



**CALIFORNIA STATE SCIENCE FAIR  
2012 PROJECT SUMMARY**

<b>Name(s)</b> Nidhi A. Navaratna	<b>Project Number</b> <b>S0417</b>
<b>Project Title</b> <b>Confusion of the Senses: Exploring Cross-Modal Plasticity and the Elevated Recall Ability of Grapheme-Color Synesthetes</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> This study explored the visual recall implications of grapheme-color synesthesia, a neural phenomenon in which the viewing of letters and numbers leads to the perception of certain colors. The cross-activation of two occipital and temporal areas- the V4 (color processing) and PGTA (graphemes)- induces the "seeing" of colors upon the sight of a grapheme stimulus, resulting from a possible genetic mutation prompting deficiency in synaptic pruning. Individual case reports claim synesthetes harbor above-average memory recall abilities. Due to the proven bi-directionality of grapheme-color synesthesia, and the involvement of memory-controlling mechanisms (limbic system) during synesthetic experiences, I hypothesized grapheme-color synesthetes possessed a greater visual recall ability compared to non-synesthetic controls.</p> <p><b>Methods/Materials</b> Seven female grapheme-color synesthetes and seven matched controls (sex, age, years of education, handedness) were each administered a standard memory test (Brown, 2007) containing forty-eight slides with various grapheme combinations through the online sharing program Skype. Each slide was shown for five seconds. At the conclusion, subjects were instructed to record their recalled grapheme combinations as well as log any specific reasons for remembrance (the synesthetes' reasons mostly involved color associations). Delayed recall was measured with the same procedure after a thirty-minute period of delay.</p> <p><b>Results</b> The findings showed that synesthetes as a group displayed consistently greater average recall compared to the controls. Synesthetes recalled 53% more combinations than controls for immediate recall, and 49% more combinations for delayed recall. Effect sizes (d) were &gt;0.8, showing a large magnitude of difference between the groups, and t-tests showed p-values &gt;0.05, greater than the statistically significant &lt;0.05, likely attributed to the relatively small synesthete sample size (simulations of a sample size of 30 showed p&lt;0.05).</p> <p><b>Conclusions/Discussion</b> Taken as a whole, these findings show that grapheme-color synesthetes display significantly elevated visual recall ability, furthering knowledge concerning sensory perception, cross-modal wiring, and brain development.</p> <p>Being a grapheme-color synesthete myself, this has provided deeper insight into mine and fellow synesthetes' cognitive abilities.</p>	
<b>Summary Statement</b> People with the neural condition grapheme-color synesthesia possess greater visual recall ability than non-synesthetes.	
<b>Help Received</b> Dr. Brittany Stevens provided help at school; Mr. Sean Day, Mr. Brian Alvarez & Dr. Ed Hubbard gave insight through email.	