The Role of Linguistic Knowledge and Listening Strategies in Bottom-up and Top-down Processing of L2 Listening

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This study investigated the relative contributions of linguistic knowledge and strategy use to L2 listening success, especially in bottom-up and top-down dominant listening tasks. Participants (n = 130) were Korean college students in a required listening course. The tested variables for linguistic knowledge were sentence processing speed, grammar, receptive vocabulary, and productive vocabulary. Listening strategy use was measured with a metacognitive awareness listening questionnaire. We hypothesized that linguistic knowledge will make greater contributions to Bottom-Up-Listening-Comprehension (BULC) than to Top-Down-Listening Comprehension (TDLC), and different aspects of strategies will be accessed in each comprehension type due to different psycholinguistic features of the tasks. A series of stepwise multiple regressions were conducted and confirmed our prediction. The unique variance explained by linguistic knowledge was 27.8% in BULC, but 22.4% in TDLC. Strategy items that address problem solving and mental translation were significantly related to BULC, while items dealing with directed attention and person knowledge had significant explanatory power for TDLC.

**Key words:** second language listening comprehension, bottom-up processing, top-down processing, linguistic knowledge, metacognitive strategy use

* This work is financially supported by the Ministry of Education (MOE), through the fostering project of the Innovation for Engineering Education.
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1. INTRODUCTION

An ability to comprehend input in English has become critically important in modern societies. The availability of countless materials via the Internet has made it possible for those with better comprehension abilities in English to gather, analyze, synthesize, and apply needed information to their fields of work more efficiently. In this sense, it has become of great value to understand English language learners’ (ELLs) ability to comprehend English materials in aural form. In particular, identifying specific variables that make significant contributions to the second/foreign language (L2) listening can help teachers of ELLs design and practice evidence-based curricula and instruction, and as a result, ELLs can develop L2 listening skills more effectively.

Studies on variables contributing significantly to L2 listening have focused mostly on two areas: differential abilities in linguistic knowledge (Bonk, 2000; Conrad, 1985; Field, 2008; Kelly, 1991; Mecartty, 2000; Nation, 2006; Stæhr, 2008, 2009) and metacognitive knowledge (Goh, 2008; Vandergrift, 2005, 2010; Vandergrift, Goh, Mareschal, & Tafaghodtari, 2006). Addressing a unique feature of listening tasks as an online cognitive process, a more recent study that took an individual differences approach tested the effect of processing efficiency as well (Andringa, Olsthoorn, van Beuningen, Schoonen, & Hulstijn, 2012). These studies inform us of noteworthy insights on various constructs that influence L2 listening. However, these studies have not investigated how these constructs are related to two different levels of bottom-up and top-down processing in L2 listening. Top-down and bottom up processing are recognized as two distinct but closely intertwined cognitive processes in listening, but existing research has not investigated distinctive features of these two processes together or has focused on only one process. Therefore, the present study attempts to fill this gap by exploring the relative contributions of these variables, linguistic knowledge (vocabulary and grammar), processing speed, and metacognitive knowledge (listening strategy use) to the bottom-up and top-down processing of L2 listening respectively. The operationalization of bottom-up listening processing was made via questions about single utterance aural input, of which L2 listeners did not have prior knowledge. Top-down listening processing was operationalized with questions about conversations and long talks whose topics listeners had prior knowledge of. The findings of this study can shed light on how to conceptualize L2 listening in a more specific manner, which can be conducive to evidenced-based curriculum design and instruction. Implications of the findings for further research and pedagogy will be discussed.
2. LITERATURE REVIEW

This review of previous studies focuses on the effects of linguistic knowledge (lexical and syntactic knowledge), processing efficiency, and metacognitive knowledge on L2 listening because these are the independent variables that we tested in our study in seeking differential patterns between bottom-up dominant and top-down dominant L2 listening processing. To justify our operationalization of top-down dominant L2 processing, we also included findings from studies on the effects of prior knowledge on L2 listening.

2.1. Linguistic Knowledge – Lexical and Syntactic Knowledge

Listening is considered a comprehension process that involves semantic information to a considerable degree. Even though the scope of semantics can vary, it is generally accepted that meaning construction is initiated by the recognition of aural vocabulary and the retrieval of its meaning, accompanied by parsing. Vocabulary and grammar knowledge are the most widely studied linguistic knowledge variables in L2 listening, and have been shown to be significant in several studies (Bonk, 2000; Mecartty, 2000; Staehr, 2008, 2009). In Mecartty’s (2000) study that explored the contribution of lexical and grammatical knowledge to L2 listening, 77 English speaking college students were given tests of their lexical and grammatical knowledge of Spanish and L2 listening. Correlational analyses of these measures showed that both lexical knowledge and grammatical knowledge were significantly correlated with L2 listening ($r = .34$ and $r = .26$, $p < .05$). However, when the effect of lexical knowledge was controlled for, the significant effect of grammatical knowledge disappeared. 14% of the variance in L2 listening was explained by lexical knowledge.

Another study by Bonk (2000) investigated the relationship between the text-lexis familiarity (familiarity with words in the aural text) and L2 listening. 59 Japanese college students were asked to listen to English narrative passages followed by L1 recall. Text-lexis familiarity was measured by dictation of the aural text that the participants listened to for recall. The percentage of accurately reproduced lexical words in the dictation task was found to be significantly correlated with the level of comprehension measured with the recall task ($r = .45$). Bonk reported that acceptable comprehension levels were significantly related to higher text-familiarity, and those with text-lexis familiarity levels lower than 75% of the entire aural text were rarely classified as good L2 listeners. Even though the meaning of dictation task scores may require more investigation, the results still suggest that recognizing sounds or segmentation and having sufficient lexical and grammatical knowledge are important elements for successful L2 listening.

Staehr (2009) looked into a different aspect of vocabulary in listening, the effects of
vocabulary size and depth on L2 listening; 115 advanced Danish EFL adult learners participated in the study. A measure of receptive knowledge of word meaning was used to indicate vocabulary size; the selection of words was taken proportionately from the 2,000, 3,000, 5,000, and 10,000 word frequency levels. To measure depth of vocabulary knowledge, the format of a word associates test (Read, 1993) was adopted; the participants were asked to choose words that are relevant to a stimulus word relationally or semantically. The correlations between each type of vocabulary measure and L2 listening were significant ($r = .70$ and $r = .65$, $p < .01$). However, when the shared variance between vocabulary size and the depth was controlled for, vocabulary depth explained only 2% of the total variance. Staehr then concluded that vocabulary depth was too trivial to be considered an important predictor in a practical sense, even though its unique variance of 2% was statistically significant.

As far as syntactic knowledge is concerned, the aforementioned Mecartty’s (2000) study found that when the effect of lexical knowledge was controlled for, grammatical knowledge did not add any significant portion of explanatory power to the total variance, indicating that it is not a strong predictor of L2 listening. Another study that investigated the role of grammatical knowledge took a different methodological approach. Field (2008) analyzed intake by intermediate level L2 listeners. The participants were asked to listen to an informal interview audio, which had several pauses in between. Wherever there were pauses, they were asked to write five or six words that they heard. The transcription of the responses was analyzed based on content words and function words. Field reported that content words were recognized significantly better than function words. Vandergrift (2012) interpreted this finding as support for an insignificant role of grammar because function words carry grammatical information, whereas content words are semantic in nature. Thus, the results of the two studies may suggest that grammatical knowledge does little in the process of L2 listening comprehension. However, parsing plays a critical role in L2 listening processes because the assignment of appropriate syntactic rules on semantic chunks requires a rapid and efficient parsing ability. The conclusion of a minor contribution of grammatical knowledge to L2 listening drawn from a few available studies is premature. In order to generalize this conclusion, support from further studies is necessary, and this is part of what the present study aims to ascertain.

2.2. Processing Efficiency

Testing the effect of processing efficiency on L2 listening is a relatively recent endeavor compared to other research topics such as linguistic knowledge and metacognition. Processing efficiency was shown to be an important factor for L1 readers; L1 readers suffered in a grammaticality judgment task when time pressure was imposed (Hopp, 2010).
Considering the nature of listening tasks as online processing, the importance of processing efficiency may well play a critical role in L2 listening.

One study has directly investigated the effect of processing speed on listening. Andringa, Olsthoorn, van Beuningen, Schoonen, and Hulstijn (2012) set up four independent factors to explain individual differences in L2 listening: knowledge measures, processing speed measures, cognitive measures (IQ), and working memory. Processing speed was indicated via semantic processing speed, grammatical processing speed, segmentation speed, word monitoring, and self-paced listening. A structural equation modeling analysis conducted on the data from 113 non-native adult speakers of Dutch showed that all the factors were significantly correlated with L2 discourse listening comprehension. However, when the variances shared by the four factors were considered, the effects of processing speed and memory factors disappeared. Andringa, et al. reported that unlike L1 listeners whose individual differences in listening were significantly predicted by knowledge and processing speed factors after controlling for these four common variances, L2 listeners were not significantly influenced by their processing speed. They attributed faster processing of L2 linguistic information to a greater amount of knowledge, as indicated by their scores for receptive vocabulary and accuracy in grammatical processing and segmentation.

However, processing speed can involve “a number of different processes undertaken during language comprehension, from decoding of orthography/speech sounds, to lexical access and selection, to integration with syntactic and other knowledge, as well as to the prediction or anticipation of up-and-coming input” (Roberts, 2012, p. 181). Given the prominent role of online parsing in listening comprehension processes, processing efficiency in aural linguistic input needs to be considered in relation to individual differences in syntactic knowledge as well. Even though the findings from Andringa et al. (2012) are of great value, interpretations of the role of processing efficiency in L2 listening needs to be made cautiously because more discussion is needed of what processing efficiency is and how it should be operationalized. Different levels of L2 proficiency and linguistic distance between L1 and L2 may well play important roles as well. This may need further research in order to draw more reliable conclusions.

2.3. Metacognitive Knowledge

Listening strategies may entail various aspects of comprehension processes such as cognitive, affective, and metacognitive processes. However, more attention has been given to metacognition in recent years due to its prominent role in regulating one’s cognition. Studies on metacognition in L2 listening have focused on types of strategies used during L2 listening comprehension (Goh, 2000, 2002; Vandergrift, 1997; Vandergrift & Goh,
analyses of strategy use by more skilled listeners and less skilled ones (Goh, 2002; Vandergrift, 2003), the development of an L2 listening metacognitive questionnaire (Vandergrift, Goh, Mareschal, & Tafaghodtari, 2006), and the effects of instruction on metacognitive strategy use (Goh, 2008; Vandergrift & Tafaghodtari, 2010). Studies most relevant to the topic of the current investigation concern the strategy use by more proficient listeners. Goh (2002) collected two Chinese students’ listening diaries and their retrospective think-aloud protocols. The analyses of the verbal materials provided evidence that cognitive and metacognitive tactics were at work in both bottom-up and top-down processes of listening comprehension. In comparing the more proficient and less proficient listeners, the more proficient ones were reported to have used various listening strategies such as comprehensively using prior knowledge, linguistic knowledge, and contextual information, whereas the less proficient listeners relied mostly on one inferencing tactic and low-level comprehension monitoring tactics.

The differential use of listening strategies among different proficiency levels of L2 listeners was confirmed by Vandergrift (2003). Thirty-six 7th grade Canadian students learning French were asked to listen to three different texts and verbalize whenever there was a pause; all of the participants were at the Novice level on the ACTFL proficiency scale, but they were divided into more-skilled and less-skilled L2 listeners by a listening test. The appropriate points to stop the audio were predetermined by the researcher based on natural discourse boundaries. The analyses of this think-aloud data showed that there were twenty-one different strategy items used by the participants. The frequency of each strategy use then was calculated for the different types of listeners respectively, and an ANOVA was conducted to look for significant differences for each strategy item between the two types of listeners. The strategy items that more skilled listeners used significantly more often were found to be comprehension monitoring elaboration-questioning, and translation. Further qualitative analyses revealed that more proficient listeners relied more on top-down processing because they used world knowledge and text knowledge as a frame of reference for better comprehension, whereas less proficient ones used mostly bottom-up processing of what they heard.

Based on these studies, Vandergrift, Goh, Mareschal, and Tafaghodtari (2006) conducted a validation study on the metacognitive awareness listening questionnaire. An exploratory factor analysis of 966 responses from language learners and a confirmatory factor analysis with a different sample of 512 resulted in a 21-item instruments that are grouped into five factors: problem-solving (Cronbach’s $\alpha = .74$), planning and evaluation ($\alpha =.75$), mental translation ($\alpha =.78$), person knowledge ($\alpha =.74$), and directed attention ($\alpha =.68$). To confirm a significant relationship between the questionnaire and actual listening comprehension, the scores of the listening test were regressed on strategy items. The variance accounted for by the strategy was found to be 13.9%, which was significant.
This is the listening strategy instrument that we used to measure strategy use in our study.

2.4. Prior Knowledge

Prior knowledge plays a crucial role in top-down processing for successful listening comprehension, and its role has been supported by several studies (Chung, 2003; Long, 1990; Tsui & Fullilove, 1998; Tyler, 2001). Long (1990) had 188 American university learners of Spanish listen to two different topics of aural texts; a background questionnaire confirmed that the participants had different levels of prior knowledge on the topic of the aural text that they listened to. In a recall task, students recalled more information about the more familiar topic (53%) than the less familiar one (68%), and the difference was even greater, in that students recognized 28% more information from the familiar text than the unfamiliar text. This result is consistent with the study by Markham and Latham (1987), who observed that students with different religions recalled more information from the text about their own religion than the one with a different religion. The reason for greater recall and recognition was suggested to be more working memory capacity facilitated by topic knowledge. That is, topic knowledge can help comprehension from top-down and make up for inefficiency or controlled decoding processes of L2 listeners.

The differential effects of topic knowledge were also tested on native and non-native listeners. Tyler (2001) confirmed that the effect of topic knowledge was greater in nonnative listeners than native speakers. Non-native listeners enjoyed more benefit than native speakers when a topic was given. This result was consistent with what the shallow structure hypothesis (Clashen & Felser, 2006) maintains. Non-native speakers cannot use syntactic information as efficiently as native speakers, which leads to poor representations of aural input. However, non-native speakers in the study managed to compensate for the gap due to shallow structure processing by resorting to topic knowledge.

Furthermore, many other studies have been conducted on the positive effects of pre-listening activities using visuals, advanced organizers, or pre-listening questions or captions on listening comprehension. These pre-listening activities can elicit background knowledge and activate the schema on the topic and favorably influence comprehension (Ginther, 2002; Chung, 2002; Flowerdew & Miller, 2005). The present study used listening comprehension tests based on aural texts that were already taught in class, so students have an ample amount of topic knowledge as long as they sat in class or studied for the test. This particular context made it possible to operationalize the top-down processing dominant listening task, in which listeners were familiar with the topic.
2.5. Present Study

Bottom-up and top-down listening processes are two distinct psycholinguistic phenomena that are intertwined so closely that it may be impossible to tease apart the two processes into two separate listening tasks. However, it is feasible to operationalize bottom-up processing dominant and top-down processing dominant listening tasks. We operationalized the former type of processing with twenty questions of single aural utterances followed by four possible responses to the single aural utterances. In this condition, listeners had to rely heavily on rapid recognition of sound information and rapid parsing of activated semantic information that are mostly driven by outside stimuli in order to select one appropriate response to the stimulus utterance. Since the four answer choices were not semantically connected, an expectation-driven comprehension process was deemed to be extremely difficult under this condition. However, in a top-down processing dominant condition, listeners were asked to listen to long conversations and long talks on which they already had prior knowledge because the aural texts in this condition had been covered in classes. Since the participants had studied the materials already, a strong expectation-driven processing on the topic of the aural texts was expected to dominate throughout this task.

Under this operationalization of bottom-up and top-down processing, we investigated how linguistic knowledge, sentence processing efficiency, and metacognition influence two types of listening processing. The three research questions that we came up with were as following:

1) What linguistic knowledge variables explain significant variances in bottom-up and top-down processing of L2 listening?
2) What strategies explain significant variances in bottom-up and top-down processing of L2 listening?
3) Which linear combination of linguistic knowledge variables and listening strategy items explain significant variances in bottom-up and top-down processing of L2 listening?

The variables tested for linguistic knowledge were receptive vocabulary, productive vocabulary, and grammatical knowledge. For the sentence processing efficiency, we had only one measure of this construct in our study. Since processing efficiency is closely intertwined with listeners’ linguistic knowledge, we analyzed it along with the other linguistic variables together. To examine listening strategy use, we used the metacognitive awareness listening questionnaire by Vandergrift et al. (2006).

Our overall prediction is that bottom-up listening comprehension (hereafter, BULC) will
be more influenced by linguistic knowledge variables such as vocabulary and grammatical knowledge and sentence processing efficiency than top-down listening comprehension (hereafter, TDLC), in that BULC is expected to be characterized by stimuli-driven linguistic processes. On the other hand, an expectation-driven listening condition is likely to offer more room for inferencing or strategy use than BULC, in that listeners are likely to activate relevant prior knowledge from their long-term memory and use it to subsume incoming outside linguistic stimuli. As far as listening strategy use is concerned, L2 listeners are expected to use different strategy items that tap into different kinds of cognitive processes due to the distinct features of two listening processing we postulated.

3. MATERIALS AND METHOD

3.1. Participants

Intact group sampling was used; students from five listening classes that the two researchers were teaching participated in the study. Since those with missing data were excluded from the analysis, the total number of participants was reduced to 130 who were still available from the five different classes. The participants were mainly sophomores in college who took the listening course as a requirement for graduation. There were 70 male and 60 female students, and their majors were taxation (19%), material science (14%), architecture (10%), environmental science (9%), international relations (8%), social welfare (8%), computer science (7%), urban sociology (7%), philosophy (5%), economics (5%), Korean language and literature (4%), and Korean history (4%).

3.2. Instruments

3.2.1. Listening achievement test

Listening achievement was measured in the form of midterm and final exams in the course. The test items were made collaboratively by the six instructors who taught the course. The exam consists of three parts: Short sentence comprehension (Part I); Conversation comprehension (Part II); and Lecture comprehension (Part III). In part I (20 items total for midterm and final exams), participants were asked to listen to a question or statement of one sentence in length and to select the best response to the utterance. The test item was made with the target vocabulary that was taught in class, but the words in the test were used in a wholly new context. Therefore, the utterance in Part I was not taught before, so the students had to decode a new sentence that they could not predict. As a result, we
postulated that students had to depend heavily on bottom-up processing of listening to understand the speech stream by perceiving the meaning of the words and parsing. We specified this listening outcome as Bottom-Up-Listening-Comprehension (BULC). The Cronbach’s alpha for this test was .569. On the other hand, Parts II and III consist of 60 items in total for the midterm and final exams, where students were asked to choose the right answer after listening to a conversation (Part II) and a long lecture (Part III). The notable difference from Part I is that the aural texts used in this part of the exam utilized the exact same content as the aural texts used in class. That is, the students did not have to decode the meaning of the aural text much during the exam because they already knew the contents from attending class or preparing for the test. They had to focus more to listen to the subsequent questions and understand the choices by reading them under a time constraint. Consequently, the students should heavily rely on top-down processing because they are armed with sufficient prior knowledge for the aural text; we specified these listening tasks as Top-Down-Listening-Comprehension (TDLC). The Cronbach’s alpha for this test was .799.

3.2.2. Receptive and productive vocabulary tests

To measure the students’ vocabulary level, two types of vocabulary tests were administered: a receptive (40 items) and a productive test (20 items). Students were tested on vocabulary items randomly chosen from the word list in the Korean high school curriculum. These words are the most frequently used words as specified by two to four diamond icons in the online version of the Collins Cobuild Dictionary. Vocabulary tests were administered as part of the midterm examination, but students were told that the score for this part would not be included in their grade. Students were asked to write the definition in Korean for each word. The reliability of this test was confirmed ($\alpha = .913$). The productive vocabulary test used 20 high frequency words randomly chosen from the same source as the receptive vocabulary test, but this time students were asked to fill in the blank in a sentence with the word that fit the sentence most appropriately. The sentence with a blank is followed by the corresponding Korean word to provide a hint for recalling the target word. This type of controlled-production vocabulary-levels test was found to be reliable, valid and practical (Laufer & Nation, 1999). The Cronbach’s alpha was .799 in the present study.

3.2.3. Grammatical knowledge test

We followed the same format that the paper and pencil version of the TOEFL structure section used to have. There were 15 error recognition questions and 10 sentence
completion questions. The fifteen error recognition questions concerned number agreement (two questions), articles (one), pronoun insertion (two), voice (two), grammatical word choice (two), and word form (six). Fifteen sentence completion questions involved completing a blank with an adverb (one), comparatives (one), noun phrases (two), verb phrases (two), an adjective clause (one question), and prepositional phrases (one). The Cronbach’s alpha was .814.

3.2.4. Sentence processing speed

Sentence processing speed can vary greatly when the linguistic distance between the L1 and the L2 is great. Since the participants’ L1, Korean, and English are linguistically quite distant, we deemed that a measure of sentence processing speed should include not only simple clauses but also the sentences with three kinds of dependent clauses (noun clauses, adverb clauses, and adjective clauses); we assumed that individual differences in sentence processing speed are very likely to be observed in processing these dependent clauses. Using only high frequency words, we developed 40 simple sentences, 20 sentences with dependent clauses for each type. Half of the 100 sentences were changed such that the sentence does not make sense semantically (e.g., *A semester starts in sky). The participants were asked to decide whether the sentence makes sense semantically. One sentence was presented in one PowerPoint presentation screen for five seconds for simple clauses and seven seconds for sentences with dependent clauses on average; longer sentences were given one or two more seconds. The order of presentation was forty simple clauses, twenty noun clauses, twenty adverb clauses, and twenty adjective clauses. The Cronbach’s alpha was .916.

3.2.5. Metacognitive strategies

Students’ use of metacognitive strategies was measured by the Metacognitive Awareness Listening Questionnaire (MALQ, hereafter, Vandergrift, et al., 2006); see Table 2. The questionnaire is composed of 21 randomly ordered statements related to L2 listening comprehension. The items measure students’ perceived use of the strategies for better listening comprehension, self-efficacy beliefs, and self-regulating strategies, which are grouped into five factors: Planning and Evaluation (how students plan to listen and evaluate the outcome); Problem Solving (inferencing and monitoring these inferences); Directed Attention (how listeners concentrate and stay focused on the task); Mental Translation (the ability to use translation minimally); and Person Knowledge (learners’ perception of how they learn best, and/or their self-efficacy belief in L2 listening). The MALQ was significantly correlated with L2 listening performance, and explained 13% of
the variance in L2 performance in Vandergrift et al.’s (2006) study. The reliability for the present study was shown by the Cronbach’s alpha of .790.

3.3. Procedure

The data were collected throughout a 16 week semester in the Listening course for sophomores. The aim of the course was to help students improve listening in academic English. Contemporary Topics: Academic Listening and Note-Take Skills was used as a main textbook, and students practiced listening through pre-listening tasks, listening for main ideas, and note-taking for important details after they listened to a seven-minute lecture. On the first day of the course, the students took the grammar and sentence processing tests in class. On the seventh week, the students took the receptive and productive vocabulary tests as a part of the first quiz. Students were informed that the scores of the receptive and productive vocabulary quizzes would not be included in the final grade. Students took the midterm exam in the eighth week and the final in the sixteenth week. In the fourteenth week, the MALQ was administered in class and students were asked to check their responses regarding their listening strategies they use in general rather than for specific listening tasks. All the tests and the MALQ were administered by the researchers; the scoring and coding were done by the researchers and sometimes with the help of a research assistant.

4. RESULTS

4.1. Research Question 1

Our first research question was what linguistic knowledge variables explain significant variances in bottom-up and top-down processing of L2 listening. The linguistic knowledge variables included SPS (sentence processing speed), grammar, receptive vocabulary, and productive vocabulary. Table 2 shows the means and standard deviations of the linguistic knowledge variables and the two listening variables, correlations of the linguistic knowledge variables with BULC and TDLC, and their intercorrelations. All of the variables had significant correlations among themselves. To determine whether redundancy existed among the predictors, we checked the variance inflation factor (VIF) that quantifies the severity of multicollinearity. The values of VIF for all variables were between .829 and .1000, all of which were less than 4.00, the acceptable VIF value for evaluation of multicollinearity (Rogerson, 2001).
4.1.1. Linguistic knowledge variables predicting BULC

In order to determine the combination of linguistic knowledge variables that best predicts BULC, a stepwise multiple regression was conducted. At step 1 of the analysis, grammar, RecepV, and SPS were entered into the regression equation and were significantly related to BULC, $F(3, 126) = 20.107, p < .001$. The multiple correlation coefficients were .274 (grammar), .269 (RecepV), and .177 (SPS), indicating that approximately 32.4% of the variance in BULC could be explained by these three variables. The other variable, ProduV, did not enter into the equation at step 2 of the analysis: $t = -.309, p > .05$. Thus, the regression equation of the best linear combination for predicting BULC was:

$$\text{Predicted BULC} = .173 \times \text{grammar} + .084 \times \text{RecepV} + .053 \times \text{SPS} + 4.272$$

4.1.2. Linguistic knowledge variables predicting TDLC

The same procedure of stepwise multiple regression was administered with TDLC as an outcome variable. At step 1 of the analysis, grammar, ProduV, and SPS were entered into the regression equation, and were significantly related to TDLC, $F(3, 126) = 12.205, p < .001$. The multiple regression coefficients were .286 (grammar), .208 (ProduV), and .188 (SPS), indicating that approximately 27.8% of the variance of TDLC could be accounted for by these three variables. The variables that did not enter into the equation at step 2 of the analysis were RecepV, $t = 1.387, p > .05$. Thus, the regression equation of the best linear combination for predicting TDLC was: Predicted TDLC = .478 x grammar + .389 x ProduV + .150 x SPS + 25.403

The stepwise regression analyses showed that grammar and SPS significantly predicted BULC and TDLC. However, one type of vocabulary knowledge that showed a significant contribution differed between BULC and TDLC; RecepV was the part of the linear
combination of the significant variables in BULC, whereas ProduV was a significant predictor in TDLC.

4.2. Research Question 2

Our second research question was what strategies explain significant variances in bottom-up and top-down processing of L2 listening. To ascertain the overall relationship of each listening strategy item with BULC and TDLC, correlations between listening strategies items and two outcome variables were calculated first. Table 2 shows the means, standard deviations, and correlations of each strategy item with BULC and TDLC. Overall, item 2 (DA), item 5 (PS), item 9 (PS), item 11 (MT), item 12 (DA), and item 17 (PS) were reported as being used more often; the means of these items were greater than 4 on a five-point Likert scale. The items that were used less frequently were item 15 (PK), item 16 (DA), and item 18 (MT); the means of these items were smaller than 3.
### TABLE 2
Listening Strategies Items and Correlations with BULC and TDLC

<table>
<thead>
<tr>
<th>Listening Strategies Items</th>
<th>M</th>
<th>SD</th>
<th>L2-BULC</th>
<th>L2-TDLC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Before I start to listen, I have a plan in my head for how I am going to listen.</td>
<td>3.69</td>
<td>1.34</td>
<td>0.014</td>
<td>0.003</td>
</tr>
<tr>
<td>2. I focus harder on the text when I have trouble understanding.</td>
<td>4.40</td>
<td>1.27</td>
<td>0.054</td>
<td>-0.004</td>
</tr>
<tr>
<td>3. I find that listening in English is more difficult than reading, speaking, or writing in English.</td>
<td>3.25</td>
<td>1.56</td>
<td>-0.216*</td>
<td>-0.079</td>
</tr>
<tr>
<td>4. I translate in my head as I listen.</td>
<td>3.88</td>
<td>1.33</td>
<td>-0.246**</td>
<td>-0.163</td>
</tr>
<tr>
<td>5. I use the words I understand to guess the meaning of the words I don’t understand.</td>
<td>4.32</td>
<td>1.14</td>
<td>-0.052</td>
<td>-0.064</td>
</tr>
<tr>
<td>6. When my mind wanders, I recover my concentration right away.</td>
<td>3.61</td>
<td>1.11</td>
<td>0.141</td>
<td>0.193*</td>
</tr>
<tr>
<td>7. As I listen, I compare what I understand with what I know about the topic.</td>
<td>3.89</td>
<td>1.18</td>
<td>-0.053</td>
<td>0.004</td>
</tr>
<tr>
<td>8. I feel that listening comprehension in English is a challenge for me.</td>
<td>3.88</td>
<td>1.25</td>
<td>-0.154</td>
<td>-0.029</td>
</tr>
<tr>
<td>9. I use my experience and knowledge to help me understand.</td>
<td>4.11</td>
<td>1.12</td>
<td>-0.193*</td>
<td>-0.152</td>
</tr>
<tr>
<td>10. Before listening, I think of similar texts that I may have listened to.</td>
<td>3.69</td>
<td>1.34</td>
<td>-0.157</td>
<td>-0.119</td>
</tr>
<tr>
<td>11. I translate key words as I listen.</td>
<td>4.00</td>
<td>1.19</td>
<td>-0.146</td>
<td>-0.018</td>
</tr>
<tr>
<td>12. I try to get back on track when I lose concentration.</td>
<td>4.61</td>
<td>0.98</td>
<td>-0.002</td>
<td>0.180*</td>
</tr>
<tr>
<td>13. As I listen, I quickly adjust my interpretation if I realize that it is not correct.</td>
<td>3.86</td>
<td>1.17</td>
<td>0.113</td>
<td>0.088</td>
</tr>
<tr>
<td>14. After listening, I think back to how I listened, and about what I might do differently next time.</td>
<td>3.00</td>
<td>1.08</td>
<td>-0.128</td>
<td>-0.119</td>
</tr>
<tr>
<td>15. I don’t feel nervous when I listen to English.</td>
<td>2.92</td>
<td>1.33</td>
<td>0.005</td>
<td>-0.152</td>
</tr>
<tr>
<td>16. When I have difficulty understanding what I hear, I give up and stop listening.</td>
<td>2.78</td>
<td>1.23</td>
<td>-0.079</td>
<td>-0.092</td>
</tr>
<tr>
<td>17. I use the general idea of the text to help me guess the meaning of the words that I don’t understand.</td>
<td>4.38</td>
<td>1.07</td>
<td>-0.026</td>
<td>-0.008</td>
</tr>
<tr>
<td>18. I translate word by word, as I listen.</td>
<td>2.62</td>
<td>1.19</td>
<td>-0.270**</td>
<td>-0.139</td>
</tr>
<tr>
<td>19. When I guess the meaning of a word, I think back to everything else that I have heard, to see if my guess makes sense.</td>
<td>3.95</td>
<td>1.09</td>
<td>-0.068</td>
<td>0.009</td>
</tr>
<tr>
<td>20. As I listen, I periodically ask myself if I am satisfied with my level of comprehension.</td>
<td>3.28</td>
<td>1.13</td>
<td>-0.080</td>
<td>-0.020</td>
</tr>
<tr>
<td>21. I have a goal in mind as I listen.</td>
<td>3.45</td>
<td>1.24</td>
<td>-0.069</td>
<td>-0.012</td>
</tr>
</tbody>
</table>

**Note.** Planning-evaluation (PE): items 1, 10, 14, 20, and 21; Problem-solving (PS): items 5, 7, 9, 13, 17, and 19; Directed attention (DA): items 2, 6, 12, and 16; Mental translation (MT): items 4, 11, and 18; Person knowledge (PK): items 3, 8, and 15; Source: Vandergrift et al. (2006)

*p < .05; **p < .01

### 4.2.1. Listening strategy items predicting BULC

A stepwise multiple regression was conducted to find which linear combination of listening strategy items best predicts BULC. At step 1 of the analysis, item 9 and item 18
were entered into the regression equation and was significantly related to BULC $F(2, 127) = 7.718$, $p < .01$. The multiple correlation coefficients were -.188 (item 9) and -.266 (item 18), with approximately 10.8% of the variance of BULC accounted for by the two strategy items. The remaining items (nineteen) did not enter into the equation at step 2 of the analysis; $t = numbers between -1.635$ and $1.753, p > .05$ for all. Thus, the regression equation for predicting BULC was:

$$\text{Predicted BULC} = -0.591 \times \text{item 18} - 0.446 \times \text{item 09} + 16.485$$

### 4.2.2. Listening strategy items predicting TDLC

The same procedure was administered with TDLC as an outcome variable. At step 1 of the stepwise regression analysis, item 6 and item 15 were entered into the regression equation and was significantly related to TDLC $F(2, 127) = 6.094$, $p < .01$. The multiple correlation coefficients were .267 (item 6) and -.236 (item 15), indicating that 8.8% of the variance in TDLC was explained by these two listening strategy items. The remaining items (nineteen) did not enter into the equation at step 2 of the analysis; $t = numbers between -1.767$ and $.499, p > .05$ for all. Thus, the regression equation for predicting TDLC was:

$$\text{Predicted TDLC} = 1.688 \times \text{item 06} - 1.245 \times \text{item 15} + 46.462$$

Since we assumed that two cognitive phenomena of distinct features would result in tapping into different strategy items in BULC and TDLC, our prediction was confirmed. Item 9, “I use my experience and knowledge to help me understand.” and item 18, “I translate word by word, as I listen.” made significant contributions to BULC, whereas item 6, “When my mind wanders, I recover my concentration right away,” and item 15, “I don’t feel nervous when I listen to English.” were significant predictors for TDLC.

### 4.3. Research Question 3

Our third research question was which linear combination of linguistic knowledge variables and listening strategy items explain significant variances in bottom-up and top-down processing of L2 listening. The aim of the research question 3 is to find whether different features involved in BULC and TDLC tap into different sets of linguistic knowledge variables and strategy items to different degrees when they are entered together as one model. To answer this question, a stepwise regression was conducted; each set of variables from linguistic knowledge and strategy items identified from Research Question
2 as strong predictors were entered into the equation. Table 3 shows unstandardized regression coefficients of the variables entered into the equation at step 1 for each outcome variable. The BULC model had 35.1% of explanatory power, and the TDLC model, 31.2%; BULC $F(4, 125) = 16.884, \ p < .001$ and TDLC $F(4, 125) = 14.151, \ p < .001$. The regression coefficients were .253 (grammar), .264 (RecepV), -.168 (item 18), and .161 (SPS) for BULC, and .334 (grammar), .251 (item 06), .217 (ProduV), and -.162 (item 15) for TDLC. The variable that did not enter into the equation at step 2 of the analysis was item 09 in BULC ($t = -.961, \ p > .05$), and SPS in TDLC ($t = 1.931, \ p > .05$). Thus, the regression equations for BULC and TDLC were:

Predicted BULC

$= .160 \times \text{grammar} + .082 \times \text{RecepV} - .372 \times \text{item 18} + .049 \times \text{SPS} + 5.890$

Predicted TDLC

$= .599 \times \text{grammar} + 1.588 \times \text{item 06} + .406 \times \text{ProduV} - .854 \times \text{item 15} + 33.483$

Interestingly, the combination of linguistic knowledge variables differed between BULC and TDLC. It was grammar, RecepV, and SPS that entered into the best linear combination of predictors for BULC, but for TDLC, grammar and ProduV were significant linguistic predictors. SPS failed to make a significant contribution to TDLC when entered together with the strategy items. In strategy use, the significant effect of item 9 disappeared in the combined model for BULC. Item 18 for mental translation still had a negative significant effect; that is, the more listeners reported translating word by word, the poorer the BULC scores were. In TDLC, two strategy items, 6 and 15, retained their effect on TDLC in this combined model with linguistic knowledge. Listeners who reported recovering their concentration right away and feeling nervous when listening to English scored better.

In order to evaluate the unique contributions of linguistic knowledge and strategy use to BULC and TDLC, we ran hierarchical regression analyses, through which we could partial out the effects of the control variables. The results are presented in Table 4. The unique variance explained by linguistic knowledge (grammar and receptive vocabulary) was 27.8% in BULC, while 22.4% of the variance in TDLC was accounted for exclusively by linguistic knowledge (grammar and productive vocabulary). The unique variance explained by strategy use (item 18) was 2.7% in BULC, while 6.3% of the variance in TDLC was uniquely accounted for by strategy use (items 6 and 15). Overall, the relative contribution of linguistic knowledge was slightly greater in BULC than in TDLC, and strategy use explained slightly more variance in TDLC than in BULC.
TABLE 3  
Predictors of BULC and TDLC

<table>
<thead>
<tr>
<th>Predictor</th>
<th>B</th>
<th>95% CI</th>
<th>Predictor</th>
<th>B</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>5.890</td>
<td>[1.97, 9.81]</td>
<td>Constant</td>
<td>33.483</td>
<td>[27.89, 39.07]</td>
</tr>
<tr>
<td>Grammar</td>
<td>0.160</td>
<td>[0.05, 0.27]</td>
<td>Grammar</td>
<td>0.559</td>
<td>[0.28, 0.84]</td>
</tr>
<tr>
<td>RecepV</td>
<td>0.082</td>
<td>[0.03, 0.14]</td>
<td>Item 6</td>
<td>1.588</td>
<td>[0.61, 2.57]</td>
</tr>
<tr>
<td>Item 18</td>
<td>-0.372</td>
<td>[-0.70, -0.05]</td>
<td>ProduV</td>
<td>0.406</td>
<td>[0.09, 0.72]</td>
</tr>
<tr>
<td>SPS</td>
<td>0.049</td>
<td>[0.00, 0.10]</td>
<td>Item15</td>
<td>-0.854</td>
<td>[-1.678, -0.031]</td>
</tr>
<tr>
<td>R²</td>
<td>0.351</td>
<td></td>
<td>R²</td>
<td>0.312</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>16.884</td>
<td></td>
<td>F</td>
<td>14.151</td>
<td></td>
</tr>
</tbody>
</table>

TABLE 4  
Unique Variance of Linguistic Knowledge and Strategy Use in BULC and TDLC

<table>
<thead>
<tr>
<th>Predictor</th>
<th>ΔR²</th>
<th>β</th>
<th>Predictor</th>
<th>ΔR²</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td>Step 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control variables</td>
<td>.073**</td>
<td>.088**</td>
<td>Control variables</td>
<td>.088**</td>
<td>.073**</td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
<td>Step 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grammar</td>
<td>.278**</td>
<td>.233**</td>
<td>Grammar</td>
<td>.224**</td>
<td>.233**</td>
</tr>
<tr>
<td>RecepV</td>
<td>.253**</td>
<td>.253**</td>
<td>ProduV</td>
<td>.334**</td>
<td>.253**</td>
</tr>
<tr>
<td>SPS</td>
<td>.264**</td>
<td>.264**</td>
<td></td>
<td>.217**</td>
<td>.264**</td>
</tr>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td>Step 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control variables</td>
<td>.324**</td>
<td>.248**</td>
<td>Control variables</td>
<td>.248**</td>
<td>.324**</td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
<td>Step 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item 18</td>
<td>.027*</td>
<td>-.168*</td>
<td>Item 6</td>
<td>.063**</td>
<td>-.168*</td>
</tr>
<tr>
<td>Item15</td>
<td></td>
<td></td>
<td>Item15</td>
<td>.251**</td>
<td></td>
</tr>
<tr>
<td>Total R²</td>
<td>.351**</td>
<td></td>
<td>Total R²</td>
<td>.312**</td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>130</td>
<td></td>
<td>n</td>
<td>230</td>
<td></td>
</tr>
</tbody>
</table>

*p < .05; **p < .01

5. DISCUSSION

The aim of the study was to identify linguistic knowledge variables and strategy items that significantly predict bottom-up and top-down listening comprehension (BULC and TDLC), respectively, and to compare the relative contribution of each predictor type to BULC and TDLC. We will discuss the findings based on these two topics, the specific variables of each type that made a significant impact on BULC and TDLC and then their relative contribution to each outcome variable.

We first operationalized different kinds of linguistic knowledge, using four variables, receptive vocabulary (RecepV), productive vocabulary (ProduV), grammar, and sentence processing speed (SPS). Grammar and SPS made significant contributions to both outcome variables, but a type of vocabulary knowledge of significant influence was different; this
was RecepV in BULC, but ProduV in TDLC. Some studies of receptive and productive vocabulary sizes of L2 learners in general (Webb, 2008; Henriksen, 1999) have shown that L2 learners’ productive vocabulary knowledge lags behind receptive vocabulary knowledge. However, the differential effects of receptive and productive vocabulary on listening comprehension have not yet been investigated, to the authors’ knowledge. Thus, it should be noted that our interpretation of this result is preliminary and open to further discussion. Simply speaking, the difference between BULC and TDLC can be explained in the initiation of semantic processing. Comprehension in BULC is initiated by outside linguistic stimuli, which requires listeners to recognize aural input. Since the RecepV asked the participants to recognize meanings of given words and translate them into Korean (even though it was presented in written form rather than aurally), it is not difficult to see how receptive vocabulary knowledge is strongly related to BULC. Comprehension in TDLC, on the other hand, is assumed to be driven by listeners’ background knowledge that subsumes outside linguistic stimuli into listeners’ reference frames. This process taps into not only the ability to recognize incoming aural input but also an ability to actively predict what comes next based on listeners’ schema activated by the aural text. Thus, we speculate that the participants may have been engaged in some kind of implicit productive language use in TDLC. If this was the case for the participants in our study, it is likely that those with a better ability to recall English words as in the case of productive vocabulary knowledge use could proceed better in a top-down dominant listening comprehension process.

The roles of grammar and SPS in L2 listening comprehension also need to be noted. Unlike a previous study whose finding showed that the effect of grammatical knowledge disappeared after the effect of lexical knowledge was considered (Mecartty, 2000), grammar had a significant unique contribution (4.9% in BULC and 3.6% in TDLC) after all the other linguistic variables were controlled for in our study; this was from additional hierarchical analyses conducted that were not reported in the result section. Unlike Andringa, et al. (2012), the effect of SPS was still significant when the other linguistic variables were controlled for; 2.8% for both conditions. Our study provided empirical support for general intuition that processing efficiency plays a significant role in L2 listening under time constraints. An interesting finding concerning SPS, however, was observed when strategy use items were analyzed together with linguistic variables. SPS retained its significant contribution when strategy use items were entered into the regression equation together as one model of BULC, but lost its explanatory power in TDLC; see Table 3. This indicates that individual differences in SPS were compensated by strategy use in TDLC but not in BULC. That is, those with appropriate prior knowledge but relatively slower processing efficiency can succeed in top-down dominant listening tasks when they manage to use listening strategy successfully; specific strategy items will
follow. This finding is consistent with our prediction that L2 listeners will rely less on linguistic resources but more on strategy use in TDLC than in BULC.

The findings on listening strategy use also showed interesting patterns. In BULC, item 09, “I use my experience and knowledge to help me understand.” and item 18, “I translate word by word, as I listen.” were shown to have significant explanatory power in predicting BULC in a negative direction. The listeners who reported having tried to use prior experience and knowledge to facilitate BULC, and having translated word by word while listening, scored considerably lower in BULC. This is consistent with the characteristics of the BULC condition that we laid out in our study, in that effective listeners in BULC should direct their attention to incoming aural input rather than activating their prior knowledge, which may distract their concentration. In addition, those who translate word by word are more likely to suffer from reduced cognitive resources than those who try to access the meanings directly under this rapid bottom-up dominant comprehension processing that takes place within a few seconds. However, the effect of item 9 disappeared when linguistic variables were analyzed together with strategy use; see Table 3. A direct access to semantic information and thus efficient sentence processing and parsing addressed in item 18 is suggested as the key in explaining individual differences in BULC.

The strategy items that had significant explanatory power in the final analysis of TDLC (research question 3) were item 6, “When my mind wanders, I recover my concentration right away,” and item 15, “I don’t feel nervous when I listen to English.” However, the initial correlational analyses indicated that it was item 6 and item 12 that had significant correlations with TDLC (item 12, “I try to get back on track when I lose concentration.”), and item 15 was not significantly correlated with TDLC. When all of the strategy items were entered into a stepwise regression analysis, however, it was item 6 and item 15 that had significant predictive power for TDLC. When we examined the items, it was found that both item 6 and item 12 tapped into the same construct of directed attention, and thus keeping both of them in the final model was redundant. In addition, it appears that item 15 had some interaction with item 6. As a result, item 6 and item 15 turned out to be significant predictors in the final regression model. This pattern (item 6 and item 15 as significant predictors) stayed the same even when the linguistic variables were analyzed together; see Table 3. Initially, it was somewhat puzzling to observe item 15’s negative direction of influence on TDLC. Feeling nervous should hinder one’s concentration while listening intuitively in general, not vice versa. However, when this was placed in the context of TDLC, to which the participants were able to bring their schema, prior knowledge of the aural text, a negative direction in influence made sense. Item 15 belongs to the realm of person knowledge. It is highly probable that the participants who perceive themselves as being nervous during L2 listening in general (person knowledge) were likely
to prepare more for the listening exams by organizing background knowledge of the anticipated aural text in their TDLC. Thus, those who know their tendency toward feeling nervous in L2 listening made more efforts to prepare and ended up scoring better in the exams. In addition, the participants who were prepared better for TDLC were able to manage to use their attentional resources and recover their concentration more effectively (item 6).

Finally, patterns in relative contributions of linguistic knowledge and strategy use to BULC and to TDLC were consistent with our predictions. We hypothesized that individual differences in linguistic knowledge will be more prominent in BULC than in TDLC due to its nature of linguistic stimuli-driven processes, and thus with a more variance explained by linguistic knowledge variables. The hierarchical regression analysis confirmed this pattern. The unique variance explained by linguistic variables was 27.8% in BULC, while it was 22.4% in TDLC; see Table 4. We also anticipated that L2 listeners are more likely to resort to strategy use in TDLC than in BULC because TDLC involves more inferencing processes during listening by filling gaps in comprehension with the help of rapid educated guessing and predicting incoming contents based on activated schema for comprehension. This prediction was also consistent with our findings. This strategic aspect of TDLC was realized in two different strategy items that addressed managing one’s concentration (item 6) and person knowledge (item 15), uniquely explaining 6.8% of the variance in TDLC. However, only 2.7% of the variance in BULC was uniquely accounted for by strategy use that addressed direct access to linguistic information. Thus overall, our predictions on what would happen during BULC and TDLC were consistent with the findings of the study.

6. CONCLUSION

This study contributes to the theoretical foundation of L2 listening, in that it provides empirical support for the presence of two distinct psycholinguistic listening processes, BULC and TDLC. The identification of specific variables that significantly influence each type of listening process makes it possible to develop a more comprehensive, evidence-based curriculum design. Since authentic L2 listening tasks take various forms in reality such as lectures, media reports, and personal interaction, it is desirable to raise students’ sensitivities to different features of tasks, whether it involves more bottom-up dominant or top-down dominant processes. Teachers of ELLs need to teach how to deal with various kinds of L2 tasks at hand by training them to identify dominant features of the task and to deploy appropriate linguistic competences and strategies accordingly. In addition, predictors such as pragmatics and discourse knowledge missing in our study are good candidates for further investigation as predictors that can explain the variances in two
different kinds of processing not accounted for by linguistic knowledge (vocabulary, grammar, sentence processing speed) and listening strategies. Since pragmatics and discourse are essential part of many listening texts, findings from such studies can help teachers address relevant aspects of pragmatics and discourse knowledge specific to each type of listening processing.

However, the findings of the current study need to be replicated with different samples which no other studies have addressed before. Further investigation of the roles of productive vocabulary as opposed to receptive vocabulary in TDLC definitely requires more support for generalizability. Another interesting finding on significant strategies was that automatic processing without translation was important for bottom-up processing, while self-regulating strategies to recover concentration successfully compensated for relatively slower sentence processing in TDLC. This compensatory relationship between linguistic knowledge and strategy use also needs further studies. Furthermore, pedagogical implications can be drawn from this; since the listening process is inevitably interwoven with bottom-up and top-down process, both types of tasks should be balanced in listening classes. Practically speaking, the significant effects of grammar and vocabulary and a few metacognitive strategy items for both types of L2 listening observed in our study suggest that teaching these constructs is an essential element to be incorporated into the curriculum. That is, grammar, vocabulary, and strategy use need due attention, respectively, in L2 listening instruction.

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Received in March 2014  
Reviewed in April 2014  
Revised version received in May 2014