sup> as joyful, brilliant. Among philosophers, musicologists, musicians, and psychologists in Western music, a connection has often been made between various aspects of music and emotions (e.g., Juslin & Sloboda, 2001). It would seem relevant to establish whether the range of emotions discussed in each tradition showed similarities or not. Moreover, finding correspondences between the traditions and their attribution of meaning to various intervals would bear

some relevance for the debate on whether musical meaning can be universal or not (cf. Nettl, 2000; Trehub, 2000).

One possible problem is that our reliance on Daniélou's account may be flawed. Some musicologists (e.g., Neuhoff, 2001) have expressed serious doubts on his description of the *raga* models. Moreover, Daniélou's work summarizes Indian music theorists' and musicians' writings, which reflect an introspective method that is certainly not the same used by Western empirical psychologists in investigating the emotional attributions of sound. However, we believe that Daniélou's expertise as a musician (in both European and Indian music) may be all is needed for providing a workable description of such Indian tradition and this might well turn out to be of great value for psychological research. Indeed, if Daniélou's interpretation of the Indian tradition were to be quite wrong, then the chances that it would be appropriate in another context would seem really minimal. Hence, if our study were able to support a correspondence between the classical Indian musicians' attributions, as used here, and those of listeners from another cultural/historical context, this might also validate the account described by Daniélou.

In order to investigate the above ideas, we asked participants to listen to four natural intervals corresponding to four of the fundamental *shruti*-s: The *Ri* (major 2<sup>nd</sup>), *Ga* (major 3<sup>rd</sup>), *Ma* (4<sup>th</sup>) and the *Pa* (5<sup>th</sup>). These consisted of two sine waves played harmonically (as 'bichords'). All the participants rated the intervals on the same questionnaire, where each item mentioned properties listed in Daniélou's review of *raga*-s for the four chosen *shruti*-s. These were words describing the actual expression of the sampled intervals (p. 40) but also the most distinctive words describing the scales of each *raga* (p. 98 ff.). The intervals had all the same fundamental tone as it is defined for each *raga*.

We predicted that each interval would evoke a specific and reliable expression for a participant (across repetitions of the intervals) as well as among participants. If a high degree of agreement were to be found between the ancient Indians' attributions and those of modern day's Norwegians, this commonality would support the view that there exist human universals in musical meaning for, at least, individual intervals.

## 2. METHOD

The study made use of a questionnaire similar to a semantic differential with each item naming two opposites. Lines of equal length were drawn between the two opposites and participants were requested to indicate the degree of appropriateness of the probed expression by marking with a pencil a position on the line. If the participants found any of the sounds to be neutral in meaning with respect to a specific pair of opposites, they marked the centre of the line. The scale contained a total of 24 items or lines to be marked. Most of these items named emotions and moods (e.g., joyful-sad, vigorous-serene, pleasing-unpleasing, peaceful-lively), whereas some items mentioned objects (e.g., sun-moon) or objects' attributes (e.g., light-dark). All names were taken from Daniélou's description of the four intervals used. These were heard four times for the duration of about two minutes. A Latin square design was used in ordering the presentations of the intervals to prevent either fatigue or practice effects. The sounds were played on a CD-player and heard through headphones. The

intervals had all the same fundamental tone (c') as it is defined for *raga*-s: c'-d' (9:8; 261.626:293.665 Hz), c'-e' (5:4; 261.626: 329.628 Hz), c'-f' (4:3; 261.626: 349.228 Hz) and c'-g' (3:2; 261.626:391.995 Hz). The listeners sat comfortably in a quiet room while listening to the 16 sounds. All lines between the pairs of words were marked. There were 29 participants (females, N = 15; males, N = 14; range of age 21-60; mean age m = 34.38) who volunteered to participate in an experiment on the perception of musical intervals. They were selected from the Institute of Psychology at the University in Tromsø (N = 13), the Tromsø Academy, Dept. of Arts (N = 7), the Tromsø Symphony Orchestra (N = 3), and also included a few participants who did not belong to any of the groups mentioned above (N = 6). The participants were divided into three groups: The 'Naïve' listeners (N = 5), who had no musical training; the 'Amateurs' (N = 13), who learned to play an instrument since childhood, via formal training, or as autodidacts. Finally, there was the group of the 'Professionals' (N = 11), who had at least some training at the conservatory and were still practicing their instrument (at least four hours a day). Two participants reported to have absolute pitch, one a 'Professional' and the other one 'Amateur'.

## 3. RESULTS

First we obtained descriptive data: Each mark on the line among opposites for each item was measured and then entered as cell in a repeated-measures ANOVA with Group (Professionals, Amateurs, and Naïve), Interval (major 2<sup>nd</sup>, major 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup>) as the between-subjects factors, Meaning (the 24 items) as the within-subject factor, and ratings as the dependent variable. This Analysis revealed a main effect of Interval,  $F(3,28) = 11.622, p < .001$ , as well as a main effect of Meaning,  $F(23,84) = 4.662, p < .001$ . Thus, each interval was indeed rated differently. Most importantly, there was a significant interaction between Interval and Meaning,  $F(69,644) = 6.461, p < 0.001$ , indicating that each interval evoked a specific meaning and showed a unique profile of expressions. Figure 1 illustrates this interactive effect. Interestingly there was neither a main effect of Group (i.e., musical expertise) nor any interactive effect of this factor with the others (cf. Costa et al., 2000).

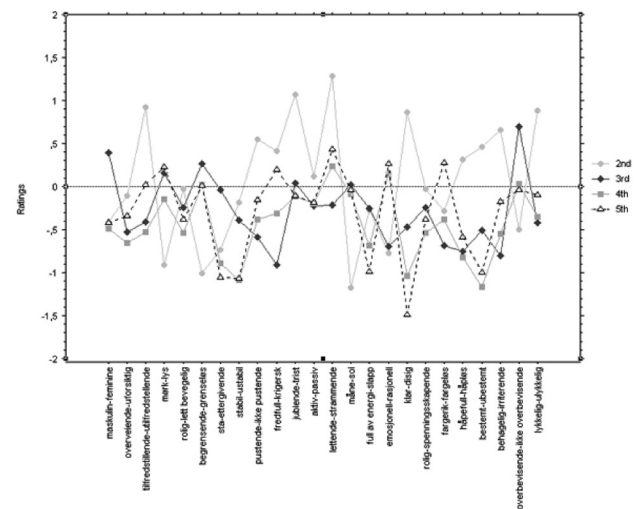
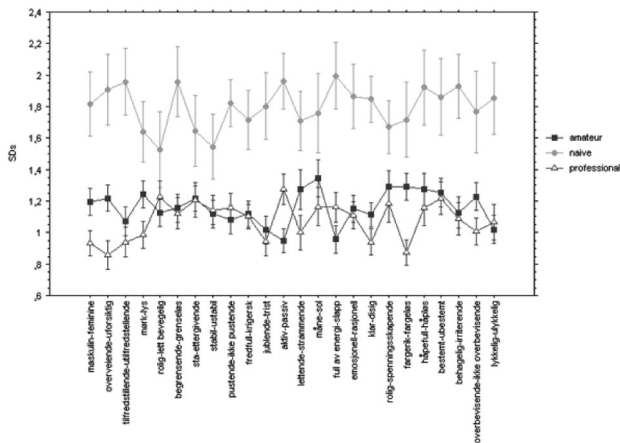


Figure 1: Line graph of mean ratings for each interval over all items.

In order to evaluate whether the groups of participants – ‘Professionals’, ‘Amateurs’ or ‘Naives’ – differed in reliability of ratings, a separate ANOVA was performed on the average standard deviations of each participant’s ratings for each item. The analysis revealed a main effect of Group,  $F(26,2) = 7.75$   $p < 0.002$ . As illustrated in Figure 2, the ‘Naive participants’ were on average less reliable (i.e., they showed larger SDs) than the ‘Amateurs’ and the ‘Professionals’. Surprisingly, the scores of the latter two groups did not differ significantly (according to post-hoc tests).



**Figure 2:** Line graph of the average standard deviations of ratings for each item.

Finally, we performed separate t-tests on the ratings of each item and for each interval in order to identify those ratings that differed significantly from neutrality (i.e., marks that on average differed from the center of each line). In this manner we could then assess 1) which proportions of the meaning attributed to one interval according to the classical Indian music tradition were also chosen as a significant meaning of the same interval by the participants in the study; and 2) whether the polarity of such choices would agree between the Western participants and the non-Western standard.

As mentioned earlier, there were 24 possible attributions according to the classical Indian music theory (Daniélou, 1968): 6 describing the expression of the major 2<sup>nd</sup>, 4 for major 3<sup>rd</sup>, 7 for the 4<sup>th</sup>, and 9 for the 5<sup>th</sup>. It turned out that our participants made 15 non-neutral choices for the major 2<sup>nd</sup> and of these 3 were also mentioned in the Indian tradition; 12 non-neutral choices for the major 3<sup>rd</sup> and of these 4 were also mentioned in the Indian tradition; 12 non-neutral choices for the 4<sup>th</sup> and of these 3 were also mentioned in the Indian tradition; 7 non-neutral choices for the 5<sup>th</sup> and of these 2 were also mentioned in the Indian tradition. Another way to describe the above results is that 50% of the expressions described by Daniélou (1968) for the major 2<sup>nd</sup> were confirmed, 100% for the major 3<sup>rd</sup>, 43% for the 4<sup>th</sup>, and 22% for the 5<sup>th</sup>. Perhaps most impressively, the polarity of the attributed meaning by our participants was in all cases the same indicated by the classical Indian tradition.

## 4. DISCUSSION

Participants attributed a distinct meaning to each of the intervals and there was agreement between and within each participant for their attributions. Thus, intervals showed different characters, which were indicated in a similar way by our groups of raters. However, the Naive participants’ ratings were more variable than those of the ‘Amateurs’ and the ‘Professionals’, with no difference between these two groups. This suggests that minimal musical training, (i.e., being a music ‘Amateur’) is sufficient in learning to categorise musical intervals in a similar way as the professional musicians do. The lack of a difference of Naive participants’ attributions of meaning from the other groups also shows that having no musical training is not an impediment to the understanding of the expression of a specific interval; although, it would seem that music-making could sharpen and refine the perception of meaning of each interval.

There was considerable overlap between the meaning attributed by our participants to simple sine wave bichords and those reported for natural intervals in the millenary tradition of classical Indian music. Most importantly, none of the expressions that were significantly non-neutral for our raters turned out to indicate the opposite expression to that attributed by the Indians. In other words, wherever there was evidence that Westerners would have a definite preference for an expression describing an interval, this confirmed the Indian interval’s character (e.g., when participants rated a major 3<sup>rd</sup>, and showed that they were non-neutral on items like ‘emotional-rational’ or ‘pleasing-unpleasing’, they also showed that the polarities of their choices corresponded to those of the Indians; i.e., ‘emotional’ and ‘pleasing’, on the respective items). Hence, the evidence appears to be supportive of the idea that meaning attributed to musical intervals is rather consistent across cultures and time and thus might be universal.

We conclude from the present findings that there appears to be support for 1) coherence and 2) universality in the meaning of individual intervals. However, it could be argued that such meaning might be strongly dependent on shared competence of listeners of a ‘musical syntax’ (Sloboda, 1985) or an (often intuitive) understanding of musical structure (Gabrielsson & Lindström, 2001). In other words, since the series of intervals we used all belonged to the C major scale, it may be the case that their meaning would still differ in another context, that is, when the same interval is included within a different musical frame or structure (cf. Bharucha & Krumhansl, 1983). We are currently carrying out another study that might help in clarifying this aspect.

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