Synesthetic Color Processing and its Influence on Attention During Visual Search

Chris Graulty, Oliver Chesley, Enriqueta Canseco-Gonzalez, & Michael Pitts
Grapheme-Color Synesthesia

A B C D E F
G H I J K L M
N O P Q R S T
U V W X Y Z
Visual Search

Synesthetes

Controls
An Inconsistent Finding

<table>
<thead>
<tr>
<th>RT Difference</th>
<th>No RT Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carriere et al. (2009)</td>
<td>Laeng et al. (2009)</td>
</tr>
</tbody>
</table>
An Inconsistent Finding

Eagleman et al. (2011)
An Inconsistent Finding
Our Approach

1. Individually tailor stimuli based on the strength and consistency of each synesthetic association.

2. Use Event-Related Potentials to assess the timing of attention during visual search.
Methods

- Grapheme-Color Synesthetes (N=12)
- Controls Matched for Age and Biological Sex (N=12)

- Seven Distractor Letters
- Two Possible Targets (i.e. A or M)

Synesthetic Perception
Methods

An index of covert attention

N2pc

Ipsilateral

Contralateral
Methods

Hypothesis: Synesthetes will have an earlier N2pc
RESULTS
Behavioral Results

Reaction Time (ms)

- Synesthetes
- Controls

*P<0.01
Behavioral Results

![Behavioral Results graph showing reaction times for Synesthetes and Controls across different participant pairs.]

- Reaction Time (ms)
- Participant Pair
- Synesthetes
- Controls
ERP Results

- Ipsilateral
- Contralateral

Synesthetes

Controls
Difference Waves

- Controls
- Synesthetes

Graph showing difference waves with time in milliseconds (500ms) on the x-axis and voltage in microvolts (-1µV to +1µV) on the y-axis.
**Mass Univariate**
Cluster Permutation Analysis

---

**Synesthetes**

- CP1/2
- CP3/4
- CP5/6
- P1/2
- P3/4
- P5/6
- P7/8
- PO3/4
- PO7/8
- P9/10
- O1/2
- PO9/10
- O9/10

**Controls**

- CP1/2
- CP3/4
- CP5/6
- P1/2
- P3/4
- P5/6
- P7/8
- PO3/4
- PO7/8
- P9/10
- O1/2
- PO9/10
- O9/10

---

**t-value**

-6 -4 -2 0 2 4 6

---

**190ms**

- 200
- 250
- 300ms

**230ms**

- 200
- 250
- 300ms
Difference Waves

Controls
Synesthetes

*P<0.01
## Results Summary

<table>
<thead>
<tr>
<th></th>
<th>Synesthetes</th>
<th>Controls</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reaction Time</td>
<td>630 ms</td>
<td>720 ms</td>
<td>*P &lt; 0.01</td>
</tr>
<tr>
<td>N2pc Onset</td>
<td>190 ms</td>
<td>230 ms</td>
<td>*MUA</td>
</tr>
<tr>
<td>N2pc Amplitude</td>
<td>-0.98 μV</td>
<td>-0.45 μV</td>
<td>*P &lt; 0.01</td>
</tr>
</tbody>
</table>
Discussion

- Synesthetic Color in Early Visual Processing
  - Reaction Times
  - N2pc Latency

- Is this strictly an effect of synesthetic color perception, or could this be a difference in general visual processing?

- Do individuals with acquired synesthesias show these same effects? (Schwartzman et al. 2014, Nature)
Thanks for your attention!

Oliver Chesley

Michael Pitts

Enriqueta Canseco-Gonzalez