# Learning mechanisms for acquiring knowledge of tonality in music

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## Introduction

Most people think that musical knowledge is exclusive to trained musicians. Actually, casual music listeners have implicit knowledge of important structural aspects of music, such as tonality. Tonality contributes to the feeling of anticipation one would experience when hearing someone sing “do re mi fa so la ti” without singing the final “do”. Knowledge of tonality may be learned through the statistics of music (Krumhansl, 1990). However, learning mechanisms have rarely been investigated experimentally (Creel et al., 2002). Artificial grammar learning experiments have shown that listeners can acquire highly structured knowledge such as syllable co-occurrence and language syntax through passive exposure. (Saffran et al.,1996; Saffran, 2001). Two experiments used an artificial grammar learning paradigm to explore mechanisms by which listeners might learn about tonality. Experiment 1 investigated whether listeners could infer tonal prominence from the frequency of pitch occurrence. Experiment 2 investigated whether listeners could infer tonal prominence from contingencies between pitch and metrical position.

## Design

Experiment 1

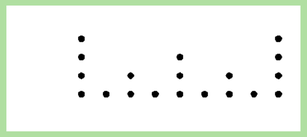
a) Participants listened to a two-minute familiarization having a specific frequency-of-occurrence distribution. Following the familiarization, participants were asked to determine which of two test melodies was most like the familiarization.

b) Participants listened to a two-minute familiarization having a specific frequency-of-occurrence distribution. Following the familiarization, participants listened to test melodies and judged how well a probe tone fit with each.

Experiment 2

a) Participants listened to a two-minute familiarization having a specific pitch-meter distribution. Following the familiarization, participants were asked to determine which of two test melodies was most like the familiarization.

b) Participants listened to a two-minute familiarization having a specific pitch-meter distribution. Following the familiarization, participants listened to test melodies and judged how well a probe tone fit with each.



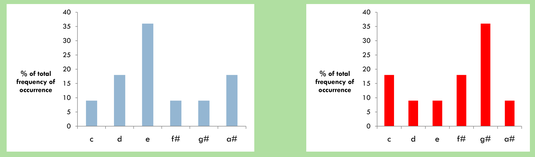
## Stimuli and Methods

Experiment 1

- All stimuli were isochronous and used notes from the whole tone scale: C D E F# G# A#
- Familiarizations were composed of 480 sounded pitches and were two minutes long.
- Prominent notes in one distribution were less prominent in the other distribution and vice versa.
- Test melodies were composed of 11 sounded pitches and were 3 seconds long.

Participants were familiarized to :

**Distribution A** or **Distribution B**




Experiment 1a- If a participant was familiarized to distribution B, then test melody B would be the correct answer.

Familiarization Phase: **Distribution B**

Test Phase: **Test Melody A** **Test Melody B**

Correct Response

Experiment 1b- If a participant was familiarized to distribution A, then the participant would indicate how well a probe tone fit with test melodies from distribution A.

Familiarization Phase: **Distribution A**

Test Phase: **Test Melody A** + Probe Tone

## Stimuli and Methods

Experiment 2

- All stimuli were composed in triple meter and used notes from the whole tone scale: C D E F# G# A#
- Familiarizations were composed of 295 sounded pitches and were two minutes long.
- For each distribution, one sub-set of notes occurred primarily on strong beats and another sub-set of notes occurred primarily on weak beats.
- Test melodies were composed of 16 sounded pitches and were 6 seconds long.

Participants were familiarized to :

**Distribution A** or **Distribution B**


Experiment 2a- If a participant was familiarized to distribution A, then test melody A would be the correct answer.

Familiarization Phase: **Distribution A**

Test Phase: **Test Melody A** **Test Melody B**

Correct Response

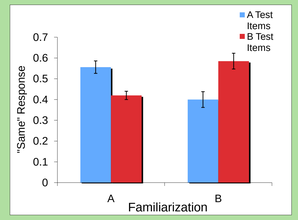
Experiment 2b- If a participant was familiarized to distribution B, then the participant would indicate how well a probe tone fit with test melodies from distribution B.

Familiarization Phase: **Distribution B**

Test Phase: **Test Melody B** + Probe Tone

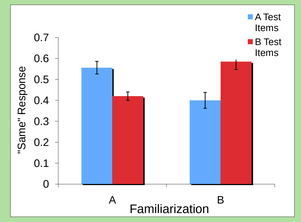
## Results

Experiment 1a



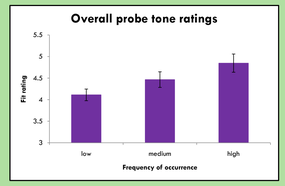

- No effect of test item
  $F$ (34,1) = .08, $p$ >.05
- Familiarization x Test Item Interaction
  $F$ (34, 1) = 11.736, $p$ <.01

Experiment 2a



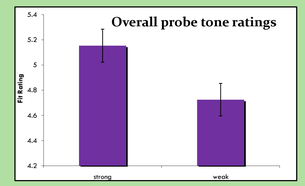

- No effect of test item
  $F$ (38,1) = 1.053, $p$ >.05
- Familiarization x Test Item Interaction
  $F$ (38,1) = 18.909, $p$ <.01

Experiment 1b




- No effect of familiarization
  $F$ (22,1) = .001, $p$ >.05
- Effect of frequency-of-occurrence
  $F$ (22,1) = 8.138, $p$ <.01

Experiment 2b




- No effect of familiarization
  $F$ (36,1) = .549, $p$ >.05
- Effect of metrical position
  $F$ (36,1) = 19.901, $p$ <.01

## Conclusion

- Listeners categorized melodies by the frequency with which pitches were sounded and by contingencies between metrical position and pitch.
- Listeners provided the highest fit ratings for notes that occurred frequently and for notes that occurred at strong metrical positions.
- Thus listeners may acquire tonal knowledge using these two distributional cues.
- Future research may explore sensitivities to different strengths of the metrical hierarchy.

## References

Creel, S., Newport, E. (2002). Tonal profiles of artificial scales: implications for music learning. In C. Stevens, D. Burnham, G. McPherson, E. Schubert, & J. Renwick (Eds.), *Proceedings of the 7th International Conference on Music Perception and Cognition*, Sydney, 2002. Adelaide: Causal Productions.

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