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Exercise #10

Question 9.2

Summary stats for testing trials testing epoch–level log data

UpdtView | Config | Add Rows | Sort... | Filter... | Show All | Open CSV... | Save CSV...

Index	Run	Epoch	Lesion	LesionP	ConVis	ConSen	ConVisS	ConBler	ConOthe	AbsVis	AbsSem	AbsVisS	AbsBlen	AbsOthe
00000	0	-1	NoLesion	0	0	0	0	0	0	0	0	0	0	0
00001	0	-1	SemanticsFull	0	8	0	0	0	1	1	0	0	0	0

In a semantic pathway lesion, the network is forced to rely on the direct pathway from orthography to phonology. This pathway tends to produce phonologically similar errors to the target words because it processes based on the visual similarity of words, without the semantic context to correct or inform the phonology.

Question 9.3

Summary stats for testing trials testing epoch–level log data

UpdtView | Config | Add Rows | Sort... | Filter... | Show All | Open CSV... | Save CSV...

Index	Run	Epoch	Lesion	LesionP	ConVis	ConSen	ConVisS	ConBler	ConOthe	AbsVis	AbsSem	AbsVisS	AbsBlen	AbsOthe
00000	0	-1	NoLesion	0	0	0	0	0	0	0	0	0	0	0
00001	0	-1	SemanticsFull	0	8	0	0	0	1	1	0	0	0	0

Here we can see that for the ConVis error there were 8 visual errors and AbsVis had 1 error.

Question 9.4

Summary stats for testing trials testing epoch–level log data

UpdtView | Config | Add Rows | Sort... | Filter... | Show All | Open CSV... | Save CSV...

Index	Run	Epoch	Lesion	LesionP	ConVis	ConSen	ConVisS	ConBler	ConOthe	AbsVis	AbsSem	AbsVisS	AbsBlen	AbsOthe
00000	0	-1	NoLesion	0	0	0	0	0	0	0	0	0	0	0
00001	0	-1	SemanticsFull	0	8	0	0	0	1	1	0	0	0	0
00002	0	-1	DirectFull	0	4	7	2	1	5	3	2	1	4	14

When we only rely on the semantic pathway, errors tend to expand. This includes semantic mistakes rooting from misinterpreted word meanings, visual inaccuracies due to the absence of orthographic cues, and a mixture of "blend" and "other" errors as the network tries to make phonological representations without orthographic direction. During the simulation, we had multiple different types of errors: 4 visual errors in the ConVis category, 7 semantic errors under ConSem, and 5 miscellaneous errors classified as ConOther. For abstract errors, the count was 3 for AbsVis, 2 for AbsSem, and 14 for AbsOther.

Question 9.5
The manifestation of deep dyslexia symptoms, more so the occurrence of semantic errors and visual-semantic confusions, may be made worse by increasing the damage that is done to the semantic processing pathways. The simulation indicates the main cause for this is the disruption of the direct lexical access route. Additional semantic pathway damage does not seem to be needed for an increase in semantic error symptoms, which proves that the main cause of these symptoms is the loss of the direct pathway rather than the condition of the semantic pathways. Therefore, while additional damage may slightly alter the error profile or severity, it is not necessary to produce characteristics of deep dyslexia in the simulated model.

Question 9.6
Yes, there is evidence that the model makes more mistakes with abstract words than with concrete words. This is because in the simulated conditions of deep dyslexia, the model relies more on the semantic pathway. Because abstract words have less notable features compared to concrete words, the model's ability to correctly process and read out abstract words is heavily affected. This leads to a higher number of errors for abstract words, which reflects some of the key characteristics of deep dyslexia.

Question 9.8
The model's correct pronunciation of "j" at the end of words, despite not being trained on it, illustrates its ability to generalize based on its learning. This generalization is due to the design of the network, which supports translation invariance and a position-independent understanding of phoneme sounds. The network is able to learn how "j" sounds in different positions within words anc is able to utilize this knowledge in other words, including words where it might not have encountered "j" during the training process. This reflects the model's approach to phonological patterns, which enables it to apply familiar situations to unfamiliar situations, ultimately demonstrating that of how humans handle word pronunciation.

Question 9.11
If we take a look at the word “learning” we are able to note that it refers to biological mechanisms in the brain, core principles behind machine learning algorithms or the processes involved in gaining new knowledge or skills. We can pair "learning" with other terms to guide the network towards different senses of the word. First if the word is paired with “neural” this highlights the biological aspect which highlights the brain's ability to adapt. Testing this pair against terms related to biological learning like the word “Hebbian” for example, can reveal the network's desire to associate "learning" more with biological processes when presented with "neural." Next, pairing "learning" with "algorithmic" pushes the representation towards computational models and machine learning algorithms, which is different from that of the biological sense. Comparing the network's response to this combination against the same sets of terms used before can demonstrate a shift in semantic space, demonstrating closer alignments with computational learning concepts. Through these manipulations, we are able to see that the

network's distributed representations accommodate the semantic flexibility of the word "learning," which further reflect its capability to manipulate its understanding based on the situation.