

Memory of a Prior Key after Modulation

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ABSTRACT

Background

Tonal closure is an important concept in music theory, and is often discussed in the context of form and aesthetics. Previous work (Cook, 1987; see Tillmann & Bigand, 2004 for review) indicates that perception of tonal closure is limited due to the constraints of memory. However, the question remains open regarding how long the memory of a tonal region is retained after a modulation to a new key.

Aims

This study examines the how the percept of a tonal center is retained in working memory, and in particular, how long the memory of a previous tonal region continues to affect the perception of harmony following a key change.

Method

To explore this question, an experiment was designed to systematically explore responses to key changes from an established key to a new key, and then from this new key back to the original key. The stimuli were chords progressions consisting of three sections: Section 1 in the original key, Section 2 in the new key, and Section 3 in the old key. Sections 1 and 3 were always the same length and same progression. The possible durations of Section 2 in the new key were 0, 3, 7.5, 13, and 21 seconds.

Three harmonic contexts were explored by varying the chord progressions in Section 2. Context 1 consisted of clearly functional, or conventional tonal progressions in the new key. Context 2 consisted of meandering and unpredictable tonal progressions. Context 3 consisted of a single repeated tonic triad in the new key. Two versions of all possible stimuli were composed, each with exactly opposite melodic contours, to control for the perceptual influence of pitch height. Stimuli in Contexts 1 and 2 all modulated to a key three steps away on the descending circle of fifths away from the starting key (e.g., C major to Eb major). Context 3 shifted the starting major triad by a tritone.

Fifty subjects participated in the experiment, mean age 23.64 years ($SD = 6.39$), 28 male, 22 female, with an average of 9.70 years of formal training on a primary musical instrument ($SD = 5.52$) and mean overall self-ranked musical training level of 3.40 ($SD = 1.12$), where 1 = no training and 5 = professional-level training.

Subjects were asked to indicate how they felt harmonic tension was changing for each chord progression by moving a slider on a computer interface. There were two trials for each stimulus; the order of stimulus presentation was randomized; and no stimulus of a particular Context type was immediately followed by another stimulus of that same type. Each stimulus was transposed so that it was at least three steps on the circle of fifths away from the key of the previous stimulus.

Results

ANOVAs were performed on responses to the first and second key changes using the slopes of the linear fit of the 3 seconds of continuous data immediately following the key changes. It was expected that for the initial key change, there would be a clear increase in tension indicated by the positive slopes. That change was considered a baseline measure of tension change when moving into a completely new key context. The tension slope following the second key change back to the original key was intended to provide an indication for how well the original key was retained in memory: a negative slope would indicate that the prior key was recalled, given that a decrease in tension would indicate the original key was still the primary key context; a positive slope would indicate that the original key had been forgotten and the new key had completely replaced the original key in working memory.

Looking across all Context types, the results indicated the following:

- 1) The initial key change did elicit an increase in tension consistently across subjects as predicted.
- 2) When there was no key change (0 s case) there was no change in tension, also as expected.
- 3) Returning to the original key after 3 s elicited a decrease in tension.
- 4) Returning to the original key after 7.5 s and 13.5 s resulted in ambiguous results, depending on the Context type.
- 5) Returning after 21 s elicited an increase in tension.

Conclusions

The magnitude and sign of the tension slopes indicate a gradual decay in the memory of the previous key, tapering off completely between 13.5s and 21s. Furthermore, harmonic context (stability and predictability of chord progressions) plays an important role in how long a previous key is retained in memory. In particular, the meandering chord context did not have clear cadences in the new key, thus memory of the previous key appeared to be retained for a longer period of time. These results provide new insight into how abstract contextual information is retained in memory despite considerable interference from new pitch material.

Keywords

Harmonic tension, modulation, tonal induction, global structures, tonal closure.

REFERENCES

- Cook, N. (1987). The perception of large-scale tonal closure. *Music Perception*, 5, 197-205.
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