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Sandia National Laboratories

STAR Fellow Internship

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The ASK Academy

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Organizations

- Cognitive Systems (1463)

  -Phil Bennett – Manager

  - Michael Haass - Mentor
  - Robert Abbott
  - Kristin Divis
  - Laura Matzen
  - Ann Speed

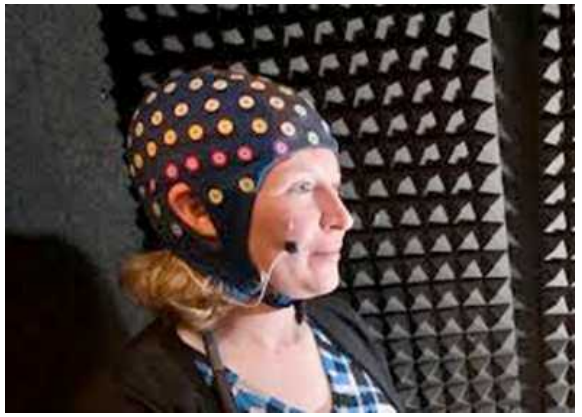
- Cognitive Modeling (1462)

  - John Wagner – Manger

  - Austin Silva - Mentor
  - Michael Trumbo
  - Glory Emmanuel

Many Experiences

- Eye Tracking
- EEG Lab
- Python
- Cyber Narrative
- Working Memory
  - N-Back Test



Python

- Biggest Challenge of the internship
- Learn to program in Python
- Applied it to:
  - Learning
  - Modeling Test Results
  - Creating an N-Back Test
- Problems:
  - Making all the components work together
  - Learning programming logic and Python syntax

```
import random
threshold = [0.55, 0.65, 0.75, 0.85, 0.95]
nTrials = [10, 30, 60, 100]
y = 0
nRight = 0
nWrong = 0
for n in threshold:
    for b in nTrials:
        nRight = 0
        nWrong = 0
        print ("Using nTrial %i" % (b))
        print ("Using threshold %f" % (n))
        for x in range(b):
            y = random.random()
            if y >= n:
                print ("Correct")
                nRight = nRight + 1
            else:
                print ("Incorrect")
                nWrong = nWrong + 1
        print ("Number correct %i" %(nRight))
        print ("Number incorrect %i" % (nWrong))
        input("Press Enter to continue...")
        print("")
input("All Done! Press Enter to continue...")
```

N-Back

- What is it?
- A tool to measure cognitive differences
- Measures a part of the working memory and fluid intelligence
- Brain training exercise to improve the working memory and fluid intelligence
- The trick of the N-Back is trying to remember if the Letter that was three before matches with the current letter

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	A	F	K	H	H	K	F	U	F
N = 1	X	X	X	X	✓	X	X	X	X

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	A	F	K	H	H	K	F	U	F
N = 1	X	X	X	X	✓	X	X	X	X
N = 2	X	X	X	X	X	X	X	X	✓

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	A	F	K	H	H	K	F	U	F
N = 1	X	X	X	X	✓	X	X	X	X
N = 2	X	X	X	X	X	X	X	X	✓
N = 3	X	X	X	X	X	✓	X	X	X

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A

B

L

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A

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Q

B

How many were Correct?

- Can you recall on how many of the letters matched for N=3?

Correct

Python and N-Back

- Problem:
  - Combining the two
- Writing the program for an N-Back in Python
- Seeing how individual parts work
- Seeing what did and did not work with the program

```
1  import random
2
3  nTrials = 100
4  y = []
5  threshold = 0.5
6  possibleLet = ['A', 'B', 'C', 'D', 'E']
7  nRight = 0
8  nWrong = 0
9
10 for x in range(nTrials):
11     y.append(random.choice(possibleLet))
12
13 print ("Incorrect %s" % y[0])
14 print ("Incorrect %s" % y[1])
15 print ("Incorrect %s" % y[2])
16 for x in range(3, nTrials):
17     k = random.random()
18     if k >= threshold:
19         y[x] = y[x-3]
20
21         print ("Correct %s" % y[x])
22         nRight = nRight + 1
23     else:
24         ii = possibleLet.index(y[x-3])
25         if ii == 4:
26             y[x] = possibleLet[ii-1]
27         else:
28             y[x] = possibleLet[ii+1]
29     print ("Incorrect %s" % y[x])
30     nWrong = nWrong + 1
31
32 print("Number Correct %i" % nRight)
33 print("Number Incorrect %i" % nWrong)
34 input("Press Enter to continue...")
```

Python and N-Back

- Correct Code
- Many trials to get this to work
- Randomization Issue
- Translating my thought process into Python code

```
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16 for x in range(3, nTrials):
17     k = random.random()
18     if k >= threshold:
19         y[x] = y[x-3]
20
21         print ("Correct %s" % y[x])
22         nRight = nRight + 1
23     else:
24         while y[x] == y[x - 3]:
25             y[x] = random.choice(possibleLet)
26         print ("Incorrect %s" % y[x])
27         nWrong = nWrong + 1
28
29 print("Number Correct %i" % nRight)
30 print("Number Incorrect %i" % nWrong)
31 input("Press Enter to continue...")
```

Working Memory

- Question:

Do different types of working memory tasks effect visual learning and auditory learners differently?

- Hypothesis:

I believe that such differences exist and can be measured through an N-Back test

Future

- Senior Project
- N-Back Test
- Apply the experiences I gained and skills I acquired
- Once I have enough data, I will perform a statistical analysis to determine whether my hypothesis is correct or not

Q&A