Timbre Change on Memory for Melodies in Musicians and Nonmusicians

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ABSTRACT

This study investigates the effects of changing timbre from encoding to test on recognition memory for melodies, and is the extension of Lim & Goh (2012). Highly trained musicians, moderately trained musicians, and non-musicians were asked to give discrimination ratings for 72 melodies in a continuous-running memory task. 36 of the melodies were new "to be remembered", while the other 36 melodies were manipulated to be either exact transpositions (T), same-contour lures (SC), or different-contour lures (DC). These three types of test melodies also varied in timbre. They either stayed in the same timbre, shifted to a similar timbre, or shifted to a distinctly different timbre to the original timbre it was heard in.

PARTICIPANTS

182 participants recruited from UT Dallas or communities around the DFW area:

60 Non-musicians (less than 2 years of experience)
60 Moderate Musicians (2 – 9 years of experience)
62 Highly Trained Musicians (10+ years of experience).

TASK

Listeners heard 72 melodies and were asked to indicate whether they believed they have heard the melody previously in the task on a four point confidence scale. The melodies were short, single phrase, monophonic melodies from *The Traditional Tunes of the Child Ballads* (Bronson, 1962). Test melodies were either targets, different contour lures (DC), or similar contour lures (SC), where a previously heard melody had two notes moved up or down the scale one or two semitones, but still preserved the contour of the original melody. Additionally, test melodies could be in the same timbre, a similar timbre, or a distinctly different timbre. The list of timbres include:

Piano & Harpsichord
Clarinet & Tenor Saxophone
Violin & Cello

Test melodies were heard either 2, 3, or 4 trials after the original melody. Test melodies were always transposed to a nearby key. A 3 way mixed ANOVA was used to analyze the data. Area under the curve was used to measure memory performance (.50 as chance performance), which is less biased than *d'*.

REFERENCES

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RESULTS

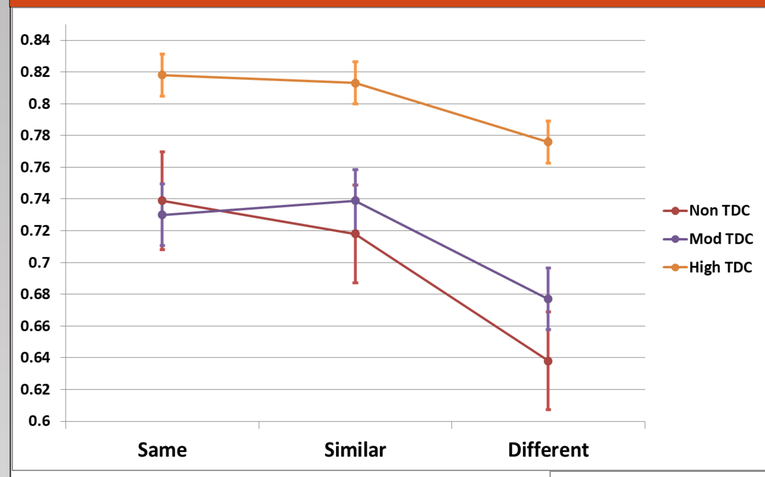

Figure 1: Target/Different contour lure area scores across timbre conditions

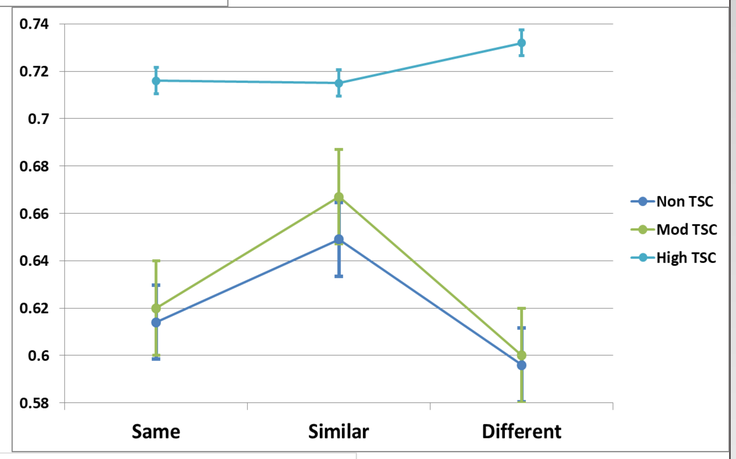

Figure 2: Target/Similar contour lure area scores across timbre conditions

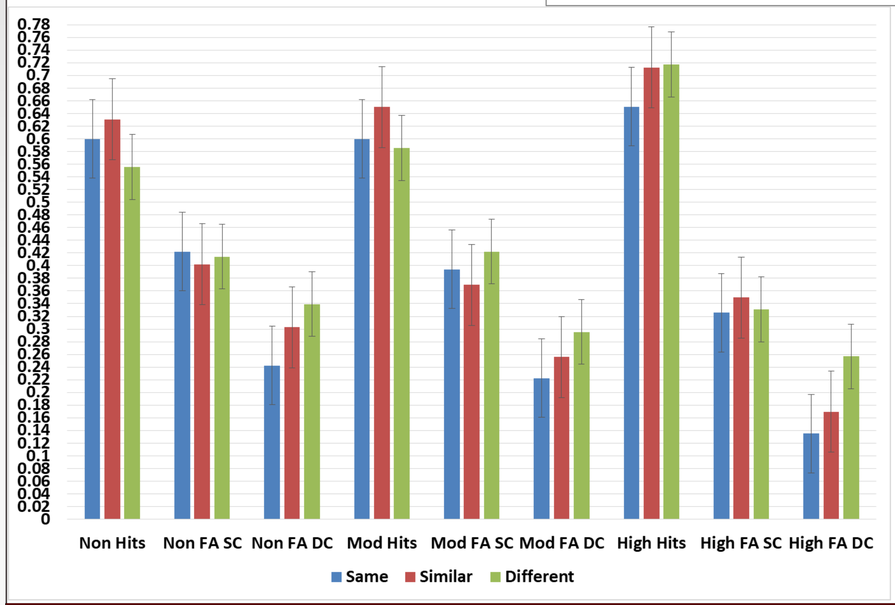

Figure 3: T/DC & T/SC Hit and False Alarm rates across timbre conditions

RESULTS & DISCUSSION

(**Figure 1**) The T/DC results replicate Lim & Goh (2012); there was not a significant difference between staying in the same timbre or switching to a similar timbre for any experience group. However, there was a significant difference between similar and different timbre, as well as same and different timbre for all groups. Highly trained musicians performed significantly higher than moderate and non-musicians, but moderate and non-musicians were not significantly different from each other. Additionally it seems like highly trained musicians were more consistent in their performance than moderate and non-musicians as seen by the smaller error bars.

(**Figure 2**) The T/SC results show a different pattern from the T/DC results. Highly trained musicians performed similarly across timbre conditions (no significant differences), suggesting music mastery or cognitive ability to resist timbre change influence. Moderate and non-musicians show an increase in performance when timbre was changed to a similar timbre. Highly trained musicians were significantly different from moderate and non-musicians. Bonferroni adjusted multiple comparisons revealed that there were no mean difference between the timbre conditions when all experience groups are included. However, when we only include moderate and non-musicians, different timbre switches were significantly lower than similar timbre switches.

(**Figure 3**) Hits and False alarms data suggests that the increase in the T/SC performance for moderate and non-musicians is due to an increase in hits and decrease in false alarms, which is not the case for highly trained musicians who had an inverse pattern of false alarms. T/DC performance was similar across all groups which resulted from an increase in false alarm rates as timbres became increasingly different.

Whereas T/DC performance relates to memory for melodic contours, T/SC performance is more specific to intervallic memory/knowledge. This might explain why there is a different pattern of results. Highly trained listeners likely have more training and capacity to attend to the specific intervals than less trained listeners, but the ability to tell two different melodies apart is general enough to be accomplished by everyone.

T/SC results for similar timbre could potentially be the result of encoding specificity being similar enough to aid in the memory trace, as well as the timbre being different enough to interact with changes in pitch interval (Warrier & Zatorre, 2002). However, when the timbre is distinctly different there is a lack of aid from encoding specificity and when the timbre stays the same there is a lack of aid from the interval/timbre interaction; both of which result in lower performance.

Overall, these results replicate the encoding specificity results found by Lim & Goh (2012) and further found timbre context effects for similar contour lures that follows a different pattern than different contour lures. Additionally, we found effects of high level expertise that differs from listeners who have less experience, similar to Dowling (1986).