4.5 5.75

Computational Cognitive Neuroscience – CH9

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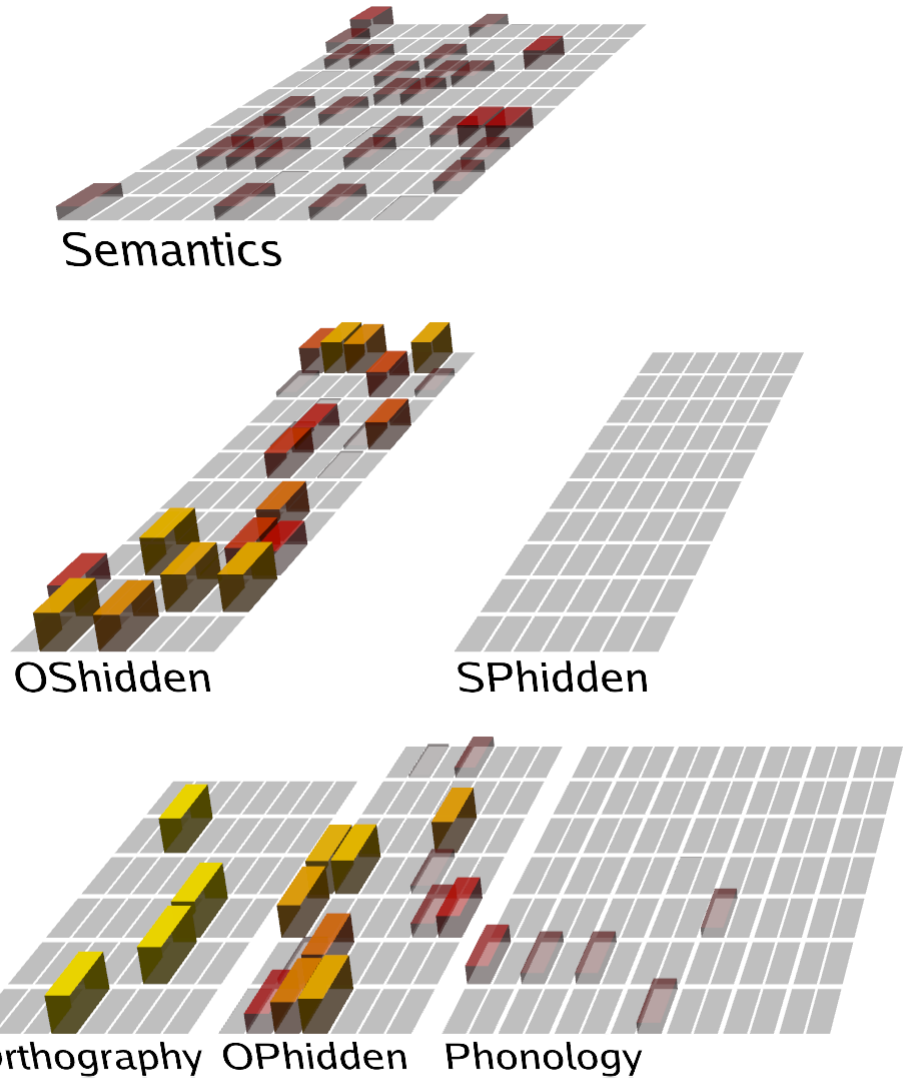
Question 9.1



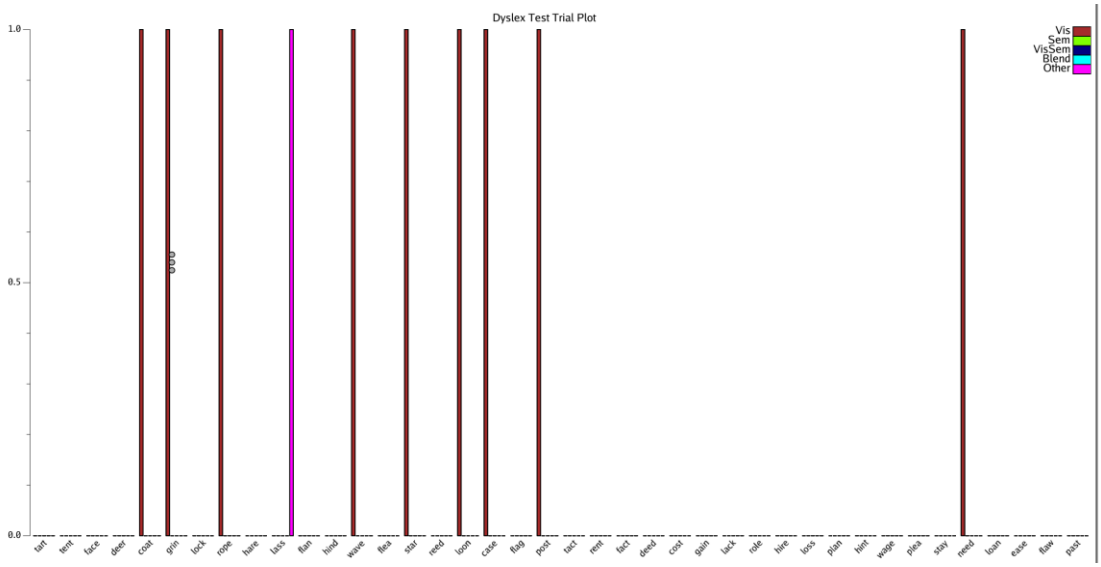
0.5

Rather than the “direct” input from orthography, the “indirect” input from semantics is mostly responsible for the initial phonological activation. The network creates phonological representations by combining data from semantics and orthography.

In certain situations, the latter input may cause the initial phonological pattern to change. One could witness this behavior in the term “fffAsss”. When the network first receives the orthographic input “fffAsss” (orthography input), it may begin to activate

the phonological representation of “fffAsss”. However, the phonological representation may change to reflect the semantics as the semantic information associated with this word becomes available and influences the phonological layer. In the event that the semantic information suggests the meaning of “face”, the phonological representation “fffAsss” may be changed to “face”.

Question 9.2



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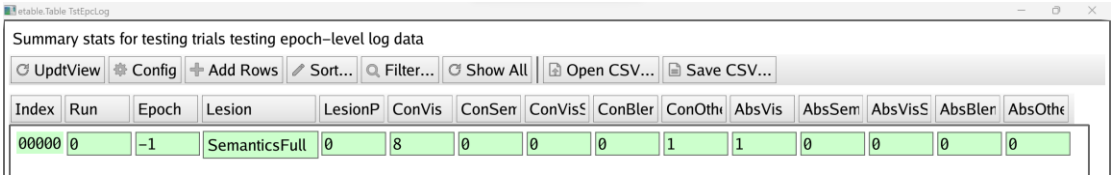
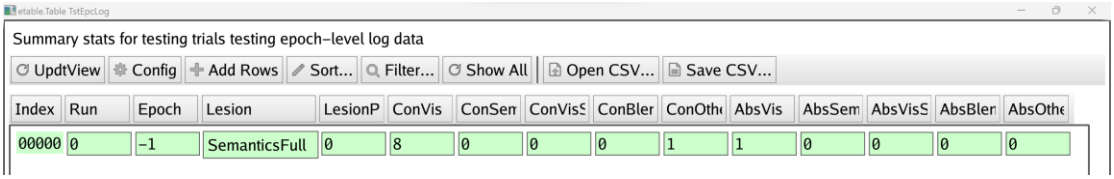


ConVis: 8 times
ConOther: 1 time
AbsVis: 1 time
Total: 10 times

Question 9.3

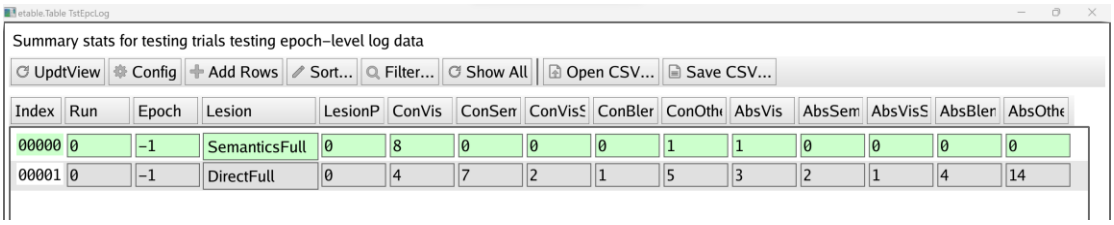
should be 8 ConVis, 1 AbsVis and 1 ConOther



0.75

Visual errors: 9 times (8 by concrete and 1 by abstract)

Question 9.4



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

1

Total errors: 43 times
Visual errors: 7 times (4 by concrete and 3 by abstract)
Semantic errors: 9 times (7 by concrete and 2 by abstract)
Both errors: 3 times (2 by concrete and 1 by abstract)
Other errors: 19 times (5 by concrete and 14 by abstract)

Question 9.5

0.25

Additional semantic pathway damage is required to produce the symptoms characteristic of deep dyslexia, particularly the presence of semantic errors alongside visual and other errors.

Direct pathway lesion shows mainly visual errors, as the direct pathway helps constrain phonological outputs based on orthographic inputs. When there's increasing damage to the semantic pathway along with a complete lesion of the direct pathway, the network starts exhibiting a mix of semantic, visual, and other errors. The semantic errors are particularly noticeable at higher levels of semantic pathway damage. These results are more consistent with the symptoms of deep dyslexia.

Question 9.6

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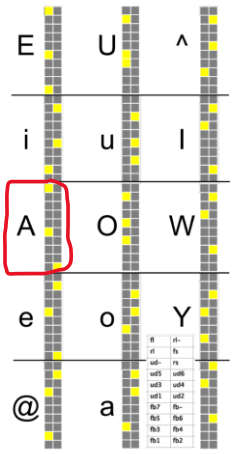
It can indeed be proved in the orthography to semantics hidden layer, but with the increase of lesion proportion in the semantics to phonology layer (SPhidden), the semantic errors of the SPhidden's abstract words are first greater than the semantic errors of concrete words, but eventually smaller than the semantic errors of concrete words.

Question 9.7



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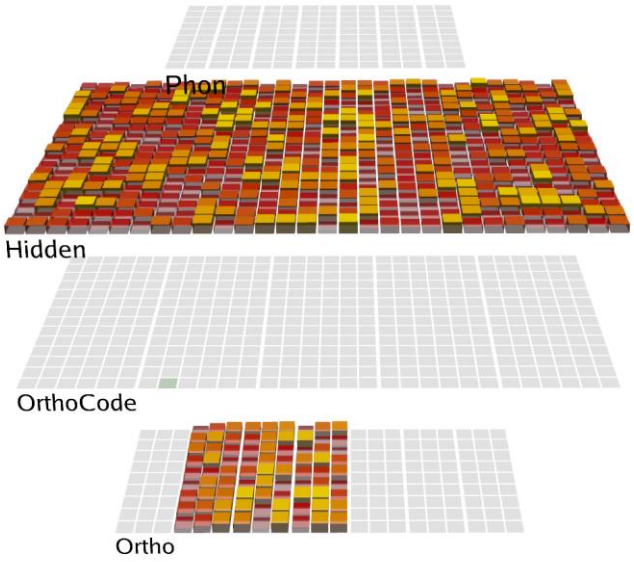
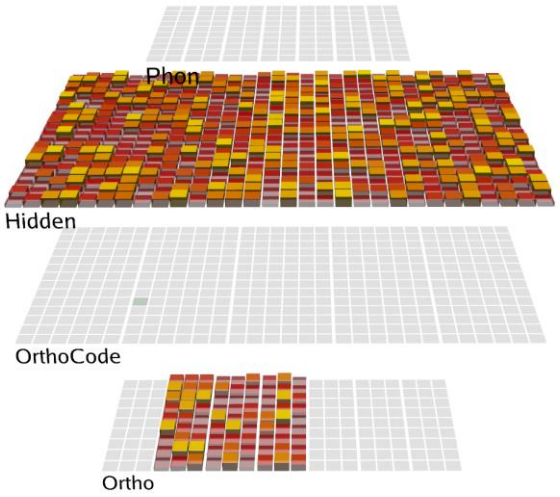
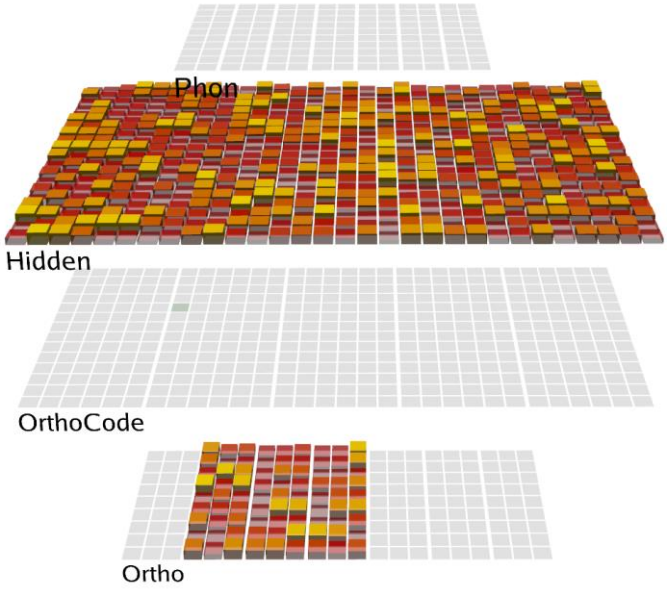




more explanation would be great... not su



Question 9.8

The network's learning of positional dependencies and the translation invariance property it has acquired during training can be used to explain the model's occasionally accurate pronunciation of the "j" in nonword codas, even though this sequence was not present in the training set.

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The network has the ability to identify specific letter combinations and the phonemes that go with them in different word locations. Even while the precise sequence "j" at that position may not have happened during training, the presence of the letter "j" in the coda of the nonwords may trigger particular patterns in the input layer that are similar to patterns seen elsewhere in the training data.

Question 9.9

WtWords Result

UpdtView | Add

00000	ability
00001	able
00002	absolute
00003	abstract
00004	abstraction
00005	accommodat
00006	accomplish
00007	accomplishe
00008	according
00009	accounts
00010	achieve
00011	achieved
00012	achieving
00013	activated
00014	activations
00015	actual
00016	added

1

Achieve, achieved, achieving and accomplish.

Question 9.10

etable.Table TstEpcLog

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	Words	TstWordsC(
00000	0	-1	atte v bind	0.206057
00001	0	-1	atte v spel	-0.0251064
00002	0	-1	atte v atte	-0.0251907
00003	0	-1	atte v zero	-0.0258888

1

Question 9.11

etable.Table TstEpcLog

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	Words	TstWords(
00000	0	-1	bind v obje-reco	0.475805
00001	0	-1	bind-feat v obje-reco	0.725863
00002	0	-1	feat v obje-reco	0.257749
00003	0	-1	rapi-bind v obje-reco	0.0501716
00004	0	-1	rapi-bind v hipp	0.252318
00005	0	-1	fit v comb-enco	-0.0203306
00006	0	-1	fit-acts v comb-enco	-0.0363279
00007	0	-1	acts v comb-enco	-0.0345782
00008	0	-1	rapi-acts v comb-enco	-0.0258633
00009	0	-1	rapi-acts v hipp	-0.00266985

1

My experiment reproduced combinations of words influence the hidden layer representations and how different senses of a word can be highlighted or diminished

based on the input combinations, showcasing the network's flexible semantic representation capabilities.

Question 9.12

The cluster structure observed in the Gestalt layer's representation reflects a combination of both syntactic and semantic information. In the context of the sentences provided (with agents, verbs, and patients), the clustering influenced by the syntax (agents, verbs) as well as the semantics (patients) of the sentences.

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The clustering according to verbs primarily indicates the syntactic structure of the sentences. The Gestalt layer seems to organize or group sentences together based on the shared action or verb. Within each verb cluster, the differentiation based on patients (iced tea, koolaid, soup, steak) suggests that semantic information also plays a role.