Methods

Participants

Seventy-two students enrolled at Louisiana State University participated in this study. Forty-two participants were recruited from the School of Music, and thirty participants from the Department of Psychology. Due to technological failures, XX participants were dropped. Eligible participants were between the ages of XX and XX (M = XX, SD = XX; XX females). Participants received course credit.

Material

Melodies

Eight melodies, taken from XX and ranging from XX seconds and XX seconds in length, were chosen as the tonal stimuli for this study. They were chosen because XX. Four of the chosen melodies included a re-do cadence, and four of the melodies included a ti-do cadence. Four vocalists (two men and two women) recorded two versions of each melody; one version included the original cadence, while the second version included the altered cadence.

Measures of Musical Sophistication

Goldsmiths Musical Sophistication Index (Gold-MSI) Self-Report

Participants completed a 38-item self-report survey which included free response and Likert scale questions (Müllensiefen et al., 2014). The complete survey can be found at goo.gl/dqtSaB.

Gold-MSI Beat Perception

Participants were presented with 18 excerpts of instrumental music from rock, jazz, and classical genres (Müllensiefen et al., 2014). Each excerpt was presented for 10-16s through headphones and had a tempo ranging from 86-165bpm. A metronomic beep was played over each excerpt either on or off the beat. After each excerpt was played, participants decided if the metronomic beat was on or off the beat and indicated a confidence rating for their response from the following selection: “I am sure,” I am somewhat sure,” or “I am guessing.” The final score was the proportion of correct beat responses.

Gold-MSI Melodic Memory

Participants were presented melodies between 10 and 17 notes in length through headphones (Müllensiefen et al., 2014). During each trial, two versions of a melody were presented. The second version was transposed to a different key. There were 12 trials, 6 of which included the same melody and the other 6 with different melodies. In the different melody versions, a note was altered either a step up or down from its original position in the structure of the melody. After each trial, participants decided if the two melodies had identical pitch interval structures.

Gold-MSI Sound Similarity

XX

Measures of Working Memory Capacity

Participants completed one block each of three measures of working memory capacity (Foster et al., 2014). Each included a practice trial before the test trial.

Operation Span (OSPAN)

Participants were tasked with completing a two-step math operation and then recalling a letter (F, H, J, K, L, N, P, Q, R, S, T, or Y) in an alternating sequence (Unsworth et al., 2005). The letter was presented visually for 1000ms after each math operation. During letter recall, participants were presented with a 4x3 matrix of all possible letters, each with its own check box. Participants clicked the check boxes for each letter in the serial order they recalled them being presented.

Symmetry Span (SSPAN)

Participants were tasked with completing a two-step symmetry judgement and then recalling a visually presented red square on a 4x4 matrix in an alternating sequence (Unsworth et al., 2009). The square was presented in one of sixteen locations on a 4x4 matrix for 650ms after each symmetry judgement. In the symmetry judgement, participants were shown an 8x8 matrix with random squares filled in black, and they decided if the black squares were symmetrical about the matrix’s center vertical axis. During square recall, participants were presented with the 4x4 matrix and clicked the locations in the serial order they recalled the squares being presented.

Rotation Span (RSPAN)

Participants were tasked with completing a two-step rotation match judgement and then recalling a visually presented arrow in an alternating sequence (Unsworth et al., 2009). The arrow was either of short or long length and pointed in one of eight different directions. In the rotation match judgement, participants were shown a rotated letter, and they decided whether the letter was presented correctly or as a mirrored image of the letter. During arrow recall, participants were presented with the sixteen possible arrows and clicked them in the serial order they recalled the arrows being presented.

Procedure

Participants in this study completed eight tasks in about 75 minutes.

In the first task, participants were asked to listen to, and then record themselves singing, eight unique melodies. Upon arrival, participants were assigned to one of two conditions. In Condition A, Melodies 1-4 were each presented in sets of 4 that included 3 re-do cadences and 1 ti-do cadence, while Melodies 5-8 were each presented in sets of 4 that included 3 ti-do cadences and 1 re-do cadence. In Condition B, Melodies 1-4 were each presented in sets of 4 that included 3 ti-do cadences and 1 re-do cadence, while Melodies 5-8 were each presented in sets of 4 that included 3 re-do cadences and 1 ti-do cadence. To carry out the experiment, we designed software in Max/MSP. The interface played the four versions of each unique melody, as recorded by four vocalists (two men and two women), in a random order with two seconds of silence between them. Then, following a ten-second break after the final version of the melody played, the interface recorded the participant’s own sung version of the melody. Participants were instructed to match the melody presented as best they were able. When they were finished recording, participants were given the option to either erase their current recording and re-record their rendition, or to continue on to the next melody set. During their session, the software logged data to an embedded dictionary, keeping track of their subject number, the playback order of each melody set’s audio files, and the number of times they opted to re-record their rendition of the melody before moving on to the next melody. At the end of each participant session, the research assistant is exported and saved the embedded dictionary log as a JSON file. Participants were able to learn this process during a practice trial before continuing on to the experimental melodies.

Participants then completed the Gold-MSI Self-Report, Beat Perception, Melodic Memory, and Sound Similarity Tests. Following that, they completed one block each of OSPAN, SSPAN, and RSPAN. Each task was administered on a desktop computer. Sounds were presented at a comfortable listening level for the tasks that required headphones. All participants provided informed consent.

Results

Our hypothesis stated that ti-do cadences would transform more often into re-do cadences than vice-versa through the act of oral transmission, despite the presentation of the opposite cadence alongside the original. Melodies recorded by participants sourced from the Department of Psychology were often difficult to label with solfege; as a result, we operationalized the re-do cadence as a descending cadence and the ti-do cadence as an ascending cadence. To test our hypothesis, 5 coders independently coded a subset of the melodies in the following way: assigned solfege to the final three pitches, discounting repeated pitches; provided a contour vector for the last three pitches; and labeled the movement from the penultimate pitch to the final pitch as “ascending” or “descending.”

Melodies 1-4 in Condition A and Melodies 5-8 in Condition B each were presented in sets of 4 that included 3 re-do cadences and 1 ti-do cadence; the presentations in this subset are referred to as Descending Dominant presentations. Melodies 1-4 in Condition B and Melodies 5-8 in Condition A each were presented in sets of 4 that included 3 ti-do cadences and 1 re-do cadence; the presentations in this subset are referred to as Ascending Dominant presentations.