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Musicians' Timbral Adjustments in Response to Emotional Cues in Musical Accompaniments

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ABSTRACT

Background

Previous research has linked the musical communication of emotion to changes in timbre (e.g. Hailstone et al., 2009). Furthermore, timbral changes in musical performances have been observed when musicians are given verbal instructions to convey a certain emotion in their playing. (Gabrielsson & Juslin, 1996).

Aims

The present study aimed to evoke changes in timbre in a cellist's performance using musical cues, as opposed to verbal cues, and to explore whether these changes could be successfully perceived by listeners.

Method

Three melodies were composed that were intended to be neither specifically major nor minor. Both major (happy) and minor (sad) accompaniments were composed for each melody, and each accompaniment was recorded on both MIDI and real piano. The intention was that the minor accompaniment would prompt the cellist to create a "sad" timbre in the melody and the major accompaniment would prompt a "happy" timbre. Further, a bass line only accompaniment was used, intended as an emotionally "neutral" comparison. The MIDI/real piano comparisons were included to allow exploration of the effects of these modes on the cellist's playing. The cellist was asked to write down his performance intentions and what informed them.

Firstly, acoustic features of the cello recordings alone were extracted and analysed using the MIRtoolbox in MATLAB (Lartillot & Toiviainen, 2007). Secondly, the cello recordings were perceptually rated by 47 listeners in terms of how happy and sad they were perceived to be on a scale of 1 to 7, in comparison to the "neutral" version. Listeners could not hear the accompaniment and were asked to describe how they made their decisions.

A two-way ANCOVA was used to analyse the data obtained from the feature extraction and a factorial repeated-measures ANOVA was used to analyse the perceptual data. Content analysis was used on the qualitative data.

Results

The "mode" (major or minor) of the accompaniments had a significant effect on mean "attack time", $F(1,7) = 6.86$, $p = .03$, $\eta^2 = .50$ and mean "RMS" $F(1,7) = 8.87$, $p = .02$, $\eta^2 = .56$. The effects were not significant when "melody" was entered as a covariate. There were no significant main effects of "mode" on "spectral centroid", "inharmonicity", or "spectral flux".

There was a significant main effect of mode on perceptual ratings $F(1,44) = 16.29$, $p < .001$, $\eta^2 = .27$. The direction of the effect was as expected; happier ratings for major keys and sadder ratings for minor keys.

Content analysis of the cellist's comments confirmed that the major accompaniments were considered "happy" and the minor accompaniments were considered "sad". Content analysis of the participants' comments showed that the ratings were influenced by musical features such as dynamics and technical aspects of playing such as vibrato, articulation and bowing. Surprisingly, some listeners perceived changes in the tonality and "speed" of the melodies.

Conclusions

Attack time was the only timbral feature analysed that was significantly affected by mode of accompaniment. Variations in mean attack time and mean RMS may be related to differences in mode (major-minor) of accompaniment, although they may have been caused by aspects of the melodies themselves. It cannot be concluded, from this study, that timbre was significantly affected by mode of accompaniment.

However, the perceptual results suggest that the musician did encode emotions in his playing, prompted by major and minor accompaniments that were successfully decoded by listeners. Investigating the acoustic features related to these emotions could be the topic of future research.

Keywords

music perception; timbre; emotion; music performance; expressivity; MIR

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