

# PERCEPTION AND PROCESSING OF MUSICAL SCALE STRUCTURES: A CROSS-CULTURAL ERP STUDY

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## Background

So far, experimental studies concerning the cross-cultural aspect of music perception have been based on two main approaches: the 'probe-tone method' designed by Krumbhansl & Shepard, and the developmental aspect, i.e. the investigation of the stages before, during and after musical enculturation. Compared to those forms of testing, modern methods of brain science have the decisive advantage of measuring activity not only pre-verbally, but also directly and simultaneously while listening to music.

## Aims

The current experiment was designed to investigate how members of different cultures will perceive musical scales with various structures.

It is based on recording event-related brain potentials (ERPs) as a method of study.

## Method

Five German, five Turkish and five Indian musicians listened attentively to four types of heptatonic scales played in an upward movement - the major and harmonic minor scales, the equiheptatonic Thai scale and the Turkish makam Hicaz. Scales were combined in pairs in five different blocks, according to the so-called 'oddball paradigm'. Each block consisted of 45 standard and 15 deviant scales. Bioelectrical responses were registered at electrode placements Fz, Cz and Pz.

## Results

Analyzing block 1 (major standard scale versus Thai deviant scale), data analysis revealed a P300 as well as a (non-expected) negative shift in the latency range between 430 msec and 540 msec, named 'processing negativity' (not in the sense of Näätänen's 'Processing Negativity' (dichotic listening task)). The negative shift was generally found after clear pitch identification wherever differences in frequency between the deviant and the standard scale-tone had a sufficient amount.

Furthermore, non-western groups showed a large P300 as a reaction to the first tetrachord. For them, scale-tone 4 has the function of a cognitive reference point and is obviously more relevant than scale-tone 3. For German musicians, Thai-tone 7 caused a violation of the 'leading tone expectancy', indicated by a large P300.

In contrast to German and Turkish subjects, Indian musicians did not respond to the whole scale pattern after having perceived tone 8, as they are used to a combination of upward and downward scale movement, termed 'arohana' and 'avarohana'.

## Conclusions

Overlearned listening strategies applied to culturally imprinted scale material had a significant influence on all investigated brain reactions.