Proceedings of the 12th International Conference on Music Perception and Cognition and the 8th Triennial Conference of the European Society for the Cognitive Sciences of Music, July 23-28, 2012, Thessaloniki, Greece
Cambouropoulos E., Tsougras C., Mavromatis P., Pastiadis K. (Editors)

Optimising short tests of beat perception and melodic memory

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ABSTRACT

Background

Traditional musical ability tests tend to assess performance aptitude and aural skills, often relating to objectives defined by Western art music training curricula. Their use may lead us to underestimate the range of individual differences in musical cognition that has been enhanced by musical engagement other than formal musical training (Bigand & Poulin-Charronnat, 2006). For example, culture-specific melodic knowledge can be learned implicitly through listening (Saffran et al., 1999), whilst rhythmic perception may be trained by sensorimotor experience of rhythmic movement (Zachopoulou et al., 2003).

Aims

We aimed to optimise two short tests of fundamental musical skills to assess individual differences in non-specialist populations. We adapted Iversen and Patel's (2008) measure of beat perception (BAT), which is assumed to have little bias towards any particular musical style. We also tested memory for unfamiliar melodies, which is only partially affected by formal musical training (Cuddy & Lyons, 1981), thus measuring both skill level arising from musical training and also musical memory not affected by formal musical training.

Method

162 participants identified whether 18 fifteen-second musical clips (from rock, jazz or pop/orchestral styles) were in time with overlaid beep tracks or slightly off. Beeps deviated either by phase or tempo and extracts had duple or triple meters. 152 participants listened to 28 four- to nine-second melody pairs, judging whether or not the second, transposed, version was melodically identical to the first. Variants differed by changes in interval structure, contour, and/or tonal variations. Test data were modelled using an Item Response Theory approach to identify item subsets with optimal overall task difficulty and non-redundancy of measurement parameters between items.

Results

BAT performance was high (proportion correct M=0.91, SD=0.11). Difficulty increased with triple meter and phase shifts, with a significant interaction (all p<.001). Response data were fitted to a one-parameter Rasch model relating item difficulty to person ability, and an optimal subset of items was identified. Melodic memory performance was also high (proportion correct M=0.71, SD=0.45), with differences significantly easier to detect when violating tonality (p<.001) and showing no main effect of contour (p=.115). Performance was best for contour plus tonality violations, and worst for contour without tonality violation (p<.001). Rasch modelling again identified an optimal stimulus subset.

Conclusions

Short, easily-administered tests were produced which measure beat perception at a fundamental level and across a variety of stylistic contexts, and melodic memory across a wide ability range. These are freely available for research purposes and can serve to control for individual differences in metric and melodic perception in music cognition experiments. The role of both tests as measurement components within the overall assessment of musical sophistication as measured by the Goldsmiths Musical Sophistication Index will be discussed.

Keywords

Musical sophistication, psychometrics, item response theory, beat perception, melodic memory.

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