Skill-specificity in the Acquisition of Automaticity in L2*

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Byun, Jin-Suk. 2009. Skill-specificity in the Acquisition of Automaticity in L2. *The Linguistic Association of Korea Journal. 17*(3). 57-78. The present study explored the effect of input and output practice on the automatization of three Korean morphosyntactic rules. Twenty-eight native speakers of English in input and output groups participated in fifteen learning, practice, and test sessions over a 5-week period. The study tested automaticity in oral production of morphosyntactic rules and measured the length of time of speech for the first time in addition to reaction time and error rate in a dual-task condition. The analysis of their performance suggested that automaticity was acquired through skill-specific processing, especially automaticity in production, showing that output plays an important role in L2 acquisition at least at the procedural knowledge level. The findings are discussed in relation to their theoretical and methodological implications.

Key Words: skill-specificity, automaticity, input, output

1. Introduction

L2 acquisition may be discussed in two different meanings (de Bot, 1996; Nobuyoshi & Ellis, 1993). One is the acquisition of the underlying linguistic knowledge and the other is that of the use of the underlying linguistic

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knowledge, which includes the acquisition of automaticity. Unfortunately, however, automaticity has not been studied enough in L2 acquisition so far. DeKeyser (1997) has stated that there have been almost no fine-grained experimental studies on the process of rule automatization in the course of L2 learning. He has also stated that although a number of studies have been done on the automaticity of L2 access in comprehension, particularly in reading, not much information on the automaticity in listening or speaking is available. In light of the need for such research, therefore, the current study investigated automaticity in L2 acquisition through production practice, discussing whether output practice promotes automaticity.

2. Studies of Automaticity of L2 Morphsyntactic Rules

2.1 General Characteristics of Automaticity

It seems that the current approaches to automaticity are based on a continuum where "continuous process of automatization" occurs (DeKeyser, 1997). This means that, for instance, when a language learner acquires a grammatical form, it is stored as memorized knowledge, which forms an end of the automaticity continuum. However, as the learner practices that form repeatedly, the memorized knowledge gradually moves to the other end of the continuum, which is represented by procedural knowledge. Finally, the form is incorporated into the learner's spontaneous and automatic speech.

As general characteristics of automaticity, although unstoppability, effortlessness, and unconsciousness have been suggested in the literature (Segalowitz, 2003), DeKeyser (2001) has argued for three things: the power law of practice, skill-specificity of automatized behavior, and load independence, which is the elimination of influence by memory set size. The power law of practice is related to increased processing speed. Practice causes substantial gains in speed-up function at its early stage but soon the degree of speed-up diminishes with further experience (Logan, 1988).

The skill-specificity of automatized behavior means that a skill is acquired only through the practice of that specific skill. In other words, automaticity in

comprehension is acquired only through comprehension practice and automaticity in production only through production practice, not vice versa. The skill-specificity of automatized behavior was supported by the DeKeyser's (1997) study, which showed that the increase of comprehension ability did not facilitate the increase of production ability in a proportionate way.

Finally, load independence means that automatized behaviors become independent of the memory set size that is processed at the moment. This means that if a person performs an automatized behavior, he can process other things at the same time almost without being affected by limited working memory capacity. In other words, a behavior is said to be automatic when it is processed regardless of how much information needs to be processed (Segalowitz, 2003). Considering the huge amount of information processed for a human behavior, load independence seems to be obligatory for automatized human behavior, especially for the use of language, which requires the simultaneous processing of all aspects of language such as phonetics, phonology, syntax, and semantics.

As far as the operationalization of automaticity is concerned, DeKeyser (1997) argues that there seems to be wide agreement among researchers about reliable criteria, which are "drop-offs in reaction time and error rates, and diminished interference from and with simultaneous tasks" (p. 196). This means that automaticity can be measured through reaction time and error rates and by measuring how well two different tasks are carried out at the same time by the learner. Therefore, the present study also measured reaction time and error rates. However, it did not measure diminished interference. Instead the study employed a dual-task condition where participants were required to do two tasks at the same time.

However, when a study involves the acquisition of automaticity in oral production, there may be one more construct that should be measured, the length of time of speech. The importance of length of time of speech in measuring automaticity in oral production may be explained in relation to incremental production. In Levelt's production model (1989, 1993), there are three components for speech production – the conceptualizer to form a message, the formulator for grammatical and phonological encoding, and the articulator to produce actual sounds. In terms of the way of transition of a message

through each component in production, it was indicated that the message proceeds to subsequent components in an incremental way. The incremental way means that as soon as a bit of the output, not all of the output, is produced by the previous component, it is moved to the next processing component to be processed without waiting for the entire output to be produced. Therefore, for a message, *The book is not mine* to be produced, it may be that *the book* is processed in the formulator first and moved to the next level, the articulator before the next utterance, *is* or *is not mine*, is moved to the articulator. This way a speaker can produce the beginning part of the message before she/he completes processing the entire message or before she/he finishes grammatical and phonological encoding of it. If this is the case, what matters in oral production might not be only the beginning of the speech, but also the ending point of the speech, where the entire incremental production process ends. Therefore, to discuss automaticity in oral production of morphosyntactic rules it seems necessary to measure the time from the beginning to the end of the speech. Therefore the present study employed the length of time of speech as another way of operationalizing automatiticy in oral production.

2.2 Studies of Automaticity of Morphosyntactic Rules

As discussed above, L2 acquisition has not fully investigated how second language learners acquire automaticity (DeKeyser, 1997, 2001). This seems to be especially true of the acquisition of morphosyntactic rules. There are few studies (DeKeyser, 1997; Robinson, 1997; Robinson & Ha, 1993) on automaticity in morphosyntactic rule acquisition. Also even the small number of studies do not have agreement. Although some studies (DeKeyser, 1997; Robinson & Ha, 1993) have shown that more exposure to and more practice of target rules had led to significantly reduced reaction time and more accurate performance, Robinson's (1997) study showed that different amounts of exposure to items did not affect the reaction time. Though Robinson speculated that this was due to too short a training period to develop enough automaticity, this may need to be tested through more empirical studies.

In addition, currently skill-specificity appears to be an important question in

L2 acquisition that needs to be answered empirically (Byun, 2007). As far as types of practice are concerned, some researchers (Allen, 2000; Dekeyser, 1997; DeKeyser, Salaberry, Robinson, & Harrington, 2002; Dekeyser & Sokalski, 1996, 2001; Swain, 1985, 1993, 1995, 1998) emphasize the importance of output practice in L2 acquisition. They argue that input and output practice have different effects on L2 acquisition, showing a largely skill-specific pattern, namely comprehension practice leads to the increase of comprehension ability and production practice to the increase of production ability. However, other researchers do not agree with skill-specificity (Farley, 2001a, b; Sanz & VanPatten, 1998; VanPatten, 1996, 2002a, b; VanPatten & Cardierno 1993a, b; VanPatten & Oikkenon, 1996). They argue that output practice does not affect the learner's underlying linguistic system and that output is just the product that comes out of the underlying linguistic system. However, only DeKeyser's (1997) study has compared automaticity through input and output practice so far and the findings of the study supported skill-specificity.

Furthermore, DeKeyser (1997) tested skill-specificity only on the written production of participants. The participants of the study had to complete given sentences by typing in proper phrases corresponding to pictures displayed on the screen. So far no studies have tested automaticity in oral production of morphosyntactic rules by measuring reaction time and the length of time of speech.

However, considering that a learner's output functions as a type of input, i.e., 'auto-input' as some researchers pointed out (Ellis, 1994; Levelt, 1989, Levelt, Roelofs, & Meyer, 1999; Platt & MacWhinney, 1983), it may not be appropriate to distinguish comprehension and production as two completely mutually exclusive types of practice. Ellis (1994) has stated that a learner's output provides 'auto-input,' which is the learner's own speech working as input to the learner himself or herself. Levelt et al. (1999) have also indicated the importance of output as auto-input to the speaker. They stated that people listen to their own speech most. With auto-input taken into consideration, when a learner has output practice, it would be like having both output and input practice. Therefore, the present study predicts that production practice may also increase automaticity in comprehension as well as automaticity in production.

3. The present study

3.1 Research Questions and Hypotheses

The present study was guided by the following research question: how does practice type affect automaticity in oral production and comprehension? In relation to the research question, there were two predictions. First, it was predicted that automaticity in production would be acquired in a skill-specific way. Levelt's (1989, 1993) production model and Anderson's (1993) proceduralization process together support skill-specificity in the acquisition of automaticity in production. As de Bot (1996) discussed, declarative knowledge is proceduralized through production practice that strengthens the connection between declarative knowledge and procedural knowledge. This process involves the formation of production rules, which are specific to production and lead the skill acquired through practice to work well in the same direction it was acquired but not the other way (Anderson, Fincham, & Douglas, 1997). As indicated earlier, the skill-specific acquisition of production ability was also confirmed by DeKeyser's (1997) findings that the increase of comprehension ability did not facilitate the increase of production ability in a proportionate way.

Second, as for automaticity in comprehension, it was predicted that it would be promoted by production practice as well as comprehension practice because of auto-input function of output (Ellis, 1994; Levelt, 1989, Levelt, Roelofs, & Meyer, 1999; Platt & MacWhinney, 1983). Therefore, the findings of the previous studies (DeKeyser, 1997; Robinson & Ha, 1993) on automaticity of L2 morphosyntactic rules and suggestions and implications about skill-specificity discussed above led the present study to posit the following two hypotheses about the research questions:

(1) The practice effect in production will be skill-specific in the sense that L2 learners of Korean who had output practice will show shorter reaction time, shorter length of time of speech, and lower error rates in a dual-task condition during production tasks than L2 learners of Korean who had input practice.

(2) There will be no difference in the practice effect in comprehension between L2 learners of Korean who had output practice and L2 learners of Korean who had input practice.

3.2 Participants

The participants were 28 native speakers of English for two experimental groups. They were randomly assigned to either the input group or the output group, with 14 learners in each group. The input group had six men and eight women and the output group had eight men and six women. Their age ranged from 18 to 37 for the input group with the mean of 24 and from 19 to 24 for the output group with the mean of 20. Originally 30 participants were recruited for the experimental groups through flyers posted on the campus, but one participant withdrew from the input group and the data of one participant in the output group were discarded because her speech was not recorded due to technical problems.

The participants in both experimental groups were graduate or undergraduate students at the University of Illinois at Urbana-Champaign and they were all paid participants. Any English native participants with previous experience of learning Ural-Altaic languages, including Korean, were excluded from the study.

3.3 Target structures

This study explored the relationship between practice and automaticity by targeting three Korean morphosyntactic rules: word order, case-marking for nominative and accusative, and classifier construction. The first target structure was word order. The acquisition of word order is considered to follow a developmental sequence in L2 acquisition (Clahsen, 1984; Johnston, 1985; Meisel, Clahsen, & Pienemann, 1981; Pienemann, Johnston, & Brindley, 1988). Pienemann et al.'s (1988) study showed that Romance learners began with SVO word order, placing adverbials in sentence-final position. In contrast to English with SVO as a canonical word order, Korean is an SOV (subject, object and verb) language. More specifically, though it also allows OSV, Korean has SOV as its canonical word order (Kwon, 1992; Sohn, 1999) and the English word order,

SVO, is not allowed in Korean. Since canonical word order may be acquired at the beginning stage in developmental sequences and Korean and English have different canonical word orders, the canonical word order of Korean was used for the study. The example of word order is shown in the example sentence below:

(3) Tony-ka Lisa-reul keurimnida
Tony-SUBJ Lisa-OBJ draw
'Tony draws Lisa.'

The second target structure was case-marking. In principal, the subject and the object nominals are followed by nominative and accusative case particles, respectively (Sohn, 1999). Therefore, case-particles were the second target grammar point in the present study. In this case, the particles and the nominals together may be omitted when they are predictable from the context especially in colloquial speech. However, this study explicitly used the nominals and the particles for experimental purpose. As mentioned above, in Korean the subject and the object nominals are followed by nominative and accusative case markers. The nominative case marker is *-i* or *-ka* and accusative case marker is *-eul* or *-reul*. When the noun that functions as subject ends with a consonant, it takes *-i* and when with a vowel, it takes *-ka*. When the noun that functions as object ends with a consonant, it takes *-eul* and when with a vowel, it takes *-reul*. However, only *-ka* and *-reul* were employed for the present study. An example of case-marker is shown in the example sentence below:

(4) Gloria-ka Tony-reul bomnida
Gloria-SUBJ Tony-OBJ see
'Gloria sees Tony.'

The last target structure was classifier construction, which is 'noun + number + classifier.' Typologically, Korean is a numeral classifier language whereas English is not (Greenberg, 1972). Downing (1996) has indicated that in numeral classifier languages the use of classificatory morphemes is almost obligatory when quantity is expressed. Because of the typological difference in expressing the quantification of nominals between Korean and English, the present study employed classifier construction as the final grammar point.

The present study employed two classifiers. The first is the classifier for an animal, *mari*, and it follows the number of the animal. If the noun is a fruit or a vegetable, the classifier for it is *kae*, which was the other classifier of the two classifiers in the present study. When a specific numeral needs to be expressed, the presence of classifiers is obligatory in Korean. Therefore, if an English phrase, *two rabbits*, is translated word by word into '*du tokki*' in Korean, it would be ungrammatical. The number and the noun should be inversed and followed by the classifier, *mari*. The numbers which the present study used were *du* (two) and *se* (three). The example of classifier construction is shown below:

(5) tokki du mari
rabbit two classifier for animals
'two rabbits'

3.4. Materials

There were two kinds of materials used for the present study: training materials and treatment materials. The training materials were designed to provide participants with declarative knowledge about Korean sounds, vocabulary, and grammar. They consisted of explanations and multiple-choice or true-false practice activities. For the sound training, 14 consonants and 8 vowels were targeted. They were written in a specially developed Romanization for the present study. For the vocabulary training, 22 Korean nouns and verbs, two classifiers, and two numbers were targeted. Twelve words (6 nouns and 6 verbs) were used from the beginning of the experiment and 10 new words were employed as new items later.

For the grammar training, an on-line text was provided to explain each of the three grammatical rules. Also sets of Korean and English sentences were made and digitized for practice activities. Since the purpose of the study was to investigate automatization process through repeated practice, the study did not employ filler grammar rules to allow participants to have more opportunity to practice the target grammar rules within the limited time period.

The treatment materials consisted of practice items and dual task items

which were used in the proceduralization phase and the final testing phase. Both the practice and test items consisted of Korean sentences and their English translations (see Appendix A). A special software program called DMDX was used to develop the practice and test items.

3.5 Design

For clarification, in the present study input and output refer to group names or practice types whereas comprehension and production refer to test items or task name. The study employed two experimental groups—input and output to investigate the effect of practice on the automatization of L2 morphosyntactic rules. The independent variable was practice type which had two levels, input practice and output practice. In terms of automaticity in comprehension, the dependant variables were reaction time and error rate. For automaticity in production, the dependent variables were reaction time, error rate, and the length of time of speech. Participants were randomly assigned to either the input practice group or the output practice group. Whereas the participants in the input group completed comprehension activities, the participants in the output group completed production activities. The entire study consisted of 15 sessions, each of which took 30 - 40 minutes. It had three phases, declarative knowledge phase (sessions 1 - 4), procedural knowledge phase (sessions 5 - 14) and final testing phase (session 15).

The present study was a part of a larger study, which employed both within group and between group designs, but in this paper only the between group analysis was reported. The between group comparison was used to test hypotheses 1 and 2 by comparing the two groups' reaction time, error rate, and length of time of speech at the final testing phase. For dual task activities during the proceduralization phase and all tests during the final testing phase participants did two tasks at the same time: translation accuracy judgment task and color identification task, where they were asked to indicate the color of sentences on the screen. In other words, they were tested in a dual-task condition.

3.6 Procedure

The experiments took place in a computer-assisted language laboratory with 16 desktop computers at the University of Illinois at Urbana-Champaign. Both experimental groups participated in 15 sessions divided into 3 phases, declarative knowledge phase, procedural knowledge phase and final testing phase, over a 5-week period. The declarative knowledge phase consisted of sound training, vocabulary training, grammar training, and review activity. During this period participants acquired declarative knowledge of target vocabulary and grammar points and their performances were checked to ensure that they had firm declarative knowledge.

The procedural knowledge phase consisted of practice and dual task activities. During the period, participants proceduralized the declarative knowledge they had acquired in the previous sessions. Both groups had 48 practice items and 8 dual task items for each session. However, as mentioned earlier, the input and the output groups differed in terms of the task they did – comprehension or production task. More specifically, when the input group pressed the spacebar of a computer, they saw a Korean sentence and its English version on the screen. Then they were asked as quickly as possible to judge whether or not the English sentence is a right translation of the given Korean sentence by pressing 'right' (right shift) or 'wrong' (left shift) key.

As described earlier, practice activity was followed by dual task activity, which had only one difference from practice activity, color identification task. In the color identification task, the input group described orally the color of the given sentences at the same time they made accuracy judgment of the translation on the screen by pressing shift keys to prevent them from doing the two tasks in a serial manner.

In contrast, the output group had production opportunities only, without any opportunities for input practice. When they pressed the spacebar of a computer, they saw an English sentence and were asked as quickly as possible to translate it orally into Korean. Then their speech was recorded into the recording software program installed in the local computer. As the input group did, in the dual task activity, the output group also did the color identification task. Differently from the input group, however, they described the color of the

sentences by pressing shift keys with red or blue stickers on them because they translated the given English sentence into Korean orally. Also when they did it, they were asked to press the shift keys in the middle of the oral translation process to ensure the dual task condition.

Finally, the final testing phase consisted of tests to measure automaticity both in comprehension and in production. Although the input and output groups differed in terms of their practice activities, they completed the same activities during the final testing phase, which consisted of both comprehension and production items. More specifically, both groups had 16 practice items (8 for input practice and 8 for output practice) and 20 test items (10 for comprehension and 10 for production).

As for vocabulary presented during the procedural knowledge phase and the final testing phase, the same words introduced in the declarative knowledge phase were used, but six new words were introduced in sessions 10 through 14, and four new words were introduced in the final testing phase to exclude the possibility of word knowledge affecting the result of the study.

The researcher participated in session 1 through 4 to ensure that everyone acquired the declarative knowledge of Korean sounds, vocabulary and three grammatical rules. Except some comments of the researcher to manage the experiment, all instructions, practice, dual task, and test activities in session 5 through 15 were done through software programs installed in the local computers. As for the software programs, the study employed Microsoft Word for the declarative knowledge phase. For procedural knowledge and final testing phase, DMDX was used to present practice and testing materials and to measure all participants' performance that did not involve their oral speech. To record and analyze participants' oral speech, the study employed Audacity and Cool Edit.

3.7 Analysis

The data obtained during the final testing phase consisted of reaction time, error rate, and length of time of speech for both groups. Reaction time and length of time of speech were measured in milliseconds while error rate was measured in terms of the number of errors. Performance on the color

identification task was also scored in terms of accuracy, with one point given for each correct answer.

For the input practice group, reaction time was measured as the length of time it took for participants to press the 'right' or 'wrong' key after the appearance of target sentences on the screen. For the output practice group, reaction time was measured as the length of time between the appearance of target sentences and the beginning of their speech. The length of time of speech was the time period between the beginning and the end of the utterance. If there was a correction, the end of speech was the end of the correction. Alpha level was set at 0.05 for all statistical tests.

4. Results

4.1 Declarative knowledge tests and color identification task

The results of declarative knowledge tests showed that both the input and the output groups had attained declarative knowledge of the target vocabulary and morphosyntactic rules before beginning the procedural knowledge phase. In terms of the vocabulary test, which had 24 questions, the mean was 23.79 (*SD* = .43) for the input group and 23.86 (*SD* = .36) for the output group. So both the input and output groups showed more than 99% accuracy on the vocabulary test. This high accuracy on the vocabulary test indicated that the participants in both the input and the output groups established firm declarative knowledge of target vocabulary before beginning to practice it. In terms of the grammar test, which had 28 questions, the mean was 27.43 (*SD* = .85) for the input group ,and 27.71 (*SD* = .47) for the output group. So both the input and output groups showed more than 97% accuracy on the grammar test. Again, the high accuracy on the grammar test indicated that the participants in both the input and the output groups established firm declarative knowledge of target grammar prior to the practice sessions.

The results of the color identification task showed that both input and output groups carried out the two tasks simultaneously throughout the procedural knowledge phase (sessions 5-14) and in the final testing phase

(session 15). For the final testing phase, the mean was 19.64 (*SD* = .63) for the input group and 19.71 (*SD* = .73) for the output group. So both the input and output groups showed more than 98% accuracy, which indicates that they were carrying out two tasks simultaneously during the final testing phase. One concern, however, might be that the task might have been too easy to ensure the dual task condition.

4.2 Output practice and automaticity in production

The production items on the final test were designed to test the hypothesis 1 which predicted that students who had output practice would show shorter reaction time, shorter length of time of speech, and lower error rates during production tasks than those who had comprehension practice. In terms of reaction time, as shown in Table 1, the mean was 2,966 milliseconds (*SD* = 532) for the input group ,and 2,532 milliseconds (*SD* = 376) for the output group. So, as expected, the output group had shorter reaction times than the input group. In terms of error rate, also as shown in Table 1, the mean was 1.50 (*SD* = 2.40) for the input group, and .07 (*SD* = .26) for the output group. Again, as expected, the output group had a lower error rate than the input group. Finally, in terms of the length of time of speech, as shown in Table 1, the mean was 6,384 milliseconds (*SD* = 1,127) for the input group, and 4,137 (*SD* = 587) for the output group. So the output group showed a shorter length of time of speech than the input group. The results of independent-samples t-tests were significant for all three measures: for reaction time, $t(26) = 2.07$, $p = .025$ (one-tailed), for error rate, $t(13.32) = 2.20$, $p = .025$ (one-tailed), and for length of time of speech, $t(19.57) = 6.61$, $p<.01$ (one-tailed).

Table 1: Performance measures of the final production test

	Input group (n = 14)		Output group (n = 14)			
	M	*SD*	*M*	*SD*	*t*	*p*

Reaction time (ms)	2,966	686	2,532	376	2.07	.025
Error rate	1.50	2.40	.07	.26	2.20	.025
Length of time (ms)	6,384	1,127	4,137	587	6.61	.000

3.3 Input practice and automaticity in comprehension

The comprehension test of the final tests was designed to test hypothesis 2, which predicted that there will be no practice effect in comprehension between L2 learners of Korean who had production practice and L2 learners of Korean who had comprehension practice. No difference between the input and output groups was predicted because the auto-input function of output may cancel out the skill-specificity in comprehension. In terms of reaction time, as shown in Table 2, the mean was 4,211 milliseconds (*SD* = 1,383) for the input group and 7,146 milliseconds (*SD* = 894) for the output group. So the input group had shorter reaction times than the output group. In terms of error rate, also as shown in Table 2, the mean score was .57 (*SD* = .85) for the input group, and. 29 (*SD* = .47) for the output group. So there was not a large difference between the input and the output groups in error rate. The independent-samples t-test, as also shown in Table 2, was significant for reaction time, $t(26) = -6.67$, $p<.01$, but it was not significant for error rate, $t(26) = 1.10$, $p=.282$.

Table 2: Performance measures of the final comprehension test

	Input group (n = 14)		Output group (n = 14)			
	M	*SD*	*M*	*SD*	*t*	*p*
Reaction time (ms)	4,211	1,383	7,146	894	-6.66	.000
Error rate	.57	.85	.29	.47	1.10	.282

5. Discussion

The study has largely shown that automaticity in second language morphosyntactic rules is acquired through skill-specific processing, especially automaticity in production. This means that although a learner has much comprehension practice, the learner will not improve production ability at the procedural knowledge level. To improve production ability, the learner must have production practice. Therefore, if the goal of a lesson is to promote automaticity in production, the teacher should include many opportunities in the lesson for production practice. Opportunities for comprehension will not promote automaticity in production.

The present study also shows that output plays an important role in L2 acquisition at least at the procedural knowledge level and supports Swain's (1985) output hypothesis that output has a role to play in L2 acquisition. This means that the findings give at least a partial answer to the skill-specificity debate discussed earlier. In other words, output does not have a peripheral function but plays an important role in L2 acquisition, at least in the acquisition of procedural knowledge.

However, the picture of acquisition of automaticity in comprehension is not as clear as that in production. While the reaction time data supported skill-specificity, the error rate data did not. This result might have been caused due to the auto-input function of output. In other words, the auto-input function of output might have cancelled out the comprehension practice effect. This may be the reason no difference was found in error rate between the two groups. This finding may indicate that more studies need to be done on auto-input in relation to L2 acquisition. The entire picture, however, is still not clear because the question remains as to why the auto-input function of the output did not affect reaction time. The input group was significantly faster in reaction time in the comprehension task than the output group. Future studies may give an answer to this puzzle.

In addition to the theoretical implications, the study also gives an important implication about the way to operationalize automaticity in oral production. As discussed earlier, reaction time might not be enough to measure automaticity in oral production, and length of time of speech may complement the

operationalization of automaticity in oral production. For example, the participants in the output group who had the shortest reaction times for production items scored 1,974 and 2,120 milliseconds, respectively, which were much shorter than the mean score of 2,532 milliseconds. However, they had the longest length of time of speech, scoring 4,646 and 5,181 milliseconds, respectively, which were above the mean score of 4,127 milliseconds. A similar performance was also observed in the input group. For example, the participant who had the second shortest reaction time for production task scored 2,430 milliseconds when the mean score was 2,966 milliseconds. However, she scored 6,999 milliseconds on length of time of speech, ranking tenth in the group, which had 6,384 milliseconds as the mean score.

An important consideration in future research is skill-specificity in four basic skills of language－listening, speaking, reading, and writing. Although the current study compared reading comprehension and oral production, it did not investigate reading comprehension and written production or aural comprehension and oral production. Also it did not investigate oral production and written production or aural comprehension and reading comprehension. Future studies need to test whether there would be similar findings to those of the present study for these topics.

Also the present study showed that skill specific processing involves the acquisition of automaticity at the morphosyntactic level. However, empirical studies that explore whether skill specificity applies to other levels of language such as phonology, word learning, or discourse are needed. Since procedural knowledge is a separate construct from that of declarative knowledge, it is expected that all the linguistic levels that declarative knowledge acquisition involves can be examined and discussed in relation to skill acquisition and skill-specificity.

6. Conclusion

The present study explored the effect of input and output practice on the automatization of three Korean morphosyntactic rules: word order (SOV), case-marking for nominative (-ka) and accusative (-reul), and classifier

construction. The findings have shown that L2 acquisition is driven by skill-specific processing, especially for production. The findings give current L2 acquisition some important implications. First, to increase automaticity in production learners need to have production practice. Comprehension practice will not promote automaticity in production. Next, differently from what some researchers argue (Farley, 2001a, b; Sanz & VanPatten, 1998; VanPatten, 1996, 2002a, b; VanPatten & Cardierno 1993a, b; VanPatten & Oikkenon, 1996), output plays an important role in L2 acquisition at least at the procedural knowledge level. Finally, the findings have shown that to measure automaticity in oral production one may not need only to measure reaction time, but also length of time of speech.

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Appendix A

Sample Test Item for Comprehension Task

Part 4 will be a real test. It will be the same as previous parts except one thing. The sentences will be presented in red or in blue.
Read the Korean sentence and say the color, 'RED' or 'BLUE' as you begin to read the English sentence.
First, you will have 3 practice sentences.

Say 'Part 4' and press SPACEBAR to continue.

tokki du mari-ka Gloria-reul bomnida. = Two rabbits see Gloria.
(The sentences above were presented in red)