A Study of Dichotic Listening Using the TOEIC Listening Test

Myung-Sook Lee* · Kyung-Whan Cha**

ABSTRACT

The purpose of this research was to investigate dichotic listening, that is, whether the left and right ears have different functionalities in actual listening. Unlike previous studies, which used short words or a list of two or three numbers, these researchers investigated more comprehensive listening ability using the Toeic listening test. Sixty-three university students participated in this study. The subjects took three tests in total: one using only the right ear, another using the left ear, and the third using both. T-analysis of SPSS on the data revealed that there is a significant difference between the test results with only the right or left ear and the ones with both ears. So we cannot find right-ear priority in this study. We can see that in comprehensive listening, right hemisphere plays an important role as well as left hemisphere. When grouped according to language ability, test result of low group is the same as the total test result. However, in high group there is no significant difference between the test results with left ear and the results with both ears in high group. In mid group there is no significant difference between the test results with right ear and the results with both ears. The different functionalities of left and right ears and suggestions for future research are presented.

Keywords: dichotic listening, lateralization

1. Introduction

The notion that the two ears (cerebral hemispheres) have different functions has a long history (Bryden, 1982). Recently an article in *Science* magazine (Gordon, 2004) and Hugdahl et al. (2001)'s paper also showed that our right and left ears have different faculties. So far much data on functional localization of the ear or brain have come from studies of people with head injuries, stroke, or brain tumor, who learned English as their mother tongue. The researchers wanted to discover whether the ears of healthy normal people showed different functionalities in the

* Sun Moon Institute for Language Education, Sun Moon University

** Dept. of English Education, Chung-Ang University

context of using English as a foreign language. These researchers investigated more comprehensive listening ability using the TOEIC listening test, whereas many previous studies used short words or a list of two or three numbers.

The purpose of this paper is to investigate dichotic listening, i.e., whether the left and right ears have different functionalities in listening to English as a foreign language. To investigate this, we utilized the TOEIC listening test. Sixty-three university students, taking a course entitled "English Listening Practice" at Chung-Ang University in Seoul, Korea, participated in this study during the fall semester of 2004. The instrument used in the study was a set of the Oxford Practice Tests for the TOEIC Test 1 developed by Oxford University Press in 2002. The purpose was not to test the subjects' English language ability, but to test the different functions of the two ears. The researchers used the first two parts of the TOEIC listening test: Part I which consists of 20 questions utilizing pictures, and part II using questions and responses (30 questions), which were rather short and easy to test. The subjects took three tests in total: using only the right ear, another using the left ear, and the third using both ears. At each test, we utilized different test forms of Oxford Practice Test. They used an earplug manufactured by 3M.

2. Studies of dichotic listening

At a simple level, the left hemisphere can be viewed as concerned with speech and language, whereas the right hemisphere is concerned with nonverbal skill. The left hemisphere is often described as analytic or concerned with sequential processing, whereas the right hemisphere is considered to be concerned with the integration of information over space and time, a holistic or Gestalt processor. Both the clinical and the experimental literature point toward the conclusion that the two cerebral hemispheres have very different functions (Bryden, 1982).

At first time, the dichotic procedure involved the presentation of short lists of numbers, arranged in such a way that some came to the left ear, while others arrived simultaneously at the right ear. Thus, a subject might hear the list "7-9-1" at the left ear, and "8-3-4" at the right ear. Kimura (1967) found that normal subjects showed a significant right-ear superiority in recall accuracy. Kimura's model on dichotic performance proposed that information ascending to the brain along the ipsilateral auditory pathways was blocked or occluded by competing information. Because of this occlusion, speech information would be at an advantage when it was presented to the right ear because it would be transmitted directly to the hemisphere

specialized for speech and language. On the other hand, left-ear information would be forced to the right hemisphere and then have to be passed transcallosally before it could be analyzed by the speech centers of the left hemisphere. Left-ear information would therefore take longer to reach the speech centers and/or be degraded by the longer transmission route. Kimura's model is shown in Figure 1.

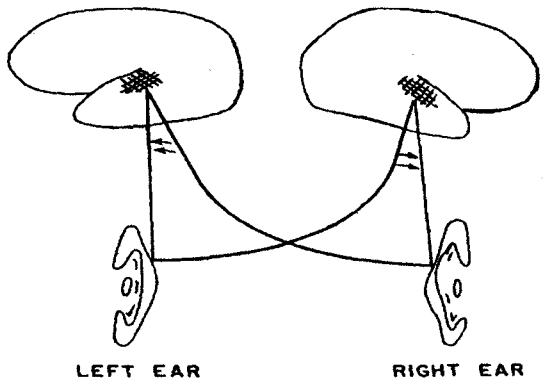

Figure 1. Kimura's model for asymmetries in dichotic listening

It is an easy job for most normal adults to remember three pairs of numbers, even in the novelty of the dichotic situation. So later dichotic experiments increased the difficulty of the task for normal subjects by increasing the amount of material to be recalled or by employing other types of verbal material to increase the size of the stimulus set. The right-ear advantage was also observed with various types of material, ranging from nonsense syllables (Curry & Rutherford, 1967) to meaningful words (Satz et al., 1967). These researchers wanted to see if the right ear priority would be observed with comprehensive listening material.

When the pairs of items are presented, most subjects spontaneously report all the items that arrive at one ear before giving any that come to the other ear. This strategy of reporting implies that items from the second ear will be at a distinct disadvantage; not only will they be reported later in time, but they will also be subject to more output interference than items from the other ear. The particular sequence in which the items are reported will influence which ones are correctly identified and will thereby influence not only the magnitude but also the direction of any left-right difference that is observed. Further, with the general instruction to "report all you can remember," subjects may choose to deploy their attention in a variety of different ways. Some will divide attention between the two ears; others will focus on one ear. The manner in which attention

is deployed will have an effect on the observed laterality effect (Bryden, 1982; Rost, 2002). There does seem to be a large body of evidence indicating that auditory laterality effects can be obtained in the absence of dichotic competition (Bryden, 1982). The researchers in the present study wanted to investigate whether this right ear advantage effect also applies to listening ability involved in solving problems. The monaural method, not dichotic method was more suitable to our study.

There were some limitations to our study. Primarily, most studies of dichotic listening used head-sets, not earplugs. Earplugs were used in this study, because of the number of subjects who took the test at the same time. Even though a language laboratory was available, it was too small to test all the students at the same time. If headsets had been used, we would have had greater control of the auditory stimuli and more accurate results.

3. Method

3.1 Subjects

Sixty-nine university students, taking a course entitled "English Listening Practice" at Chung-Ang University, participated in this study during the fall semester of 2004. Six students missed one of the three tests and their data were thrown out, leaving a total sample of 63. Of the 63 subjects, 50 were majoring in English Education, others in various subjects, such as psychology, education, French language and literature, and chemistry. The majority of the participants were freshmen (43), with 2 sophomores, 10 juniors, and 8 seniors.

3.2 Instrument

The instrument used in the study was Oxford Practice Tests for the TOEIC Test 1 published by Oxford University Press in 2002. First the researchers pre-tested 69 students taking "English Listening Practice." The researchers explained the format of the TOEIC Test before the pre-test. The purpose of this study was not to test the subjects' English language ability, but to test the different functionalities of the two ears. The first two parts of the TOEIC listening test were used: Part I which consists of 20 questions utilizing pictures and Part II using questions and responses (30 questions), which were rather short and easy items. The subjects took three tests in total: one with the right ear, another with the left ear, and the third with both ears. They used an earplug manufactured by 3M (See appendix 1 for their reliability.).

4. Results and discussion

The pre-test results were as follows. The mean score of the total 63 subjects is 37.5 which is rather high, for almost all the scores were above 25 out of 50. Subjects with lower scores have complicated impediments to listening comprehension. Many barrier factors affect their listening performance at the same time. So the subjects with middle or high scores are appropriate for this study, that is, the different functionalities of the two ears, or the different functions of the two hemispheres could be seen clearly. When the scores are divided into three groups, high, mid, and low, the mean scores are 44.7, 37.5, and 30.3 respectively. Figure 2 shows the distribution of the pre-test scores for all subjects.

Table 1. Pre-test results

Group	total	high	mid	low
Mean score	37.5	44.7	37.5	30.3

* Note: total score is 50 (part I = 20, part II = 30)

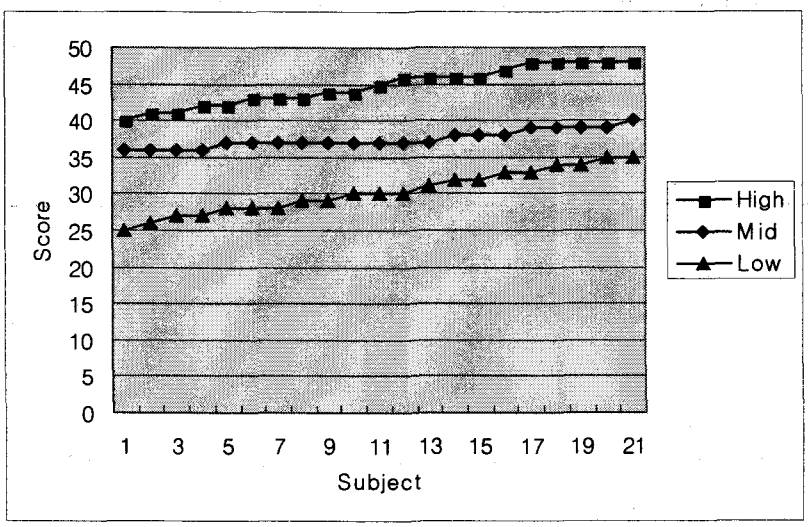

Figure 2. Pre-test scores for all subjects

The students took the test once a week for three weeks in the order of left ear, right ear, and both ears. The test results are as follows.

Table 2. The mean scores of three tests

	Left ear	Right ear	Both ears
Total	32.8	34.0	36.5
High	39.1	39.1	41.8
Mid	32.1	34.3	36.7
Low	27.2	28.6	30.9

The mean score of the test with both ears (36.5) is the highest of all three tests. The mean score of the test with the right ear (34.0) is second. When the test was taken with the left ear, the mean score was lowest (32.8). By group, the test results in the mid and low range are similar to the overall test results. However, in the high group the students received the same mean score in tests with the left ear and with the right ear, which means that there was no difference between the left and right ear results for the high group. However, when the same group took the test with both ears, the scores were higher.

The t-test result shows that there is no significant difference between the test results with the left ear and those with the right ear. However, there is a significant difference between results with the right ear and those with both ears, the results with the left ear and those with both ears (Table 3).

Table 3. The t-test result

		Paired Differences				t	df	Sig. (2-tailed)
		Mean	Std. Deviation	99% Confidence Interval of the Difference				
				Lower	Upper			
Pair1	Left-Right ear	-1.22	5.89	-2.71	.26	-1.65	62	.105
Pair2	Left-Both ear	-3.67	5.84	-5.14	-2.20	-4.99	62	.000*
Pair3	Right-Both ear	-2.44	5.19	-3.75	-1.14	-3.74	62	.000*

*$p<0.05$

Unlike previous studies which show right ear priority, in this study we cannot find any significant difference between the test results with left ear and those with the right ear. This is because to solve problems students use mechanisms located in the right hemisphere, which are considered to be concerned with the integration of information over space and time, a holistic or Gestalt processor (Seliger, 1982) as well as those of left hemisphere. Other studies which used short words or a list of two or three numbers in their dichotic listening tests showed right ear priority, whereas in this comprehensive listening ability right hemisphere might play an important role. The researchers will discuss it more in detail next section.

According to the t-test result for each group, there is also no significant difference between the test results with the right ear and those with the left ear for all groups-

Table 4. The t-test result for the high group

		Paired Differences				t	df	Sig. (2-tailed)
		Mean	Std. Deviation	99% Confidence Interval of the Difference				
				Lower	Upper			
Pair1	Left-Right ear	.00	5.12	-3.18	3.18	.00	20	1.000
Pair2	Left-Both ear	-2.71	6.39	-6.68	1.25	-1.95	20	.066
Pair3	Right-Both ear	-2.71	4.93	-5.78	.35	-2.52	20	.020*

*$p<0.05$

In fact, in the high group there is no significant difference between the test results with left ear and the results with both ears. However, there is a significant difference between the test results with the right ear and those with both ears (Table 4). It means that we can get the same test results when students use left ear (right hemisphere) or when they use both ears (both hemispheres). We might say that high group students are good at subjugating the individual parts that make up an entity to the whole. That is, high group students might be good at using mechanisms of right hemisphere. Again we can see right hemisphere plays an important role in comprehensive listening.

Table 5. The t-test result for the mid group

		Paired Differences				t	df	Sig. (2-tailed)
		Mean	Std. Deviation	99% Confidence Interval of the Difference				
				Lower	Upper			
Pair1	Left-Right ear	-2.24	7.32	-6.79	2.31	-1.40	20	.177
Pair2	Left-Both ear	-4.57	6.10	-8.36	-.78	-3.43	20	.003*
Pair3	Right-Both ear	-2.33	6.32	-6.26	1.59	-1.69	20	.107

*$p<0.05$

In the middle group, there is a significant difference between the test results with left ear and those with both ears. However, there is no significant difference between the test results with the right ear and the results with both ears (Table 5). In this group, students might be more dependent on left hemisphere than right hemisphere in solving problems. In other words they might be poorer at using mechanisms of right hemisphere than high group students. These two t-test results showed that high group students, who are more right hemisphere-oriented, got a higher score in comprehensive listening. However, this needs to be studied more. In the low group there is a significant difference between the test results with the right ear and both ears, and between the test results with the left ear and both ears (Table 6). In this group, the test result is the same as the total test result.

Table 6. The t-test result for the low group

		Paired Differences				t	df	Sig. (2-tailed)
		Mean	Std. Deviation	99% Confidence Interval of the Difference				
				Lower	Upper			
Pair1	Left-Right ear	-1.43	5.00	-4.53	1.67	-1.31	20	.205
Pair2	Left-Both ear	-3.71	5.08	-6.87	-.56	-3.35	20	.003*
Pair3	Right-Both ear	-2.29	4.37	-5.00	.43	-2.40	20	.026*

*$p<0.05$

In short, there is no significant difference overall between the test results with the right ear and the results with the left ear. However, there is a significant difference between the test results with the right ear and those with both ears, and between the test results with the left ear and the results with both ears. From the above the t-test results, it may be summarized that using mechanisms of right hemisphere is very important in comprehensive listening.

5. Discussion and Conclusion

So far, almost all studies of dichotic listening come from first-language research. However, the subjects of this study are students who are learning English as a foreign language. The researchers wanted to know whether the right ear priority also applies to foreign language learners This study is also different from previous studies in that comprehensive listening ability is tested rather than the ability to memorize short words or a list of two or three numbers.

Previous studies used short words or a list of two or three numbers in their dichotic listening tests. So the test results show right ear priority (left hemisphere priority). However, in this study the researchers investigated a comprehensive listening ability, using TOEIC listening items. The right hemisphere is generally considered to be concerned with the integration of information over space and time, a holistic or Gestalt processor, while the left hemisphere is often described as analytic or concerned with sequential processing (Seliger, 1982). That is, the learner subjugates the individual parts that make up an entity to the whole. The learner perceives the whole pattern as a gestalt rather than as the elements that constitute it. Learners attend to the input and, using mechanisms located in the right hemisphere, identify a number of commonly occurring whole utterances in terms of the contexts in which they are used (Ellis, 1985). Therefore, as seen from this comprehension test, right hemisphere may play an important role in solving problems as well as left hemisphere.

In high group there is no significant difference between the test results with left ear and the results with both ears. On the other hand, in mid group there is no significant difference between the test results with right ear and the result with both ears. In the low group there is a meaningful difference between the test results with the right ear and both ears, and between the test results with the left ear and both ears. We might say that high group students are more right hemisphere-oriented. That is, right hemisphere plays an important role in comprehensive listening.

Next, according to the test results, people can hear better with both ears than with one ear. Kimura (1961a, b) contends that any unilateral lesion past the trapezoid body (where crossing of fibres takes place) which interrupts one half of the auditory system should decrease the input from the contralateral ear. Unilateral lesions of the brain-stem auditory system do in fact cause impairment in the recognition of words arriving at the contralateral ear. So people can listen better when using both ears than when using only one ear.

In conclusion, we cannot find right-ear advantage in this study which used comprehensive listening items and whose subjects are learning English as foreign language. That is, right hemisphere plays an important role as well as left hemisphere in comprehensive listening.

In future studies, the difference between right-handedness and left handedness, sex-related difference and the predominance of the right hemisphere in melodic-pattern (non-verbal) perception can be considered.

References

Bryden, M. P. 1982. *Laterality: Functional asymmetry of the intact brain.* Academic Press.

Curry, F. K. W. & Rutherford, D. R. 1967. Recognition and recall of dichotically presented verbal stimuli by right and left-handed persons. *Neuropsychologia*, 119-126.

Ellis, R. 1985. *Understanding second language acquisition.* Oxford University Press.

Gordon, S. 2004. Ears work in stereo before brain does-They respond differently to certain stimuli, baby study says. Retrieved from the World Wide Web: http://www.-healthday.com

Hugdahl K., Carlsson G. & Eichele T. 2001. Age effects in dichotic listening to consonant-vowel syllables: interactions with attention. *Developmental Neuropsychology*, 20(1), 445-457.

Kimura, D. 1961a. Some effects of temporal lobe damage on auditory perception, *Canada Journal Psychology*, 15, 156-165.

Kimura, D. 1961b. Cerebral dominance and the perception of verbal stimuli. *Canada Journal Psychology*, *15*, 166-171.

Kimura, D. 1967. Functional asymmetry of the brain in dichotic listening. *Cortex 3*, 163-178.

Rost, M. 2002. *Teaching and researching listening.* Longman.

Satz, P., Achenbach, K. & Fennell, E. 1967. Correlations between assessed manual laterality and predicted speech laterality in a normal population. *Neuropsychologia*, 5, 295-310.

Seliger, H. 1982. On the possible role of the right hemisphere in second language acquisition. *TESOL Quarterly*, 16, 307-314.

received: May 1, 2006
accepted: May 25, 2006

▲ Myung-Sook Lee, Ph.D.
Sun Moon Institute for Language Education, Sun-Moon University
#100, Kalsan-ri, Tangjeong-myeon, Asan-si, Chung Nam, 336-708, Korea
Tel: +82-41-530-2463 Fax: +82-41-530-2964
Email: leems70@sunmoon.ac.kr/ leems70@hanafos.com

▲ Kyung-Whan Cha, Ph.D
Department of English Education, Chung-Ang University
221, Heukseok-Dong, Dongjak-Gu, Seoul, 156-756, Korea
Tel: +82-2-820-5395 Fax: +82-2-814-2193
Email: kwcha@cau.ac.kr

Appendix 1. A verification of 3M earplug

(별지 제12호 서식)

보호구검정결과통지서 재교부

신청인	성명(법인명및 대표자성명)	한국쓰리엠(주) 폴디러소	주민등록번호 (사업자등록번호)	(116-81-06399)
	주소 (소재지)	서울 영등포구 여의도동 27-3	전화번호	(02) 3771-4114

검정결과내용

품목명	규격및 등급	검정결과			판정	합격번호
		검정항목	기준치	실험실측치		
방음 보호구 (귀마개)	1100 EP-1	o 재료시험	이상유무	이상없음	합격	방음 제 43호
		o 구조시험	이상유무	이상없음		
		o 성능시험 - 중심주파수 (Hz)	기준치 (dB)	차음치 (dB)		
		125	10이상	14		
		250	15이상	18		
		500	15이상	21		
		1,000	20이상	26		
		2,000	25이상	30		
		4,000	25이상	38		
		8,000	20이상	44		

- 끝 -

귀하가 1993년 5월 4일자로 ~~실시한~~ 합격한 보호구 검정결과에 대하여 위의 내용과 같이 ~~재발급~~ 재발급되었음을 산업안전보건법시행규칙 제65조의 규정에 의하여 알려드립니다.

1997년 2월 3일

한국산업안전공단 이사장

190㎜×268㎜
(백상지 150g/㎡)

011218