Chunking of Letter Strings into Words by Japanese EFL Learners: Correlation between Word-Recognition Abilities and Cloze/Reading Comprehension Abilities

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Abstract

[Purposes] This research investigates how Japanese EFL university students chunk orthographic strings into meaningful words in order to find out which is more related to chunking abilities: cloze or reading comprehension abilities. The frequencies of overshooting errors and undershooting errors and the chunking patterns were also explored.

[Method] The first-year university subjects (n=47) were requested to predict the word boundaries on the chunking test, and they were administered the cloze and reading comprehension tests.

[Results] (1) The ability of chunking letter strings into words was more related to reading comprehension abilities than cloze ones. (2) The learners produced more overshooting than undershooting errors in both nominals and verbals. It seems that they failed to understand the meanings of the undershooted words more frequently than those of overshooted ones. (3) It was easy for the learners to detect stems in both nominals and verbals. Furthermore, they failed to understand anaphoric relations.

[Conclusion] The results suggest that (1) the subcomponents of reading comprehension are tied to those of chunking, and (2) learners raise their consciousness to affixes and discourse development in reading/vocabulary in order to comprehend text/word more correctly.

Keywords: chunking, word recognition, letter strings, overshooting error, undershooting error, Matsuno Chunking Test

1. Introduction

Word recognition is considered the basics in reading written texts silently or aloud. While reading them, language learners have to process a large number of words quickly and try to comprehend the messages of the text. They are required to have both syntactic and semantic processing: it is necessary to recognize word boundaries employing syntactic knowledge (even contrasted forms such as *I'd*) as well as lexical or semantic knowledge, that is, to work with not only the linear structures but also the propositions of the sentences. Hence, one can examine the learners' ability of segmenting a stream of letters into recognizable chunks such that the boundaries are identified at the word and sentence levels. At the basic processing level, the learners need to segment letters into recognizable words, while at the high level, they are requested to organize words into meaningful sentences. Therefore, on the chunking test, called "*the Matsuno Chunking Test*," which has been administered by Professor Kazuhiko Matsuno at the University of Tokyo since 1982, the subjects must activate on the strategies of lower-order skills (e.g., localized recognition of each word) as well as higher-order skills (e.g., global comprehension of the whole sentence). On the lower level, they are requested to recognize words in each localized point: it may not be necessary to understand the meaning of the text on a discourse level. On the contrary, they must interpret the meaning of the whole sentence on the discourse level so that they may identify the boundaries of each sentence.

The connectionist model of phonotactic, orthographic, lexical, and word sequences regularities is proposed by Elman (e.g., 1990). A simple recurrent network was used to examine the temporal properties of sequential inputs of language. In the computer simulation, the letters were presented in sequence, one at a time, with no breaks between the letters in a word, and no breaks between the words of different sentences, as follows:

Manyyearsagoaboyandagirllivedbytheseatheyplayedhappily...

The task at each point in time was designed to predict the next letter as follows:

(Many/years/ago/a/boy/and/a/girl/lived/by/the/sea/they/played/happily/...)

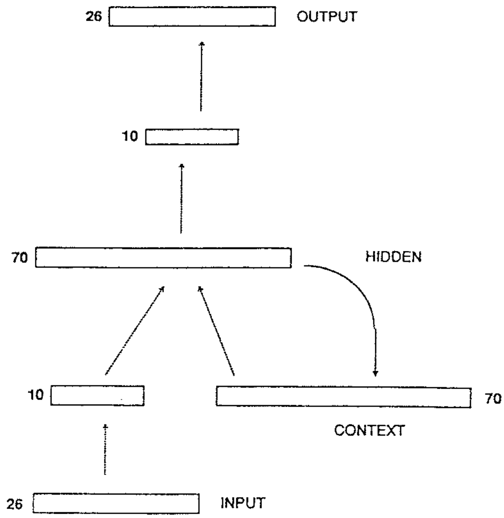
High frequency of the error means that the network has trouble predicting the letter. Errors tend to be high at the onset of each new word and decrease until the word boundary is reached. Before it is exposed to the first letter in the word, the network is unsure what is to follow. But the identity of the first two phonemes is usually sufficient to enable the network to predict subsequent phonemes in the word with a high degree of confidence (see Ellis 1997 for details). The error is statistical (but not categorical) in relation to co-occurrence. The criteria for boundaries are relative, which could lead to the misidentification of common sequences that incorporate more than one word but co-occur frequently enough to be treated as a quasi-unit.

This behavior is similar to child language acquisition process, where children are likely to produce formulaic phrases as prefabricated or fixed patterns (Elman 1990: 192-193). The computer simulation reveals that there is information in the signal that could serve as a cue to the boundaries of linguistic units which must be learned, and it demonstrates the ability of simple recurrent networks to extract this information (Elman 1990: 193).

One of the interesting issues in the simple recurrent network is related to Baker's paradox (Baker 1979, Pinker 1989): the learnability problem is that "children acquire L1 (first language) eventually despite so little evidence available to them." The paradox illustrates that L1 children do not appear to receive direct negative evidence, but they may receive indirect negative evidence, which means the absence of a form in the input which would be predicted by a learner's current grammar and signals to the learner/learning device that the form in question might not be correct (Chomsky 1981: 8, Schachter 1991: 92, Sharwood Smith 1991: 123, 1994: 203, Plough 1995: 89). In addition, innate knowledge may narrow what can be learned (see Elman 1993: 73-74). Elman (1993: 74) provides the third explanation of the learnability problem: "L1 children are themselves undergoing significant developmental changes during precisely the same time that they are learning language." That is, when children may make covert predictions about the speech they will hear from others, failed predictions constitute an indirect source of negative evidence which could be used to refine and retract the scope of generalization (Elman 1991: 201). The simple recurrent network actually makes the wrong generalizations in the course of learning, when the network predicts the subsequent word. The increase of input data, however, makes the network modify the previous predication when the hidden unit activation patterns are propagated back at every time step to provide an additional input (see Figure 1). It follows that the network in itself is able to restrict the range of generalizations (i.e., learn what should not be correct) without any explicit information on the structure provided (see Elman 1991: 201).

The network has the typical connections from input units to hidden units, and from hidden units to output units, as demonstrated in Figure 1. There are an additional set of units, called context units, which provide for limited recurrence (Elman 1991: 199). The context units are activated on a one-for-one basis by the hidden units with a fixed weight of 1.0, and have linear activation functions. The results show that at each time cycle, the hidden unit activations are copied into the context units. On the next cycle, the context combines with the new input to activate the hidden units, which take on the job of mapping new inputs and prior states to the output. Thus, the network improves its accuracy with experience (see Ellis 1997). The network is simple in the sense that the error derivatives are propagated only one time step back into the past, and this does not prevent the network from storing information in the distant past but learning longer distance temporal dependencies may be difficult (Elman et al. 1998: 80-81).

Figure 1: Architecture of the simple recurrent network (Elman 1991: 200, 1993: 76)



The cohort model of word recognition, developed originally by Marslen-Wilson and Welsh (1978), explains that the spoken word recognition may be achieved quickly by only a minimal amount of acoustic-phonetic information owing to the word-initial cohort, before the final syllable of a word is heard. Hence, it predicts the time course and consists of two stages. Suppose the following sentence with the initial phonetic stimulus */sta-/* (Marslen-Wilson and Tyler 1981):

John was trying to get some bottles down from the top shelf.
To reach them he had to sta-....

Spoken word recognition starts with the generation of the cohort. The acoustic-phonetic information at the beginning of a target word activates all words in memory that resemble it in the first stage. The cohort members may be *stamina, statue, standard, stagger, stag, stand, stack*, etc. At the second stage, the elimination takes place in one of two ways — either by more phonetic information coming in or by the context of a sentence (i.e., syntactic or semantic information): all possible sources of information (phonetic or contextual) may narrow the selection of the target word from the cohort. Syntactic information may be employed to eliminate other than verbs (*stamina, statue, standard*), and semantic information may exclude the choice of words that are irrelevant to the action of getting something down from the shelf (*stagger, stag*). Finally, a single candidate (*stack*) remains in the cohort by eliminating *stand*, when the subsequent phonetic input is /k/. Accordingly, the cohort model is interactive, since it incorporates the joint operation of multiple sources of information, including both bottom-up and top-down information (Yeni-Komshian 1998: 143). The model is also mediated, categorical, on-line, parallel, and contextually dependent to some extent: "[w]ord recognition is mediated by phoneme recognition, phonemes are recognized on-line categorically, words are accessed in parallel, and the word alternative finally recognized can be influenced by context" (Massaro 1994: 243-244).

It can be argued, however, that people can recognize auditory input even if it is mispronounced, or if a sound such as a cough blocks out part of the stimulus. The original model could not guarantee a correct selection of the target word if the initial cohort was inappropriate. Hence, the revised version of the cohort model (Marslen-Wilson 1987) posits that the word-initial cohort for a word is assumed to contain words that have phonetically similar initial phonemes, thereby loosening the constraints on cohort membership (see Lively et al. 1994: 285).

The recognition process breaks down into three basic functions: (1) access (i.e., the mapping of the speech input onto the representations of lexical form), (2) selection (i.e., the discrimination of the best-fitting match to this input), and (3) integration (i.e., the mapping of syntactic and semantic information at the lexical level onto higher processing levels). In particular, the revised version assumes that multiple sources of information, such as word frequency effects as well as acoustic-phonetic input and the syntactic/semantic context, may impinge on the selection mechanism in the process. Early in the word, high-frequency words will be stronger candidates than low-frequency words, just because the relative activation level of the former will be higher (Marslen-Wilson 1987: 93). Thus, Marslen-

Wilson (1990) in the recent model adds continuous activation functions to the model. Note that the cohort model is concerned with auditory or spoken word recognition, but I assume that it may extend to visual recognition.

In the process of chunking, learners are assumed to associate orthographic signal with the form and the meaning of the word. Both syntactic and semantic analyses include anaphoric and cataphoric processing in that the recognition of the current vocabulary relies on both previous and subsequent information on syntactic and semantic levels. Thus, the current research examines how Japanese EFL (English as a Foreign Language) learners will chunk word sequences.

2. The Study

2.1. Research Questions

The following two research questions are posed in this study.

Research Question (1): Which will be more related to chunking (i.e., word-recognition) abilities, cloze or reading comprehension abilities?

Research Question (2): Which type of error will occur more frequently, overshooting or undershooting errors?

Research Question (3): What kind of chunking patterns will be revealed?

2.2. Subjects

A total of 47 Japanese EFL learners participated in this research. They were all first-year university students. A chunking test was administered to the subjects (see Appendix 1). They were asked to chunk letter strings into meaningful words by inserting slashes. The average length of time spent on the chunking test was 12.06 minutes. One week afterwards, the cloze/reading comprehension tests were given during the same class period (see Appendix 2). The tests took 20 minutes.

2.3. Test Items

Unit 20 ("Teens & Tabacco") was used for the chunking test and cloze/reading comprehension tests (Terauchi et al. 1997: 84-85). The full mark of the chunking test was 190 points. When the subject marked the boundary between words correctly, one point was given. Four phrases such as '*Lloyd D. Johnson, M.D.*,' '*Leslie*,' '*Saint George Island, Arkansas*,' and '*emphysema*' were deleted from the analyses. The first three words were personal nouns, and the final one was a new word for the subjects.

The tests consisted of the cloze test and the reading comprehension test. The full marks of the cloze test and the reading comprehension test were 6 and 4 points, respectively. On the cloze test, the learners were required to write down an appropriate word that fits the context. The model answers were ① clueless, ② risk, ③ smoking, ④ number, ⑤ thing, and ⑥ smoker. On the reading comprehension test, they responded to the four comprehension questions regarding the contents of the text.

Specifically, two types of grammatical features were targeted at in analyzing overshooting and undershooting errors.: (1) nominals and (2) verbals. The former includes nouns and pronouns, and the latter includes verbs, past tenses, present and past participles, and auxiliary verbs. The number of nominals examined was 56 items, and the number of verbals was 42. As for the scoring method, in the case of errors such as *'*argument/shave*' (correct response: *arguments/have*), I counted one point for overshooting errors and another point for undershooting errors.

In order to discover chunking patterns that the subjects prefer, the following five words were selected in nominals and verbals, respectively. They were among the most difficult words to chunk:
[Nominals] *investigators, weakening, packages, advertisements, them*
[verbals] *boxed, quitting, causes, gotten, notice*

2.4. Data Analysis

The alpha level was set at α=.05. The Pearson product-moment correlation, the Wilcoxon signed-ranked test, and a χ^2 test were used for data analysis.

3. Results

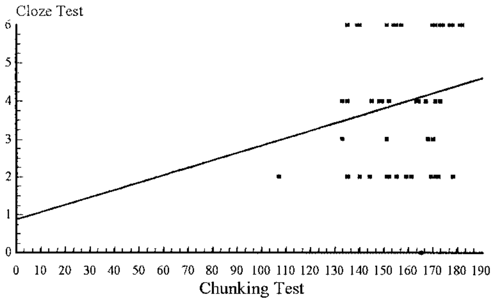
Table 1 shows the means and standard deviations of the chunking and cloze tests. Figure 2 shows the correlation between the two tests. The Pearson product-moment correlation was r =.18. It was not statistically significant ($F_{(1,45)}$=1.51, ns). The coefficient of determination (r^2) was only 3%. Thus, no relationship was found between chunking and cloze tests.

Table 1: Means and standard deviations of chunking and cloze tests

	chunking	cloze
Mean	157.45	3.96
SD	15.94	1.72

$r=.18$, $r^2=.03$

Figure 2: Correlation between chunking and cloze tests



NB: The regression line was drawn over a scatterplot of the two variables.

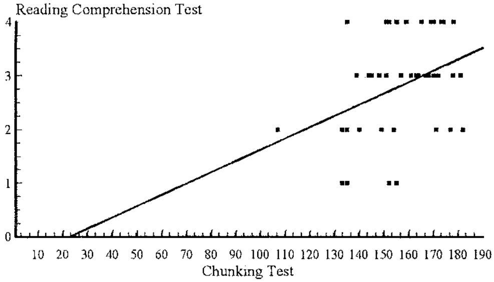
Table 2 shows the means and standard deviations of the chunking and reading comprehension tests. Figure 3 shows the correlation between the two tests. The Pearson product-moment correlation was $r=.35$. It was statistically significant ($F_{(1,45)}=6.28$, $p<.05$). The coefficient of determination (r^2) was 12%. Therefore, there was a small relationship between chunking and reading comprehension abilities.

Table 2: Means and standard deviations of chunking and reading comprehension tests

	chunking	reading comprehension
Mean	157.45	2.83
SD	15.94	0.96

$r=.35$, $r^2=.12$

Figure 3: Correlation between chunking and reading comprehension tests



NB: The regression line was drawn over a scatterplot of the two variables.

Table 3 shows the numbers of overshooting and undershooting errors in nominals and verbals.

Table 3: Numbers of overshooting and undershooting errors in nominals and verbals

Subject No.	Nouns		Verbs	
	Overshooting errors	Undershooting errors	Overshooting errors	Undershooting errors
1	13	11	11	10
2	7	3	6	5
3	4	3	3	4
4	3	0	0	2
5	11	6	13	3
6	3	1	4	2
7	6	1	5	4
8	4	1	5	2
9	6	1	2	2
10	6	1	1	3
11	6	7	2	1
12	1	3	0	2
13	4	3	1	5
14	3	5	2	2
15	3	5	1	5
16	11	5	6	1
17	9	8	4	4
18	3	8	3	0

Table 3 (continued)

19	3	1	1	3
20	9	10	1	11
21	8	5	5	3
22	6	5	9	1
23	15	7	6	1
24	4	3	1	4
25	12	2	11	2
26	5	4	8	2
27	9	7	11	7
28	6	2	2	2
29	17	6	13	0
30	8	15	9	4
31	15	5	15	1
32	3	4	1	3
33	3	0	0	3
34	11	3	6	0
35	9	4	3	5
36	11	8	5	3
37	10	2	4	3
38	4	6	6	6
39	13	2	8	1
40	8	0	2	3
41	12	7	9	3
42	2	1	0	2
43	7	4	4	4
44	8	2	3	3
45	4	7	6	3
46	9	4	7	2
47	13	2	9	4

As shown in Tables 4 and 5, the Wilcoxon signed-rank test revealed that overshooting errors were more frequent than undershooting ones in both nominals and verbals, respectively.

Table 4: Wilcoxon signed-rank test of nominals

	Number	Sum of ranks
Negative (−)	10	166
Positive (+)	37	962
None	0	

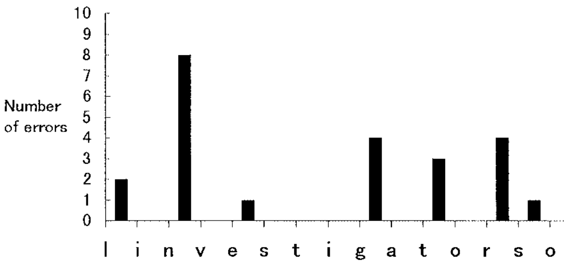
z = −4.21, N (sample size) =47, p<.0001, 2-tailed

Table 5: Wilcoxon signed-rank test of verbs

	Number	Sum of ranks
Negative (−)	14	221
Positive (+)	26	599
None	7	
	z = −2.54, N (sample size) =40, p=.0111, 2−tailed	

Figure 4 show the error patterns in nominals. Five items are examined here.

Figure 4: Error patterns in nominals
(a) *investigators*

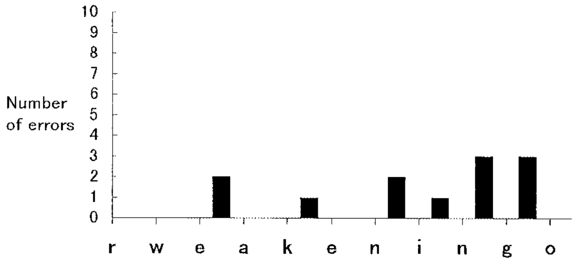


When there was no boundary marked after '*investigators*,' one error was counted. I analyzed the differences of chunking patterns within the target word. One sample goodness of fit test shows that chunking letter strings into prepositions such as '*in*'/'*at*'/'*or*' was the learners' favorite patterns compared to other chunks (χ^2=5, df=1, p=.025), as shown in Table 6.

Table 6: Error frequency of the word '*investigators*'

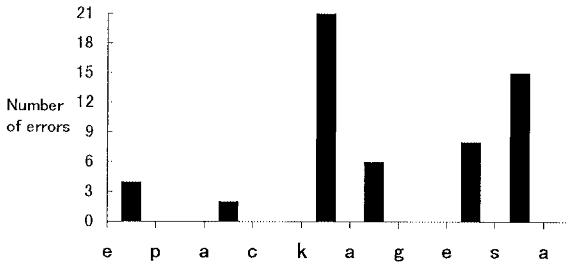
	Error frequency	
in/at/or	15	(=8+4+3)
other chunks	5	(=1+4)
	χ^2=5, df=1, p=.025	

(b) *weakening*



In the word *weakening*, the number of each behavior was too small to analyze the differences.

(c) *packages*



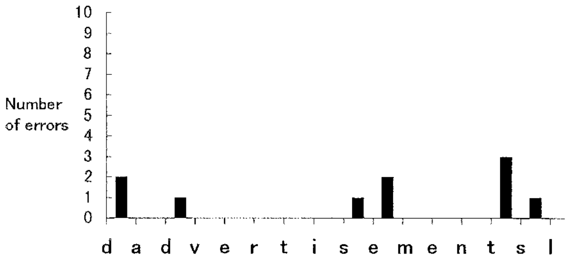
The differences of error frequencies were statistically significant (χ^2 =11.37, df=2, p=.0034), as demonstrated in Table 7. A Ryan's procedure reveals that the error '*pack*' was more frequent than '*age*' and '*a*' but there was no statistical difference between '*age*' and '*a*.' This result shows that the subjects recognized the word '*pack*' almost unconsciously.

Table 7: Error frequency of the word '*packages*'

	Error frequency
pack	21
age	8
a	6

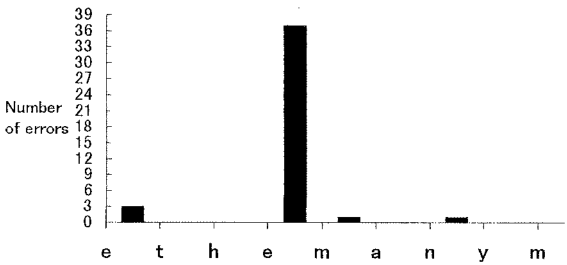
χ^2 =11.37, df=2, p=.0034

(d) *advertisements*



In the word *advertisements*, the number of each response was too small to analyze the differences.

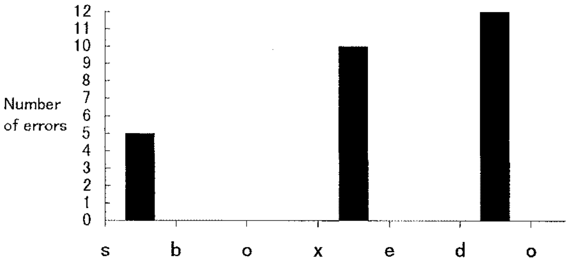
(e) *them*



Thirty-seven subjects (78.7%) out of 47 chose the word '*the+many*' incorrectly.

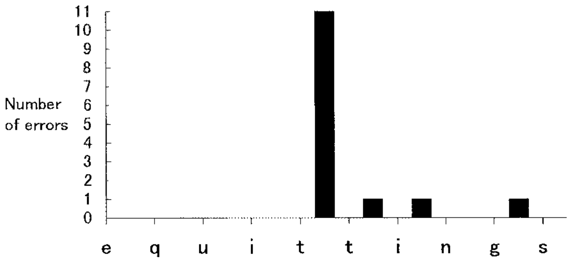
Figure 5 displays the error patterns in verbals. Five items are examined here.

Figure 5: Error patterns in verbals
(a) *boxed*



10 subjects (21.3%) out of 47 chose the word 'box' incorrectly.

(b) *quitting*

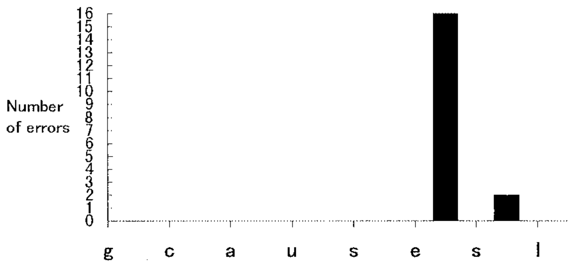


One sample goodness of fit test shows that the difference was statistically significant (χ^2=6.23, df=1, p=.013) (see Table 8). Chunking letter strings into the stem ('*quit*') was more favored.

Table 8: Error frequency of the word '*quitting*'

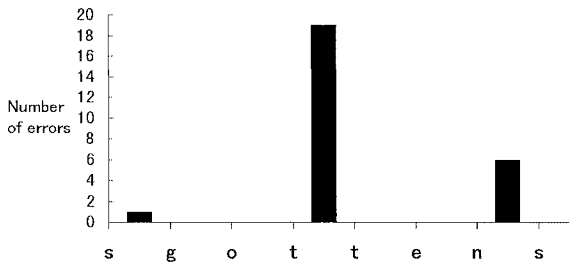
	Error frequency
quit	11
other chunks	2 (=1+1)
	χ^2=6.23, df=1, p=.013

(c) *causes*



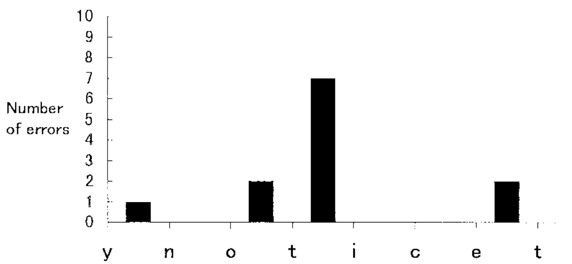
16 subjects (34.0%) of 47 chose the word '*cause*' incorrectly.

(d) *gotten*



19 subjects (40.4%) of 47 chose the word '*got*' incorrectly.

(e) *notice*



One sample goodness of fit test shows that there was a trend toward statistical significance (χ^2=2.78, df=1, p=.096), as shown in Table 9. Chunking letter strings into '*not* + ...' was more favored than '*no* +... .'

Table 9: Error frequency of the word '*notice*'

	Error frequency
not+ ···	7
no + ···	2
	χ^2=2.78, df=1, p=.096

4. Discussion

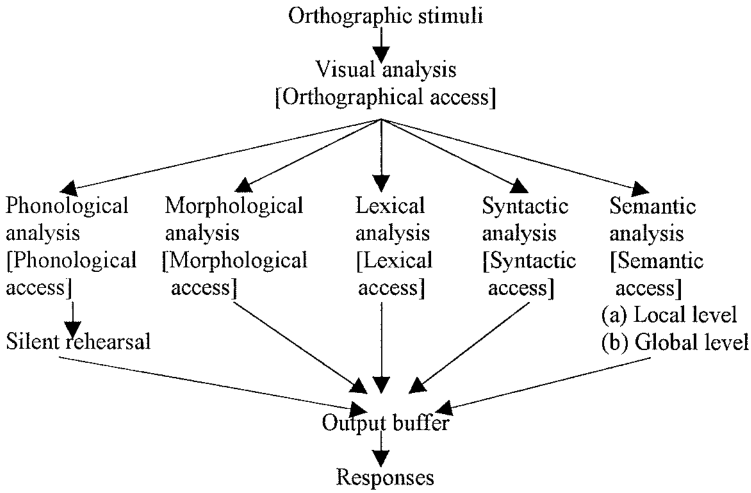
In this research, the following results were obtained:

(1) There was no relation found between chunking and cloze abilities, but a small correlation was discovered between chunking and reading comprehension abilities. That is, the ability of chunking letter strings into words is more related to reading comprehension abilities than cloze ones.

Such integrative tests as cloze tests may require learners to tap global proficiency. "Integrative tests lump many elements and possibly several components, aspects and skills together and test them all at the same time" (Oller 1979 :70). The cloze procedure is a good measure of overall proficiency, although its limitation is that it is not a sensitive measure of short-term gains (Madsen 1983: 47 & 52). In addition, the cloze tests require the utilization of discourse level constraints as well as structural constraints within sentences (Oller 1979: 347). Previous research found that correlations between cloze scores and multiple-choice reading comprehension tests are consistently strong, usually between .6 and .7 and sometimes higher (Oller 1979: 357). The current research, however, discovered that chunking was more correlated with reading comprehension by question-answering than with clozing.

This finding asserts that the subcomponents of reading comprehension are tied to those of chunking. In chunking, learners may group each orthographic signal that they have visualized into words by relying mainly on syntactic, morphological, and semantic knowledge. According to Taft and Forster (1975: 643), visual word recognition starts with a morphological analysis of words prior to lexical search. Both syntactic and semantic analyses include anaphoric and cataphoric processing in that the recognition of the current vocabulary depends on both previous and subsequent information on syntactic and semantic levels. Semantic analysis contains both local and global levels. A local level refers to the analysis within words, whereas a global level goes beyond words and deals with the semantic analysis on phrasal, sentential, and discoursal levels. Furthermore, phonological analysis is also carried out as a silent rehearsal when learners try to understand the passage. This phenomenon is called 'internal speech.' By so doing, lexical analysis is achieved, confirming or disconfirming learners' initial hypothesis. The following diagram is proposed here (Figure 6).

Figure 6: A schematic diagram of the chunking process.



Following Marshall and Newcombe (1981), Stillings et al. (1995: 307-311) proposed the symbolic model of reading, which contains two parallel information-processing routes of reading individual words. One route is based on the lexical route, and the other on the phonological route. In the lexical route, words are parsed in the early stages to identify the base root of a word and affix. In the phonological route, letters are grouped together into syllabic units, which are then converted to the proper phonemes. The two routes are assumed to operate in parallel (see Stillings et al. 1995: 307-308 for the details).

In reading comprehension, it seems that after learners make visual analysis, semantic analysis is often activated along with a syntactic one. In this process, internal phonological processing continues.

Unlike chunking, reading comprehension seems not to put a weight on morphological and lexical analyses. The processes of chunking and reading comprehension are somehow overlapped.
(2) Overshooting errors were more frequent than undershooting errors in both nominals and verbals, respectively.

The learners tended to segment letter strings globally rather than locally. It seems that they failed to understand the meanings of the undershooted words more frequently than those of overshooted ones. In the case of undershooting errors, a previously determined chunking response may have a negative effect on the selection of the following chunked words (e.g., *we→akening* in *weakening*). This kind of double and dependent phenomenon may lead to a relatively lower frequency of undershooting errors. On the contrary, in the case of overshooting errors, which contain the stems, learners are likely to grasp the main meanings of the message but morphological or word-combinational errors may occur more often. Global processing such as overshooting plays a role in absorbing non-recognition or the remnants of previous errors into overshooted words.
(3) The results of error patterns in nominals show that the subjects preferred chunking letter strings into prepositions (*'in'*/*'at'*/*'or'*) in the case of the word *investigators*. They found it easy to detect the stem (i.e., *pack*) regarding the word *packages*. In the case of the word *them+any*, a majority of learners mistakenly recognized the word combination *'the+many.'* They failed to understand anaphoric relation: *them* refers to *the warnings*. They tended to perceive a smaller unit such as *the* rather than *them* unconsciously in this case, presumably because the definite article is one of the most high-frequency words.

When it comes to verbals, a noun (*box*) was the most frequent type selected by the learners, as compared to a verb (*boxed*). The stem (*quit*, *cause*, *got*) was also the most favorite pattern for the subjects. They did not pay attention to the third person singular *-s* or past participle *-ed/-en*. Chunking letter strings into a smaller unit was easy for them to process, and they are not likely to follow discourse development. The results pedagogically suggest that learners should raise their consciousness to affixes and discourse development in the teaching of reading/vocabulary so as to comprehend text/word more correctly.

5. Conclusion

The current research revealed the following findings:
(1) The ability of chunking letter strings into words was more related to reading comprehension abilities than cloze ones. This result

suggests that the subcomponents of reading comprehension are more tied to those of chunking.

(2) The learners produced more overshooting than undershooting errors in both nominals and verbals, respectively. It seems that they failed to understand the meanings of the undershooted words more frequently than those of overshooted ones.

(3) It was easy for the learners to detect stems in both nominals and verbals. Furthermore, they failed to understand anaphoric relations.

Stems and affixes are processed independently in word recognition (Taft and Forster 1975). The reason may be that in a mental dictionary it is economical to store the stem for a number of different words just once (e.g., *mit* for sub*mit* and trans*mit*) (Taft and Forster 1975: 645). For instance, the ERP (Event-Related Potential) results by Münte et al. (1999) suggest that regular (but not irregular) past tense forms may be decomposed into stem plus affix. This topic deserves future research to examine brain activity using ERP, PET (Positron Emission Tomography), f-MRI (functional Magnetic Resonance Imaging), MEG (Magnetoencephalography), and NIRS (near-infrared spectroscopic topography).

This research did not take into account the potential relations between phonological, morphological, syntactic, semantic, and lexical analyses (see Figure 6 on page 14). Each modular may be (a) serial, (b) parallel, or (c) ranked parallel in nature (see Fodor 1990). Hence, I will need to investigate whether EFL learners may pass through three phases in visual/spoken word recognition, in particular, the initial phrase structure assignment (first phase) → thematic role assignment (second phase) → structural reanalysis (third phase) (Friederici 1995, Gunter et al. 1997). During the first phase, the parser incrementally assigns the initial syntactic structure on the basis of word category information only. During the second phase, lexically bound information other than word category information is processed. During the third phase, lexical-semantic and syntactic information is mapped onto each other. In case of an unsuccessful match, a reanalysis or repair becomes necessary (Hahne and Friederici 1999: 195).

The current experiment only dealt with word-level chunking, but not with sentence-level chunking, i.e., chunking letters into each sentence, for instance, by pushing double slashes (//) between sentences. Word-level chunking requires learners to recognize visual patterns of each word, so that it is not always necessary to take contexts into account (Yamauchi 1997). Further research should investigate sentence-level chunking abilities. Another issue may be to examine whether the positions of the stem may elicit chunking differences ('prefix+stem' or 'stem+suffix').

Note

I would like to thank Prof. Leon Richards for his insightful comments on earlier versions of this study.

Appendix 1: Chunking Test

・単語の間を /(斜線)で区切りなさい。
・赤色のボールペンで解答しなさい。
・あまり深く考えず、最初から順番に解答し、後戻りしたり、とばしたりしてはいけません。
・単語は全て小文字に直してあり、ピリオド(.)・カンマ(,)・クエスチョンマーク(?)・アポストロフィー(')・ハイフン(-)・ダッシュ (–)・クォーテーションマーク (" ") は、省略してあります。

[Put slashes (/) between meaningful words in red ball-point pens, starting with the first letter. Do not go back to your previous responses. All words are converted into small letters, and periods (.), commas(,), question marks (?), apostrophes ('), hyphens (-) , dashes (–), and quotation marks (" ") are omitted here.]

whathassparkedtheteenagesmokingepidemiccouldteen
sactuallybecluelessaboutthedangersofsmokingyessayi
nvestigatorsnotingthatonlyhalfofalleighthgradersbeli
evethatsmokersrunagreatriskofharmingthemselvesbys
mokingapackormoredailyandaccordingtolloyddjohnst
onmdprincipalinvestigatorsoftheuniversityofmichiga
nstudytherehasbeenaclearweakeningofpeernormsagai
nstsmokingwhilemostteensstilldisapproveofregularsm
okingthatnumberhasbeendecliningsteadilysincetheear
ly90siknowitisnotthegreatestthingicouldbedoingsaysl
esliea14yearoldpackadaysmokerfromsaintgeorgeislan
darkansasbuttherearealotworsethingsicouldbedoingto
obesideslesliea ddsilikesmokingiloveitandmostofmyfr
iendssmokewhataboutthosesurgeongeneralwarningsbo

xedoncigarettepackagesandadvertisementslikequittin
gsmokingnowgreatlyreducesseriousriskstoyourhealth
orsmokingcauseslungcancerheartdiseaseemphysemaan
dmaycomplicatepregnancyhaslesliee venreadthemsurei
havereadthewarningssayslesliebutithasgottensoidonot
reallynoticethemanymore

所要時間: (　)分 (　)秒
time spent　minutes　seconds

(cf. Terauchi et al. 1997: 84-85)

Appendix 2: Cloze and Reading comprehension Tests

次の英文を読んで、下記の問いに答えなさい。

What has sparked the teenage smoking epidemic? Could teens actually be (①) about the dangers of smoking? Yes, say investigators, noting that only half of all eighth-graders believe that smokers run a great (②) of harming themselves by smoking a pack or more daily. And, according to Lloyd D. Johnston, M.D., principal investigators of the University of Michigan study, "There has been a clear weakening of peer norms against (③)." While most teens still disapprove of regular smoking, that (④) has been declining steadily since the early '90s.

"I know it's not the greatest (⑤) I could be doing," says Leslie, a 14-year-old, pack-a-day (⑥) from Saint George Island, Arkansas. "But there are a lot worse things I could be doing too. Besides," Leslie adds, "I like smoking. I love it. And most of my friends smoke."

What about those Surgeon General warnings boxed on cigarette packages and advertisements? Like QUITTING SMOKING NOW GREATLY REDUCES SERIOUS RISKS TO YOUR HEALTH. Or SMOKING CAUSES LUNG CANCER, HEART DISEASE, EMPHYSEMA, AND MAY COMPLICATE PREGNANCY. Has Leslie even read them? "Sure, I've read the warnings," says Leslie, "but it's gotten so I don't really notice them anymore."

Like many teens, Leslie is addicted to cigarettes. Part of the addiction is psychological. They associate smoking with fun activities such as going to parties or hanging out with friends. Many teens claim that smoking makes them feel more alert. Others claim it's like taking a chill pill; it helps relax them when they're bored or stressed.

But the addiction is more than psychological. It's physical. The nicotine in tobacco products is a powerful drug that affects the brain and central nervous system. It can stimulate nerve cells, causing the smoker to feel hyped up or relaxed, depending on the dosage and factors, such as the smoker's metabolism and the time of day. The first time someone smokes he or she may cough and become dizzy and nauseous. But repeated use leads to tolerance. This means that a person can become accustomed to a certain amount of nicotine in his or her bloodstream — and need more and more nicotine in order to maintain that effect! That's how a person goes from smoking a couple of cigarettes a day to smoking a pack or more. If the nicotine concentration in a smoker's blood drops below a certain point, a smoker may experience symptoms of withdrawal, including a craving for tobacco, headaches, light-headedness, discomfort, irritability, anxiety and tremors. To avoid such symptoms, smokers keep smoking.

(Terauchi et al. 1997: 84-85)

(1) 括弧内に適切な語を書きなさい。

(2) 英語で答えなさい。

1. What kind of daily activities is teenage smoking similar to?
2. What kind of psychological effects does smoking have?
3. What does nicotine affect in the body?
4. What will happen if a person gets used to a certain amount of nicotine in the bloodstream by smoking repeatedly?

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