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The Role of Syllable Representation in Korean Script

A Connectionist Modeling

Hee-Jo You and Kichun Nam

***Abstract*— to understand the syllable representation in Korean script 'Hangul', modeling study was conducted. Two types of models were constructed by the existence of syllable representation. These models were trained and tested through the same stimulus list. As the result, whereas the model, which did not have the syllable layer, can only simulate the word frequency effect, the model, which had the syllable layer, can simulate the both of word frequency and syllable frequency effects. This result proposed the syllable representation contributed the stabilization of representation.**

Keywords-modeling, connectionist, syllable, letter, semantic, lexical decision task, Hangul

I. INTRODUCTION

In many studies, the inner structure of language process is considered important, and that is the basis about the result predicted in the psycholinguistic experiments. This also applied to the Korean language. However, whereas the many English visual perception models has considered that the letter is the basic-structure, some Korean studies proposed the syllable representation as a unit of the language process. There has been some studies which argued the existence of the syllable representation. Perea and Carreiras (1998) investigated the role of syllable frequency in lexical decision and naming. The result showed the inhibitory and facilitatory syllable frequency effect in lexical decision tasks and naming task, respectively. They argued that the sallow language as the Spanish had the syllable representation as the sublexical unit [1].

In addition, Carreiras and Perea (2004) progressed the similar experiments about the pseudowords. As the results, they reported the facilitatory syllable frequency effect in naming, and not the lexical decision. Therefore, they argued that the syllable frequency influences to the speech production stage [2].

On the other hand, Koo et al. (2012) tried to establish the role of the syllable in the visual language recognition process through the naming ta sk and lexical decision task. They distinguished the single syllable word as three types (i.e. High word frequency-High syllable frequency, High word frequency-Low syllable frequency, Low word frequency-Low syllable frequency), and compared among the response times about these categories. The result showed the strong word and the facilitatory syllable frequency effect in a lexical decision task, and no word frequency effect and very weak facilitatory syllable frequency effect in naming task. As a result, they demonstrated that the syllable representation plays an important role in visual word recognition. Moreover, they argued that syllable frequency effect is independent from the word frequency effect. They also refuted the argument of Perea and Carreiras (2004) by their result and argued the syllable representation influence to the stage of visual perception [3]. However, the previous studies focused the effect on the syllable representation, so the mechanism of the syllable representation is unclear. This problem makes we cannot be sure about the syllable representation. Moreover, the human experiments have no choice but to guess because the usual behavior experiment cannot control the inner structure. In this situation, the computational modeling might can be a solution through the framework changing. Therefore, this study was conducted to investigate the role of the syllable representation. We tried to make the connectionist models which consist of different frameworks by the existence of syllable representation and compare the process between the models. We expected to know the role of syllable representation in language process through difference of syllable representation. In particular, we interested the syllable frequency effect which has been considered as the influence of the syllable representation.

II. BACKGROUND

A. Psycholinguistic effects

1) Syllable frequency effect

The syllable frequency effect means that the syllable frequency influence the response time of the participants in the psycholinguistic tasks like the lexical decision or naming task. Not only the research which I mentioned, but also there are some studies which investigated the syllable frequency effect. Levelt and Wheeldon (1994) reported that participants spoke the disyllable word faster when the disyllabic word ended in a high frequency syllable [4], [5].

On the other hand, Simpson and Kang (2004) also studied to investigate that the syllable has a special processing status in Korean through using a naming task. They classified the

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stimulus words as three types. First type was named *free syllable*. Free syllables had a meaning, that is, were one syllable words. Second type was named *bound syllable*. Bound syllables were the syllable used in some word, but it was not used independently. Third type was named *pseudosyllable*. These syllables could be expressed and pronounced in Hangul rule, but there was no word which use the syllable. In their experiments, participants pronounced the stimulus words, and the reaction time was measured. In experiment 3, the reaction times of bound syllables were faster than the pseudosyllables. And, in experiment 2 and 4, the reaction times of the free and bound syllables were affected by the syllable frequency, respectively. About this result, they proposed that the syllable had a special processing status because of the syllable frequency effect.

Macizo and Van Petten (2007) also studied the syllable frequency effect. The participants did the naming and lexical decision tasks, and their response time was measured. The result showed the facilitatory syllable frequency effect of the first syllable in both tasks [6].

2) *Word frequency effect*

In addition, we considered the *word frequency effect*. The word frequency effect is the correlation between naming times and word frequencies. The main mechanism has been considered that as frequent exposure to words makes listeners and readers process them more often, they become skilled in processing high-frequency words [7]–[10]. There were two reasons which we considered this effect.

The first reason was that this effect has been very consistent in various psycholinguistic tasks such as naming or lexical decision task regardless of the language, including Korean [3], [11]–[14]. This consistency of effect suggests that the frequency affects the salient part in the language processes.

The second reason is that the effect is very strong. Therefore, a lot of experiments, which wanted to see other effects, have treated the word frequency as the control variable. To see the real syllable frequency effect, which is not affected by the word frequency, we had to handle this factor as the important control variable [15]–[18].

B. *Lexical decision task*

Lexical decision task (LDT) is an experimental method to measure language performance. In LDT task, a stimulus of letter string is displayed, and participant have to decide whether to display letter string is a word or not. Many studies have used LDT for the study about word recognition and lexical access.

Although there are some psycholinguistic tasks, we decided to simulate the lexical decision task of behavior experiments to test. There is a reason: unlike letter, syllable can have some semantic information. In many previous studies, semantic information affected the lexical decision task [19], [20]. Therefore, we expected that the lexical decision task will reflect the syllable representation better than other tasks.

III. SIMULATION

A. *Framework*

Two types of model were constructed. A type of models had only letter and semantic layers (*L-type*). Another type of models had the additional syllable layer (*LS-type*). Figure 1 showed the structures of two types.

The letter layer was constructed for representing letters. Each unit of the letter layer represented a single letter. There were 62 units in the letter. On the other hand, the semantic layer was constructed for representing semantic information. Each unit represented a semantic feature. Total 166 units were used in semantic layer. In our model, letter and semantic layer were used as the input and output layer, respectively. In addition, there was a hidden layer between these two layers (*Hidden 1* in Figure 1). This layer had 8 units and was used for the activation calculation.

In LS-type model, the syllable layer was added. Each unit of syllable layer represented a syllable which can be mixed with the letter representation of letter layer. Because the syllable information process, two additional hidden layers were added. Each layer was located between the letter and the syllable layers and between the syllable and the semantic layers, respectively (*Hidden 2* and *3* in Figure 1). This structure made the activation values of the letter layer reached the semantic layer through another pathway, so both of activation values, which are from a letter and syllable layer, could affect to the semantic layer. The 186 units and 8 units were used in syllable layer and each hidden layer, respectively.

We trained 16 L-type and 16 LS-type models for statistical analysis. In analysis, we used a model as a participant. The language for coding of models was *C#* and programing environment was *Visual studio 2013*. The computer, which was used for training, was Intel i7-4770K, 16384MB RAM and Windows 8.1 system.

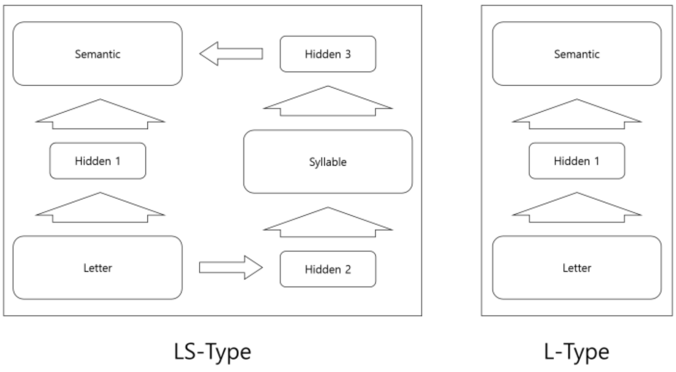

Figure 1. The structure of two types.

B. *Stimulus*

Initially, we tried to use a single syllable word for this modeling. However, in Korean, because the number of single syllabic words has been small and the meanings of the words were independents, the relation between the syllable and the semantic might become just one-to-one match. To avoid this, we decided to use filtered disyllabic words, and made the stimulus list.

First off, 50 disyllabic words, which each syllable is a morpheme, selected randomly to make a list of stimuli, and the syllables of these words became the criteria. Through this process, we selected the 93 criterion syllables, and these syllables' morpheme became the semantic representations. After selecting the criteria syllables, all Korean disyllabic words were filtered by the criteria syllables list. If all syllables of a disyllabic word were included in the list, the word became a stimulus.

As the result of filtering, model used 35 letter representations (13 onsets, 16 nuclei, and 6 codas), 83 syllable representations, and 93 semantic representations, and the 196 filtered disyllabic words.

C. Training

Before the training, the LS - type model had the phase which the model learned the relation between letters to syllables. Only letter and syllable layers were assigned in this phase, and back-propagation was used as training algorithm. All syllable were always trained in an epoch, and total 10,000 epochs conducted. After the syllable training, we tested the output of the syllable layer for the check syllable layer's performance.

In the training phase, both models were learned the relation between the letter and the semantic. The learning possibility of a stimulus was calculated by the equation (1).

$$P = 0.3 * \log (F + 2) \qquad (1)$$

The variable F is the frequency per million (FPM) of stimulus word. These compressed frequency help to avoid the learning omission and reflect the frequency difference [21]–[23].

In each learning trial, the pathways of activation value were different by the types of model. Whereas L-type model only used the pathway, which connected between letter layer and semantic layer, the LS - type model did not use only the pathway, but also used the *syllable pathway* that the pathway is via the syllable layer and reached the semantic layer.

The detailed training method was as in the following: First off, the inserted activations of input layer were sent to the hidden layer which was located between the input and output layer, and the activations of the hidden layer were calculated by the sent activation values. Likewise, the activations of hidden layer were sent the output layer, and the activations of output layer were calculated. In addition, before the calculation of output layer activation, the input layer of LS-type also sent to the hidden layer which was located between the input and syllable layer. Like the hidden layer of input-to-output layer, the activations of this hidden layer also calculated and sent to the syllable layer. The similar process was progressed in the syllable-to-output layer, so both of activations, which are from input and syllable layers, summed in the output layer. The activations of the output layer calculated, and the value was used for the calculation of *squared errors*. Squared error has used to check how this model conducted correctly. The squared error was calculated by the equation (2).

$$\text{Error Rate} = 0.5 * \sum(A_i - T_i)^2 \qquad (2)$$

A_i and T_i are the activation value and the target value of each output layer unit, respectively. The squared error approaches gradually to 0 [21]–[23].

After these processes, models used the back-propagation algorithm for learning. The weights of connections were renewed for modifying error, except the connections between letter and syllable layers. This was because these connections, which were between letter and syllable layer, meant the knowledge of Hangul grammar in LS-type. The training phase conducted 10,000 epochs, so the highest and lowest frequency words were stochastically trained 8,865 times and 1,431 times, respectively.

D. Test

After the training, the performance of the model was tested about all trained words. Test method was similar to the training method, but the weights of connections were not renewed. We observed the activation value of semantic layer, and calculated another value as well as the squared error: *semantic stress*. Semantic stress was used to check the model's decision about the stimulus word. The semantic stress was calculated by the equation (3).

$$\text{Semantic Stress} = \sum(A_i * \log_2 A_i + (1\text{-}A_i) * \log_2 (1\text{-}A_i) - 1) \quad (3)$$

Like the equation (2), A_i is the activation value of the output layer. This value becomes minimum when all unit activations are 0.5 and approaches gradually to 1. Plaut (1997) reported that this value increased when high frequency word were displayed and this value reflected the reaction time and accuracy of human participants [23]–[28].

On the other hand, we made two lists for the tests. One list was for the word frequency effect. We composed the list from 30 high word frequency and 30 low word frequency words. High and low word frequency word were defined 30 words from the top and 30 words from the bottom (High word frequency average = 165.216, Low word frequency average = 1.431).

Another list was for the syllable frequency effect. Before the composition of this list, we had to calculate the syllable frequency which can reflect how much model the syllable was exposed. Because of that, the syllable frequency of each syllable was calculated by the equation (4).

$$\text{Syllable Frequency} = \sum \text{Syllable attended word FPM}_i \qquad (4)$$

The values, which were calculated by equation (4), became a criteria, and we composed the second list from 30 high frequency and 30 low frequency words. The high and low syllable frequency word were defined 30 words from the top and 30 words from the bottom like the word frequency criteria (High syllable frequency average=1668.313, Low syllable frequency average=55.56).

IV. RESULT

1) Performance transition in training

In syllable output test, all units which had to be activated had the activation value 0.7 more, and all units which did not have to be activated had the activation value 0.3 less. So, we judged all 16 LS-type models passed the syllable test. Figure 2 showed the transition of the syllable representation training.

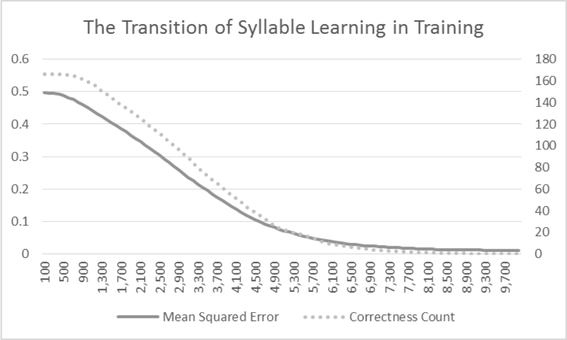

Figure 2. The transition of the syllable representation training

Figure 3 and Figure 4 showed the transition of squared error and semantic stress in the models of two types. Around 8000 epochs, the models became an attractor which means stabilized status.

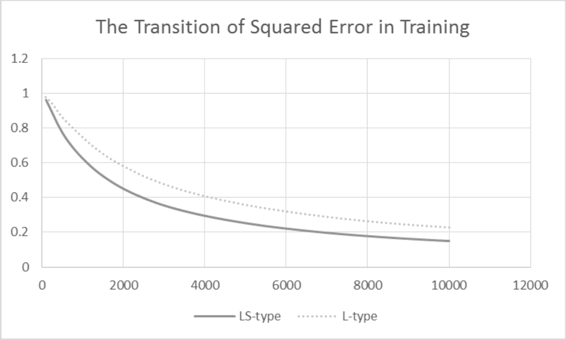

Figure 3. The transition of squared error of two models in training.

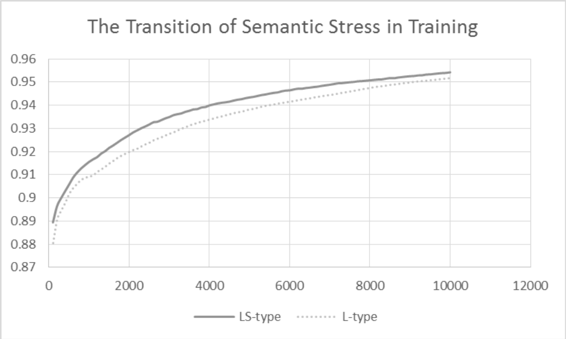

Figure 4. The transition of semantic stress of two models in training.

TABLE I showed the result of the lexical decision task about all training stimuli after the training. In squared error and semantic stress, the LS-type is better than the L-type.

TABLE I. THE MEAN SQUARED ERROR AND THE MEAN SEMANTIC STRES OF MODELS ABOUT ALL STIMULI

	Lexical Decision Task	
	Mean SE(SD)	Mean SS(SD)
LS-Type	0.150(0.0138)	0.954(0.0009)
L-Type	0.227(0.0150)	0.952(0.0018)

Note. Mean SE= mean squared error. Mean SS = mean semantic stress

In addition, we conducted the mixed-effects model about word frequency for the comparison. However, there was no difference between the models (F (1, 30) = 0.761, p = 0.390). Figure 5 showed the semantic stress difference between high and low word frequency.

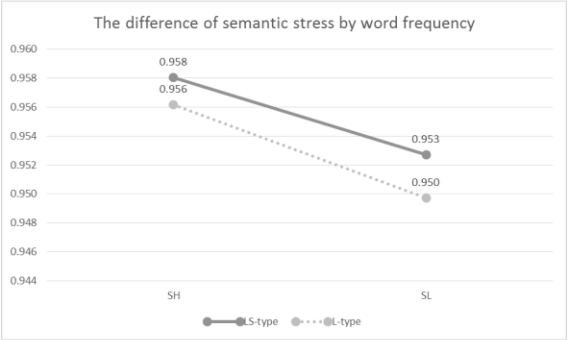

Figure 5. The difference of semantic stress by word frequency.

On the other hand, we conducted the mixed-effects model about syllable frequency for the comparison, and two models' difference was significant (F (1, 30) = 6.477, $p < 0.05$) in the syllable frequency. To know more detail result, we conducted repeated measure ANOVA. As the result, whereas the difference between the high and low syllable frequency was significant in LS-type (F (1, 15) = 61.463, $p < .000$), there was not the difference between high and low syllable frequency in L-type (F (1, 15) = 3.523, p = 0.080). Figure 6 showed the semantic stress difference between high and low syllable frequency.

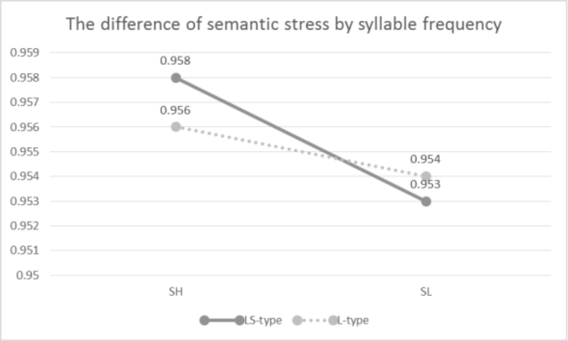

Figure 6. The difference of semantic stress by syllable frequency.

V. DISCUSSION

The purpose of this study was investigating the role of the syllable representation through the connectionist model. We constructed the models which had different frameworks by the existence of syllable representation. The result showed the superiority of LS-type in both of the training and test. In particular, LS-type could simulate the both of the word frequency effect and syllable frequency effect, but L-type only could simulate the frequency effect. In syllable frequency effect, LS-type only showed the syllable frequency effect significantly.

Why did these differences occur? We think that the noise of learning was a cause. In the training, the models were learned the relation between letter patterns and semantic representations. However, this learning was not perfect, and some noise also learned.

When the model learned the relation between a syllable and the meaning of the syllable, the letter layer used the mixed letter patter of the syllable. However, in this situation, because the letter layer was a mixed pattern, the relation between each letter like the onset, nucleus, and coda and the meaning will be partially affected, and this partial influence became the noise. Of course, this noise occurred in both types. However, the syllable layer of the LS-type model was not. There was no noise in the learning of the relation between syllable and semantic. Because of that, the performance of LS-type models was more stable than L-type models, so there was only the syllable frequency effect in LS-type. We guessed that the human mechanism of syllable representation also can be explained similarly. When people see a word, the semantic representation will be activated by the letter representation, but this representation may be not clear because of the noise. In this situation, if the syllables' frequencies are high, the syllable representation will make the pattern of meaning clearer, so the reaction time will decrease.

VI. CONCLUSION

This study showed the role and mechanism of the syllable representation through the two types of model. Although both types could simulate the word frequency effect, the L-type model could not simulate the syllable frequency effect. There are some future works in this study. First off, we did restrict the length of stimuli to disyllabic word for simplification. Although this restriction increased the performance, the application of some syllable frequency studies (i.e. Koo et al. (2012) or Simpson and to apply to Kang (2004)) were hard. Therefore, this need to make improvement in the future works. Next, we will consider the phonological representation in the future. Current model did not have the module for the phonological representation. Although behavior experiment reported that there is no or very weak syllable frequency effect, we could not simulate that because of the absence of phonological representation. We do not think that this simulation perfectly showed the role of syllable representation. However, in spite of that, we expect that this model can propose some perspective about syllable representation and the orthographic structure.

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APPENDIX – TRAINING AND TEST LIST

Word	Semantic	WFrequency	SFrequency	WFreRank	SFreRank
인간	人間	899.7	2597.9	1	1
방법	方法	606.5	1525.5	2	20
학생	學生	547.4	1637.6	3	16
자체	自體	419.1	1079.1	4	28
인물	人物	270.3	2350.3	5	3
책임	責任	246.0	587.3	6	74
인생	人生	207.6	2579.5	7	2
직원	職員	169.5	538.1	8	75
방침	方針	140.4	978.1	9	35
욕망	慾望	107.7	338.1	10	93
실험	實驗	103.3	373.6	11	85
선물	膳物	96.1	788.5	12	55
영혼	靈魂	92.9	189.3	13	124
통합	統合	91.4	202.3	14	116
물가	物價	85.9	856.4	15	46
체험	體驗	85.5	809.8	16	51
총장	總長	81.5	196.2	17	119
물음	物音	69.7	776.9	18	58
진행	進行	67.6	318.5	19	97.5

Word	Semantic	WFrequency	SFrequency	WFreRank	SFreRank
인권	人權	67.3	1789.3	20	9
방학	放學	61.2	1553.7	21	18
법인	法人	59.7	2345.7	22	4
고생	苦生	57.9	996.9	23	33
욕심	慾心	53.7	263.3	24	107
가입	加入	50.6	293.0	25	101
생물	生物	49.9	1614.0	26	17
물체	物體	44.9	1313.5	27	24
절망	絶望	42.8	215.6	28	113
약물	藥物	40.8	748.6	29	62
왕조	王朝	39.6	95.5	30	166
인원	人員	38.3	1960.7	31	6
입학	入學	37.4	845.0	32	48
인체	人體	32.2	2278.9	33	5
재능	才能	31.6	160.5	34	136
임원	任員	29.0	626.0	35	72
담임	擔任	28.9	354.5	36	88
간격	間隔	26.9	967.0	37	39
인재	人才	24.3	1758.9	38	11

Word	Semantic	WFrequency	SFrequency	WFreRank	SFreRank
자각	自覺	22.5	487.7	39	77
인용	引用	22.1	1733.8	40	14
언급	言及	21.7	72.7	41	175
진입	進入	21.3	280.9	42	104
식욕	食慾	19.9	266.9	43	106
복권	復權	18.1	180.9	44	129
진로	進路	18.0	182.2	45	128
진학	進學	17.9	867.9	46	45
원화	原畵	17.1	324.9	47	95
단식	斷食	17.0	134.7	48	148
채용	採用	16.9	94.2	49.5	167
단절	斷絶	16.9	112.7	49.5	159
실행	實行	16.7	351.5	51	89.5
실재	實在	16.5	285.9	52	102
왕권	王權	16.3	187.4	53	126
모체	母體	15.9	667.3	55	70
생식	生食	15.9	1004.8	55	31
직능	職能	15.9	294.8	55	100
행방	行方	15.9	1004.3	57	32
당원	黨員	15.8	342.1	58	92
행진	行進	15.5	318.5	59	97.5
인심	人心	14.9	1737.5	60	13
실물	實物	14.5	877.3	61	44
재학	在學	13.1	817.0	62	50
실세	實勢	12.9	209.6	63	115
원가	原價	12.6	466.8	64	80
복구	復舊	12.2	61.7	65	181
법학	法學	12.1	1403.8	66.5	21
생체	生體	12.1	1542.7	66.5	19

Word	Semantic	WFrequency	SFrequency	WFreRank	SFreRank
간식	間食	8.1	1023.3	86.5	30
직권	職權	8.1	366.7	86.5	86
재임	在任	8.0	424.2	88	81
재직	在職	7.5	336.3	89	94
입당	入黨	7.4	168.3	90	134
유모	乳母	7.1	62.9	91.5	179.5
미각	味覺	7.1	38.4	91.5	186
실용	實用	6.9	260.8	93.5	108
오색	五色	6.9	58.2	93.5	184
노고	勞苦	6.9	84.5	95	174
무인	無人	6.7	1696.7	96	15
실학	實學	6.5	900.9	97	42
권능	權能	6.5	191.0	98	123
광물	鑛物	6.3	710.9	99	69
가곡	歌曲	6.1	170.1	100	133
무직	無職	5.9	274.1	101	105
식모	食母	5.9	129.5	102	154
저번	這番	5.7	17.7	104	194
차입	借入	5.7	143.9	104	145
식용	食用	5.7	159.1	104	138
음색	音色	5.6	130.3	106	153
무능	無能	5.5	98.4	107	164
약수	藥水	5.5	113.6	108	158
총통	總統	5.4	196.7	109	118
직함	職銜	5.3	240.5	110	110
행색	行色	5.2	212.5	111	114
복학	復學	5.0	765.5	112	60
차체	車體	4.8	636.0	113	71
수장	首長	4.6	159.6	114	137

복직	復職	11.8	284.7	68	103
직책	職責	11.3	499.4	69	76
생수	生水	11.2	979.0	70	34
행인	行人	10.9	1824.5	71	8
무단	無斷	10.7	90.4	72	170
탄광	炭鑛	10.3	30.1	73	189
언행	言行	10.3	217.7	74	112
임용	任用	9.9	399.1	75	83
낙타	駱駝	9.8	19.6	76	193
자진	自進	9.7	609.9	77	73
모유	母乳	9.5	62.9	78	179.5
당수	黨首	9.3	96.7	79	165
수로	水路	8.5	87.7	80.5	172
방언	方言	8.5	888.7	80.5	43
권세	權勢	8.3	156.2	82.5	140
식수	食水	8.3	140.6	82.5	147
학장	學長	8.3	818.2	84	49
원색	原色	8.2	348.6	85	91
원폭	原爆	4.5	318.9	115	96
총체	總體	4.5	715.1	116	68
고행	苦行	4.4	241.9	117.5	109
무언	無言	4.4	89.9	117.5	171
폭음	爆音	4.3	100.5	119	163
고심	苦心	4.2	154.9	120	143
행실	行實	4.1	351.5	121	89.5
합법	合法	4.1	787.4	123.5	57
행원	行員	4.1	469.5	123.5	79
생색	生色	4.1	967.4	123.5	38
용수	用水	4.1	133.3	123.5	150
화폭	畵幅	4.0	38.1	127	187
퇴비	堆肥	4.0	8.0	127	195
생모	生母	4.0	967.9	127	37
행로	行路	3.9	197.0	129.5	117
색색	色色	3.9	91.6	129.5	168
모음	母音	3.8	130.7	131	152
당권	黨權	3.5	170.7	132.5	132

Word	Semantic	WFrequency	SFrequency	WFreRank	SFreRank
가세	加勢	3.5	188.7	132.5	125
돌입	突入	3.4	134.3	134.5	149
용언	用言	3.4	126.9	134.5	155
자책	自責	3.3	722.2	136	67
잔당	殘黨	3.3	45.1	138	185
실권	實權	3.3	316.3	138	99
생장	生長	3.3	1023.8	138	29
입금	入金	3.2	143.3	141	146
학번	學番	3.2	724.9	141	65
오행	五行	3.2	179.1	141	130
저간	這間	3.1	948.9	144	40
장물	長物	3.1	794.6	144	52
수차	水車	3.1	72.3	144	176
단수	斷水	2.9	108.9	146.5	160
용법	用法	2.9	763.7	146.5	61
금색	金色	2.8	60.1	148	182
물물	物物	2.7	1384.8	149	22
단행	斷行	2.7	218.2	150.5	111
물색	物色	2.7	738.2	150.5	63
무색	無色	2.6	84.7	153.5	173
방심	放心	2.6	917.3	153.5	41
약용	藥用	2.6	132.1	153.5	151
원생	原生	2.6	1224.4	153.5	25
합금	合金	2.5	113.9	157	157
생약	生藥	2.5	977.8	157	36
잔금	殘金	2.5	20.1	157	192
가담	加擔	2.4	195.3	159	121
노복	勞復	2.3	58.7	160	183
오욕	五慾	2.3	196.1	162.5	120
행간	行間	2.3	1106.7	162.5	27
식인	食人	2.3	1741.1	162.5	12
심통	心統	2.3	182.4	162.5	127
체통	體統	2.2	723.8	165	66
약학	藥學	2.0	772.2	166	59
돌진	突進	1.9	157.2	168	139
자생	自生	1.9	1379.7	168	23
무심	無心	1.9	118.5	168	156
고학	苦學	1.9	791.3	170	53
금광	金鑛	1.8	32.7	171	188
폭약	爆藥	1.7	72.3	172	177
물망	物望	1.7	846.9	173	47
총합	總合	1.6	193.6	174.5	122
가미	加味	1.6	172.7	174.5	131
인책	引責	1.5	1922.0	177	7
양이	攘夷	1.5	3.1	177	196
자폭	自爆	1.5	474.1	177	78
촌장	村長	1.5	103.7	179.5	161
법통	法統	1.5	790.5	179.5	54
혼절	昏絶	1.4	155.4	182	142
방임	放任	1.4	1160.9	182	26
금언	金言	1.4	65.3	182	178
채탄	採炭	1.3	29.9	185	190
차용	借用	1.3	90.9	185	169
단언	斷言	1.3	102.5	185	162
염가	廉價	1.3	165.3	187.5	135
촉망	囑望	1.3	155.7	187.5	141
방생	放生	1.2	1759.3	189	10
원음	原音	1.1	387.3	190.5	84
영물	靈物	1.1	787.5	190.5	56
영약	靈藥	1.1	151.3	192.5	144
무법	無法	1.1	726.7	192.5	64
희화	戲畵	1.0	23.1	195	191
총책	總責	1.0	358.1	195	87
책망	責望	1.0	418.6	195	82