Overview

This module is meant to introduce students to the concept of dual-process theories of the mind and the nature of decision-making in the brain, through the psychological investigation of the Stroop Effect. This module will also serve as an exercise in data collection, interpretation, and presentation.

Dual-process theories of psychology state that the mind is actually made up of two components: System 1, a fast, intuitive system; and System 2, a slow, more reflective system. These two systems work together to make decisions and carry out our day-to-day activities. More information about this theory is available here: [http://www.inudgeyou.com/video-on-basics-of-dual-process-theory/](http://www.inudgeyou.com/video-on-basics-of-dual-process-theory/)


The Stroop Effect is a simple activity that demonstrates how System 1 and System 2 work together – and sometimes come into conflict with each other. In this activity, students simply say aloud the color of a list of words. On one list, the words and colors are consonant (i.e. the word “Red” is the color red), while on the other list the words and colors conflict (i.e. the word “Red” is colored green). Because System 1 automatically reads the word (even though you are just trying to say the color, using System 2), the second list is much harder and takes longer to read. More information is available here: [http://faculty.washington.edu/chudler/words.html](http://faculty.washington.edu/chudler/words.html), [http://en.wikipedia.org/wiki/Stroop_effect](http://en.wikipedia.org/wiki/Stroop_effect), and [http://worthylab.tamu.edu/Courses_files/Stroop%20Effect.pdf](http://worthylab.tamu.edu/Courses_files/Stroop%20Effect.pdf)

Science Standards (NH Science Curriculum Frameworks)

*LS – Life Sciences*

*LS4 – Humans are similar to other species in many ways, and yet are unique among Earth’s life forms*

*S:LS4:11:3.3 Explain how the immune system, endocrine system, or nervous system works and draw conclusions about how systems interact to maintain homeostasis in the human body*
Focus Questions
How does the human mind make decisions? How, and where, does this process unfold in the brain? How does playing video games affect our decisions in real life?

Objectives
Through this lesson, students will:

- Learn about how the mind makes decisions, according to Dual-Process theories of cognition
- Learn about the evolutionary history of the human brain, and how it compares to those of other organisms
- Conduct a psychological experiment; record, organize, and present experimental data
- Interpret results of experiment in light of Dual-Process models of decision-making

Background
Introduce Dual-Process Theories of decision-making, discuss the location and evolution of brain systems underlying these capabilities, and introduce the Stroop Effect experiment (see PowerPoint presentation).

Materials
Graph paper, colored pencils/markers, calculators (if necessary), and stopwatches (or students can use cell phones).

Preparation
Obtain PowerPoint lecture presentation, print out worksheets, and assign groups for students.

Procedure
1. Give opening PowerPoint presentation on the psychology of video game play, decision making, and dual-process models of the mind.
2. Stop at slide titled “An experiment with dual processing” and click three times to bring up the three word lists.
3. Split students into groups of two (could do three if there is an odd number, but not ideal)
4. Have students take turns reciting the colors of the words in each list aloud (e.g. “green,” “blue,” “red” for first list), while the other student times them with a stopwatch/cellphone.
5. Have students record the time for each group member and on each list.
6. Give students about twenty minutes to complete the calculations, graphing exercises, and questions on the worksheet.
7. Go over answers to worksheet and demonstrate how results could be displayed graphically
8. Finish second part of PowerPoint presentation, and show video demonstration of controlled processing at end (if there is enough time)

Assessment
See worksheet.

Extensions
Students could write up results of experiment in a formal lab report, or communicate results in a poster. Future lessons could introduce the Emotional Stroop Effect and discuss emotion processing in the brain. Future lessons could also go further in depth on the topic of brain evolution (and human evolution in general).

For more information and resources on the Emotional Stroop task see: http://en.wikipedia.org/wiki/Emotional_Stroop_test

Example (List 1 on left and List 2 on right). It should take longer to list the colors on List 1 because the emotional content of the words attracts attention.

<table>
<thead>
<tr>
<th>HATE</th>
<th>CHAMPION</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEPRESSED</td>
<td>EXAM</td>
</tr>
<tr>
<td>CRYING</td>
<td>SKY</td>
</tr>
<tr>
<td>BULLY</td>
<td>CARWASH</td>
</tr>
<tr>
<td>SUICIDE</td>
<td>WIKIPEDIA</td>
</tr>
</tbody>
</table>
The Stroop Effect Lab: A Demonstration of Dual Processing

Use the following table to record the time it takes each group member to read the colors of the words aloud – make sure each group member reads the lists in a different order.

<table>
<thead>
<tr>
<th>Group Member</th>
<th>List 1 Time</th>
<th>List 2 Time</th>
<th>List 3 Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Perform the necessary computations to determine the average reading time for each list:

Mean

Create a graph to display the data from each participant (not the means) – include a key, a title, and make sure to label your axes:
Create a graph to display mean reading times for each word list – include a key, a title, and make sure to label your axes:

**Conclusion Questions**

1) What does the data show about the difficulty of reading the colors of each list? Which list was easiest? Hardest?

2) Why do you think that the most difficult list was so difficult? The easiest list so easy?

3) How do you think this relates to Dual-Process Models of decision making? What was System 1 doing? System 2?