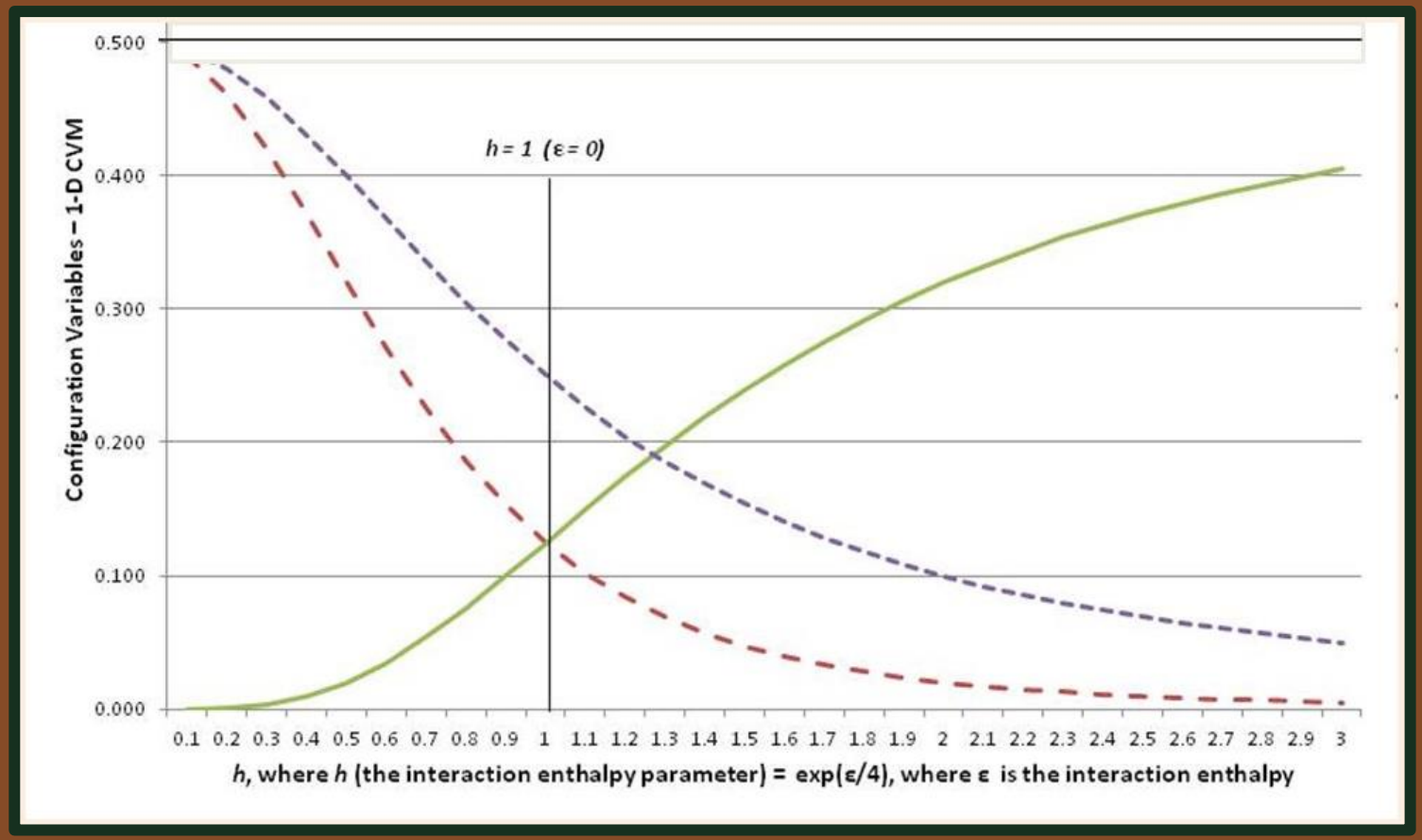
1D Cluster Variation Method: Worked Example



Je t’aime Lyrics (Original French)

Lyrics Phrase	Vowels	Cnsnts	Total
Je t’aime, je t’aime; Oh oui, je t’aime; Moi non plus; Oh, mon amour	25	21	46
Comme la vague irrésolue,	11	10	21
Je vais, je vais et je viens	10	11	21
Entre tes reins; Je vais et je viens	12	16	28
Entre tes reins; Et je me retiens	11	15	26
Je t’aime, je t’aime; Oh oui, je t’aime; Moi non plus; Oh, mon amour	25	21	46
Totals:	**94**	**94**	**188**

Je t’aime Lyrics (English Translation)

Lyrics Phrase	Vowels	Cnsnts	Total
I love you, I love you; Oh yes, I love you; Me neither; Oh my love	25	21	46
Like the undecided wave	9	11	20
I go, I go and I come	8	6	14
Between your loins; I go and I come	13	14	27
Between your loins; And I hold back	11	17	28
I love you, I love you; Oh yes, I love you; Me neither; Oh my love	25	21	46
**** BETWEEN*** (*inserted as padding, to make the total numbers of letters correspond between the French and English versions)	3	4	7
Totals:	**94**	**94**	**188**

Breaking This Down into “On” &“Off” Nodes (French; Pt 1)

Lyrics Phrase	Vowels	Total
Je t’aime, je t’aime	C v C v v C v; C v C v v C v	14
Oh oui, je t’aime	v C v v v; C v C v v C v	12
Moi non plus	C v v C v C C C v C	10
Oh, mon amour	v C C v C v C v v C	10
Comme la vague irrésolue	C v C C v C v C v C v v v C C v C v C v v	21
Je vais, je vais	C v C v v C C v C v v C	12
et je viens	v C C v C v v C C	9
Total		**88**

Breaking This Down into Grid Node Values – Rows 0 & 1

Lyrics Phrase	Row 0 Every 2nd letter is labeled in RED; goes into Row 1 (in next slide)	Row 1	Total
Je t'aime, je t'aime	C v C v v C v C v C v v C v		14
Oh oui, je t'aime	v C v v v; C v C v v C v		12
Moi non plus	C v v C v C C C v C		10
Oh, mon amour	v C C v C v C v v C		10
Comme la vague irrésolue	C v C C v C v C v C v v v C C v C v C v v		21
Je vais, je vais	C v C v v C C v C v v C		12
et je viens	v C C v C v v C C		9
Total			**88**

Breaking This Down into Grid Node Values – Rows 0 & 1

Lyrics Phrase	Row 0 Every 2nd letter is labeled in RED; goes into Row 1 (in next slide)	Row 1	Total
Je t'aime, je t'aime	C C v v v v C	v v C C C v v	14
Oh oui, je t'aime	v v v; v v C	C v C C v v	12
Moi non plus	C v v C v	v C C C C	10
Oh, mon amour	v C C C v	C v v v C	10
Comme la vague irrésolue	C C v v v v v C C C v	v C C C C v C v v v	21
Je vais, je vais	v v C v v C	C C v C C v	12
et je viens	C v v C	v C C v C	9
Total			**88**

Breaking This Down into “On” & “Off” Nodes (French, Pt 2)

Lyrics Phrase	Vowels	Total
Entre tes reins	v C C C v C v C C v v C v	13
Je vais et je viens	C v C v v C v C C v C v v C C	15
Entre tes reins	V C C C v C v C C v v C C	13
Et je me retiens	V C C v C v C v C v v C C	13
Je t’aime, je t’aime	C v C C v v C v ; C v C v v C v	14
Oh oui, je t’aime	v C v v v ; C v C v v C v	12
Moi non plus	C v v C v C C C v C	10
Oh, mon amour	v C C v C v C v v C	10
		100

The Data ("On" and "Off" Node Values) are Hard-Coded in This Program

```
#########################################################################################

def assign_activations_node_list(node_list, array_size_list, language):


    array_length = array_size_list[0]
    array_layers = array_size_list[1]

    # This assigns activations of '1" to certain nodes
    if language == 0: # Language = French
        x = 0
        for i in range(array_layers):
            for j in range(array_length):
                if i == 0:  # Turn on some nodes in Row 0
                    # Assign value of "1" to nodes associated with vowels
                    if j ==2: node_list[x].activ = 1
                    if j ==3: node_list[x].activ = 1
                    if j ==4: node_list[x].activ = 1
                    if j ==5: node_list[x].activ = 1
                    if j ==7: node_list[x].activ = 1
                    #  5 so far in row 0
```

We initially assign all nodes to have an activation of "0," and then manually assign certain values to be "1," based on if they are vowels in the text strings.

Configuration Variable Values: French Lyrics (188 Characters)

*** Fractional Configuration Variable Values for the French Grid ***

y1	2*y2	y3	w1	2*w2	w3	Sum y	Sum w
0.154	0.638	0.207	0.255	0.436	0.309	1.000	1.000

z1	2*z2	z3	z4	2*z5	z6	Sum z
0.043	0.223	0.213	0.207	0.213	0.101	1.000

We'll Use the Configuration Variable Values for y2 (divide the above by 2), z1, and z3

Configuration Variable Values: English Lyrics (188 Characters)

*** Fractional Configuration Variable Values for the English Grid ***

y1	2*y2	y3	w1	2*w2	w3	Sum y	Sum w
0.133	0.734	0.133	0.266	0.468	0.266	1.000	1.000

z1	2*z2	z3	z4	2*z5	z6	Sum z
0.021	0.223	0.245	0.255	0.245	0.011	1.000

We'll Use the Configuration Variable Values for y2 (divide the above by 2), z1, and z3

Suggested Reading: 1-D Cluster Variation Method (1D CVM) (2016 paper; see link in the associated Blogpost)

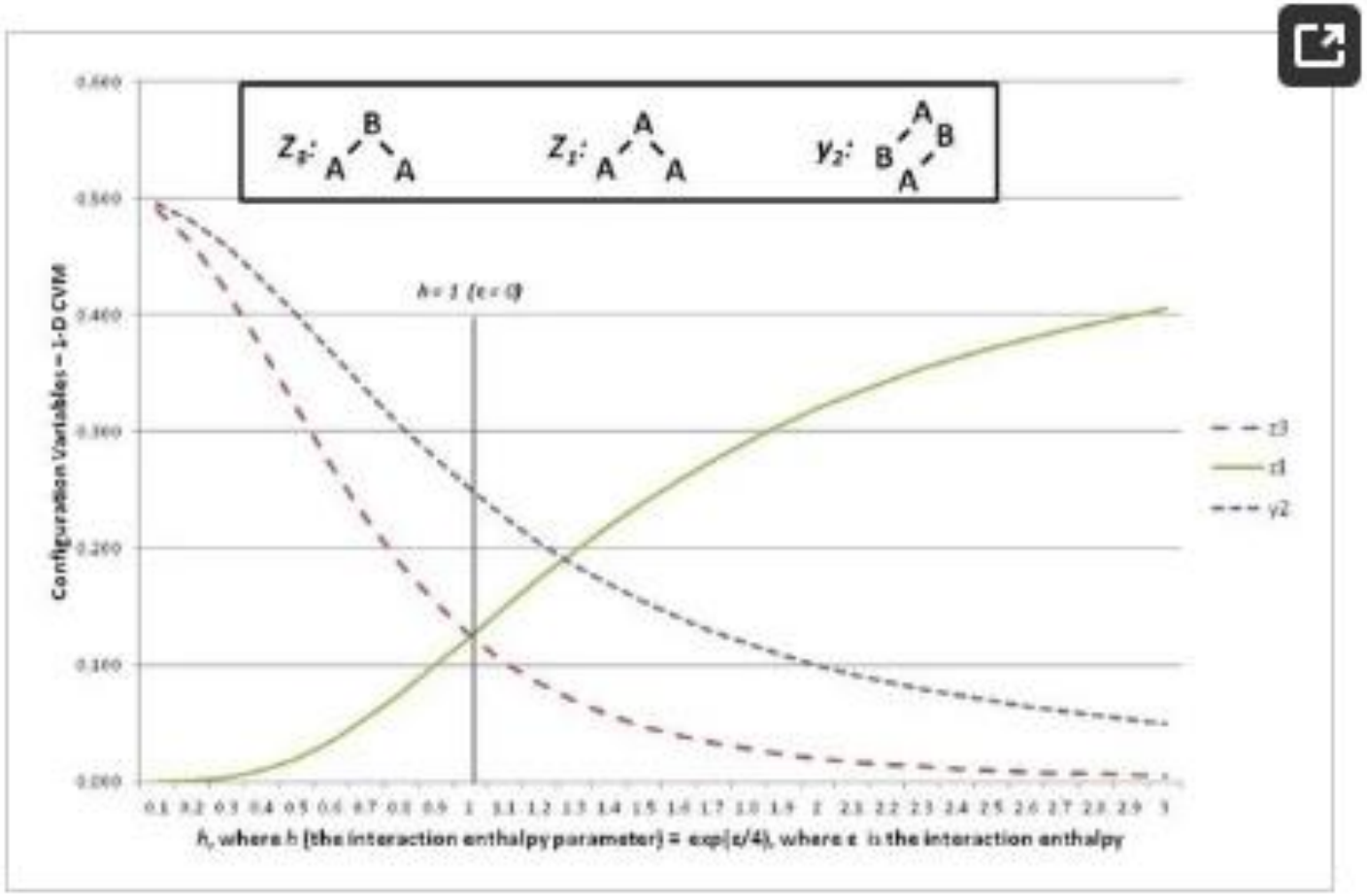
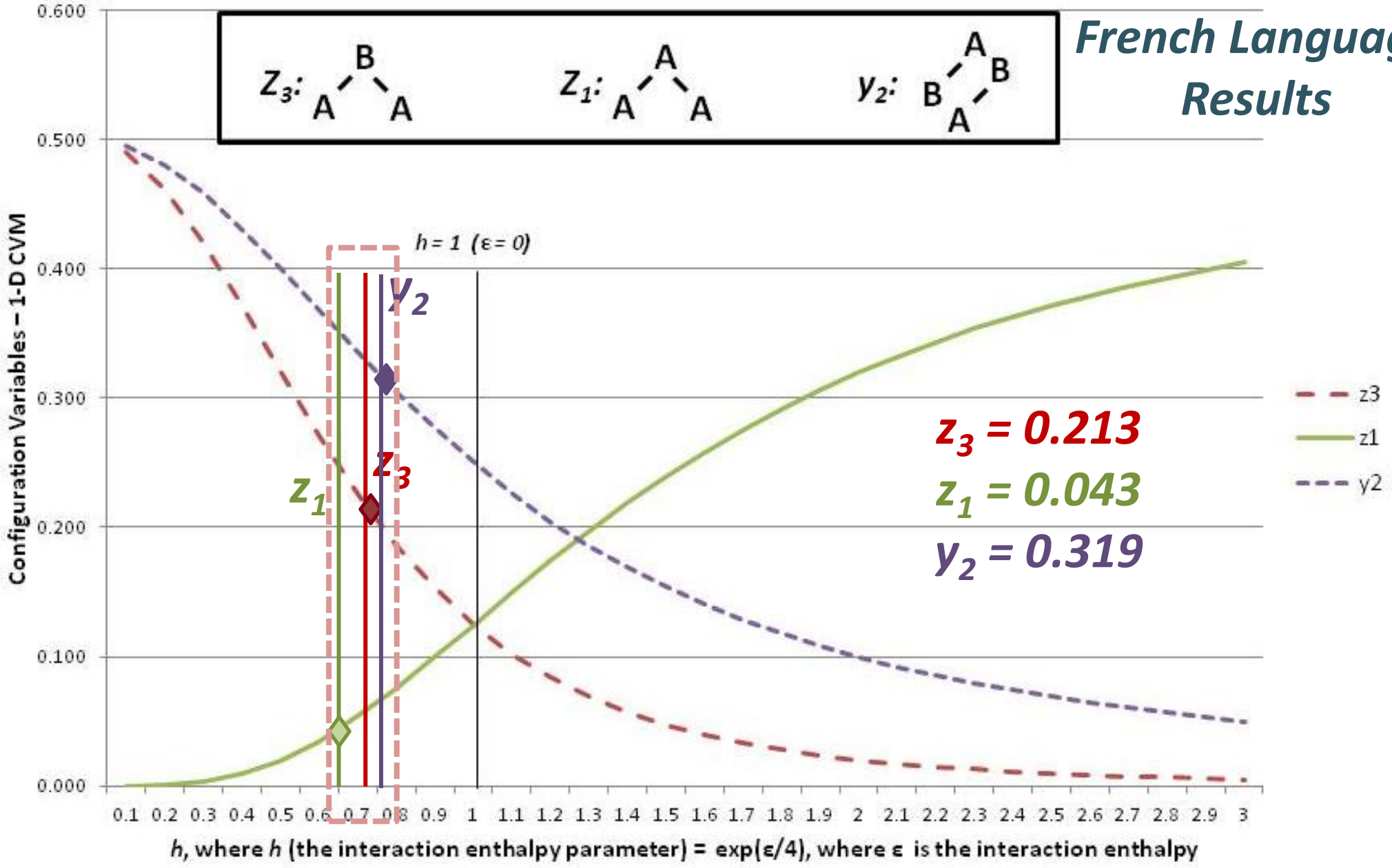


Figure 6. Results for three of the configuration variables, z_3, z_1, and y_2, used in the cluster variation method. Values for *h* are plotted along the x-axis.

French Language Results



English Language Results