



**CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY**

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Project Title Is Rhythm Sensing a Scalar Property?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals In my experience in nonprofessional orchestra and dance groups, I notice that some members do not stay on the beat. I am trying to understand if such individuals are unable to synchronize or continue a beat, or if they fail to recognize the musical rhythm. I hypothesized that if rhythm sensing is a scalar property (i.e. subjects who are rushed or delayed in maintaining a beat will have proportional variations from the mean at different test speeds), then individuals in the extremes of the distribution will have impaired rhythm sensing ability with musical passages.</p> <p>Methods/Materials I obtained informed consent from 43 participants (25 teens and 18 adults). I devised tests to measure subjects' ability to maintain 3 different beats (metronome continuation test, MCT) and to recognize the tempo in 7 musical passages (rhythm sensing test, RST), with 3 replicates for each test. Tapping results were recorded with a stopwatch and also on a digital recorder, for computer analysis. Subjects completed a questionnaire about other aspects of time keeping (circadian rhythm, morning routine, and pacing on short-term assignments) and I measured pulse rate and time sensing for 8 and 21 seconds (interval timing, a known scalar property, was a control). I analyzed the data with Voice Editing and Excel programs.</p> <p>Results Tempo matching is not scalar at the group level and is barely proportional at the individual level. Sorting by scores from the slowest MCT (40 beats per minute), subjects at the fast end of the distribution have faster RST scores and decreased interval timing. Interestingly, subjects with the slowest MCT scores did not lag in the RST, possibly because they have more musical training. Subjects without musical training performed more poorly in sensing rhythm in music, and teens had more difficulty in recognizing waltzes and slow classical music.</p> <p>Conclusions/Discussion Although tempo matching is not a scalar property, my hypothesis is partially correct. Individuals at the fast extreme of the MCT tend to rush the beat in music while those in the slow extreme are more accurate in musical rhythm sensing, possibly related to their musical training.</p>	
Summary Statement I discovered that individuals at the extremes of the distribution in a metronome continuation test have differences in rhythm sensing in music.	
Help Received I thank my participants, my Science Fair advisor for providing a testing room at school, my parents for purchasing equipment and driving me to subjects' homes, and my mother for help with typing and giving me tips in using Microsoft Excel.	