Title: From Theory to Listening: A Cross-Cultural Study of Chinese Pentatonic Scale Perception

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Abstract:
Pentatonic scales form the basis of Chinese music theory [1]. Historical sources [1, 2] propose several ways scales may relate: by sharing the same pitch-classes with a rotated order (e.g., any pitch of C-D-E-G-A can serve as the starting note), by sharing the same intervallic structure under transposition (e.g., C-D-E-G-A and G-A-B-D-E), or by emphasizing a salient surface cue such as a common final or starting tone, as often practiced in pedagogy (e.g., C-D-E-G-A and C-D-F-G-A). Direct empirical tests of these hypotheses are scarce. In contrast, Western classical music theory defines scale relationships through the number of shared tones and positions on the circle of fifths, and these have been empirically investigated using probe-tone ratings [3, 4], recognition [5, 6], and detection paradigms [7, 8].

This study investigates which cues listeners use to determine whether two pentatonic items belong to the same scale, and whether such judgments vary with musical training and cultural background. Chinese and non-Chinese participants (N = 124), with and without musical training, evaluated pairs presented in three formats (melody-melody, scale-scale, and melody-scale) and four types of scale relationships: identical; same pitch-class set in a different order; same intervallic structure with one pitch difference; and same starting or final tone differing by one pitch. Responses were analyzed with a Bayesian multilevel logistic regression model.

Three main findings emerged. First, performance and strategies varied by task. Judgments were generally easier for scale-scale pairs than for melody-melody pairs, and melody-scale comparisons were the most challenging for non-musicians. Second, patterns of cue usage differed according to musical expertise and cultural background. Order-invariant permutations caused the most confusion for musicians, whereas pairs sharing a starting or ending tone misled non-musicians, especially in scale-scale comparisons. Pairs with shared intervallic structure caused the least confusion, with performance comparable to the baseline. Finally, musical expertise had a stronger influence on accuracy than cultural background.

This study applies music cognition paradigms to Chinese music theory, providing empirical evidence on the structure of the Chinese pentatonic scale system and introducing a cross-cultural framework for examining scale relationships.

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