

שמע

Project Shema

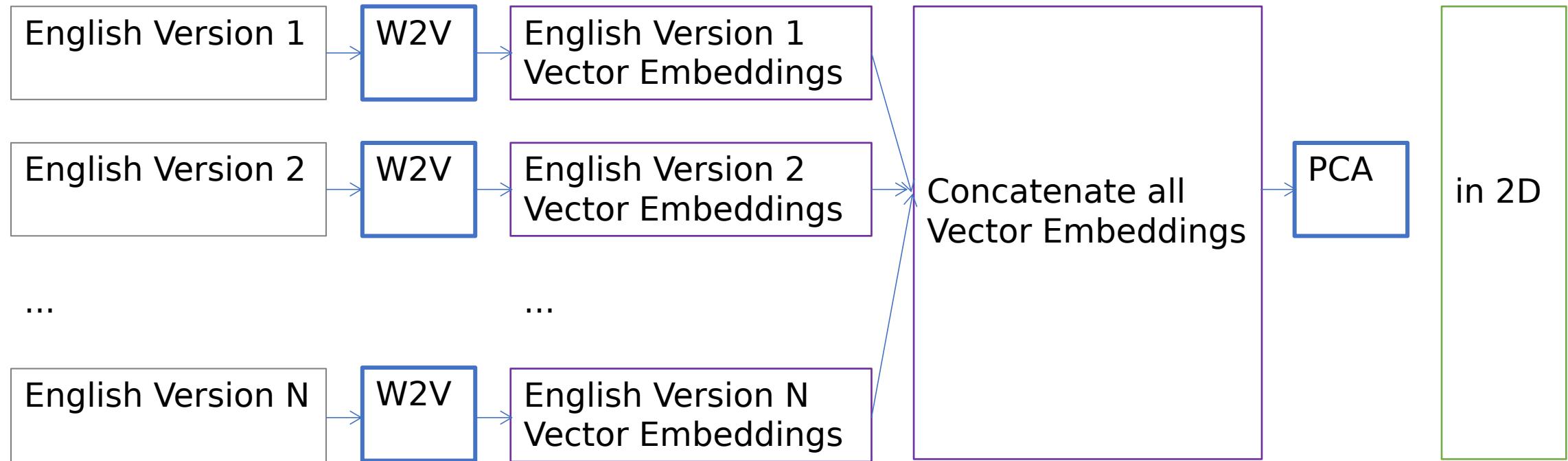
Shema: [command] “Hear”

To *actively* listen, understand, internalize, and *really* comprehend.

Exploring English Tanakh

All English texts from Sefaria.org

Pipeline

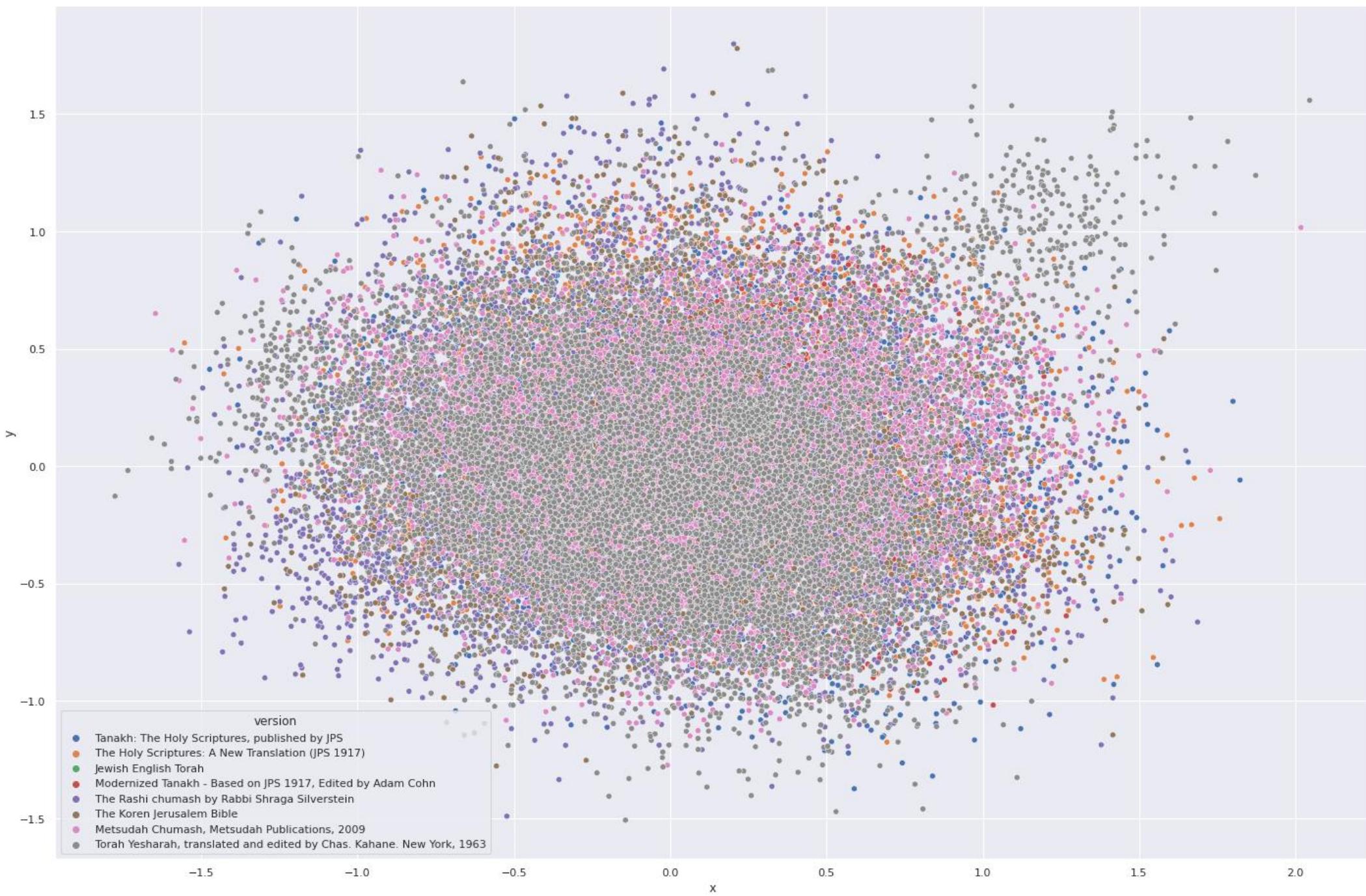


W2V

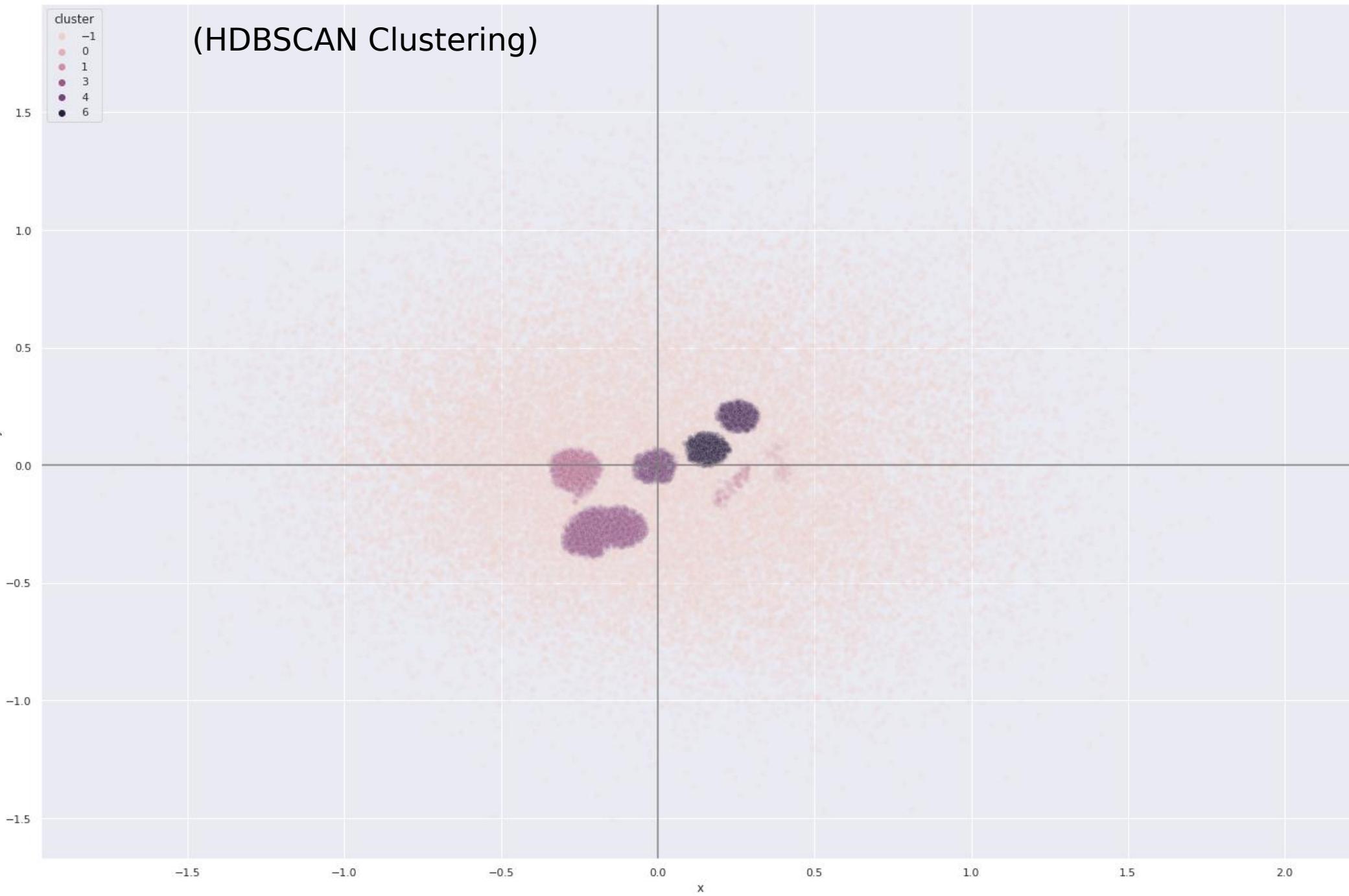
= skip-gram w/ negative word sampling

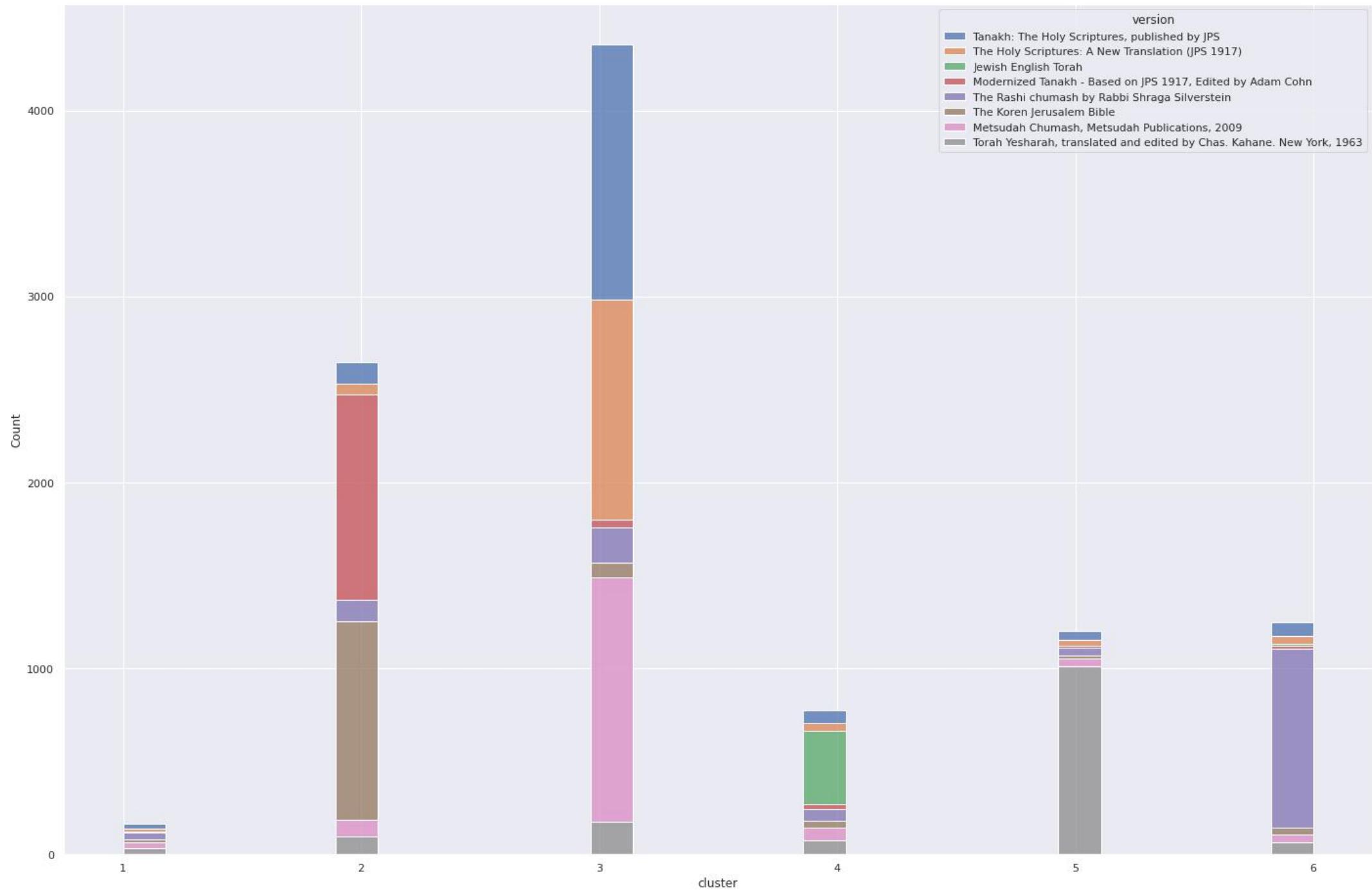
PCA

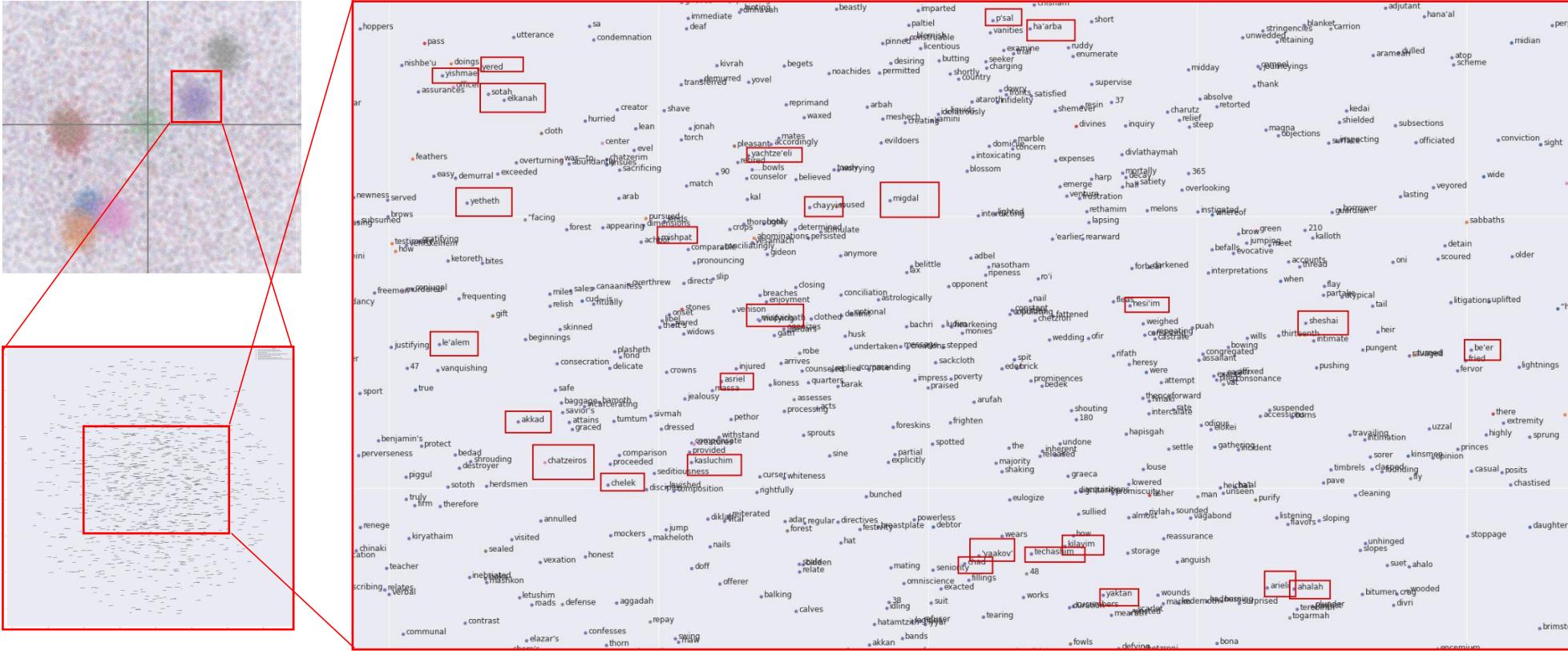
= reduced dims from 128 to 2



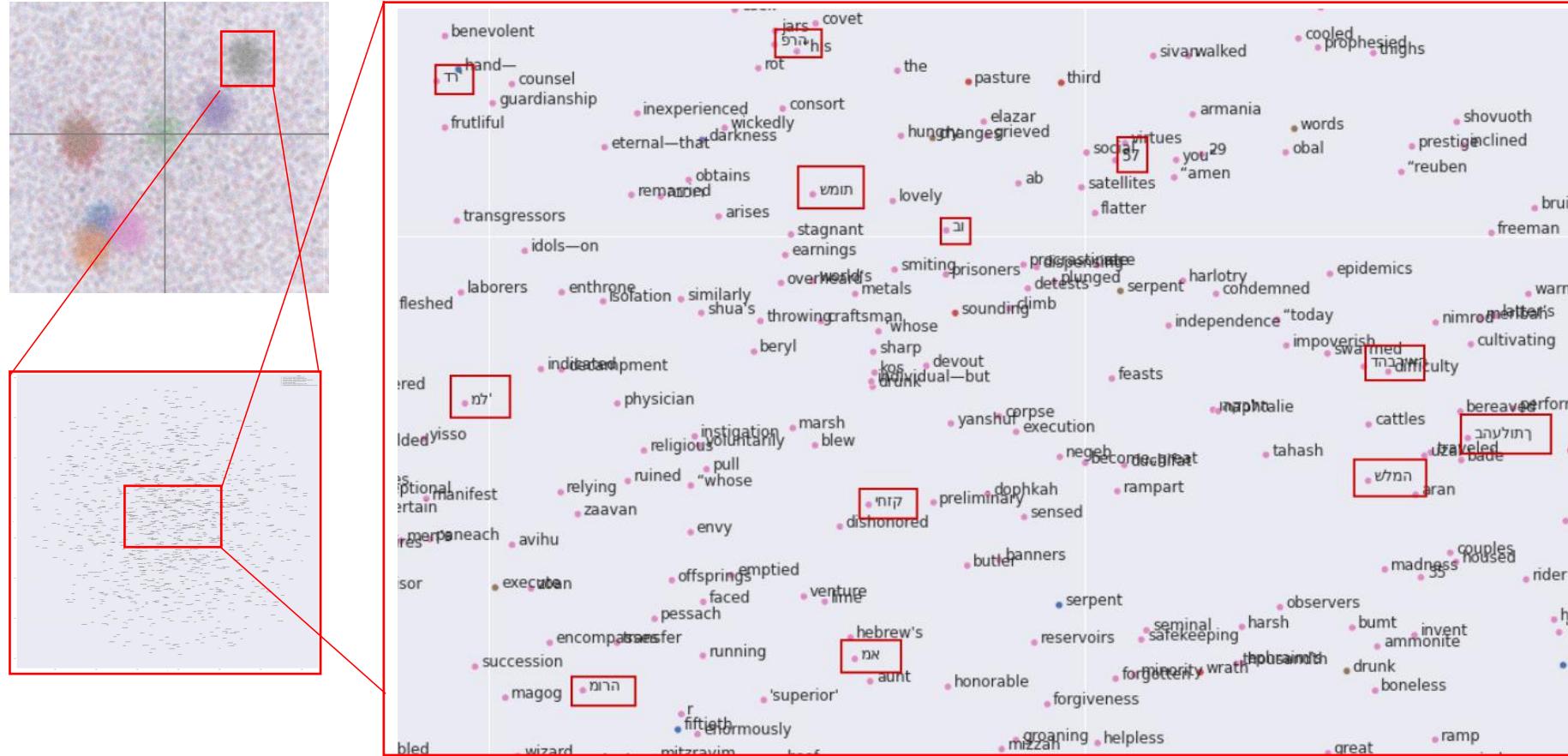


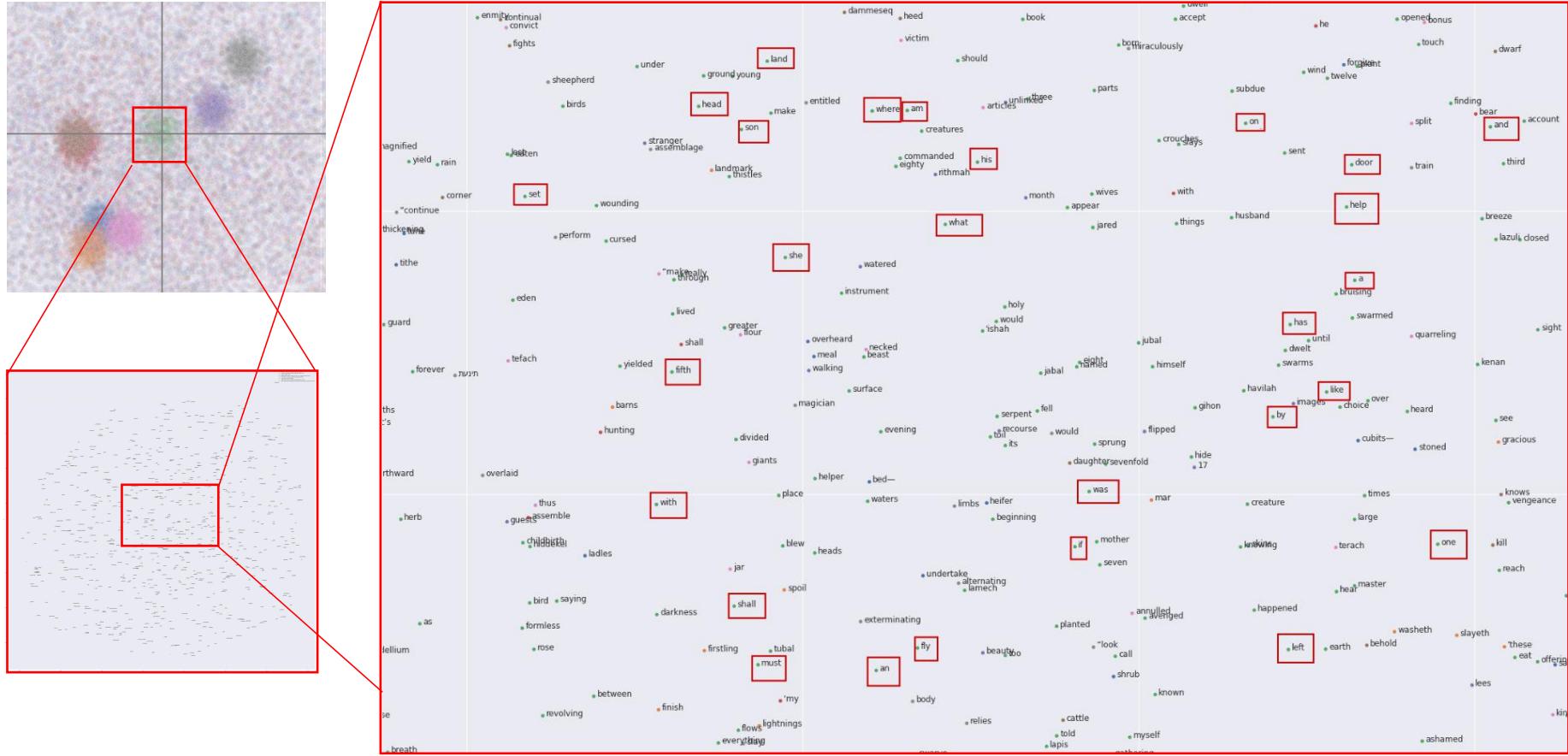




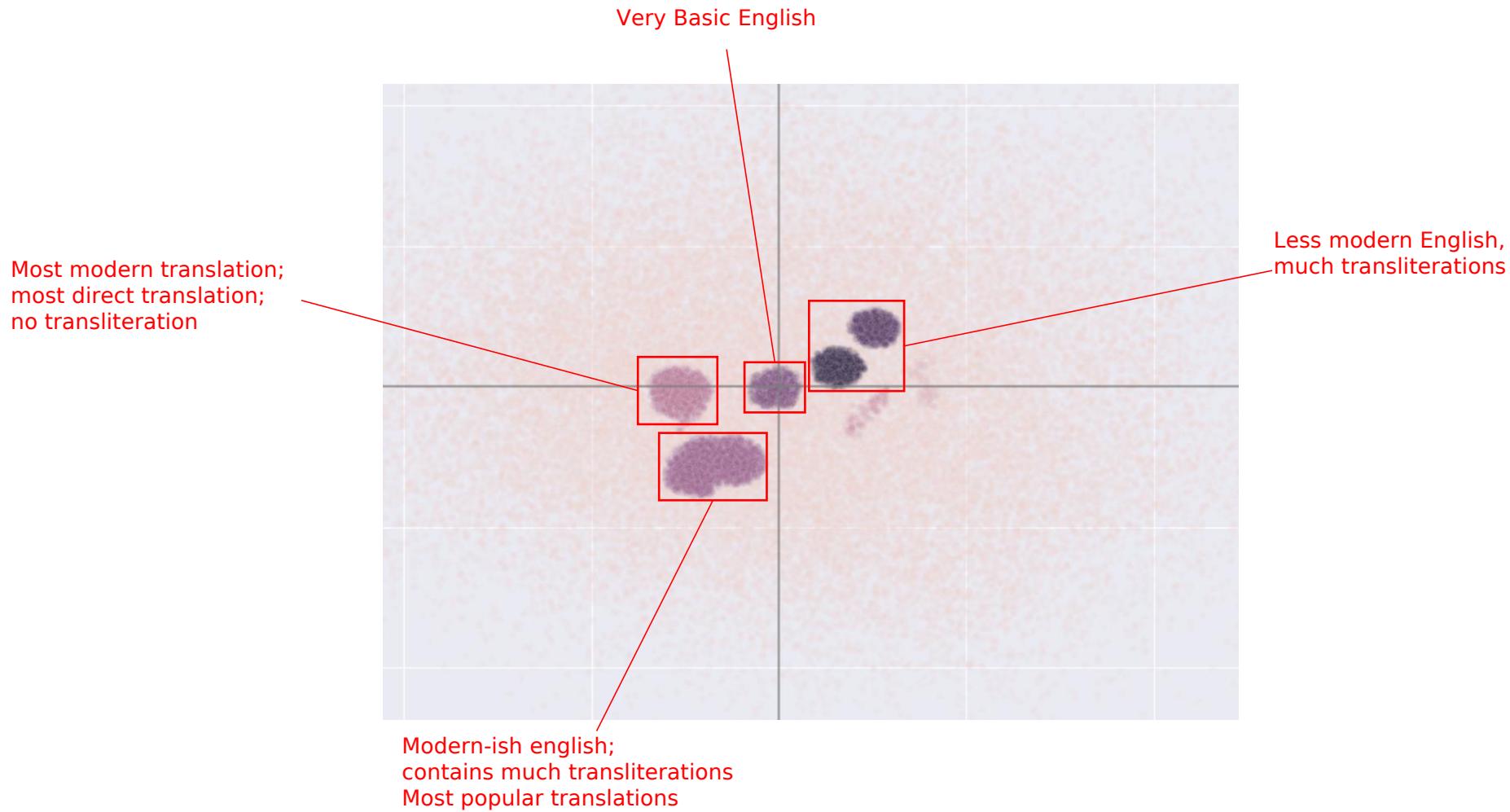


yered
 yishmael
 sotah
 elkanah
 yetheth
 le'alem
 akkad
 chazeiros
 chelek
 mishpat
 asriel
 kasluchim
 migdal
 chayyi
 p'sal





a
she
son
set
what
was
if
fly
an
has
like
by
on
fly
his
am



Exploring Hebrew & English

Version 1:

"and make fifty gold clasps and couple the cloths to one another with the clasps so that the tabernacle becomes one whole"

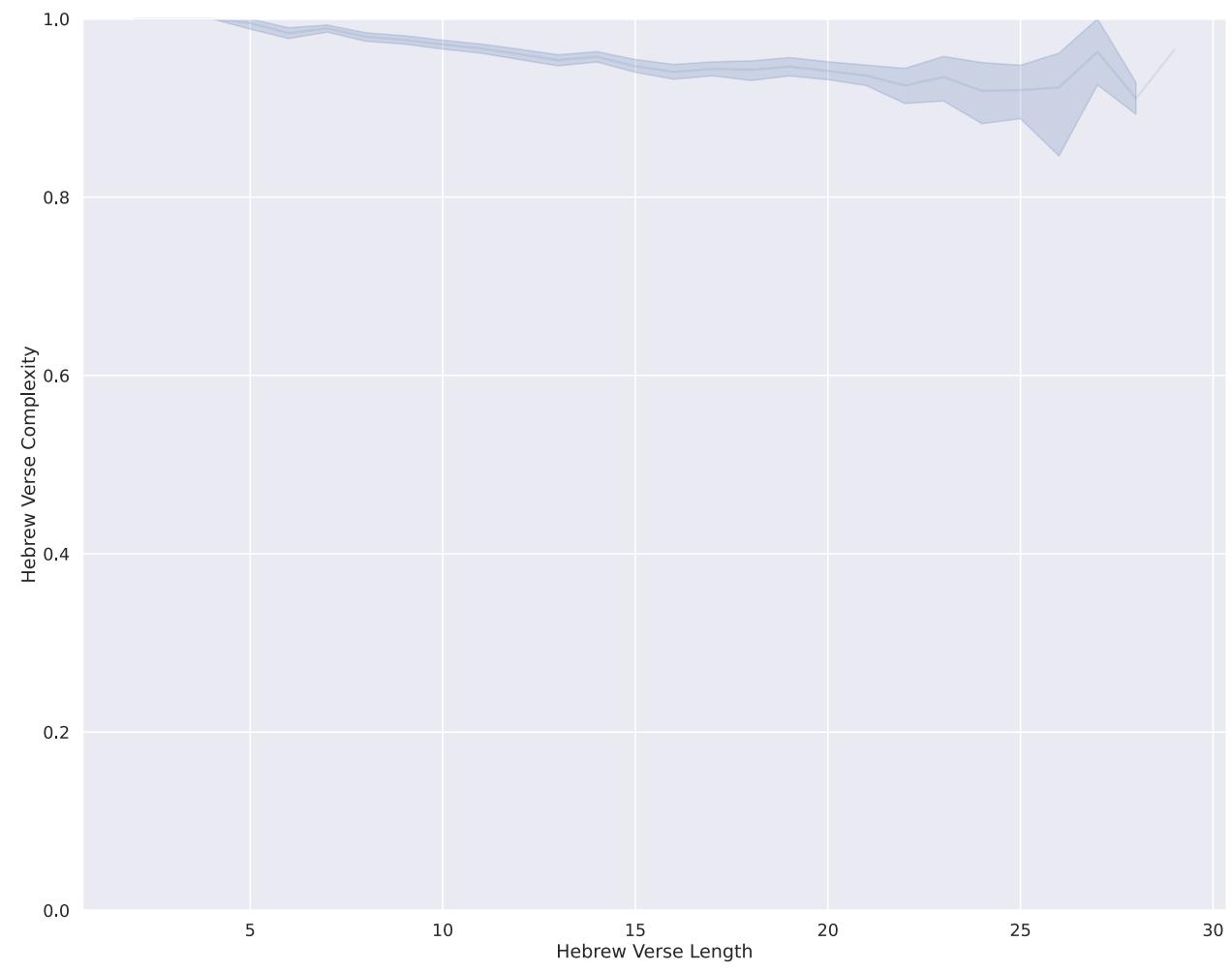
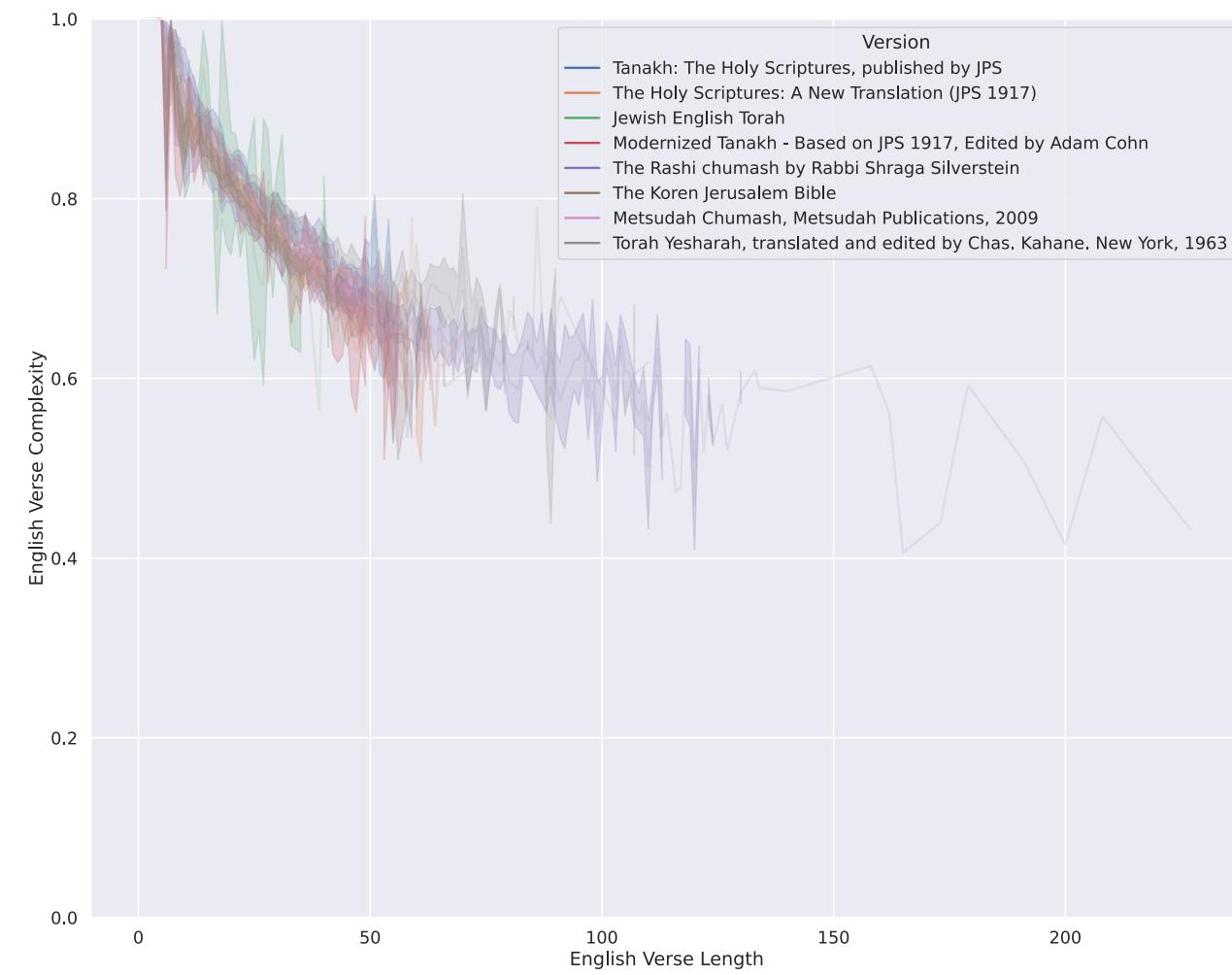
length of Version 1:
22

Version 1:

```
{'and',
 'another',
 'becomes',
 'clasps',
 'cloths',
 'couple',
 'fifty',
 'gold',
 'make',
 'one',
 'so',
 'tabernacle',
 'that',
 'the',
 'to',
 'whole',
 'with'}
```

Version 1 complexity:
 $17 / 22 = 0.77$

length of Version 2 set:
17



Version 1:
"and make fifty gold clasps and couple the cloths to one another with the clasps so that the tabernacle becomes one whole"

Version 2:
"and thou shalt make fifty golden clasps and couple the curtains together with the clasps that the tabernacle may be one"

Version 3:
"you shall make fifty clasps of gold and hook the curtains one to another with the clasps that the divine tabernacle may be one whole symbolizing the separate twelve tribes of israel linked together in peace as one people"

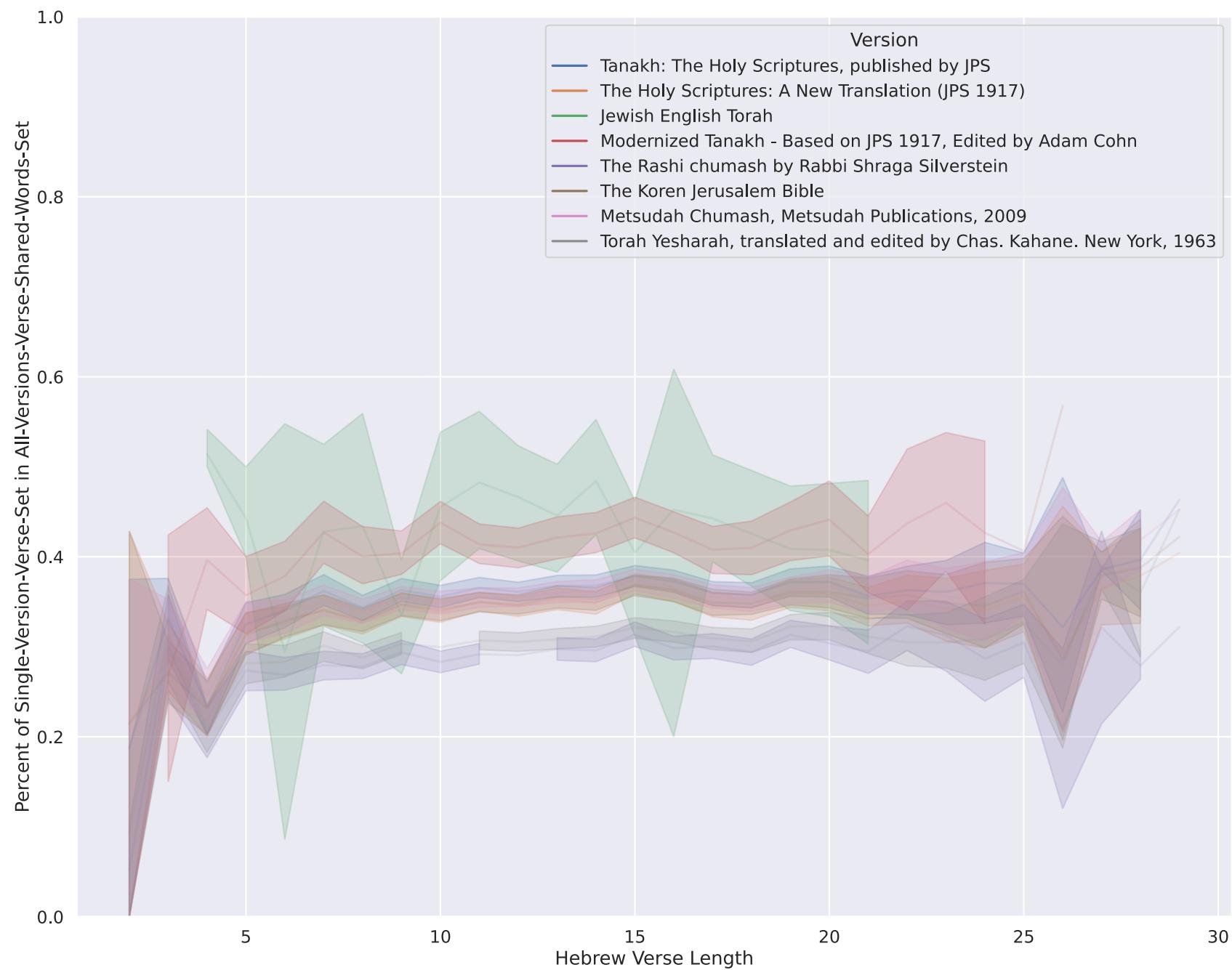
Version 1:
{'and',
'another',
'becomes',
'clasps',
'cloths',
'couple',
'fifty',
'gold',
'make',
'one',
'so',
'tabernacle',
'that',
'the',
'to',
'whole',
'with'}

Version 2:
{'and',
'be',
'clasp',
'couple',
'curtains',
'fifty',
'golden',
'make',
'may',
'one',
'shalt',
'tabernacle',
'that',
'the',
'thou',
'together',
'with'}

Version 3:
{'and',
'another',
'as',
'be',
'clasps',
'curtains',
'divine',
'fifty',
'gold',
'hook',
'in',
'israel',
'linked',
'make',
'may',
'of',
'one',
'peace',
'people',
'separate',
'shall',
'symbolizing',
'tabernacle',
'that',
'the',
'to',
'together',
'tribes',
'twelve',
'whole',
'with',
'you'}

set of sets 1-3:
{'and',
'clasps',
'fifty',
'make',
'one',
'tabernacle',
'that',
'the',
'with'}

Shared:
 $9 / 17 = 0.47$



Model Building

First Model = BAD

Input:

וַיְהִי אַפְرִי קֹתֶת מָשָׁה עָבֵד יְהוָה וַיֹּאמֶר יְהוָה אֱלֹהִים חֹזֶק בָּנֶךָ
מִשְׁכַּת מָשָׁה לֵאמֹר:

Predicted translation:

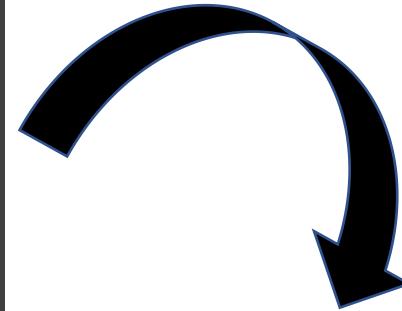
And it came to pass in the morning, when the Lord spoke to Shelomo, that the Lord said to me, Go, and number the days of old, and I will make thee a feast.

Target translation:

After the death of Moses the servant of the LORD, the LORD said to Joshua son of Nun, Moses' attendant:

Switched

וְיָהִי אַחֲרֵי מֹות יְהוָה וַיְשַׁאֲלֵ בְּנֵי
יִשְׂרָאֵל בַּיּוֹם לְאָמֶר מָה יַעֲלֵה־לְכָנוּ
אֶל־הַקְּנָעָנִי בִּתְחִלָּה לְהַלְּחָם בָּנוֹ:
וַיֹּאמֶר יְהוָה יְהוָה יַעֲלֵה
הָנָה נָתַתִּי אֶת־הָאָרֶץ בְּיָדְנוֹ:



וַיָּצֹא מֹשֶׁה וְזָקָנִי יִשְׂרָאֵל אֶת־הַעַם
לְאָמֶר שְׁמַר אֶת־כָּל־הַמְצֻוָּה אֲשֶׁר אָבִיכֶם
מְצֻוָּה אֶתְכֶם הַיּוֹם
וְהִיֵּה בַּיּוֹם אֲשֶׁר תַּעֲבֹרְנוּ אֶת־הַיַּרְדֵּן
אֶל־הָאָרֶץ אֲשֶׁר־יְהוָה אֱלֹהֵינוּ
נָתַן לְךָ וְהִקְ�מַת לְךָ אֶבֶן־יָם
גָּדוֹלָה וְשָׁדַת אֶתְכֶם בְּשָׁמֶן

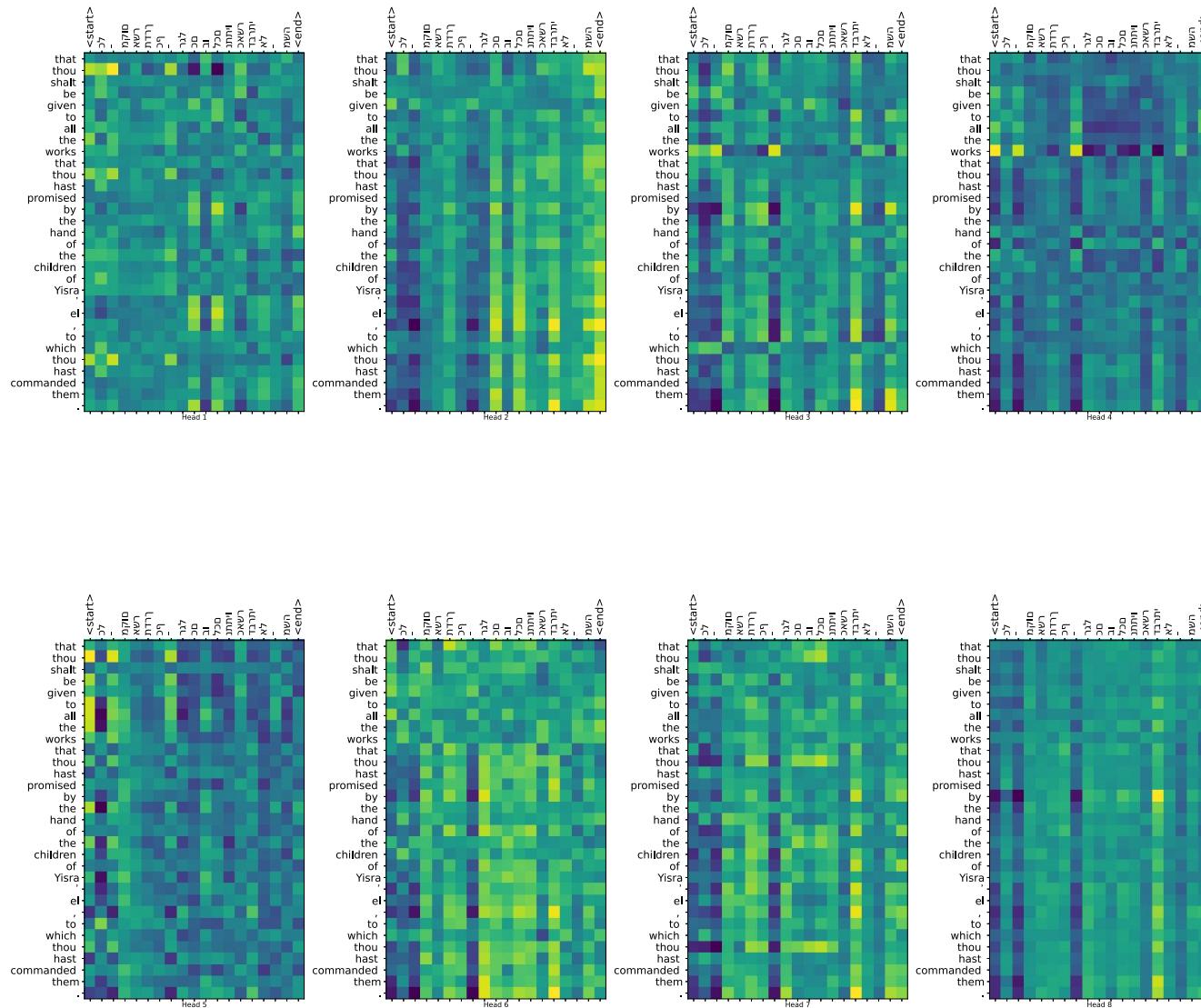
Translation Model

Transformer Model

Model Selection

```
=====  
## Second Model:  
  
inp_target_vocab_size = 2**15  
tgt_target_vocab_size = 2**15  
  
BUFFER_SIZE = 20000  
BATCH_SIZE = 64  
MAX_LENGTH = 500  
num_layers = 4  
d_model = 128  
dff = 512  
num_heads = 8  
dropout_rate = 0.1  
EPOCHS = 20
```

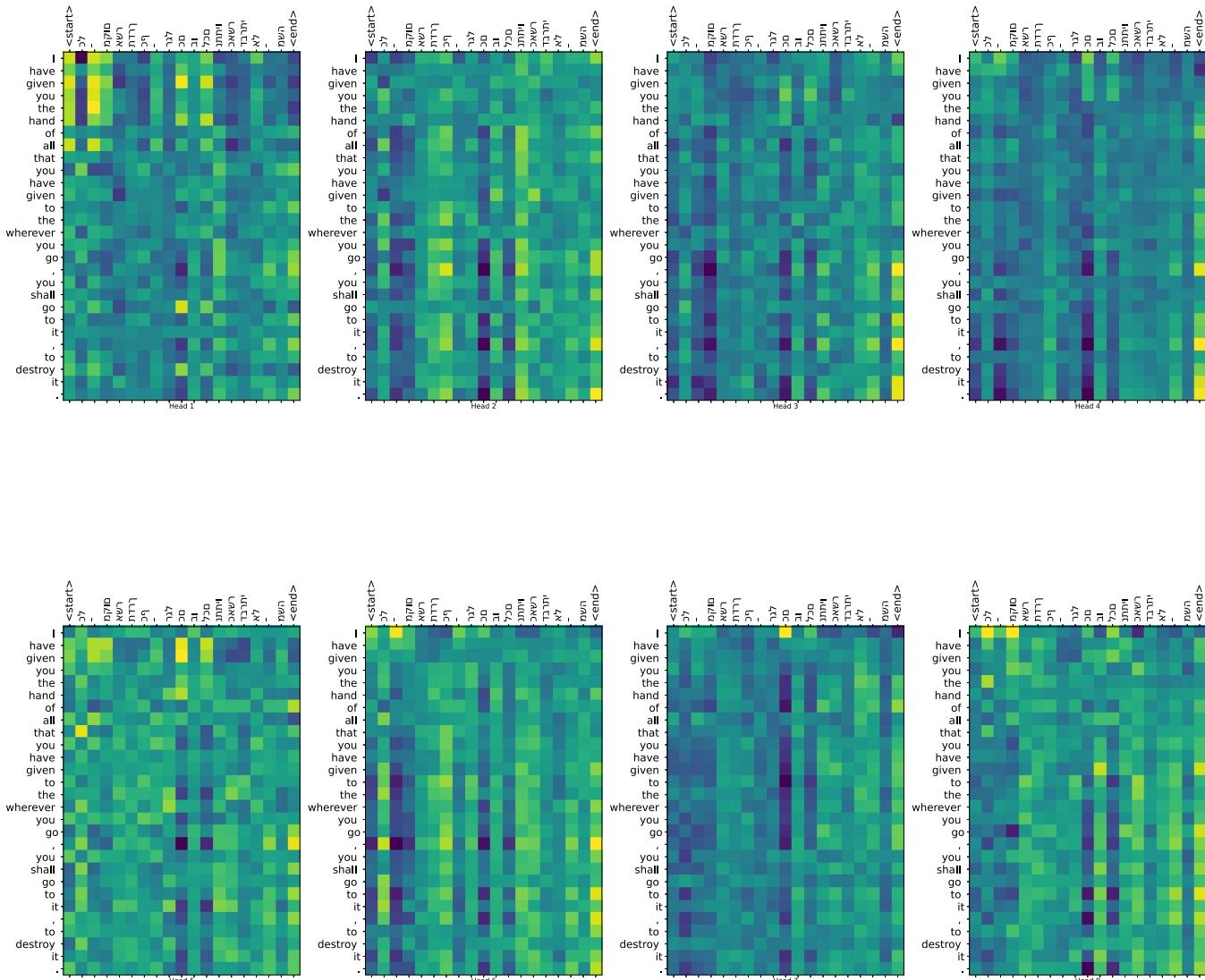
Val Loss: 3.3; Val Accuracy: 0.45



Model Selection

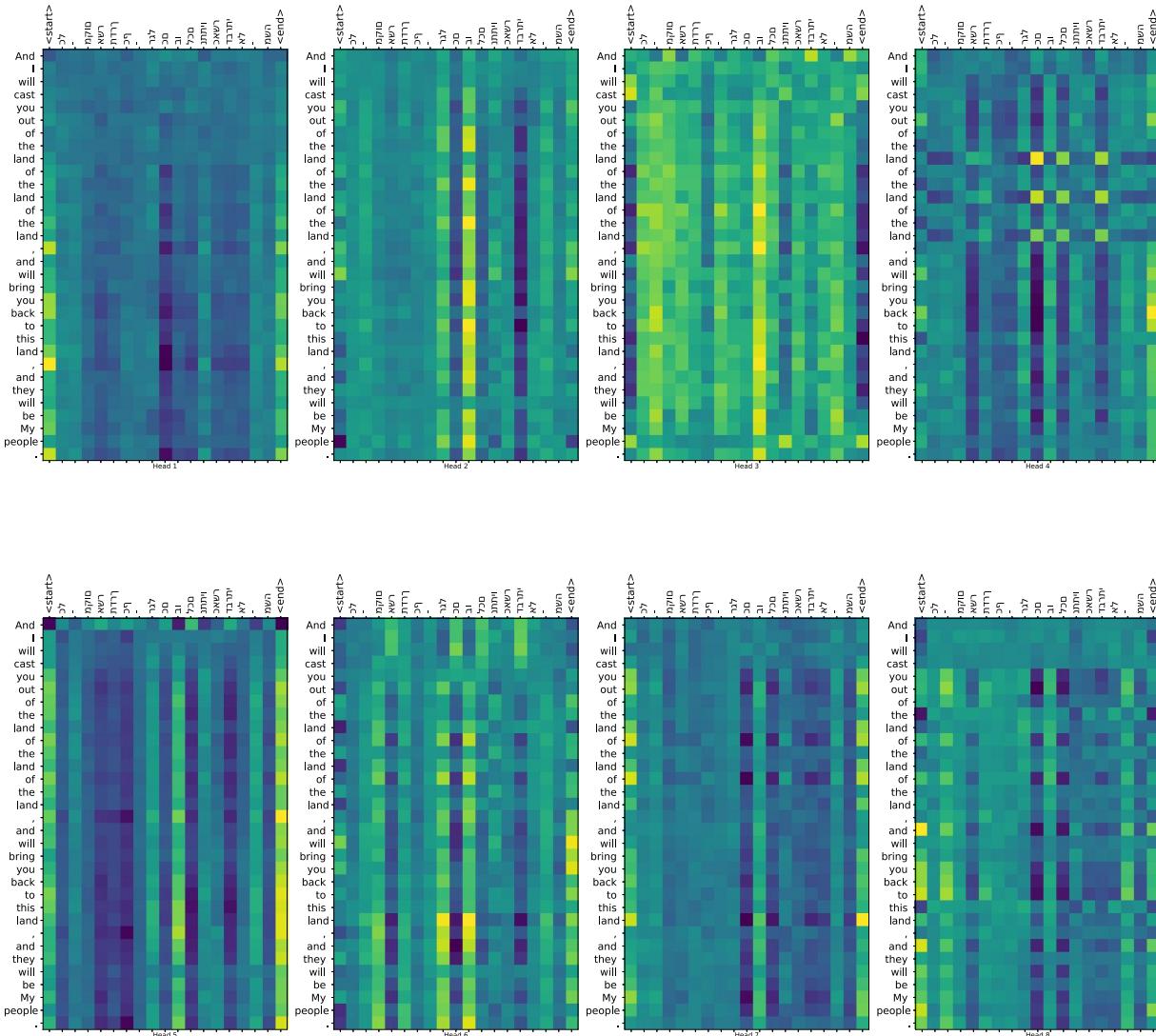
```
=====  
## Second Model Short:  
  
(maxed length of a sentence)  
  
inp_target_vocab_size = 2**15  
tgt_target_vocab_size = 2**15  
  
BUFFER_SIZE = 20000  
BATCH_SIZE = 64  
  
*MAX_LENGTH = 50  
  
num_layers = 4  
d_model = 128  
dff = 512  
num_heads = 8  
dropout_rate = 0.1  
EPOCHS = 20
```

Val Loss: 3.3; Val Accuracy: 0.45



Model Selection

```
=====  
## Second Model Short Big:  
  
(maxed length of a sentence,  
and more paramters)  
  
inp_target_vocab_size = 2**15  
tgt_target_vocab_size = 2**15  
  
BUFFER_SIZE = 20000  
BATCH_SIZE = 128  
*MAX_LENGTH = 50  
num_layers = 6  
**d model = 512  
**dff = 2038  
num_heads = 8  
dropout_rate = 0.3  
EPOCHS = 20  
  
Val Loss: 3.3; Val Accuracy: 4.4
```

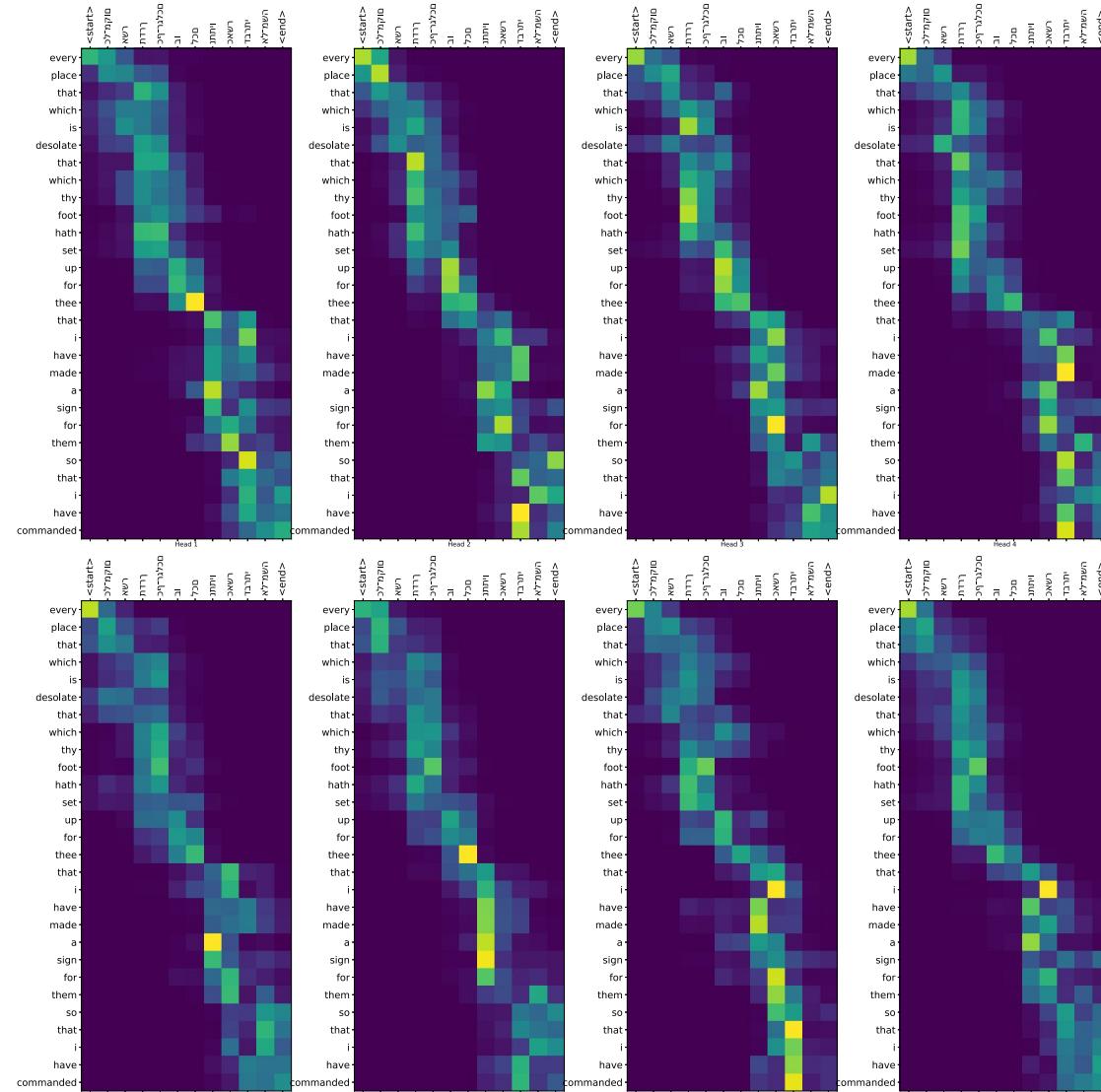


Model STILL bad >=(

Switched from “sub-word” tokenization, to normal word tokenization

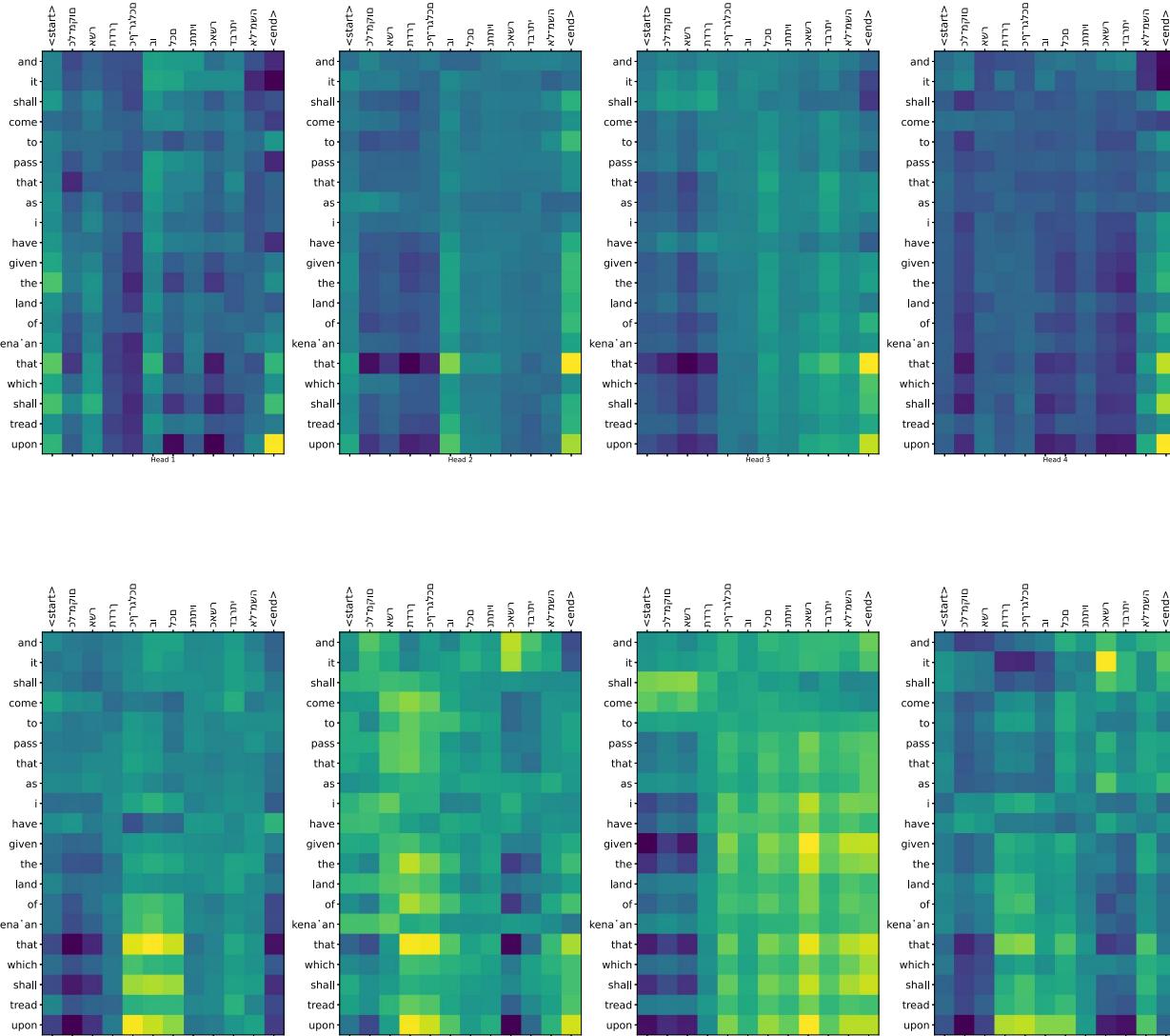
Model Selection

```
## Alternate Model:  
(tokenize words instead of sub-words)  
  
BUFFER_SIZE = 20000  
BATCH_SIZE = 64  
num_layers = 4  
d_model = 128  
dff = 512  
num_heads = 8  
dropout_rate = 0.1  
EPOCHS = 20
```



Model Selection

```
=====  
## Alternate Model Big:  
  
(tokenize words instead of sub-words;  
more params)  
  
BUFFER_SIZE = 20000  
BATCH_SIZE = 128  
num_layers = 6  
*d_model = 512  
*dff = 2048  
num_heads = 8  
dropout_rate = 0.1  
EPOCHS = 20  
  
Val Loss: 3.0; Val Accuracy: 0.5
```



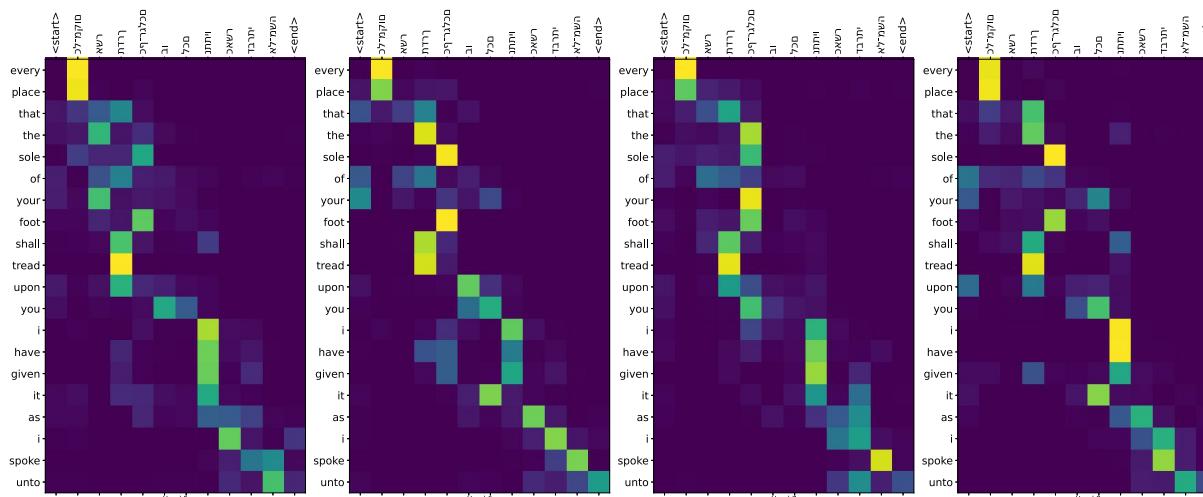
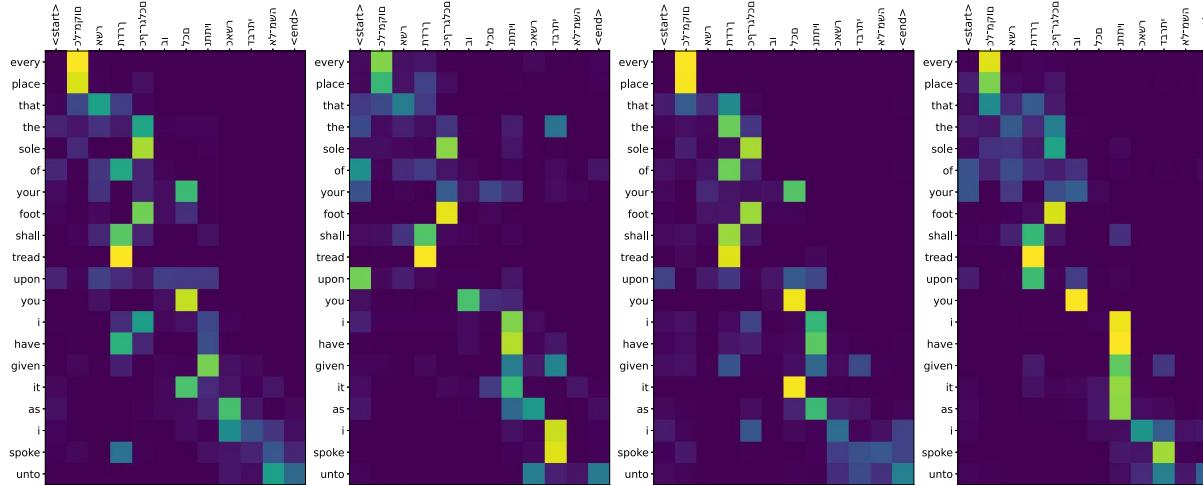
Model Selection

```
=====
## Alternate Model Small:

(tokenize words instead of sub-words;
1 less layer)

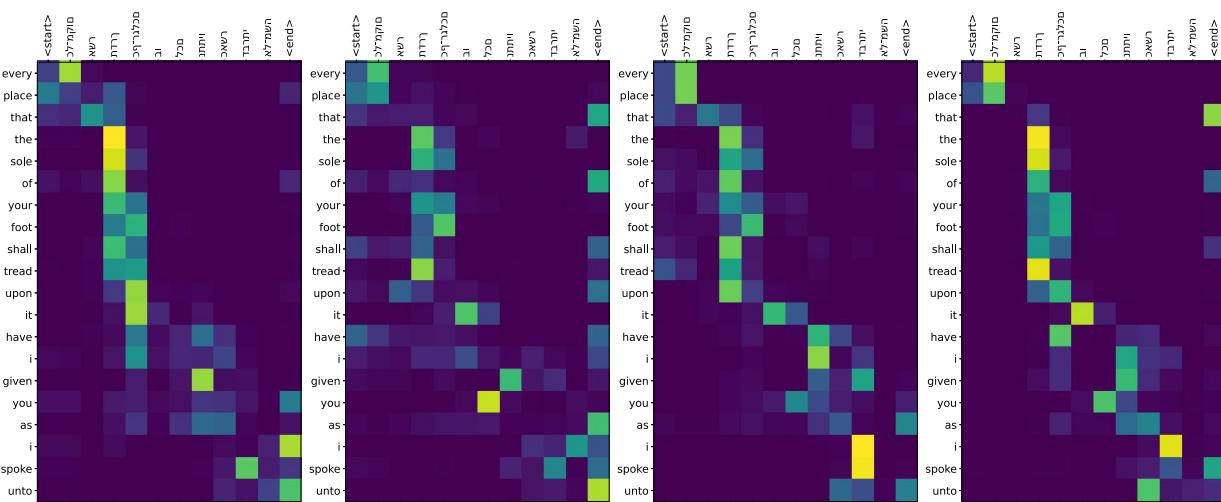
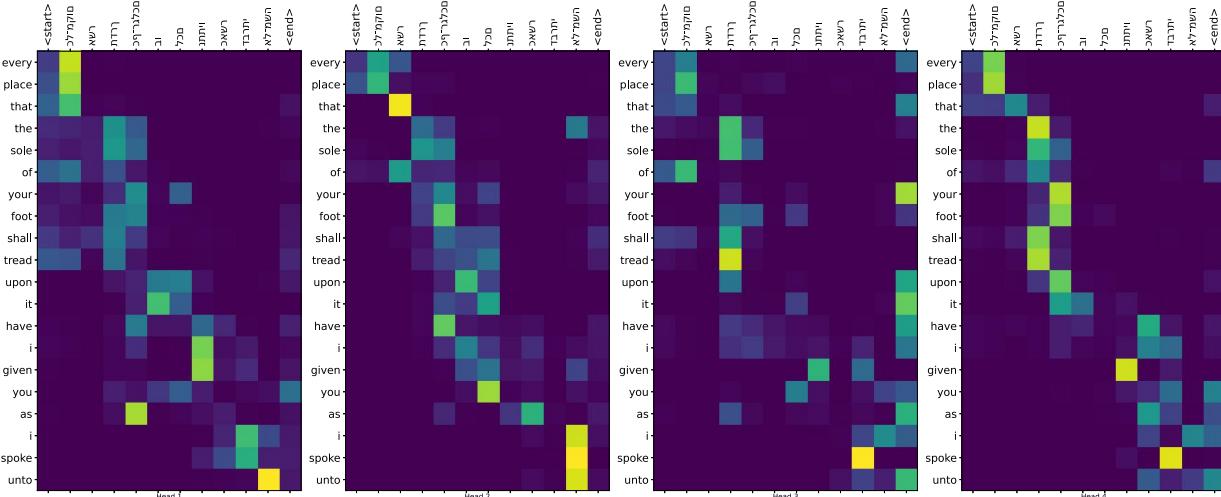
BUFFER_SIZE = 20000
BATCH_SIZE = 64
*num_layers = 3
d_model = 128
dff = 512
num_heads = 8
dropout_rate = 0.1
EPOCHS = 20

Val Loss: 2.4; Val Accuracy: 0.61
```



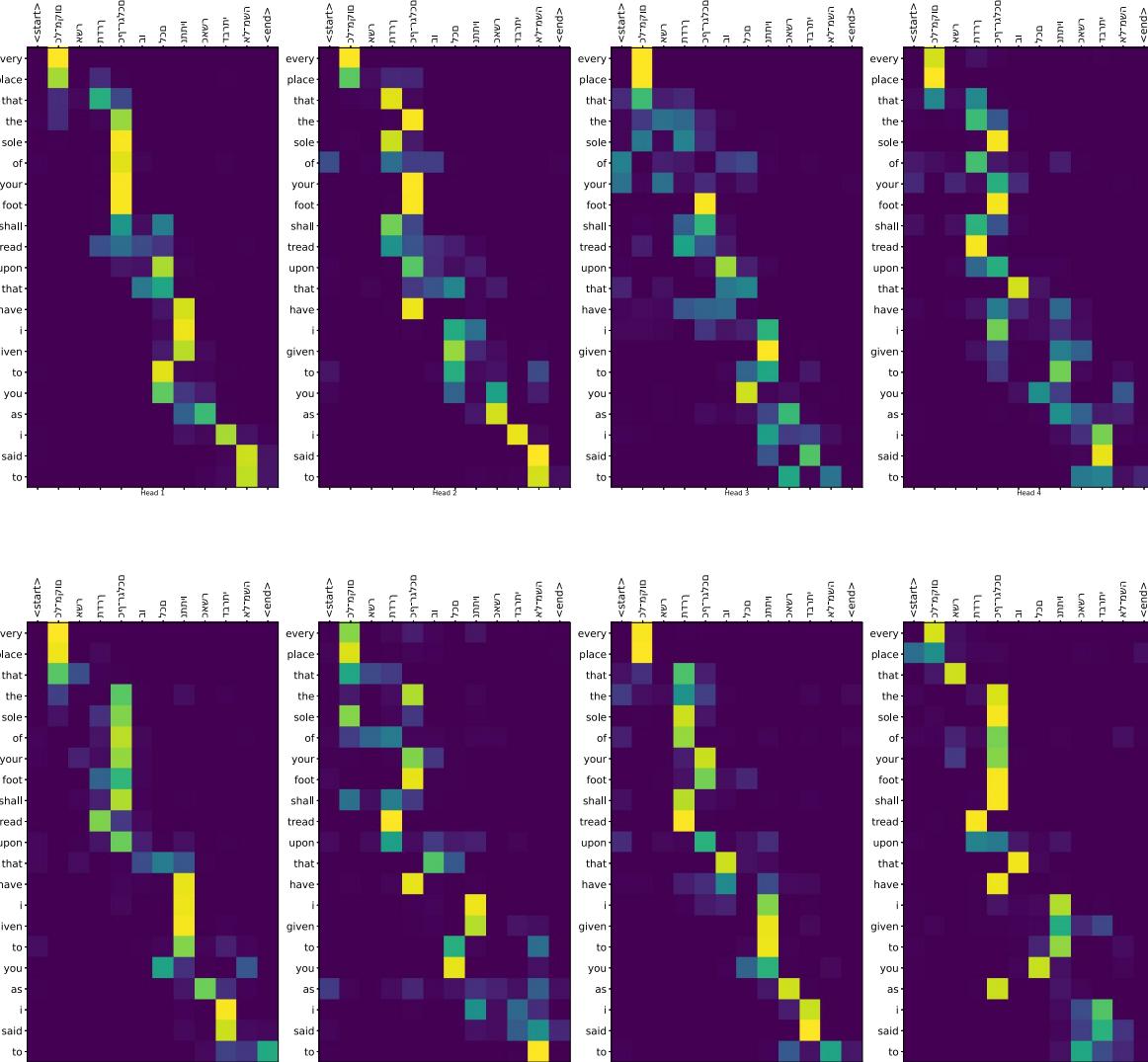
Model Selection

```
=====  
## Alternate Model Small D:  
  
(tokenize words instead of sub-words;  
1 less layer; higher d_model and dff;  
dropout of 0.2)  
  
BUFFER_SIZE = 20000  
BATCH_SIZE = 64  
*num_layers = 3  
**d_model = 512  
**dff = 1024  
  
num heads = 8  
***dropout_rate = 0.2  
EPOCHS = 20  
  
Val Loss: 2.3; Val Accuracy: .63
```



Model Selection

```
=====
## Alternate Model Small E:  
  
(tokenize words instead of sub-words;  
2 less layer;  
higher d_model and dff)  
  
BUFFER_SIZE = 20000  
BATCH_SIZE = 64  
**num layers = 2  
**d_model = 512  
**dff = 1024  
num_heads = 8  
dropout_rate = .1  
EPOCHS = 20  
  
~ 320 seconds/epoch  
Train Loss 0.5: ; Train Accuracy: 0.87  
Val Loss: 2.7; Val Accuracy: 0.63
```



Lets Translate!

(also tune batch size and epochs)

Further Development

Torah Machine Learning Translation App

Select a Verse

Book Deuteronomy **Book** 6 **Verse** Drop-Down
or
Enter Hebrew Text...
Translate

Hebrew אחד יהוה אלהים יהוה ישראל שמע

ML Translation [Neural Net Predicted Text]

JPS [English Version 1 Text]

Koren [English Version 2 Text]

Gives NN Translation, and other English Version Translations

Close

Torah Machine Learning Translation App

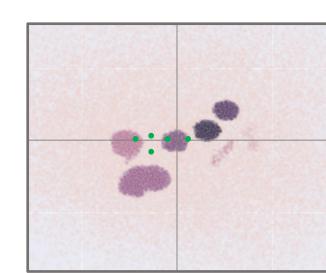
Select a Verse

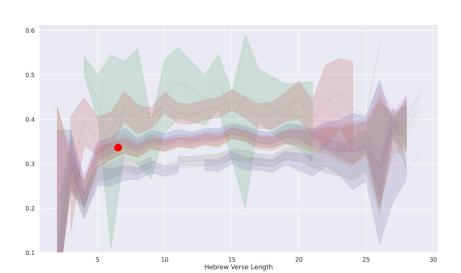
Book Deuteronomy **Book** 6 **Verse** 4
or
Enter Hebrew Text...
Translate

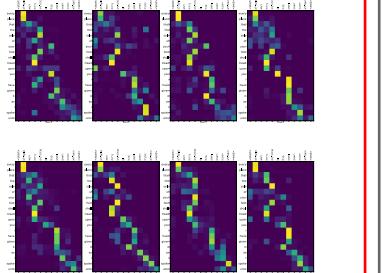
Hebrew אחד יהוה אלהים יהוה ישראל שמע

ML Translation Comprehend Yisrael: TheNAME is your Dieties, TheNAME is one.

Shows ML Translation Word Embedding positions, relation to other texts, and model attention heads







Close

Thank You!