A DICHOTIC LISTENING TEST ON VOICELESS "th" /Θ/ PHONEME PERCEPTION

Titreşimsiz "th" /θ/ Sesbiriminin Algılanması Üzerine Eşzamanlı Dinleme Testi

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ÖZ

Bu durum çalışmasında eşzamanlı dinleme testi kullanılarak İngilizce'de sözcük içinde bulunan "th" /θ/ ve "t" /t/ sesbirimlerinin algılanmasında beyin yarı kürelerindeki baskınlık ortaya çıkartılmaya çalışılmıştır. Çalışmada Gazi Üniversitesi, Türk Halkbilim Bölümü öğrencilerinden 58'i kız 26'sı erkek olmak üzere toplam 84 denek yer almıştır. Deneklerin tümü sağlıklı, sağ elle yazı yazan ve İngilizce'yi başlangıç düzeyinde bilen ve daha önceden sistemli bir şekilde İngilizce fonetik eğitimi almamış bir niteliğe sahiptir. Eşzamanlı dinleme testini hazırlamak üzere içinde /t/ fonemi bulunan 10 ve yine içinde /θ/ fonemi bulunan 10 İngilizce sözcük bilgisayar ortamında 44.100 Hz ve 16 bit çözünürlükte sayısal olarak kaydedilmiştir. Bu kayıtlar teste uygun olarak eşzamanlı bir şekilde dinlenilebilecek şekilde gruplandırılmıştır. Eşzamanlı dinleme testi boyunca öğrencilerden duydukları sözcükler içerisinde bulunan /t/ veya "th" /θ/ seslerinden hangisini daha önce algıladıklarıyla ilgili bir çizelgeyi dodurmaları istenmiştir. Kağıt üzerindeki bu veri bütünü sonuçların bilgisayar destekli istatistik programı ile yüzdeler halinde incelenebilmesi için sayısallaştırılmıştır. Elde edilen sonuçlar ışığında bağlamında işitsel verinin sol kulaktan verilmesine rağmen "th" /θ/ ses biriminin algılanma yüzdesinin "t" /t/ algılanma yüzdesine göre daha yüksek olduğu bulunmuştur. Bu bağlamda eş zamanlı dinleme sırasında sol kulaktan gelen "th" /θ/ sesinin yabancı bir öğe olarak nitelendirilerek algıda seçiciliğin devreye girmesi sonucunda aynı dinleme düzleminde sağ kulaktan verilen ve bilindik "t" /t/ sesbirimine göre daha fazla algılandığı söylenebilir.

Anahtar Kelimeler

Eşzamanlı dinleme testi, kontra yanal işitsel uyarıcı, "th" /θ/ sesbirimi algılanması, algıda seçicilik.

ABSTRACT

This case study aims at unearthing the cerebral dominance through comprehending "th" /θ/ [dental-dental voiceless slit fricative] and "t" /t/ [alveopalatal voiceless stop] sounds in English words. The target words were given by applying a dichotic listening method. There were 84 (58 female and 26 male) right handed and healthy subjects from the Department of Turkish Folklore, Gazi University, Ankara-Turkey. The subjects are the native speakers of Turkish and whose levels of English were elementary. The students have never been given any systematic instruction of English pronunciation. In order to prepare the dichotic listening sets, 10 English words containing /t/ and 10 English words comprising /θ/ phonemes separately were recorded digitally at 44.100 Hz and 16 bit resolution in mono channel and synchronized by means of professional multi-track recording and editing programs. During the dichotic listening test, the students were given a chart and they were asked to distinguish and mark the primary sound that they heard as "th" /θ/ or "t" /t/ in the recordings of words. The data which was collected from the subjects was digitized to be analyzed in frequency tables of percentages by using a statistics program. It was found that the comprehension of the voiceless "th" /θ/ sound had a higher degree of percentage even though the audio stimuli were given through the left ear and so left auditory pathway. Although the right auditory pathway was not used, the comprehension mechanism of the brain might have given priority to the perception of "th" /θ/ sound as a result of the selective attention system. It can be put forward that unfamiliar phonemes might change selective mechanisms and play an important role on the comprehension of the contralateral stimuli.

Key Words

Dichotic listening test, contralateral auditory stimuli, "th" /θ/ phoneme perception, selective attention.

1.0 Introduction

Although it was developed in the 1960s, Dichotic Listening is still widely used and can be regarded as an non-invasive and practical technique in terms of determining the cerebral dominance of auditory language abilities. This technique was brought up by Broadbent and

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later developed by Doreen Kimura at the Montreal Neurological Institute in the early 1960s (Kolb and Whishaw:1990). The idea behind this method was that audio stimuli which were given simultaneously to both ears of the right-handed subjects follow the auditory pathways and reach to the contralateral hemisphere. The auditory pathway coming from the right ear to the left hemisphere is shorter than the one coming from the left ear. The contralateral pathway conveys the data to the opposite hemisphere and at the same time repress the ipsilateral (affecting the same side of the human body) pathway linking the ear to the cortex on the same part. Therefore, the audio stimulus reaches to the Wernicke's area that is responsible for comprehension on the left hemisphere in a shorter time, which is known as a right ear advantage as well (Churchland 1989:196), (Green 1994:68). The related contralateral pathways are shown in Figure 1.

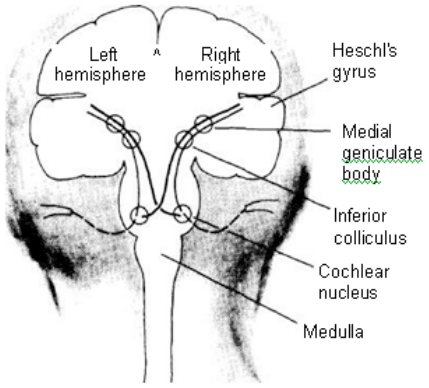


Figure 1. Contralateral auditory pathways. (Kolb and Whishaw, 1990:362)

2.0 Material and Method

This case study aims at scrutinizing the cerebral mastery during apprehending and selecting "th" /θ/ [dental-dental voiceless slit fricative] and "t" /t/ [alveo-palatal voiceless stop] sounds in English words which were given to the subjects by means of a dichotic listening method.

Speaking of the production of the voiceless "th" phoneme /θ/, the tip of the tongue is placed between the teeth and then air is blown out between the tongue and the top teeth (Lane 2005:67). The target positions and articulation points of the related sound are presented in Figure 2 and 3.

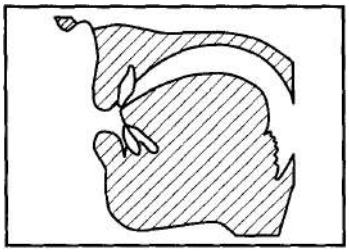


Figure 2. Crosscut Picture of the target position for the voiceless /θ/ "th" sound production. (Lane 2005:67)

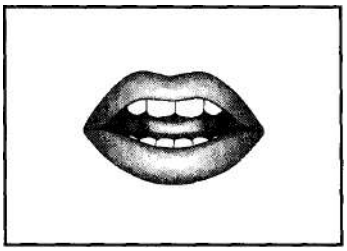


Figure 3. Picture of the mouth, teeth, and tongue as to the target position for the voiceless /θ/ "th" sound – anterior view. (Lane 2005:67)

There were 84 right handed and healthy subjects who are the native speakers of Turkish and whose levels of English were elementary at the Department of Turkish Folklore, Gazi University, Ankara-Turkey. It should be kept in mind that the students were not given any systematic instruction of English pronunciation in their English courses and they do not know how to pronounce the sounds in English accurately. The

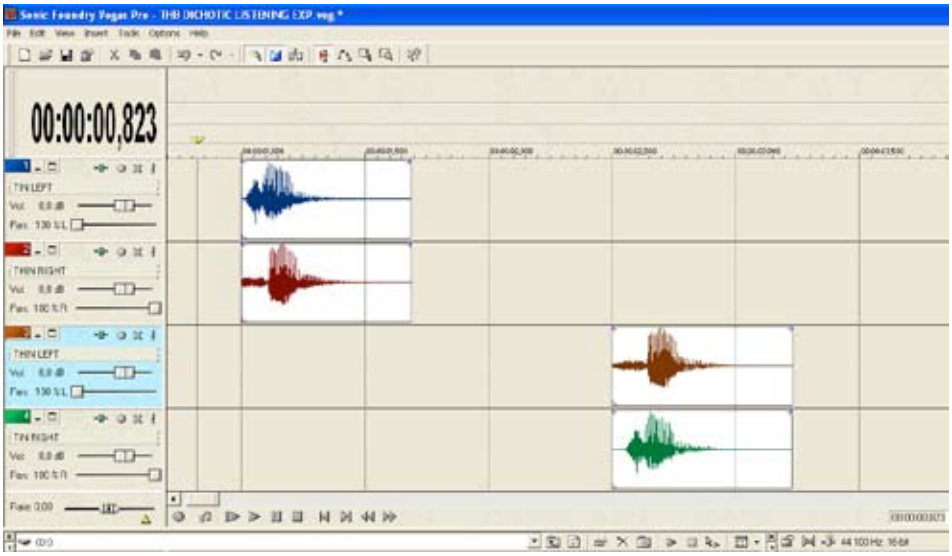


Figure 4. Samples of sound tracks which represent the waveforms of the minimal pairs of words containing /θ/ and /t/ phonemes on the computer screen.

average age of the participants was 20,70 ranging from 17 to 24. As to the gender distribution, there were 58 female and 26 male students from the first, second, third, and the fourth years at the department.

With respect to the preparation of the sound sets for the test, 10 English words containing /t/ and 10 English words comprising /θ/ phonemes separately were recorded digitally at 44.100 Hz and 16 bit resolution in mono channel by using a professional audio editing and mastering software called *Wavelab 5* (2005) on an IBM compatible computer. Afterwards, the files of the mentioned sounds of words were compiled and synchronized by means of a professional multi-track recording and editing software called *Vegas Pro* (1999) so that the subjects would listen to the word sets precisely at the same time from left and right channels at the same levels of volume. The aforementioned condition of sound editing of synchronization can be visualized as it is seen from the computer monitor in Figure 4:

The synchronization process was generated in such a way that there were ten sets of dichotic listening pairs in which the target sounds of the words were given from a different channel in each turn. The order of the words which consists the target sounds can be seen in Figure 5.

No.	THE SOUND GIVEN FROM THE RIGHT EAR	THE SOUND GIVEN FROM THE LEFT EAR
1	**Th**in	**t**in
2	**T**in	**th**in
3	**Th**ree	**t**ree
4	**T**ree	**th**ree
5	**Th**ank	**t**ank
6	**T**ank	**th**ank
7	**Th**ought	**t**aught
8	**T**aught	**th**ought
9	Shea**th**	shee**t**
10	Shee**t**	shea**th**

Figure 5. The order of the words in dichotic listening test in line with Left and Right channels.

In the course of dichotic listening test, the students were given a chart and they were told to mark the symbol of the sound which they identify predominantly, in other words, they were asked to distinguish the primary sound that they heard as “th” /θ/ or “t” /t/ in the samples of words. The chart related to data collection from the students is shown in figure 6. It should be taken into account that the place of the target sounds in the sets of dichotic listening pairs do not diverge from each other.

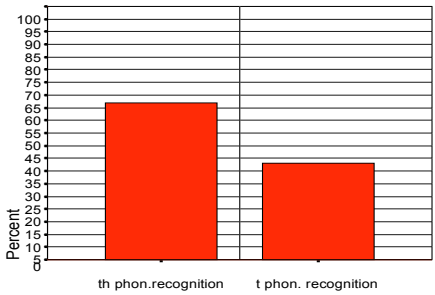
GENDER: …….. AGE : ……..	
SET OF DICHOTIC WORDS	THE SOUND HEARD
1	❍/θ/ ❍/t/
2	❍/θ/ ❍/t/
3	❍/θ/ ❍/t/
4	❍/θ/ ❍/t/
5	❍/θ/ ❍/t/
6	❍/θ/ ❍/t/
7	❍/θ/ ❍/t/
8	❍/θ/ ❍/t/
9	❍/θ/ ❍/t/
10	❍/θ/ ❍/t/

Figure 6. Data collection sheet.

The analog data which was collected from the subjects then was digitized in order to be analyzed in the light of frequency tables in percentages by using a statistics program called SPSS.

3.0 Results and Discussion

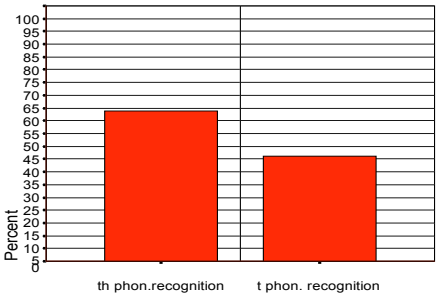
The following bar charts reveal the percentages of means concerning /θ/ or /t/ sound perception. The mentioned bar graphics are displayed in the same order of listening sets.



1- LEFT EAR "tin", RIGHT EAR "thin"

	Valid Percent
th phon.recognition	61,9
t phon. recognition	38,1
Total	100,0

In the first stage of the test, the students were given the word “thin” from their right ears and “sheet” from their left ears. As to the analysis of the data it was found that 61,9 % of “th” /θ/ phoneme was recognized by the *left* hemisphere [right auditory pathway] and 38,1 % of “t” /t/ phoneme was recognized by the *right* hemisphere [left auditory pathway].

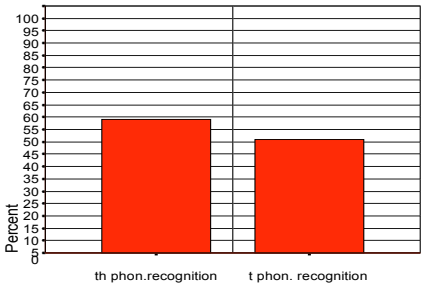


2- LEFT EAR "thin", RIGHT EAR "tin"

	Valid Percent
th phon.recognition	58,7
t phon. recognition	41,3
Total	100,0

In the second swapped channel mode of the study, the students were given word “tin” from their right ears and “thin” from their left ears. With respect to the analysis of the data it was found that 58,7 % of “th” /θ/ phoneme was identified by the *right* hemisphere

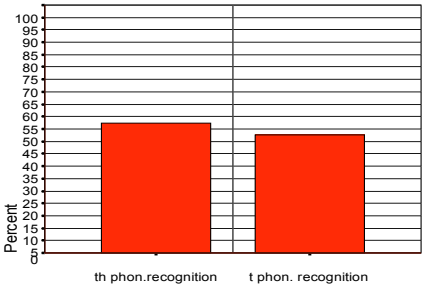
[left auditory pathway] and 41,3 % of “t” /t/ phoneme was recognized by the *left* hemisphere [right auditory pathway].



3- LEFT EAR "tree", RIGHT EAR "three"

	Valid Percent
th phon.recognition	54,0
t phon. recognition	46,0
Total	100,0

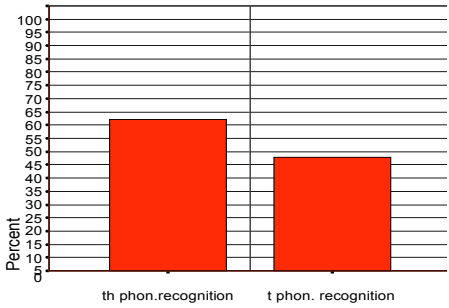
In the first stage of the test, the students were presented the word “three” from their right ears and “tree” from their left ears. Concerning the analysis of the data it was unearthed that 54 % of “th” /θ/ phoneme was recognized by the *left* hemisphere [right auditory pathway] and 46 % of “t” /t/ phoneme was recognized by the *right* hemisphere [left auditory pathway].



4- LEFT EAR "three", RIGHT EAR "tree"

	Valid Percent
th phon.recognition	52,4
t phon. recognition	47,6
Total	100,0

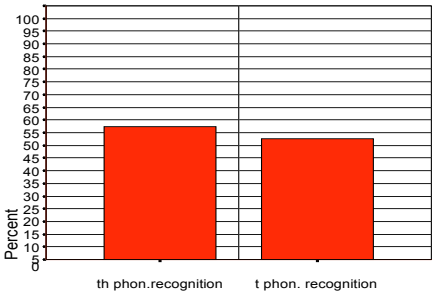
In the sixth swapped channel form of the study, the students were given the word “tree” from their right ears and “three” from their left ears. With respect to the analysis of the data, it was found that 52,4 % of “th” /θ/ phoneme was identified by the *right* hemisphere [left auditory pathway] and 47,6 % of “t” /t/ phoneme was recognized by the *left* hemisphere [right auditory pathway].



5- LEFT EAR "tank", RIGHT EAR "thank"

	Valid Percent
th phon.recognition	57,1
t phon. recognition	42,9
Total	100,0

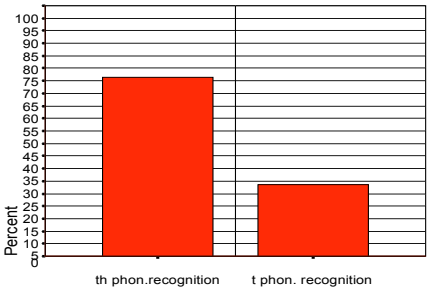
In the fifth stage of the test, the students were given the word “thank” from their right ears and “tank” from their left ears. With regard to the analysis of the data it was unearthed that 57,1 % of “th” /θ/ phoneme was identified by the *left* hemisphere [right auditory pathway] and 42,9 % of “t” /t/ phoneme was recognized by the *right* hemisphere [left auditory pathway].



6- LEFT EAR "thank", RIGHT EAR "tank"

	Valid Percent
th phon.recognition	52,4
t phon. recognition	47,6
Total	100,0

In the sixth swapped channel mode of the study, the students were presented the word “tank” from their right ears and “thank” from their left ears. As to the analysis of the data, it was discovered that 52,4 % of “th” /θ/ phoneme was identified by the *right* hemisphere [left auditory pathway] and 47,6 % of “t” /t/ phoneme was recognized by the *left* hemisphere [right auditory pathway].

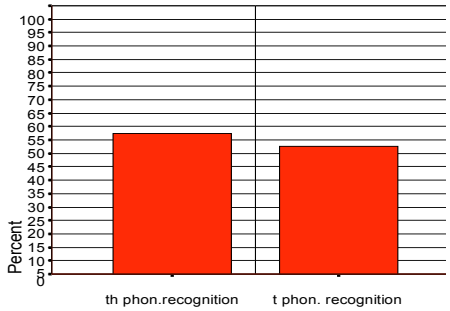


7- LEFT EAR "taught", RIGHT EAR "thought"

	Valid Percent
th phon.recognition	71,4
t phon. recognition	28,6
Total	100,0

In the seventh phase of the test, the students were given the word “thought” from their right ears and “taught” from their left ears. Concerning the analysis of the data it was found that 71,4 % of “th” /θ/ phoneme was identified by the *left* hemisphere [right auditory pathway] and 28,6 % of “t” /t/ phoneme was recognized by the *right* hemisphere [left auditory pathway].

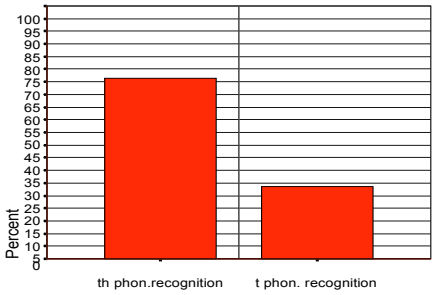
In the eighth interchanged channel form of the test, the students were presented the word “taught” from their right ears and “thought” from their left ears. In relation to the analysis of the data it was found that 52,4 % of “th” /θ/ phoneme was identified by the *right* hemisphere [left auditory pathway] and 47,6 % of “t” /t/ phoneme was recognized by the *left* hemisphere [right auditory pathway].



8- LEFT EAR "thought", RIGHT EAR "taught"

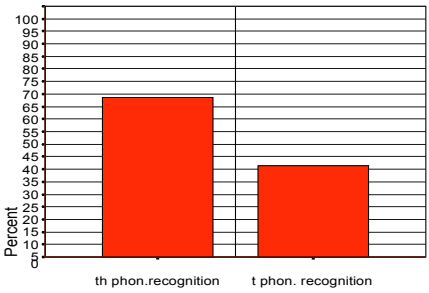
	Valid Percent
th phon.recognition	52,4
t phon. recognition	47,6
Total	100,0

In the ninth phase of the test, the students were presented the word “sheath” from their right ears and “sheet” from their left ears. With reference to the analysis of the data it was unearthed that 71,4 % of “th” /θ/ phoneme was identified by the *left* hemisphere [right auditory pathway] and 28,6 % of “t” /t/ phoneme was recognized by the *right* hemisphere [left auditory pathway].



9- LEFT EAR "sheet", RIGHT EAR "sheath"

	Valid Percent
th phon.recognition	71,4
t phon. recognition	28,6
Total	100,0



10- LEFT EAR "sheath", RIGHT EAR "sheet"

	Valid Percent
th phon.recognition	63,5
t phon. recognition	36,5
Total	100,0

In the tenth swapped channel mode of the test, the students were given the word "sheet" from their right ears and "sheath" from their left ears. As to the analysis of the data it was found that 63,5 % of "th" /θ/ phoneme was identified by the *right* hemisphere [left auditory pathway] and 36,5 % of "t" /t/ phoneme was recognized by the *left* hemisphere [right auditory pathway].

In the light of the idea behind dichotic listening test it is clearly seen and not surprising that the percentage of the sound recognition by way of the right auditory pathway is higher when compared to the left due to shorter neural transmission. In line with this contemplated result it is generally unearthed that comprehension of the audio stimulus from the right left is expected to have a lower degree of percentage. However, in this study, it was found that the comprehension of the voiceless "th" /θ/ sound which the students not only do not now how to generate but also do not use in their English language learning processes had a higher degree of percentage even though the audio stimulus was given through the left ear and so left auditory pathway. It can be put forward that although the right auditory pathway was not used, the comprehension mechanism of the brain might have given priority to the perception of "th" /θ/ sound as a result of the selective attention system. Selective attention can be defined as the focusing of conscious awareness on a distinct motive (Myers 2007). In this context, it can be surmised that when the brain was presented two sounds concurrently, one of which is not well-known and used, selective attention mechanism might have focused on the uncommon one for the students although the auditory stimulus was given from the left ear. In other words, it can be noted that unfamiliar phonemes might switch selective mechanisms and play an important role on the comprehension of the contralateral stimuli.

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