



# CALIFORNIA STATE SCIENCE FAIR 2014 PROJECT SUMMARY

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<b>Project Title</b> <b>Investigating the Patterns of Cross-Modal Perception in Converging Styles of Music</b>	
<b>Abstract</b> <b>Objectives/Goals</b> The purpose of this research was to understand the patterns among cross-modal perceptions of music, that is, how people from different intellectual, artistic, and socioeconomic backgrounds interpret music. <b>Methods/Materials</b> To observe these patterns, the articulation of the same musical phrase with a steady temporal pattern was played in five different ways: martellato (short and heavy), staccato (short and light), tenuto (long and heavy), marcato (long and heavy), and legato chiaro (long and light). Each separate stimuli was recorded with a uni-directional Trans-continental microphone on a Loree oboe (AK bore). The students were asked to listen to the recording, and within 5 seconds, correspond what they hear to a color (red, orange, yellow, green, blue, or purple). <b>Results</b> The results from the first passage, played short and heavy, showed a plurality, yellow (18 out of 40, 45%, chi squared value 31.4). Moreover, light and short styles showed statistically significant responses to be orange, yellow, and green (11 [27.5%], 10 [25%], and 9 [22.5%] out of 40, respectively, chi squared value 11.1). The third passage again showed a statistically significant outcome, that most students associated long and heavy articulation and tone with the darker colors, greens and blues (12 [30%] and 14 [35%] out of 40, respectively, chi squared value 20.5). Then, the fifth passage showed a plurality in blue (13 out of 40, 32.5%), associated with long and sharp styles (chi squared value 13.52). However, no statistically significant conclusions could be drawn from the long and sharp passage, number four. For all chi-squared analysis, the degrees of freedom were 5 and the critical value (p value, $p < 0.05\%$ ) was 11.07. <b>Conclusions/Discussion</b> The results display that there is a pattern in cross-modal perception, especially within a culturally and physically isolated group. This generally supports the hypothesis that lighter and shorter articulations would yield responses mainly of lighter colors, whereas heavier and longer articulations would entice perception of darker colors. However, it seems that the most selected color groups for all short articulations or long articulations remained the same regardless of emphasis on the beginning of each note, so students seem to be basing their responses mainly on length. This displays how a group of people with similar experiences and culture carry similar cross-modal associations.	
<b>Summary Statement</b> This study supports that it is possible to qualify a unified cross-modal perception of certain musical styles.	
<b>Help Received</b> Ms. Annabel Adriatico, my advisor throughout the entire process, helped with administering the surveys and gathering participants. Dr. Stefanie Drew, a synesthesia expert and my scientist supervisor, provided input as to the project design.	