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| **RESEARCH ARTICLE**

Effect of Conceptual Metaphors on Memory: A Preliminary Study on the Visual and Auditory Recalling

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| **ABSTRACT**

In this study, we examined the relationship between conceptual metaphor and recalling. For this purpose, 3 metaphorical and 3 equivalent non-metaphorical short texts were produced in 2 visual and auditory versions, and 47 participants were exposed to the short-term and long-term recalling immediately after reading/listening to the texts and one week later. Results indicated that in some cases, it is a metaphorical one that has been recalled better than its non-metaphorical equivalent in both short-term memory and long-term memory. This finding can be interpreted as evidence of the possible facilitative role of conceptual metaphors in memorization.

1. Introduction

The nature of metaphor, metaphoric understanding, and its functions have been recognized as three main issues in research and theoretical formulations on metaphor and metaphor processing (Allbritton, 1995). In general, metaphor is defined as understanding and experiencing one thing based on another (Lakoff and Johnson, 1980/2003: 5). Metaphor can also be considered as an expression that has two conceptual domains in which one of the domains is experienced and understood according to the other (Gentner, 1988; Gibbs, 1979; Ortony, 1979). These two conceptual domains are known as the target domain and source domain (Gentner and Holyoak, 1997). The target domain refers to the domain that involves the main expression, and the source domain refers to the domain that is used for explaining the main expression. Usually, it is said that in metaphorical expression, the element which has a more specific, familiar, and better-known concept transfers a relevant part of its meaning to another element that is seemingly less known and may not be directly accessible.

Although metaphor goes beyond its components, words as psycholinguistic units play an important role in metaphoric understanding. Therefore, the structural unit of metaphor can be considered as a "word." Accordingly, metaphor is a tool and format of psycholinguistics, and its main mechanism is formed based on polysemy (Carroll, 1964). As stated by Miller (1979), D'Andrade (1989), and Luria (1981), only rarely do words have just one meaning. Actually, it is the texture of discourse that selects a special meaning or meanings out of a set of probable and/or possible meanings and makes the speaker's meaning clear. In fact, it can be said that metaphor is formed based on the great capacity of the word as a concept, and it is encoded as a network in the memory (Ghassemzadeh, 2013: 24-26).

From a cognitive perspective, Lakoff and Johnson (1980) consider metaphor as a cognitive phenomenon, and they believe that metaphors are conceptual in nature. They suggest that metaphor flows in our daily life, not only in our language but also in the way we think and act, and our usual conceptual system in which we think and act has a fundamentally metaphorical nature.

Regarding the theoretical foundations that have been proposed about metaphor over the past few decades, it seems that metaphor has a very important role in memory and memorization processes. Metaphor comprehension involves forming an abstract connection between two concepts in semantic memory (Glucksberg, 2001, 2003). Such a link or attributive category is established by extracting and relating similar properties of different concepts in memory (Benedek et al., 2014). Memory for metaphors has been thought to depend on a number of different attributes such as metaphoricity, imagery, the similarity between the source and target domains, aesthetic quality, and comprehensibility (McCabe, 1988). Gibbs (1980) argued that the greater memorability of metaphorical sentences might stem from the fact that such sentences are an unconventional use of language (Gibbs, 1980).

In spite of the high importance of metaphorical functions in cognitive activities in general and in memory and memorization in particular, there are not many studies dedicated to investigating this matter. Only studies conducted by Reynolds and Schwartz (1983), Allbritton, Mckoon, and Gerrig (1995) can be named so far. Allbriton, Mckoon, and Gerrig (1995) raised an issue in their study under the title of "Metaphor-based schemas," which refers to a schema that is created as a result of a conceptual metaphor in the text. In their study, they presented the subjects with forty short texts, half of which had conceptual metaphors, and the other half had the literal equivalents. They concluded that at the time of remembering and recognizing the text with conceptual metaphors, metaphor-based schemas are automatically provoked in people's minds, causing them to better remember and recognize the text (Allbritton, Mckoon, and Gerrig, 1995). In coherent research, Reynolds and Schwartz (1983) investigated the relationship between metaphorical processing, perception, and memory. In their study, adults read eight short stories first, after which they evaluated the quality, effectiveness, and metaphorical aspects of the narratives. Half of those stories ended with a metaphorical conclusion, and the other half ended with the literal equivalent of the metaphorical conclusion in the first group. Then, the stories were presented to the subjects as small booklets. When they read the text fully, they were given a memorization and recognition test immediately after and once two weeks later. The results of this study suggested that the texts with metaphorical conclusions were easier to memorize. Furthermore, Reynolds and Schwartz (1983) concluded from data analysis that not only the metaphorical conclusions had been memorized better than their literal equivalents, but more details of each text had been memorized, as well. The foregoing study was done in the framework of an educational approach (Reynolds and Schwarz, 1983).

To summarize, as Reynolds and Schwartz (1983) believe, metaphors are necessary building blocks of language in that they allow ideas that were previously inexpressible to be expressed, frequently in a vivid, compact form. It is further supposed that the vividness of metaphors, along with the way in which they are comprehended, tends to enhance the memorability of metaphors themselves, as well as that of the information that appears with the help of metaphors (Reynolds and Schwartz 1983: 452). Following this direction, the main aim of the present study is to establish metaphor as a topic worthy of discussion in memory studies and to draw out some of its implications for future studies. In fact, by considering the theoretical foundations of conceptual metaphor on the one hand and memory-related studies on the other, this preliminary study, which may be considered the first one in the Persian language, is planned to find a possible connection between metaphor and memory, using short metaphorical texts. In addition, this study is intended to survey the way in which texts are presented, i.e., the visual or auditory format. Memory recall has been considered in many studies. The investigations have involved short-term memory, long-term memory, as well as different mediums, including auditory and visual processing (Linder et al., 2009). The findings of the studies mainly indicate that recall is affected by the medium the information is presented (Pickering et al., 1998). In some studies, it is auditory learning which leads to better short-term memory, while visual learning results in better long-term memory (Watkins and Peynircioglu, 1986). Whereas in some others, the results indicate that overall, visual learning leads to better scores in both the immediate and delayed posttest conditions (Linder et al., 2009). According to these researches` results, it seems that the medium by which words or texts are run is important to be considered too.

2. Method
The main goal of the study is the comparison of memorization of short metaphorical texts and memorization of the same short text in a non-metaphorical narrative. For this purpose, memorization of both metaphorical and non-metaphorical short texts is tested.

2.1. Participants
The sample was selected through convenience sampling, which included 80 twenty to twenty-five-year-old students of Foreign Languages School and Management School of Allameh Tabatabai University in Tehran. Since variations in memory capacity can affect the test results, they were given a Persian word recognition test to ensure relative consistency among all participants' memory capacity (Jarollahi, 2012). For this purpose, the students were divided into two 40-subject groups. Word recognition test was visually illustrated for one of the groups, and for the other group, it was presented as audio. The subjects with a mean and standard deviation score of ±2 were selected for the main study, and those with a higher or lower score were excluded. In the end, 25 subjects, including 15 female and 10 male students, were selected for the visual task, and 22 subjects, including 13 female and

9 male students, were selected for the auditory task. We designed and performed the task in both visual and auditory forms in order to see if there is any difference between the visual and auditory processing of conceptual metaphors. Our impression is that in real life, people are exposed to the auditory forms of conceptual metaphors in conversations more than reading them in texts.

2.2. *Stimuli (tasks)*

The main tools of the study were the texts written in fluent Persian and divided into two categories of metaphorical texts and their equivalent non-metaphorical versions. Both texts have had a shared schema. Furthermore, the number of words and the length of the short texts were equal in both texts: metaphorical text No.1a and non-metaphorical text No.1b both consisted of 28 content words and 7 sentences. Similarly, metaphorical text No.2a and non-metaphorical text No.2b both had 25 content words and 6 sentences, and metaphorical text No.3a and non-metaphorical text No.3b both consisted of 28 content words and 9 sentences as well. It is noteworthy that all texts, both metaphorical and non-metaphorical, were written and validated by the researchers in this study. The texts had not been mentioned in any Persian text before, and therefore, none of the subjects had any prior knowledge of those texts. For the purpose of providing such tasks, the following steps were taken:

A. Writing the texts based on some of the metaphors existing in the book *Metaphors We Live By* (Lakoff and Johnson, 1980) that seemed to be common in Persian judged by the judgments of the researchers.
B. Writing non-metaphorical texts equivalent to written metaphorical texts. In writing the primary version of the texts, researchers tried to keep the number of words equal in both texts having the common schemas.
C. Validation of the metaphorical/non-metaphorical versions by Persian speakers. For this purpose, a Likert table was prepared with the scores of 1 to 5, and each of them was assigned a score of 100 to 500. These scores were considered separately for each text. After explaining the conceptual metaphor for the audience, they were asked to assign a higher score to the text, which was more metaphorical according to their idea, and assign the lower scores to the texts with a lower metaphorical theme. For achieving the optimal result based on the scores of below 150 for non-metaphorical texts, and the scores of above 400 for metaphorical texts, the process of validation started in three stages by 58 Persian speakers. After each stage, researchers made some changes in the texts and tested them again in order to come up with a satisfying outcome. In the end, the texts that did not get the optimal score were excluded from the study, and 4 metaphorical texts and their equivalent 4 non-metaphorical texts were selected as the main task. Then, in order to ensure the accuracy of the schema selected by the researchers, the schema of non-metaphorical texts was also evaluated, and the speakers were asked to write the main theme they judged appropriate for each text. According to the obtained results, the schemas of 3 texts out of the 4 presented texts were consistent with the schemas selected by the researchers, and there were inconsistencies in one of the texts, which was eliminated from the study. In order to prevent systematic errors, some texts were added as fillers.

2.3. *Procedure*

In order to compare memorization of short metaphorical texts and their corresponding short non-metaphorical texts, subjects' short-term and long-term memory were measured in relation to the presented text immediately and two weeks after the task. After presenting/playing each text, subjects were asked to write down whatever they remembered from the presented text. This method was repeated without any changes regarding subjects and texts. After two weeks, participants were asked to write every sentence of any text they recalled on the google form that they were provided. The test used in this study was designed by PsychoPy software. Before this stage, the testing tool was performed in a pilot study in order to evaluate its function and to work on its deficiencies. After doing the pilot study and making some necessary changes as well as validating the test, the task was designed in the visual version of PsychoPy software. Then, another pilot study was carried out in order to evaluate the test's function within the software and overcome its probable inconsistencies. For the second part of the task (the assessment of the long-term memory when memorizing metaphorical and non-metaphorical texts), a google questionnaire form was prepared in which participants were asked to write down what they read or heard two weeks before the performance of the first stage of the experiment. This form was sent to the participants two weeks after the task performance through email.

This study was performed in three stages. The first stage was done to select the subjects making sure of their relative consistency in terms of their ability to memorize texts. In this stage, a word recognition test was performed in groups and in two groups of visual and auditory where 10 one-syllable words were presented consecutively and each one for 2 seconds on the screen in the visual group, and by a 60-db speaker in the auditory group. Before performing the test, some sheets were distributed among the subjects containing a table of the 10 presented words and 15 additional one-syllable words. The subjects were asked to write some necessary information, including their name and surname, phone number, gender, age, semester, commencement year, and their major areas. Before the test, the procedure was explained to the subjects, and they were asked to return the sheets after the end of the presentation of the words, write down their identities, and then tick the words that they thought to have heard or seen. The second stage of the study, which was done after selecting the participants, included comparing memorization of the metaphorical short texts and memorization of the equivalent non-metaphorical short texts in visual and auditory short-term memory. This stage

was completed through previous arrangements at the Foreign Languages and Literature School of Allameh Tabatabai University in the presence of the main researcher and each of the subjects individually. Distractions such as loud sounds, unnecessary traffic, and the presence of other people in the room were prevented where possible. The visual test was given using R542UR Asus VivoBook laptop with a 15.5-inch screen, full HD, and resolution of 1920*1080 pixels. Also, the subjects were seated about 40 centimeters from the computer. However, this distance could change upon the participant's request. In the auditory test, the same laptop was used with a Beats Studio headphone with the frequency response of 20 Hz to 20 kHz and wire connection with the cable length of 3.1 meters and intensity of 60-70 db. In the visual test, the texts and words were displayed on a screen with white background, using B Roya Persian font of size 28. In the auditory test, the texts were played on a headphone with a sound intensity of 60-70 db. Finally, in the third stage, which participants completed at home, a google questionnaire form was sent to them in which they were asked to write whatever they could remember from the texts they exposed to them two weeks before. The participants did not have to write exactly what they read or heard. Instead, they could have recited the theme.

Before performing the test, the researcher ensured subjects that no personal information would be treated as data, and what was important was the total score without considering individual scores. Then, the method and stages of the work were fully explained for them. The test started when the subjects declared to be ready and pushed a button on their keyboard. First, a text was presented on the screen for 25 seconds (in the previous studies, this time was dependent on the length of the text and the study goal, while in this study, the duration was determined in a pilot test). After that, a blank white page appeared for 10 seconds, and then a message appeared on the screen, which led the subjects to push a button to start the next test whenever they were ready, i.e., when they were done with writing the sentences for the previous text.

There were eight texts, including 3 metaphorical and 3 non-metaphorical ones, plus 2 texts that were used as filler texts which were excluded from the final analyses. The texts were organized in such a manner that the metaphorical text played before its corresponding non-metaphorical text with an interval. At the next round, the non-metaphorical text was played before its metaphorical version.

The test processes in the visual and auditory tests were the same except in the method of presenting the texts on the screen or playing through the headphone.

2.4. Data analysis
In this study, descriptive and inferential statistical methods were used for analyzing the data and providing tentative answers to the research questions. All the analyses were implemented SPSS V.23 software. To analyze the data in each of the visual and auditory tasks separately, Friedman non-parameter test was used. For comparing the data of the visual and auditory tasks, the Mann-Whitney test was used. Furthermore, to measure participants' recalling responses, the sentences that they wrote down after being exposed to both metaphorical and non-metaphorical texts were divided into three categories: short, medium, and long, in both short-term and long-term recalling and for each group of texts separately. The method was that sentences with 1 to 2 content words were considered short sentences, sentences with 3 to 5 content words were considered medium sentences, and sentences with more than 6 content words were considered long sentences. Then, short, medium and long sentences were each given a coefficient of 1, 2, and 3, respectively, and the amount of recalling of each text by each subject was measured.

3. Results
3.1 Comparison of visual long-term recalling of metaphorical and non-metaphorical texts
According to the table of descriptive statistics (attachment 1), the average scores of long-term recalling metaphorical and non-metaphorical texts for visual stimuli are, respectively, 7.6 and 9.08. The difference is related to two pairs of texts: (1) metaphorical text No.1a and non-metaphorical text No.1b, and (2) metaphorical text No.3a and non-metaphorical text No.3b in particular. As shown in table 1, long-term recalling of non-metaphorical text No.1b is better than long-term recalling of metaphorical text No.1a. The difference in long-term recalling is reversed between texts No.3a and No.3b, meaning that the long-term recalling of metaphorical text No.3a is more considerable than the long-term recalling of non-metaphorical text No.3b. The following table and figures present these findings.

Table 1. Comparison of visual long-term recalling of metaphorical and non-metaphorical texts

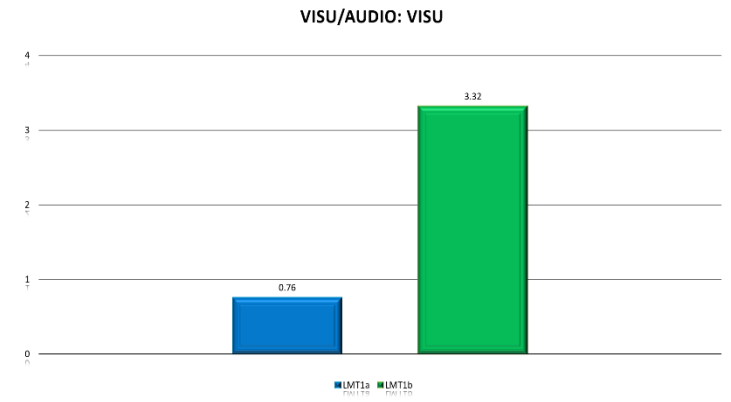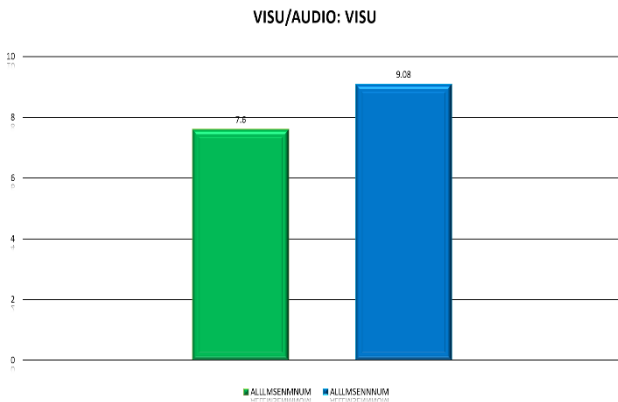| Visual/LTM/Recall			
comparison of recalled sentences of all texts	comparison of recalled sentences of text No.1a and No.1b	comparison of recalled sentences of text No.2a and No.2b	comparison of r comparison of recalled sentences of text No.3a and No.3b
$\chi^2 = 1.636$ P = 0.201	$\chi^2 = 7.118$ P = 0.008	$\chi^2 = 1.667$ P = 0.197	$\chi^2 = 5.400$ P = 0.020

Figure A.1. Comparison of visual long-term recalling of metaphorical and non-metaphorical texts

Figure A.2. Comparison of visual long-term recalling of texts No.1a and No.1b
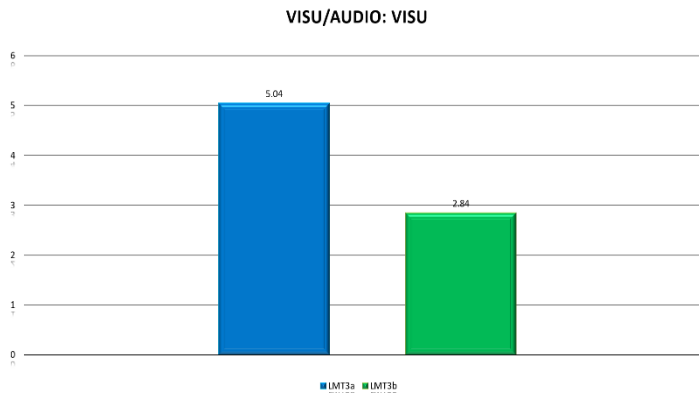

Figure A.3. Comparison of visual long-term recalling of texts No.3a and No.3b

3.2 Comparison of auditory long-term recalling of metaphorical and non-metaphorical texts

According to the table of descriptive statistics (attachment 1), the average scores of long-term recalling metaphorical and non-metaphorical texts for auditory stimuli are, respectively, 6.05 and 6.00. The observed difference is not statistically significant. However, by partitioning between texts, as shown in table 2, there is a significant difference between recalling metaphorical text No.3a and non-metaphorical text No.3b. Long-term recalling of text No.3a is more considerable than the long-term recalling of text No.3b. The following table and figures present these findings.

Visual/LTM/Recall			
comparison of recalled sentences of all texts	comparison of recalled sentences of text No.1a and No.1b	comparison of recalled sentences of text No.2a and No.2b	comparison of recalled sentences of text No.3a and No.3b
$\chi^2= 0.053$ P = 0.819	$\chi^2= 2.250$ P = 0.134	$\chi^2= 2.571$ P = 0.109	$\chi^2= 5.333$ P = 0.021

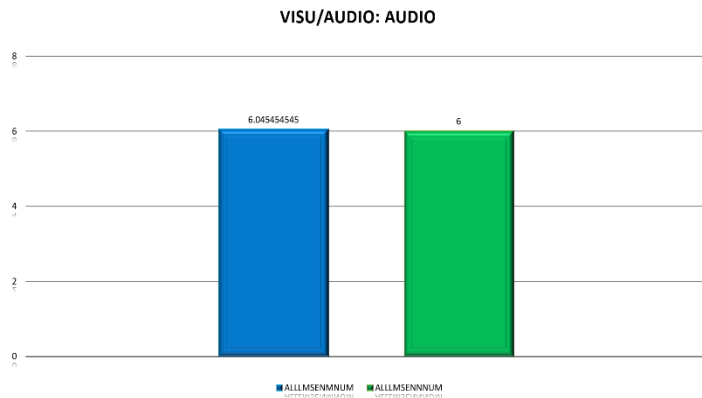Table 2. Comparison of auditory long-term recalling of metaphorical and non-metaphorical texts

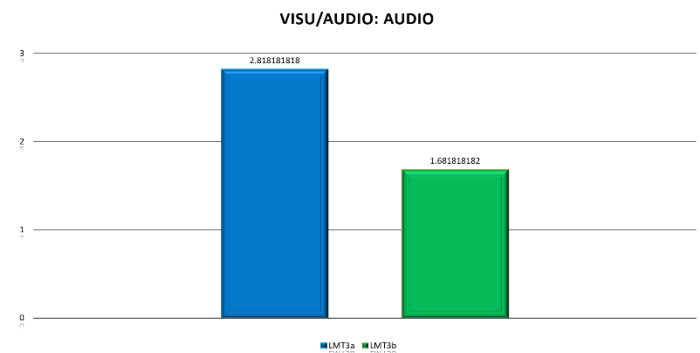Figure B.1. Comparison of auditory long-term recalling of metaphorical and non-metaphorical texts

Figure B.2. Comparison of auditory long-term recalling of texts No.3a and No.3b

3.3 Comparison of auditory and visual long-term recalling of metaphorical and non-metaphorical texts

The average scores of recalling metaphorical texts in visual and auditory long-term recalling are 7.60 and 6.05, respectively. This average for non-metaphorical texts is 9.08 in visual long-term recalling and 6.00 for long-term auditory recalling. The following table and figure present these findings. According to table No.3 and figures C, the difference between auditory and visual long-term recalling is significant in metaphorical text No.1a. Auditory recalling of metaphorical text No.1a is more considerable than the visual recalling of metaphorical text No.1a.

Table 3. Comparison of auditory and visual long-term recalling of metaphorical and non-metaphorical texts

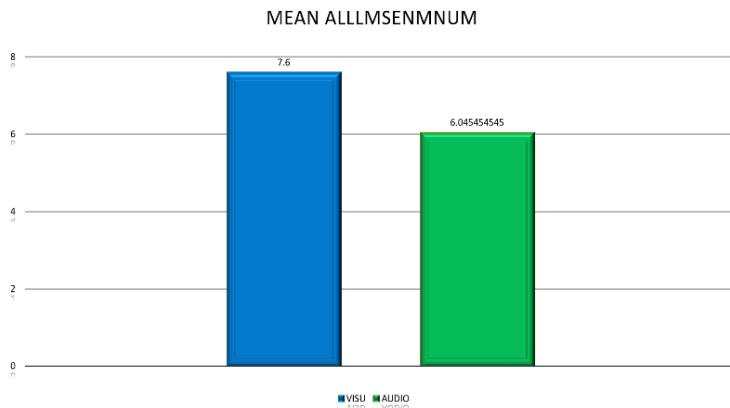| Visual/Auditory/LTM/Recall/2Independent samples			
comparison of recalled sentences of all texts	comparison of recalled sentences of text No.1a and No.1b	comparison of recalled sentences of text No.2a and No.2b	comparison of recalled sentences of text No.3a and No.3b
Mann-Whitney (a) = 226.500	Mann-Whitney (1.a) = 195.000	Mann-Whitney (2.a) = 245.500	Mann-Whitney (3.a) = 216.500
P = 0.297	P = 0.030	P = 0.446	P = 0.194
Mann-Whitney (b) = 223.000	Mann-Whitney (1.b) = 230.000	Mann-Whitney (2.b) = 249.000	Mann-Whitney (3.b) = 228.500
P = 0.265	P = 0.318	P = 0.557	P = 0.249

MEAN ALLLMSENMNUM

MEAN ALLLMSENNNUM

Figure C.1. Comparison of auditory and visual long-term recalling of metaphorical texts
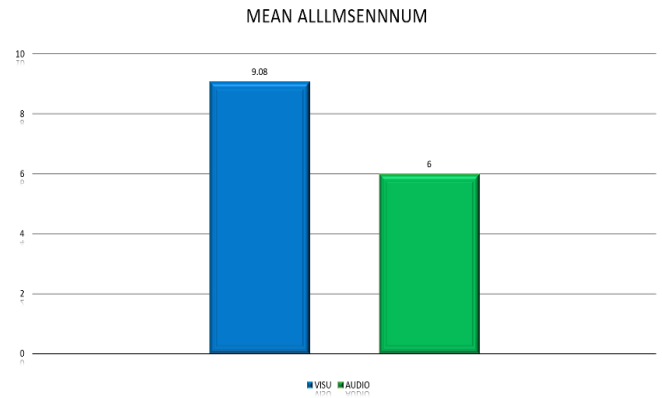
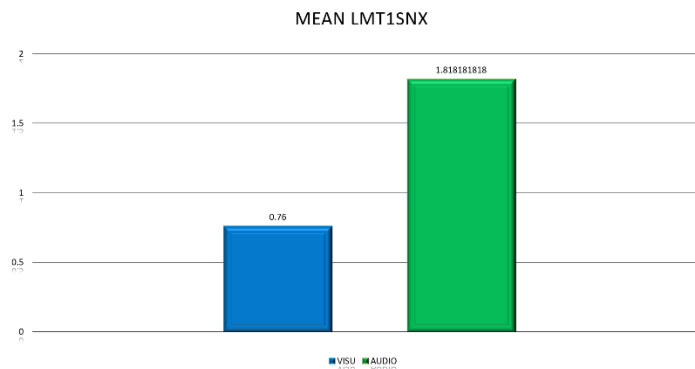Figure C.2. Comparison of auditory and visual long-term recalling of non-metaphorical texts

MEAN LMT1SNX

Figure C.3. Comparison of auditory and visual long-term recalling of metaphorical text No.1a

4. Discussion and Conclusion

The results of data analysis of this study show that auditory and visual long-term recalling of metaphorical text No.3a has occurred better than its equivalent non-metaphorical text No.3b (Metaphorical text No.3a: "*Children were still annoying their nurse. Suddenly, the nurse shouted that she would not bear their bad behavior and threatened them with punishment if they did not obey her. They knew that the nurse's remarks were a declaration of war, but they did not give in despite the unfavorable consequences",* vs non-metaphorical text No.3b: "*While approaching the enemy's infantry, they were worried about encountering mines and being spotted by the enemy before being able to do anything. Also, the probability of getting far from the supporting forces intensified their fear. So, they did not have much hope, but they did not withdraw despite the unfavorable consequences*"). No difference is observed between recalling the metaphorical text No.2a, and its equivalent non-metaphorical text No.2b (Metaphorical text No.2a: "*Many years ago, in a bad political period, when the fire of war flared, tens of people were killed. In those days, the government also burned in the fire which had been burning under the ashes for years. Some others were silent because of exhaustion, and their voice was not heard*", vs non-metaphorical text No.2b: "*Many years ago, in a tense political period, when the central building of the government was flared and burned, tens of people were killed. In that situation, although firemen stopped the fire, some people remained trapped in the fire and were burned to ashes*"). And finally, recalling the non-metaphorical text No.1b has been better than its equivalent metaphorical text No.1a (Metaphorical text No.1a: "*A group of researchers was searching for a strong foundation for a theory because some of the opponents of that theory had claimed that the reasoning basis for the theory are weak and it is will be disproved. These researchers wanted to support that theory by providing strong reasoning basis and present its frameworks fundamentally*", vs non-metaphorical text No.1b: "*A group of engineers wanted to see the materials used in a tower because some experts had claimed that the foundations of the tower are weak and it would be destroyed. These engineers wanted to ensure the strength of that tower by providing high-quality materials and fundamentally consolidate its framework*"). This trend and these results have been exactly

repeated in the short-term recalling of the texts, i.e., the subject's immediate recalling of the texts after hearing them. It seems that the obtained data are idiosyncratic to some extent, and the subjects have shown different behaviors in recalling each text. There are some reasons for this variation. First, text No.1a was the first text presented to the subjects, and, at the time of hearing or reading this text, they were not familiar with the whole process. Therefore, the difference in recalling this text with its equivalent non-metaphorical text is probably due to the fact that the subjects were not aware of the test process, and they could not pay enough attention to the task. On the other hand, non-metaphorical text No.3b was the last text to which the subjects were exposed, and based on the recency effect; the subjects were expected to recall better this text than its metaphorical version, i.e., text No.3a that had been presented before text No.3b. The recency effect was first discovered by the psychologist Hermann Ebbinghaus during his memory experiments is a memory mechanism in which those items, ideas, or arguments that came last are remembered more clearly than those that came first (Murre and Dros, 2015). However, as the results of data analysis in both visual and auditory versions show, the subjects had a better performance in recalling the metaphorical text No.3a that had been presented before non-metaphorical text No.3b. Furthermore, no difference in the recalling texts No.2a and No.2b can be due to the similar metaphorical or non-metaphorical nature of these two texts compared with other pairs. In validation of the extent of the metaphorical/non-metaphorical nature of the texts, the difference between metaphorical/non-metaphorical nature of texts No.2a and No.2b was less than the difference between metaphorical/non-metaphorical texts of the other two pairs. Thus, these two texts could be regarded as similar as far as the results are concerned. Hypothetically, the same extent of recalling these two texts can be related to their similarity in terms of being metaphorical or non-metaphorical. Accordingly, if we exclude texts No.1a and No.1b from the main analysis -- due to early exposure of the subjects to text No.1a and the difference of testing conditions -- on the one hand and texts No.2a and No.2b, on the other -- because of a smaller difference between their metaphorical/non-metaphorical aspects than the other two texts -- the only texts that remain for the final analysis are No.3a and No.3b. These two texts have a statistically significant difference in terms of recalling extent in both auditory and visual versions. The subjects had a higher performance in recalling the sentences, words, and concepts of the metaphorical text 3a than the non-metaphorical text 3b in terms of both short-term and long-term recalling.

As mentioned in the introduction, conceptual metaphor is one of the psycholinguistic aspects of a cognitive process. In conceptual metaphors, there are two conceptual areas of origin and destination, and the destination area is defined by adaptation or analogy between these two areas. When we talk about adaptation or analogy, memory is also involved. In a classical statement, Whorf (1956) believed that a person's conceptual knowledge is formed by his/her language. Later, a weaker form of this hypothesis was introduced, suggesting that language affects the formation of perception as well as memory. There is plenty of evidence showing that language directs thinking (Ervin-Tripp, 1967), affects the concepts of time and place (Boroditsky,2001), and also affects memory (Loftus & Palmer, 1974). Language and memory are two important cognitive processes of humans that are closely related to each other. In its simplest form, human needs memory to follow conversations (Goldstein, 2010). The relationship between language and memory may not seem clear at first, but when considering memory as a tool and process for storing and retrieving information, or a tool and process for transferring information, or a means of describing the content of our conscious experience, we may be able to better understand the importance and impact of each of these cognitive processes on the other.

In the present study, the effect of one of the most important cognitive functions of language, i.e., conceptual metaphor, on one of the memory processes, i.e., recalling in a textual context, was investigated. As the data indicate, it seems that when metaphor is used in a text, that text will become more memorable. We demonstrated this at least in 2 metaphorical statements. This happens probably due to the fact that metaphors create a wider network of communication in the brain, or it may be through providing strong cueing and/or activation systems related to metaphoric understanding. Memory is not just recording information that people simply playback when trying to retrieve an experience or information from it. Rather, it seems that they put together different pieces of information, including traces of the original event along with the other sources of information such as prior knowledge, expectations, and information acquired after the original event was recorded in memory. Given the growing evidence that some concepts are understood metaphorically, metaphors are probably another element of reconstructive memory. If so, metaphors are expected to affect how information is encoded in memory and retrieved from it (Crawford, 2013: 68). Metaphor is not encrypted and decrypted in vacuity. It is obvious that the creator/user and the hearer of metaphor refer to their memory for understanding the meaning of the metaphor and transmitting its concept. Memory can be considered as the mental capacity for keeping information over time. Based on this criterion, i.e., time, three types of memory can be recognized: sensory memory that keeps information for less than one second or at most a few seconds; short-term memory or active memory that keeps information for about 30 seconds; and long-term memory that may keep information for life. Squire (1995) divides long-term memory into two types of indicative and non-indicative and suggests that since different parts of indicative and non-indicative memory are involved in creating or understanding metaphor, it can be used in studies as an indicator of complex brain interactions. Organization of information is done by long-term memory, and metaphorical combinations are stored in long-term formats in the form of simile, allegory, metonymy, and proverb. Activation of these combinations takes place through understanding the similarity of a situation of the event to the stored schema and also understanding its correlation with those combinations. What happens in the brain when using, perceiving, or recalling metaphor cannot be precisely determined, but it is obvious that the condition of

using the metaphor plays the role of activator and provides a processing network for us that is different from the common non-metaphorical processing network. On the other hand, in addition to the whole memory, meta-lingual context, i.e., the conditions and agents used by the person in information exchange, also affect the perception of metaphor. All of these situational stimuli determine the type of information of long-term memory that is related to perception and interpretation of metaphor. In general, it can be said that metaphorical expression and the individual's situation play the role of sings for retrieving information of long-term memory. In mentioning the metaphor functions, Gibbs (1994, p.124) suggests that one of the major functions of metaphor is providing a coherent and condensed method for communicating. Condensation occurs when a single idea that can include an image, thought, or language is replaced for several ideas or associations. Accordingly, when the creator and hearer of metaphor are faced with coherent data, they will recall it more easily than large and scattered data. So, it may be concluded that the texts that are expressed metaphorically contain a great deal of information in small language data. Therefore, when recalling them, their components can be accessed more easily than their equivalent non-metaphorical texts. Another explanation for metaphors to be better remembered maybe that metaphor is based on mental imagery or even is its originator. It is well known that concrete, easily imaged literal sentences are remembered better than abstract, less imaged ones. But evidence concerning imagery and memory for metaphors is conflicting (McCabe, 1988). Mental imagery is a quasi-perceptual experience and is something that people are aware of and experience (Pecher, Van Dantzig, & Schifferstein, 2009). It resembles perceptual experience but occurs in the absence of appropriate external stimuli (Thomas, 2019 Edition). The central question about the role of mental imagery in metaphor understanding was raised some time ago by Gibbs and Bogdonovich (Carston, 2018). Gibbs and Bogdonovich (1999) thought that imagery has an essential role in an account of metaphor understanding. They said that metaphor theories must be amended to account for the prominence of imagery in metaphor use (Gibbs and Bogdonovich, 1999, p. 37). Based on the result of an empirical study, they concluded that mental imagery is essential in understanding at least some metaphors, those that they (following Lakoff & Turner, 1989) call "image metaphors" (Carston, 2018). Gibbs and Bogdonovich (1999) expected that participants interpret these metaphors based on the mapping of an image from the source domain onto the target domain. However, As Carston (2018) says, it is difficult, of course, to detect the presence or absence of mental imagery in the mind/brain of the person understanding a metaphor, and it is more difficult to tell whether the imagery of the target domain is being mapped onto the target domain. Carston, in a semi-experimental study, argues that the experience of mental imagery during the comprehension of a metaphor is probably a by-product or side-effect of other processes, an outcome of such factors as a novelty, creativity, and extendedness of the metaphor. He continues that, however, even if mental imagery is (merely) a cognitive side-effect of standard linguistic processes, it can be of considerable significance, in respect of that it may be the most powerful and/or memorable effect a metaphor has on its audience (Carston, 2018, p. 215). Finally, the last but not the least possible mechanism that could be a reason for better remembering of metaphorical texts is considering metaphor as a good sign or cue for recalling. A sign is an object, quality, or event whose presence or occurrence indicates the probable presence or occurrence of something else. The same description, somehow, might be true about metaphor. In metaphor, we encounter something that stands for something else. In fact, we have something specific stored in connection with each metaphor that acts as a cue (Wearing & college, 2011). Activated cue leads to activate a conceptual network that connects to it and comes with it. Anyway, what was mentioned in the explanation of probably better remembering of metaphorical texts is just some possible ways to express and, in this study, remain as a hypothesis or even question whose validity needs to test in future experimental works.

And finally, in comparison of auditory and visual processing, although the focus of the present study is primarily to compare metaphorical and non-metaphorical recalling of texts and not the medium represented texts, results indicate that there is no significant difference between visual and auditory long-term recalling of non-metaphorical texts. But about metaphorical texts, the situation was somehow different. Auditory long-term recalling of metaphorical text No.1a has led to a greater recall on memory performance tests than visual learning. The difference between the results of the present study with previous studies (Linder et al., 2009), which found that visual long-term memory performed better in recalling, might be because that we have tested long-term recalling in texture context while previously mentioned studies have done in words or even syllabus level. We couldn't find any relevant work in this area to compare our results with others.

One of the limitations of this study was the small number of subjects studied. By studying more subjects, more relevant and convincing results may be obtained. Furthermore, studying and considering the familiarity of metaphors (i.e., their novelty and conventionality) as well as vividness which is related to the imagery function of metaphors -- important in memorization -- can affect the results of the study, especially when discussing the reasons for different results related to recalling metaphorical texts compared with each other. Moreover, conducting such a study in different cultures and languages may provide us with new findings of the role of metaphors in memory.

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Appendix 1

Variables		Mean	SD	Min	Max	Lower	Upper
Long-term recalling of metaphorical texts	Visual	7.60	7.036	0	27	4.70	10.50
	Audial	6.05	7.410	0	31	2.76	9.33
Long-term recalling of non-metaphorical texts	Visual	9.08	8.154	0	29	5.71	12.45
	Audial	6.00	5.657	0	21	3.49	8.51