Volume of Subcortical Structures in Relation to Behaviour: Exploring the Caudate in People With Dyslexia

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Introduction

- The basal ganglia is made up of subcortical structures (e.g., caudate, putamen, thalamus) that are involved in reading and speech processing.
- The level of activity of each of these subcortical structures correlate with a person's reading behaviour[4].
- Impairment in reading is associated with damage to the caudate[1-4].
- It is still not well understood if the volume of these structures (specifically the caudate) are related to reading bahaviour.
- The better we understand the problem, the better equipped we are in helping people with this impairment

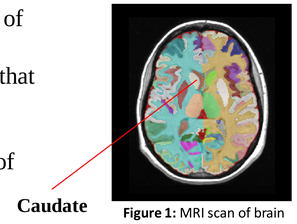


Figure 1: MRI scan of brain in the horizontal plane

Research Question

Is there a significant relationship between subcortical structure volume and reading behaviour?

Methods

- A participant's behaviour was measured with a few different methods.
  1) The first was having the participant read a list of real words in a timed setting.
  2) Then, the same task was performed with a list of non-real words.

- Participant's brains were scanned to get measurements of caudate volume using magnetic resonance imaging (MRI) (MRI Settings**:** Axial T1 images: TR = 1700, TE = 2.21, # of slices = 176, base resolution 256 x 256 x 176 with a voxel size of 1 x 1 x 1 mm).
- The data was then analyzed.

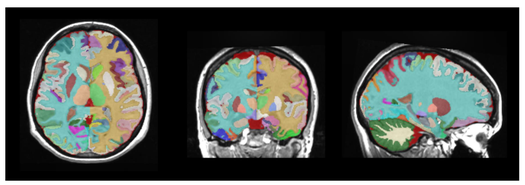


Figure 2: MRI scan of brain
From volBRain analysis

Results

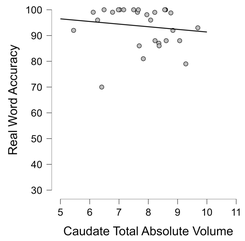
- The r value is the relationship between two factors
  - 0.5 or above is significant
- The p value is the probability of the r value being incorrect
  - 0.05 or less is acceptable and ideal

Caudate Total Absolute Volume Vs. Behaviour

Control | Dyslexia

Figure 3: Scatter plot diagram of total absolute volume of the caudate in relation to accuracy of real words in control

r = -0.135
p = 0.486



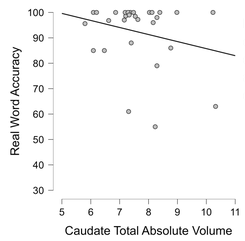
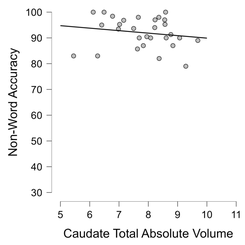


Figure 5: Scatter plot diagram of total absolute volume of the caudate in relation to accuracy if real words in dyslexia

r = -0.239
p = 0.211

Figure 4: Scatter plot diagram of total absolute volume of the caudate in relation to accuracy of non-words in control

r = -0.171
p = 0.375



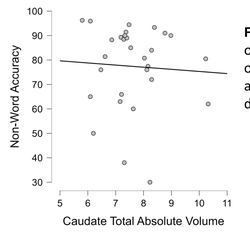


Figure 6: Scatter plot diagram of total absolute volume of the caudate in relation to accuracy of non-words in dyslexia

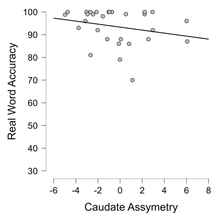
r = -0.056
p = 0.774

Asymmetry of Caudate Vs. Behaviour

Control | Dyslexia

Figure 7: Scatter plot diagram of caudate asymmetry in relation to accuracy of real words in control

r = -0.240
p = 0.211



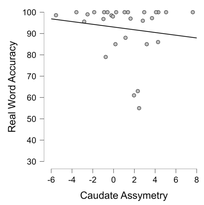
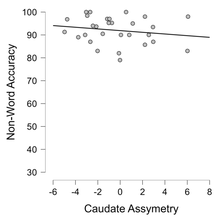


Figure 9: Scatter plot diagram of how the caudate asymmetry relates to accuracy of real words in dyslexia

r = -0.145
p = 0.454

Figure 8: Scatter plot diagram of how the caudate asymmetry relates to accuracy of non-words in control

r = -0.178
p = 0.354



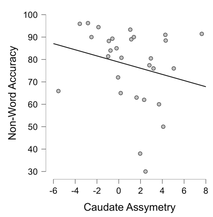


Figure 10: Scatter plot diagram of how the caudate asymmetry relates to accuracy of non-words in dyslexia

r = -0.231
p = 0.228

Conclusion

- The data suggests that there is no significant relationship between the reading behaviour, and the total absolute volume of the caudate and its asymmetry in both the control and people with dyslexia.
  - The r values in figures 3-10 are below 0.5
  - The p values in figures 3-10 are above 0.05
  - Plot points in figures 3-10 are scattered across the graph, showing no general trend

- Further Investigation:
  - Investigation on the volumes of the putamen and the thalamus in relation to the behaviour is still required.

Acknowledgements

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Citations

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