Chapter 4 Word-pair judgment tasks 1 and 2

4.1 The word-pair judgment task 1

The experimental design developed by Treiman and Zukowkski (1996) is adopted to test children's phonological sensitivity to the phonemes and syllables in judging the similarity of the speech sounds. Similar to the nonword classification tasks, the word-pair judgment tasks also require phonemic analysis and syllabic analysis. In this experiment, children had to judge whether two sounds sounded alike at the beginning. For examples, when a child heard the pair of sounds [□◆○❑◗]-[□✿▼❈❊], he/she was expected to answer "yes" because the two sounds share one phoneme correspondence [□] at the beginning. When the child was offered the pair of sounds [□◆○❑◗] - [□◆▼❈❊], he/she was expected to answer "yes" because the two sounds [□◆○❑◗] and [□◆▼❈❊] share one syllable [□◆] at the beginning. The examples above indicate that children need to utilize the abilities of phonemic and syllabic analysis in order to detect the similarity in the word-pair sounds.

The research questions continued to focus on how the size of the shared units affects the children's performances in detecting the similarity between two speech sounds. Do children reveal the reliance on a unit larger than a syllable? Does the syllable play a role for children in judging the similarity of the speech sounds?

Furthermore, in the section of multiple comparisons, I am going to explore whether the position of the shared unit has played a role in detecting the similarity of the speech sounds. Do children present more attention when the shared unit is located at the beginnings of the sounds or when the shared unit is located the ends of the sounds?

4.1.1　Subjects

Twenty kindergarteners ranging from six to seven years old were recruited from a preschool in Taipei county and served as the subjects. All of the subjects are the native speakers of Mandarin spoken in Taiwan.
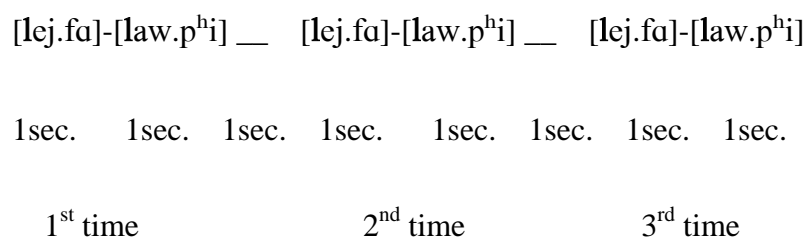
4.1.2　Materials in the word-pair judgment task 1

There are 13 pairs of test sounds in the word-pair judgment task 1. The test stimuli are disyllabic nonwords. In the test stimuli, there are 9 pairs for the answer "yes" and 4 pairs for the answer "no". In the pairs for the answer "yes", there are three types of similarity. The first type is the pair which shares the initial segment correspondence (C__.___), e.g. [mɑw.ku]-[mej.lɑ]. The second type is the pair which shares the initial syllable correspondence (CVC.___), e.g. [fɑn.ku]-[fɑn.pʰi]. The third type is the pair which shares the maximal correspondence across the whole sounds (CVC.C__), e.g. [pej.saj]-[pej.sow]. In the pairs for the answer "no", the sounds in each pair are entirely different in all parts, e.g. [□◆○❑◗]-[✳★✩▼❊❊].

As to the tonal structures, the sounds in each pair share the same tonal structures, e.g. [mɑw35-ku51]-[mej35-lɑ51] and [lej214-fɑ55]-[law214-pʰi55].

The stimuli were produced in the same way as the nonword classification task (as described in Chapter 3). The same stimulus pair is produced continuously three times with an interval of one second. Each stimulus pair contains two disyllabic nonwords. The pace for the pair is one word per second. The occurrences of all the stimulus pairs are arranged in the random orders. Figure 1 shows how the stimulus pair is produced continuously three times with an interval of one second.

Fig. 1 word-pair: [lej.fɑ]-[law.pʰi]

[lej.fɑ]-[law.pʰi] __ [lej.fɑ]-[law.pʰi] __ [lej.fɑ]-[law.pʰi]

1sec.　　1sec.　1sec.　1sec.　　1sec.　1sec.　1sec.　1sec.

1st time　　　　　　2nd time　　　　　3rd time

In the figure 1, we can see the pace for one stimulus pair is one word per second and the interval of each production is shown in "__".

Table 1 presents the materials used in the word-pair judgment task 1. There are 13 test pairs in total, which involves 9 pairs for the answer "yes" and 4 pairs for the answer "no", as shown below.

Table 1 : The test sounds used in the word-pair judgment task 1

"yes" pairs: initial segment correspondence (C__.___)
1.   [**m**ɑw35-ku51] / [**m**ej35-lɑ51]
2. [**l**ej214-fɑ55] / [**l**aw214-pʰi55]
3. [**x**ɑw51-ti35] / [**x**ən51-lu35]
"yes" pairs: one syllable correspondence (CVC.___)
1. [**naw**214-pʰi35] / [**naw**214-fɑ35]
2. [**fɑn**35-ku55] / [**fɑn**35-pʰi55]
3. [**tʂʰow**55-mu214] / [**tʂʰow**55-fɑ214]
"yes" pairs: maximal correspondence (CVC.C__)
1. [**pej**214-**s**aj55] / [**pej**214-**s**ow55]
2. [**sɑn**55-**k**ow214] / [**sɑn**55-**k**ej214]
3. [**tʂʰɑw**35-**p**u214] / [**tʂʰɑw**35-**p**ɑ214]
"no" pairs: entirely different phonemes
1.[tɑw214-lu51] / [xow214-pɑ51]
2. [pʰu55-mej214] / [pɑ55-taj214]
3. [lej35-pʰɑw51] / [maj35-xow51]
4. [xɑw51-laj35] / [tow51-pu35]

(The phonemes in bold face indicate the correspondent elements.)

4.1.3 Procedure and scoring

The children are asked to judge whether the sounds in each pair sounded alike at the beginning. For example, when the child listens to the word-pair, e.g. [tʂʰow.mu]-[tʂʰow.fɑ], he/she is expected to judge whether the two words sound alike at the beginning. Before the testing phase began, the practice trials are done in order to help the children understand the requirements in this task. The feedback is given only in the practice trials, not in the phase of test. When the test starts, the subjects would get the answer sheets from the experimenter and then listen to the tape played by the experimenter. After listening to one stimulus pair, they need to make judgment by drawing a circle on the answer sheets to indicate the similarity at the beginnings of the word-pair or drawing an "x" to indicate that the stimulus pair did not sound alike in all parts. The experimenter stopped the tape recorder whenever it was necessary for the subjects to finish their answers.

With regard to the scoring, the child would get one point if he/she correctly judges one stimulus pair which shares the correspondences at the beginnings. Each child's score on the three types, (C__.___, CVC.___, and CVC.C__) is submitted to the analysis of Repeated measures.

4.1.4 Results and analysis

Table 2 presents the mean score on the tree types (Type A: C__.___, Type B: CVC.___, and Type C: CVC.C__).

Table 2: The results of the word-pair judgment task 1

	N	Maximum	Mean	SD
Type A	20	3	.70	.80
Type B	20	3	2.80	.52
Type C	20	3	2.85	.37
Total	60	3	2.12	1.17

In Table 2, it shows that children got better score on the Type B (mean=2.80) and Type C (mean=2.85) but not on the Type A (mean= 0.70).

Table 3: Tests of within-subjects effects in the word-pair judgment task 1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Types	Sphericity Assumed	60.23	2	30.12	72.59	.000
Error(Types)	Sphericity Assumed	15.77	38	.42		

Table 3 presents the results of Repeated measures. It reveals that the performances on the three types have reached the significant differences ($F(2,38) = 72.59$, $p < .001$).

Table 4: Paired samples T test in the word-pair judgment task 1

		Paired differences			t	df	Sig (2-tailed)
		Mean	SD	Std. Error Mean			
Pair 1	Type A-Type B	-2.10	1.02	.23	-9.20	19	.00
Pair 2	Type A- Type C	-2.15	.99	.22	-9.73	19	.00
Pair 3	Type B- Type C	-5.00E-02	.69	.15	-.33	19	.75

In Table 4, it shows that the differences are significant in the comparisons between (1) Type A and Type B (t(19)= -9.20, p< .001) and (2) Type A and Type C (t(19)= -9.73, p< .001). However, the difference between Type B and Type C (t(19)=-.33, p>.05) is not significant.

Figure 2 demonstrates the mean of the score on the three test types in the form of graph in the word-pair judgment task 1.

Figure 2: Mean of the three types in the word-pair judgment task 1
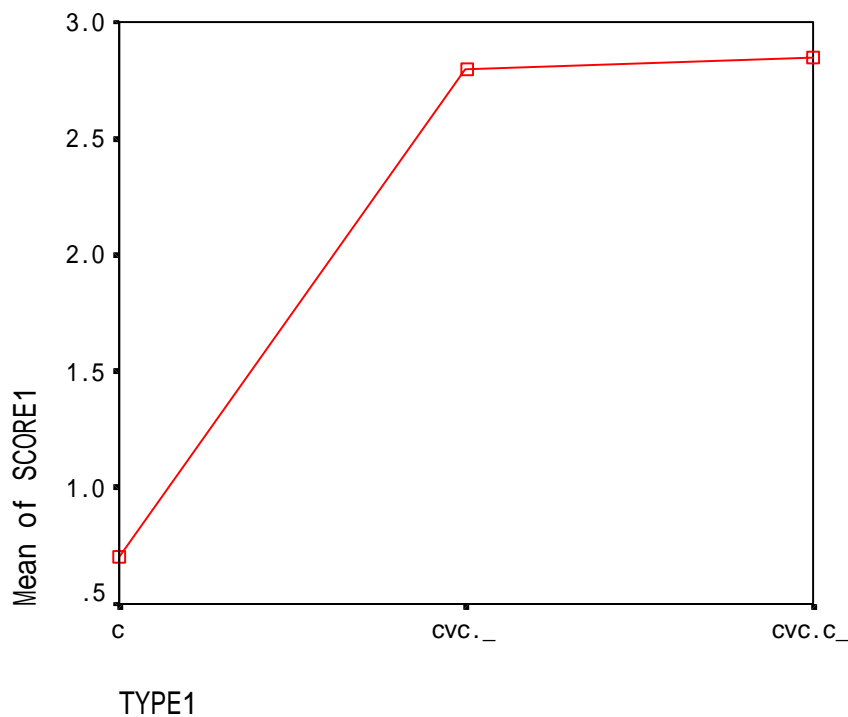
(Mean of Score1 = Mean of the score in the word-pair judgment task 1,
TYPE 1 = the types of similarity involved in the word-pair judgment task
1: C=the pairs with initial segment correspondence (Type A), CVC._ =
the pairs with one syllable correspondence (Type B), and CVC.C_= the
pairs with maximal correspondence across the whole sounds (Type C))

In Figure 2, children did not show better sensitivity to the similarity which is based on

the initially single segment correspondence (Type A) compared with syllable

correspondence (Type B) and maximal correspondence (Type C). However, their

sensitivity to the similarity is enhanced when more segments are involved such as the

initial phoneme correspondence (Type B) and the maximal correspondence (Type C).

4.2 The word-pair judgment task 2

In the word-pair judgment task 2, the location of the shared constituents is different from the word-pair judgment task 1. Compared with the word-judgment task 1, the location of the shared unit in the word-pair judgment task 2 is based on the ends of the words whereas the location of the shared unit in the word-pair judgment task 1 is based on the initial parts of the words. For example, in the word-pair judgment task 2, the children are asked to judge whether the word-pair [xɑwl**aj**]-[towp**aj**] sounded alike at the ends. Similar to the word-pair judgment task 1, the test types involved in the word-pair judgment task 2 also require phonemic analysis and syllabic analysis. In the word-pair judgment task 2, there are also three types of the correspondences in the word-pairs for the answer "yes" such as the rime correspondence (___._VC), the final syllable correspondence (___.CVC) and the maximal correspondence (_VC. CVC) which will be described in detail in the following section. In the word-pair judgment task 2, I would like observe children's sensitivity to the three types of similarity (___._VC, ___.CVC and _VC.CVC) in terms of the final correspondences between the speech sounds.

4.2.1 Subjects

The subjects were the same group who participated in the word-pair judgment task 1.

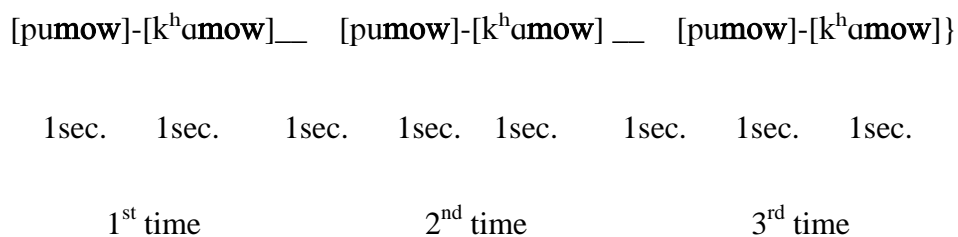### 4.2.2   Materials in the word-pair judgment 2

The test stimuli are 13 pairs of disyllabic nonwords.   The design is almost the same as the word-pair judgment task 1.   The difference is that in task 2, children are asked to judge whether the stimulus pairs sounded alike at the ends.   For example, when children are presented with the test pair, e.g. [tu.lɑŋ]-[pʰi.xɑŋ], which shares the rime at the end of the words, they have to judge whether the speech sounds [tu.lɑŋ] and [pʰi.xɑŋ] sounded alike at the ends of the words.   In the word-pair [tu.lɑŋ]-[pʰi.xɑŋ], the subjects are expected to answer "yes" because the stimulus pair [tu.lɑŋ]-[pʰi.xɑŋ] shares the rime [ɑŋ] at the end of the words.

In this experiment, there are 9 test pairs for the answer "yes" and 4 pairs for the answer "no".   In the pairs for the answer "yes", each pair shares the correspondences at the ends of the words and in the pairs for the answer "no", each pair doesn't share any of the correspondences.   In total, there are 13 test pairs in the word-pair judgment task 2.   As to the types in the test pairs for the answer "yes", there are three types of similarity included.   The first type is the word-pair which shares the rime correspondence (___._VC), e.g. [pu.mow]-[kʰɑ.tow].   The second type is the word-pair which shares the final syllable (___.CVC), e.g. [pu.mow]-[kʰɑ.mow]. The third type is the word-pair which shares the maximal correspondence in the final parts of the words (_VC.CVC), e.g. [lej.sɑn]-[pej.sɑn].   As to the test pairs for the

answer "no", the word-pair doesn't share any correspondences, e.g. [pumow]-[kʰɑtej].

The stimuli were produced in the same way as word-pair judgment task 1. The occurrences of the stimulus pairs are arranged in random orders. For each stimulus pair, it occurs continuously three times with an interval of one second. The pace for each stimulus pair is one word per second. Fig 3 shows the how the stimulus pair occurs continuously three time with an interval of one second.

Fig. 3 word-pair: [pu**mow**]-[kʰɑ**mow**]

[pu**mow**]-[kʰɑ**mow**]__ [pu**mow**]-[kʰɑ**mow**] __ [pu**mow**]-[kʰɑ**mow**]}

1sec. 1sec. 1sec. 1sec. 1sec. 1sec. 1sec. 1sec.

1st time   2nd time   3rd time

In the figure 3, we can see the pace for one stimulus pair is one word per second and the interval of each production is shown in "__".

The test pairs used in word-pair judgment task 2 are listed in table 5

Table 5: The stimulus pairs used in the word-pair judgment task 2

"yes" pairs: one rime correspondence (___._VC)
1. [ɕi214-maj51] / [ku214-laj51]
2. [tu51-lɑŋ35] / [pʰi51-xɑŋ35]
3. [tʂɑx51-ow35] / [li51-mow35]
"yes" pairs: one syllable correspondence (___.CVC)
1. [fɑ35-naj214] / [xɤ35-naj214]
2. [pʰi35-fɑŋ51] / [lu35-fɑŋ51]
3. [tɕi35-sow55] / [fɑ35-sow55]
"yes" pairs: maximal correspondence (_VC.CVC)
1. [tʂʰɑw35-pʰaj51] / [xɑw35-pʰaj51]
2. [lej214-sɑn51] / [pej214-sɑn51]
3. [mən55-low35]/ [fən55-low35]
"no" pairs: entirely different phonemes
1. [tɑw51-lu35] / [xow51-pɑ35]
2. [pu51-mej214] / [lɑ51-tow214]
3. [lej51-pɑw214] / [maj51-xu214]
4. [xɑw214-laj35] / [tow214-ʂej35]

(The phonemes in bold face indicate the correspondent elements.)

4.2.3   Procedure and scoring

The procedure is similar to the word-pair judgment task 1, and the difference is that the children are asked to judge whether the word-pairs sounded alike at final parts of the words.   The scoring is identical to the word-pair judgment task 1.   Children will get one point if they successfully judge one stimulus pair containing the correspondences.

4.2.4   Results and analysis

Table 6 presents the mean of the score on the tree types (Type D: ___._VC, Type E: ___.CVC and Type F: _VC.CVC) in the word-pair judgment task 2.

Table 6 : The mean of the score on the three types in the word-pair judgment task 2

	N	Maximum	Mean	Std. Deviation
Type D	20	3	1.00	.97
Type E	20	3	2.65	.67
Type F	20	3	2.85	.37
Total	60	3	2.17	1.09

In Table 6, it shows that children got better score on the Type E (mean=2.65) and Type F (mean=2.85) but not on the Type D (mean= 1.00).

The results in the Repeated measures are presented in table 7.

Table 7: Tests of within-subjects effects in the word-pair judgment task 2

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Types	Sphericity Assumed	41.23	2	20.62	46.73	.000
Error(Types)	Sphericity Assumed	16.77	38	.44		

In Table 7, it reveals that the performances on the three types of correspondences have reached the significant differences (F(2, 38)=46.73, p<.001).   Table 8 presents the results of paired samples T test in the word-pair judgment task 2.

Table 8: paired samples T test in the word-pair judgment task 2

		Paired Differences			t	df	Sig. (2-tailed)
		Mean	**SD**	**Std. Error Mean**			
Pair 1	**Type D – Type E**	-1.65	1.09	.24	-6.77	19	.000
Pair 2	**Type D – Type F**	-1.85	.99	.22	-8.37	19	.000
Pair 3	**Type E- Type F**	-.20	.70	.16	-1.29	19	.21

In Table 8, it shows that the differences are significant in the comparison between (1) Type D and Type E (t (19)= -6.77, p<.001), and (2) Type D and Type F (t (19)= -8.37, p<.001).   However, the difference between Type E and Type F (t (19)= -1.29, p > .05) is not significant.

Figure 4 demonstrates the mean of the score on the three types in the form of graph in the word-pair judgment task 2.

Figure 4: Mean of the score on three test types in the word-pair judgment task 2
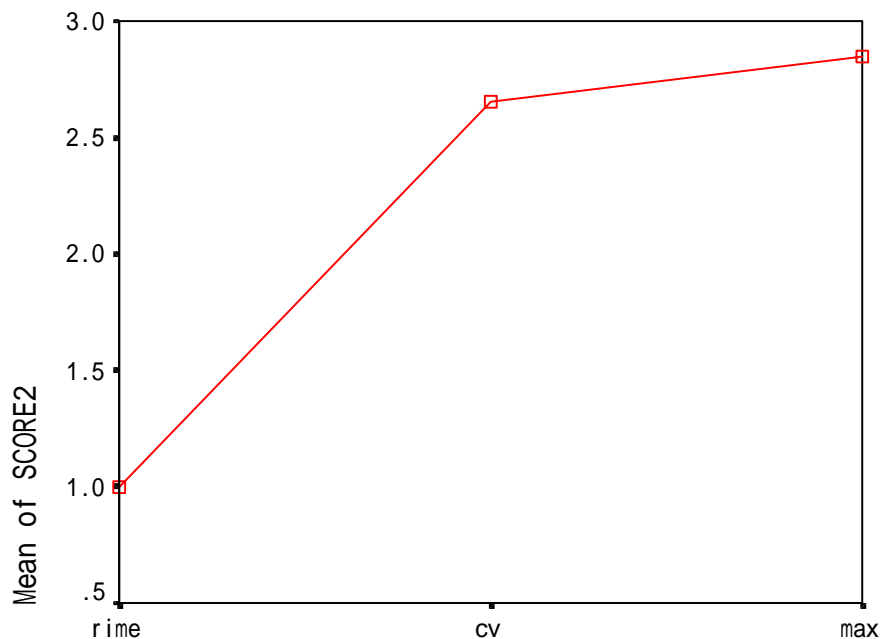
TYPE2

(Mean of Score 2 = Mean of the score on the three types in the word-pair judgment task 2, TYPE 2 = the types of similarity involved in the word-pair judgment task 2: rime=the pairs with the rime correspondences (Type D), CV = the pairs with final syllable correspondence (Type E), and max = the pairs with maximal correspondence (Type F)).

In Figure 4, children's sensitivity to the similarity is poor when the shared unit is based on the rime correspondence (Type D) and is improved when the shared unit is based on the final syllable correspondence (Type E) and the maximal correspondence (Type F).

4.8   Multiple comparisons

In this section, I am going to investigate whether the position of the shared constituents matters in children's sensitivity to the perceptual similarity of the speech sounds.   Does the location of the shared unit play a role in children's sensitivity to the perceptual similarity of the speech sounds?   Children's performances in the word-pair judgment task 1 and 2 are gathered to explore whether the position of the shared unit influences children's performances in judging the similarity of the speech sounds.   First, I would like to compare the overall performances in the word-pair judgment task 1 with those in the word-pair judgment task 2.   Then, I would like to compare the initial phoneme correspondence (Type A) with the rime correspondence (Type D), the initial syllable correspondence (Type B) with final syllable correspondence (Type E), and the maximal correspondence (Type C) in word-pair judgment task 1 with the maximal correspondence (Type F) in the word-pair judgment task 2 to exam the difference with regard to the change in position.

Table 9 presents the mean of the overall score in the word-pair judgment task 1 (mean=6.35) and task 2 (mean=6.50).

Table 9: Mean of the overall score in word-pair judgment task 1 and 2

	N	Maximum	Mean	SD
Task 1	20	9	6.35	.81
Task 2	20	9	6.50	1.40
Total	40	9	6.43	1.13

The mean of the score in word-pair judgment task 2 (mean=6.50) is little higher than

the mean of the score in the word-pair judgment task 1 (mean=6.35).   Table 10

presents the results in the analysis of Repeated measures.

Table 10:   Tests of within-subjects effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Tasks	Sphericity Assumed	.23	1	.23	.15	.70
Error(tasks)	Sphericity Assumed	28.28	19	1.49		

Table 10 shows that the difference in the overall performances between the word-pair

judgment task 1 and 2 did not reach the significant level (F(1,19)=.15, p>.05).

Hence, the present results indicate that children perform equally the same both in the

word-pair judgment task 1 and 2.

Next, the performances on the types of Type A, Type B, and Type C in the

word-pair judgment task 1and the types of Type D, Type E and Type F in the

word-pair judgment task 2 are shown in Table 11.

Table 11: Paired samples T test in the multiple comparisons in the word-pair judgment task 1 and 2

		Paired Differences		t	df	Sig. (2-tailed)
		Mean	SD			
Pair 1	Type A- Type D	-.30	1.30	-1.03	19	.32
Pair 2	Type B- Type E	.15	.93	.72	19	.48
Pair 3	Type C- Type F	.00	.46	.00	19	1.0

Table 11 presents the comparisons which are Type A vs. Type D, Type B vs. Type E and Type C vs. Type F. In Table 11, the difference between the initial segments correspondence (Type A) and the rime correspondences (Type D) is not significant (t (19)= -1.03, p > .05). It suggests that children are not significantly better either on the initial segment correspondences (Type A) or on the rime correspondence (Type D). Besides, the difference between the initial syllable correspondence (Type B) and final syllable correspondence (Type E) (t (19)= .72, p >.05) and the difference between the maximal correspondence (Type C) in the word-pair judgment task 1 and the maximal correspondence (Type F) in the word-pair judgment task 2 (t (19)= .00, p >.05) are not significant, either. The results above indicate that the position of the shared unit does not show the influence for the children in judging the similarity of the speech sounds.

Integrating the results in the word-pair judgment task 1 and 2, there appears the trend that children performed poorly when the shared unit is based on the initial single

phoneme or on the rime.

Figure 5 presents the mean of the score on the six types in the word-pair judgment task 1 and 2.
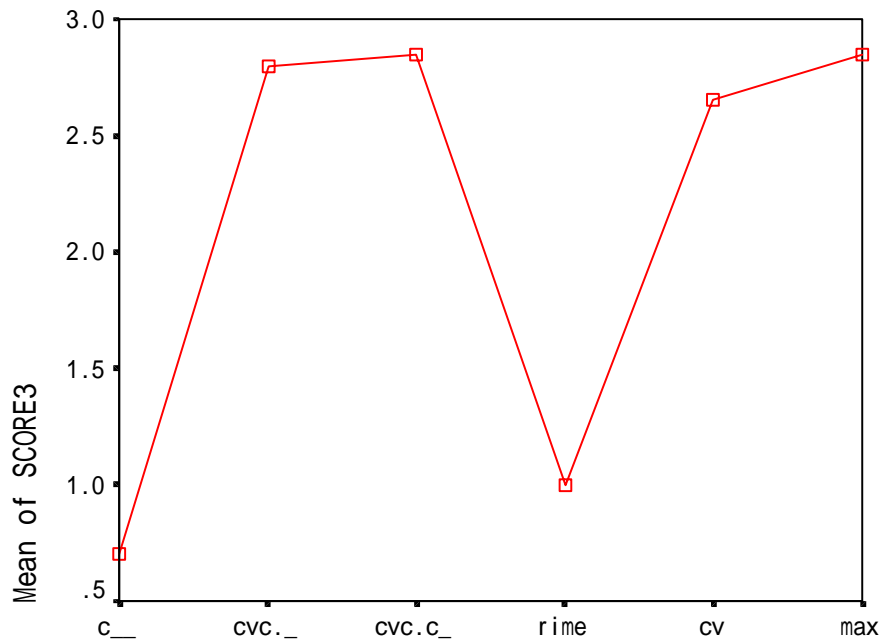
TYPE3

(Mean of Score 3= the average score in the word-pair judgment task 1 and 2, TYPE 3= the types of similarity in the word-pair judgment task 1 and 2: C__= the pairs with the initial correspondence (Type A), CVC._= the pairs with initial syllable correspondence (Type B), CVC.C__= the pairs with the maximal correspondence (Type C), rime= the pairs with the rime correspondences (Type D), CV= the pairs with the final syllable correspondence (Type E) and max= the pairs with the maximal correspondence (Type F)).

In Figure 5, children demonstrate the progress when the shared unit is based on the syllable correspondence or on the maximal correspondence in the word-pair judgment task 1 and 2. Regarding the factor of position, children do not show any

preference to either the word-initial similarity or to the word-final similarity. The

sensitivity to the rime correspondence (Type D) is not significantly better than the

initial correspondence (Type A). The sensitivity to the syllable correspondences

(Type B v.s. Type E) is similar and the sensitivity to the maximal correspondences

(Type C vs. Type F) are equally the same .