Memory Functions of Co-Speech Gestures For Child And Adult Speakers In Spatial Descriptions

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Abstract

Do gestures play a role in keeping spatial information in memory during speaking? The present study aims to find out whether gestures those speakers spontaneously use while speaking plays a role in memory maintenance for children and whether and how this changes when compared to adults. 28 adults and 25 five-year-old child participants were asked to watch simple motion events shown to them on a laptop. They were then asked to retell what they had seen to an adult listener in 3 conditions; when the still pictures of the objects they were describing (1) were not visible on the screen anymore (2) were visible only to them but not the listener and (3) were visible to both themselves and to the listener. If children and adults use gestures to keep spatial images in memory, then we expected them to use more iconic gestures per word when the objects they are describing are not visible (condition 1) than when they are visible (condition 2 and 3). However our results did not support this hypothesis. We did find neither speech nor the iconic gestures per word to be different across conditions in both adults and children. Thus the memory maintenance function of gesture might not be a primary function of gesture. Instead our findings indicated other functions of gestures similar and different between adults and children in spatial descriptions. Both groups used more points to entities when they were available to both the speaker and the addressee than other situations, indicating children understood communicative situation as adults did.

Keywords: Functions of gestures, memory maintenance, spatial information, iconic gestures, deictic gestures, children, adults

Konuşma Sırasında Yetişkinler ve Çocuklar Tarafından Kullanılan Mimiklerin Mekansal Anlatımlar Sırasında Hafızadaki Rolleri

Özet

Mimikler, konuşma sırasında mekansal bilgiyi hafızada tutmaya yardımcı oluyor mu? Bu çalışma, konuşma sırasında kullanılan mimik hareketlerinin, hafızada bilgi tutmaya yardımcı olup olmadığını çocuklarda ve yetişkinlerde karşılaştırmalı olarak araştırmayı hedeflemektedir. 28 yetişkin ve 25 çocuk katılımcıdan bir bilgisayar yardımıyla çeşitli hareketler seyretmeleri istenmiştir. Daha sonra gördüklerini yetişkin bir dinleyiciye, 3 farklı durumda anlatmaları istenmiştir; (1) izledikleri filmden hatırlatıcı herhangi bir resim önlerinde yokken, (2) izledikleri filmden bir resmi dinleyici göremiyor, sadece kendileri görebiliyorken, (3) bu resmi hem kendileri hem de dinleyici görebiliyorken. Eğer çocuklar ve yetişkinler, mekansal bilgiyi hafızada tutmak için mimikleri kullansalar, resmi görmedikleri durumda (durum 1) gördükleri durumlara (durum 2

ve 3) göre kelime başına daha fazla mimik kullanırlar. Ancak bu çalışmanın sonuçları bu hipotezi desteklememiştir. Konuşma içeriği ya da mimik hareketleri hem çocuklarda hem yetişkinlerde durumlar arasında farklılık göstermemiştir. Hafızada bilgi tutma mimik hareketlerinin başlıca görevi olmayabilir. Bu çalışmanın bulguları göstermiştir ki, mimik hareketlerinin çocuklar ve yetişkinler için birbirine benzer ya da birbirinden farklı daha başka görevleri de bulunabilir. Her iki grup da, resmin dinleyici tarafından görülebildiği durumlarda daha fazla işaret mimiği kullanmıştır. Bu da çocukların, yetişkinlerin bakış açısını anlayabildiğini gösterir.

Anahtar kelimeler: Mimiklerin fonksiyonu, hafızada bilgi tutma, şekilsel bilgi, şekilsel konuşma, şekilsel mimkler, işaret mimikleri, çocuklar, yetişkinler

Introduction

People move their hands while speaking in coordination with the content of their speech. These meaningful hand movements-called co-speech gestures- are an integral part of human communication in all cultures and ages. Why people make these hand movements is a matter of concern in the literature. So far, the literature has shown that such gestures serve two main functions. The first function of these gestures is to serve as a communication tool like language, namely, to guide interactions between people (see Kendon, 2004 for a review; Bavelas, Gerwing, J., Sutton, C., & Prevost, 2008 etc.). Another function of gestures is for the speaker. Support for this view comes from the findings which show that speakers still use gestures while speaking when there is no visual access to the listener; like gesturing while speaking on the phone (de Ruiter, 2003). Furthermore, it is found that blind speakers gesture as much as their sighted counterparts, even when they are talking to a blind person (Iverson & Goldin Meadow, 2001). These results, among others, which will be reviewed below show that gestures are helpful and necessary tools for the speaker to organize their own thinking.

Most previous studies have investigated the function of gestures for adult speakers, yet less is known about the different functions gestures serve for children (see Goldin-Meadow, 2004 for a review of studies with children). One of the functions of gestures in adult speakers is to maintain spatial imagery in the memory while a person is speaking (Wesp, Hesse, Keutmann, & Wheaton, 2001, de Ruiter, 1998). The current study will investigate this claim in adults as well as in children (5 year olds) and explore the extent to which children and adults are similar or different in the memory maintenance function of gestures.

The current study will examine the use of gestures to maintain imagery in memory in expressions of spatial information. This study interested in two types of gestures which are iconic and deictic gestures. Iconic gestures resemble their referents in terms of shape, size or movement (de Ruiter, 2003). For example somebody can trace the shape of a vase with two hands saying “there was a vase on the table". Deictic gestures indicate figure, direction or the location of the figure by pointing to actual locations or to locations in abstract space (de Ruiter, 2003). Iconic gestures are the most frequently used type of gestures while investigating memory maintenance function of gestures as used in various experiments (Wesp et al., 2001; de Ruiter, 1998; Morsella & Krauss 2004).

Functions of gestures for speakers: different hypotheses

There are several hypotheses about the functions of gestures for the speaker in the literature. Two of the hypotheses about functions of gestures for the speaker are directly relevant and will be tested in the current study.[1] Two of the most frequently studied hypotheses about the function of gestures is the lexical retrieval hypothesis and memory maintenance hypothesis which will be discussed below. Even though these two functions are somewhat linked to each other, they can be also viewed as two different functions of gestures for the speaker.

Lexical Retrieval Hypothesis

The first hypothesis about the function of gestures for the speaker is that gestures play an important role in lexical retrieval. According to this view, gestures are made during lexical search and play a role in the retrieval of speech (Morsella & Krauss, 2004; Krauss & Morsella, 2002). Evidence for this view comes from studies which show that the restriction of gestures has an adverse effect on the content and fluency of speech as well as on lexical retrieval and free recall (Frick-Horburry & Gutentag, 1998; Rauscher, Krauss & Chen, 1996; Morsalla & Krauss, 2004). Also in accordance with this view, there are other findings which show that gestures occur more frequently when there is a breakdown in speech (cited in Frick Horburry, 2002). These results indicate that gestures are used in the conditions when lexical search is needed to maintain fluent speech.

In their study Morsella and Kraus (2002) found that people gestured more when the spatial content of their speech is rich. They needed to use gestures to retrieve and sustain spatial concepts while speaking.

One problem for this hypothesis comes from the findings that both children's and adults' gestures can show aspects of their representations which are not necessarily expressed in their speech (Goldin-Meadow, 2003; Pine, Lufkin, Kirk & Messer, 2006; Kita & Özyurek, 2003). For example, when children explain how they solved an addition problem, they may make an equation sign with their hands, which they never state in their explanations (cited in Goldin Meadow, 2000). These findings showed that meanings of the gestures which are referred to spatial elements may not be stated in the speech. Therefore, the function of gestures is not solely lexical retrieval-since in the case reported above producing gestures did not cause retrieval of the lexical items. They may serve other functions for the speaker. This other function can only be found when lexical retrieval function of gestures is controlled. In this study we aim to control lexical retrieval function of gestures and to show gestures may have another function for the speaker which is memory maintenance.

[1] Note that there have been also other speaker-oriented functions of gestures for the speaker such as the 'reducing cognitive load" , 'helping learning ' (Goldin-Meadow, 2006) . According to these views gesture reduces cognitive load during thinking or problem solving. This view will not be directly tested in the current thesis.

Maintenance Hypothesis

An alternative view of the function of gestures for the speaker is that gestures maintain spatial imagery in working memory and with this information in working memory, the lexical retrieval of spatial words is facilitated (Wesp et al., 2001; de Ruiter, 1998). According to Wesp et al. (2001), unlike lexical retrieval hypothesis, gestures are not directly involved in lexical search, rather they maintain the spatial imagery of lexical concepts in memory. So, when there is an external memory aid, it is meaningful that people use less gesture than when there is not an external memory aid. In the situation when there is no memory aid, people use gestures as the aid to maintain information about to be described concepts. With this maintained information, the facilitation of the lexical retrieval might happen but is not the primary function of gesture. Even though, lexical retrieval does not occur, gestures may maintain spatial information in the memory. The only way to find this is to control for the effect of lexical retrieval and then try to find support for memory maintenance.

In their experiment, Wesp et al. (2001) required their participants to describe a painting either by looking at the painting or from memory. If gestures have a role in maintaining spatial imagery, there should be more gesturing when the picture is described from memory. In support of this view, they found that gestures are used less when to-be-described information is present than when it is absent.

Wesp et al. (2001) found support for the spatial aid function of gestures. However one weakness in their study is that they did not completely eliminate the function of lexical retrieval, since we do not know about the content of their speech. Content of spatial speech may be rich in without memory aid condition and that may be the reason why number of gestures is higher in that condition than the other condition. In order to come to conclusion of gestures maintain spatial imagery, conditions in which spatial content is similar should be compared.

The present study

The maintenance of spatial information is then an alternative function of gestures for the speaker as opposed to the lexical retrieval function. Previous studies have tested the maintenance hypothesis against the lexical retrieval hypothesis among adults (Wesp et al., 2001; De Ruiter , 2003), but it is not clear whether gestures also play a role in memory maintenance for children and how this role would compare to a similar function in adults.

To find out if gesture plays a role in memory maintenance for children and adults, or not, a similar task to the one used by Wesp et al. (2001) was used. Adult and child participants were asked to talk about simple events when the objects which were being described were available to the speakers and when they were not available. One crucial difference of this task to that of Wesp et al. (2001) and De Ruiter (1998) is that the stimuli in the current study included moving objects-unlike still pictures as used in previous studies. Previous studies tested the role of gestures in maintaining spatial information of static elements

like figure or ground. The reason for us to choose moving elements is to see whether gestures play a role in maintaining information about moving objects and their directions as well as static elements. So, different from previous studies, the function of gesture to maintain movement of objects was targeted in addition to their locations and relations etc.

5-year-old children and adult participants watched 10 short vignettes which included motions of two objects in the shape of a circle and a triangle (Ozyurek, Kita & Allen, 2000; Tomato Man vignettes that have been used for gesture and speech elicitation with children). After watching the vignettes, the participants were required to narrate what they watched to a listener who did not know the content of the vignette. Thus, the communicative role of gesture was the same for all participants. Half of the participants (*with-picture* condition) described the vignettes with a picture in front of them (but in a way can not be seen by the addressee) that contains elements in the vignette and half described without that picture (*no-picture* condition). In both conditions the listener did not see either the vignettes or the pictures. All narrations were videotaped. Thus if gestures help to maintain memory of items we expected speakers in the *no-picture* condition will use more gestures than in the with-picture condition. In order for this difference to be due to memory maintenance, content of the spatial speech in the conditions should be similar. If the spatial content is similar then gesture numbers will be compared. If spatial content is not similar, the cases in which spatial content is similar will be identified and gesture numbers of those cases will be compared.

However one potential confound variable in using simply these two main conditions for both adults and children is that communicative situation in the *with-picture* condition might be interpreted differently by adults and children. For example even though the listener doesn't see the picture in front of the child, there is a possibility that children would not take this into account in their narrations as adults would (Matthews, Lieven , Theakston & Tomasello, 2006). Adults would possibly adjust their narratives knowing that the listener can not see the picture. However children might assume that listener has the knowledge of the picture they are seeing (i.e., for example not being able to take the perspective of the listener) and they might keep pointing to the pictures in front of them even though the listener can not see them. In a study it was found that children's ability to choose different expressions depending on whether their addressee could see the intended referent or not changes according to the age of the children (Matthews et al., 2006). Knowing this, children might differ in their expressions in speech and gesture than adults in the with-picture condition.

In order to be able to check for this potential confound, and to make sure that children can differentiate a condition where they have the pictures available only to them from another condition where pictures are available to both themselves and the listeners. That's why we had an extra condition: *with-picture visible to listener.* If we find that adults and children respond in the same way to the both of the with picture conditions in terms of speech and

gesture, then we can be sure that children's responses can be compared to those of adults in the *with-picture* condition (i.e., when the picture is visible only to the child but not to the listener).

Predictions

One of the main predictions for adults and children is that, if the memory maintenance hypothesis is correct, and if gestures maintain spatial imagery in spatial memory, there will be more gesturing during descriptions of stimuli in the no-picture condition than the with-picture conditions.

Furthermore within the two with-picture conditions, it is predicted that five-year-old children will interpret the difference between *with-picture visible to listener* versus *with-picture not visible to the listener* conditions as adults do. Previous research on children's perceptive taking abilities in such tasks (Flavell, Everet, Kroft & Flavell, 1981; Matthews et al., 2006) show that children can take the perspective of others in simple tasks. In a study it was found that 3- and 4-year-old children can understand whether addressee can see the referent or not and they adjust their expressions accordingly (Matthews et al., 2006). In this study, it is predicted that for both children and adults, there will be less pointing gestures in the *with-picture* not visible to the listener condition than in *with-picture visible to the listener* condition since it is expected that participants will prefer to point to the pictures when they are available to both. We expect to find less pointing gestures in the *with-picture* not visible to the listener condition than in *with-picture visible to the listener* condition for both child and adults to ensure that adult and children interpret the *with-picture* not visible to the listener condition in the same way as with-picture visible to the listener.

Finally to be able to differentiate the maintenance hypothesis from the lexical retrieval hypothesis we will look for the content of the speech in the no-picture and with-picture conditions. To do this, the spatial content of the speech of the participants will be identified in each condition. If adult and child speakers use more gestures in the no-picture condition than in the with-picture conditions when the spatial content of speech is similar, this will provide more concrete evidence for the memory maintenance hypothesis. If the content of speech is similar for all conditions, the only explanation for the difference in the number of gestures between two conditions can be attributable to the maintenance hypothesis, because the function of gestures for lexical retrieval will be kept constant.

Methodology

Participants

25 Turkish five-year-old children and 28 Turkish adults were the participants. Child participants were chosen from three kindergardens in Sarıyer, İstanbul. Adult participants were the students in the Introduction to Psychology course in Koç University. 8 of the children and 9 of the adults were in the *no-picture* condition which is *condition 1*; 9 of the children and 9 of the adults were in the *with-picture visible to the listener condition* which is *condition 2*; remaining 8 of the children and 10 of the adults were in the *with-picture not visible to the listener condition* which is *condition 3*. Number of participants across conditions can be seen in table 1. The means of ages of children and adults across conditions can be seen in table 2.

Table 1
Number of participants across the conditions

	No-picture condition	With-picture visible to listener condition	With-picture not visible to listener condition
Adults	9	9	10
Children	8	9	8

Table 2
Mean (SD) of ages of participants across the conditions

	No-picture condition	With-picture visible to listener condition	With-picture not visible to listener condition
Adults	19.89(1.17)	20(1.58)	20.1(1.20)
Children	5.32(0.51)	5.03(0.47)	5.16(0.54)

Procedure

Participants watched 12 short vignettes which include movements of two objects which have the shapes of circle (red) and triangle (green). The first two of them were practice vignettes. Movements of circle and triangle included roll, jump, hit, go with the directions of left, right, up and down. After each vignette, the participants were required to describe what has happened in the vignette to the listener. They were informed that the listener did not know the content of the vignette. (See figure 1 in appendices for the picture of vignette 1 that was

available to speakers and/or addressees in the with-picture conditions during the telling)

As a sample content of one of the vignettes was as follows;

Vignette 1: Triangle hits tomato. Tomato rolls up the hill and then falls down on the sea.

The procedure of the experiment was the same for both adults and children. The experimenter, the participant and the listener sat around a table. The participant and the listener sat face to face on one side of the table. The computer in which the vignettes were shown was in front of the participant. In the no-picture condition, the computer screen was in front of the participant in such a way that the listener could not see the vignettes. This setting ensured that speaker prevented from describing the vignettes using the computer screen. The experimenter sat behind the participant. Once each vignette was viewed the screen went blank and the experimenter closed the lap top. In the with-picture not visible to the listener condition, for half of the participants the picture were put on the computer screen for only the participant to see during descriptions after he viewed the vignettes. For the other half of the participants, that was in the with-picture visible to the listener condition, the picture was placed between the listener and the participant in a position where both the participant and the listener were able to see the picture. The picture used in the with picture conditions was the first scene of each vignette. (See figures 2,3 and 4 in appendices for the design of the experiment for three conditions)

Before the descriptions, the same instructions were given to the participants in order to make sure that they understand what they will do.

Measures

Measures of speech and gesture were identified separately. For both measures the expressions of spatial content were chosen in additional to general ones (i.e., number of all words and all gestures). For speech general spatial words were identified. Similarly for gestures iconic gestures as well as points were identified and quantified.

Speech Coding

For each vignette spatial speech in all sentences were identified and written separately. Then all words and spatial words were counted. While deciding which word is spatial or not the criteria was the word should represent a concrete spatial image in the people's mind, such as a figure, ground, activity, motion, direction of the motion and location. Adjectives which show the degree of spatial movement was regarded as spatial, too. The words which were not regarded as spatial were facial resemblances like "smile, happy or unhappy", conjunctions such as "and, or, like, with". Neutral verbs which do not represent a movement and an action such as "do, make" were not regarded as action either.

Gesture Coding

For each vignette all the gestures were identified. For coding iconic gestures following criteria was used; non-rhythmic, spontaneous hand and finger

movements that represents a spatial element. For coding deictic gestures following criteria was used; finger, arm or head movements that points to a spatial object on the picture, computer screen or neutral space. Examples of speech and corresponding gesture coding for an adult and a child participant during the explanation of a vignette can be seen in figures 2 and 3 respectively.

Figure 5*: Speech and corresponding gesture coding sample for an adult during the explanation of a vignette*

Speech Coding		**Gesture Coding**		
Transcription	**Spatial Speech**	**Corresponding Gesture**	**Meaning**	**Type**
Here, it came straightly (burda yine düz geldi)	Here came straightly (burda düz geldi)	Right hand index moves to left	go left	iconic
It stopped here (durdu burda)	Stopped here (durdu burda)			
After that, it stopped next to the triangle by spinning around. (ondan sonra kendi etrafında döne döne üçgenin yanında durdu)	stopped next to triangle spinning around (etrafında döne döne üçgenin yanında durdu)	Right hand index moves down while rolling	go down	iconic
		Right hand index points to picture	triangle	deictic
		Right hand index points to pic	tomato	deictic
Speech Variables		**Gesture Variables**		
Number of all words=15* Number of combined spatial words=11* Number of demonstrative spatial words=2* Number of non-demonstrative spatial words =9*		Number of iconic gestures=2 Number of deictic gestures=2 Number of all gestures =4		

*Counting of the words are based on Turkish speech.

Figure 6*: Speech and corresponding gesture coding sample for a child during the explanation of a vignette*

Speech Coding		**Gesture Coding**		
Transcription	**Spatial Speech**	**Corresponding Gesture**	**Meaning**	**Type**
Now, tomato has been in the sea. (şimdi şimdi domates denizdeydi)	tomato in the sea (domates denizdeydi)	rh points to the picture	tomato	deictic
Then tomato went up to the air (sonra domates havaya gitti)	tomato went up to the air (domates havaya gitti)	rh moves up	go up	iconic
Then it came there (sonra oraya geldi)	came (geldi)	rh moves to right	go right	iconic
It went with the triangle next to the each other again (üçgenle gittiler yine yana)	Triangle went next to (üçgenle gittiler yana)	rh moves to right	go right	iconic
Speech Variables		**Gesture Variables**		
Number of all words=15* Number of spatial words =9*		Number of iconic gestures=3 Number of deictic gestures=1 Number of all gestures =4		

*Counting of the words are based on Turkish speech.

Measures of Speech Analyses

The measure for the speech was proportion of spatial words in all words. This proportion was calculated as number of spatial words divided by number of all words then multiplied by 100.

Measures for Gesture Analyses

For gesture analyses proportion of iconic gestures in spatial words, and proportion of deictic gestures in spatial words, were calculated for comparison across conditions and age. Proportions were calculated as variables (ie; number of iconic gestures divided by number of all words or number of spatial words then multiplied by 100). This proportion represents the number of gestures for every 100 spatial words used. The reason for us to choose this proportion is that would be an unbiased criterion for the comparison. This proportion also eliminates the effect of lexical retrieval because with the proportion meaning gesture per 100 words, the effect of speech was eliminated.

Results

Speech analysis

For the analysis of speech, in order to check if the spatial content across conditions and ages is similar or not, we compared proportions of spatial words across conditions.

2x3 ANOVA was conducted on *proportion of spatial words in all words* as dependent variable; age (child and adult) and condition as independent variables. Analysis showed this proportion is significantly higher in children

than adults', F(1,47)=14.72, $p<0.001$. It was not different across conditions, F(2,47)=0.90, $p=0.41$. Analysis did not reveal significant interaction between age and condition, F(2,47)=0.91, $p=0.41$. Means of *proportion of non-demonstrative spatial words in all words* for children and adults can be seen in table 3.

Table 3

Mean (SD) of proportion of non-demonstrative spatial words in all words (%)

	No-picture condition	With-picture visible to listener condition	With-picture not visible to listener condition	Totals
Adult	56.62(6.45)	56.8(6.61)	56.72(7.89)	56.71(6.79)
Child	65(9.88)	63.93(16.2)	71.99(7.76)	66.85(12.07)
Totals	60.56(9.06)	60.37(12.50)	63.51(10.9)	61.50(10.83)

Speech with spatial content did not show effect of condition for adults or children. Since speech of adults and children responded similarly to the different conditions, one can attribute the possible changes in gesture to memory maintenance but not to lexical retrieval. Next we compared with-picture conditions with no-picture condition, in terms of gesture use.

Gesture Analyses

For gesture analyses all gesture variables were calculated for comparison across conditions and age.

2x3 ANOVA was conducted on *proportion of deictic gestures in spatial words as* dependent variable; age and condition as independent variables. According to the analysis this number was significantly different across conditions, F (2,47)=15.85, $p<0.001$. Analysis also showed that this number was not significantly different between children and adults, F(1,47)=1.11, $p=0.30$. Analysis also revealed that there is no significant interaction between age and condition, F(2,47)= 0.11, $p=0.90$. According to the post hoc analysis with picture visible to listener has significantly higher proportion of deictic gestures in spatial words than no-picture condition $p<0.001$ and than with picture not visible to listener condition. $p<0.001$. However, there was no significant difference between no picture condition and with picture not visible to listener condition $p= 0.29$. Means of *proportion of deictic gestures in combined spatial words* for children and adults can be seen in table 4.

Table 4

Mean (SD) of proportion of deictic gestures in combined spatial words (%)

	No-picture condition	With-picture visible to listener condition	With-picture not visible to listener condition	Totals
Adult	0(0)	6.80(3.59)	1.65(2.16)	2.78(3.72)
Child	0.61(0.93)	7.71(7.15)	3.39(3.75)	4.06(5.52)
Totals	0.29(0.69)	7.26(5.51)	2.42(3.01)	3.38(4.66)

Finally for gesture analysis, 2x3 ANOVA was conducted on *proportion of iconic gestures in spatial words* as dependent variable; age and condition as independent variables. Analysis showed that adults' proportion of iconic gestures in non-demonstrative spatial words is significantly higher than children's, $F(1,47)=4.68$, $p=0.04$. This number was not significantly different across conditions, $F(2,47)=1.25$, $p=0.30$. Analysis also revealed that there is no significant interaction between age and condition, $F(2,47)= 0.04$, $p=0.96$. Means of the *proportion of iconic gestures in spatial words* for children and adults can be seen in table 5.

Table 5

Mean (SD) of proportion of iconic gestures in non-demonstrative spatial words (%)

	No-picture condition	With-picture visible to listener condition	With-picture not visible to listener condition	Totals
Adult	45.58(14.38)	41.27(13.52)	35.54(25.86)	40.61(18.87)
Child	33.32(28.5)	29.37(24.12)	19.87(23.30)	27.59(24.95)
Totals	39.81(22.33)	35.32(19.93	25.87(25.37)	34.47(22.70)

Summary of gesture results

Overall children and adults did not differ in the overall use of gestures per spatial word in any of the conditions. However deictic gestures and iconic gestures had different tendencies in the conditions. As we have seen above in the condition in picture visible to addressee, both adults and children used more deictic gestures than the other conditions. And there were no differences in the use of deictic gestures per word, combined spatial words and demonstrative spatial words between adults and children. Thus both age groups interpreted this condition communicatively similar both in speech and gesture. They took advantage of the pictures being visible to the addressee and described the vignette using more indexicals.

There were no differences in the use of iconic gestures per word across the conditions suggesting that gestures are not used for memory maintenance.

Conclusion And Discussion

In this study we aimed to find out whether children and adults use gestures for memory maintenance in descriptions of spatial relations. Children and adults were asked to describe motion event movies after they watched the movies, either with memory aids with the pictures of the moving figures and the ground where the motion took place or without these aids. With picture conditions also varied between a case; where the listener could see the pictures with the speaker or not.

We found that the spatial language in the speech did not differ across conditions –in the with or without picture condition for adults or children. This provided a good basis for us to test the memory maintenance hypothesis by eliminating the possibility of lexical retrieval function of gestures. If lexical retrieval was the only function of gestures, in the condition in which amount of gesturing is highest, the amount of spatial speech should have been the highest, too. Since we found no difference in the spatial speech across conditions we could not make such a comparison. If we had found differences in the amount of gesturing, that difference could have been attributed to different functions of gestures other than lexical retrieval.

In contrast to the literature that has shown that speakers use more iconic gestures in cases where they can not see what they describe- giving support for the role of gestures in memory maintenance –we have not found children or adults to use more iconic gestures when they describe the motion event they have seen without any memory aid. So the hypothesis that gestures aid memory maintenance is not supported in this study.

There can be different reasons for this null effect. The size of the sample for each group was small to reveal significant differences. When we look at the means we see there was a trend suggesting more use of iconic gestures in no picture condition than with no picture conditions both for adults and children. With a bigger sample size this trend could be significant. Secondly the conditions with and without pictures were not so different from each other because we used motion movies rather than static pictures –as used in previous literature. Static pictures can be aid for the static spatial elements like figure or ground. Thus even in the with picture conditions there were no memory aids for the motion traces. If the vignettes were open in front of the speaker during descriptions then there could have been memory aids for all spatial elements. In the future the data can be re-analyzed in such a way that the memory effects can be investigated for the references made only for the figures or the ground objects in speech and gesture.

The results of this study also revealed additional functions of gestures for adults and children. Both age groups used deictic gestures in the condition where the listener can see the pictures more often than the other two conditions. Thus 5 year old children are aware of the use of both modalities to index referents visible to both partners and they do not use gestures for objects when the listener cannot see them. Therefore 5-year old children have similar

understanding of the pragmatics of the communicative situation as adults. In the future this can be investigated to see whether it holds also for younger-i.e. 3 year old children.

Thus to conclude in the current study we did not find support for the memory maintenance function of gesture for spatial memory for adults or children. However more data and analyses could further test this claim. In addition we found evidence for other functions of gestures such as pointing gestures when the picture is visible to the listener has the same frequency for both adults and children.

Appendices

Figure 1 : Picture Depiction for vignette 1

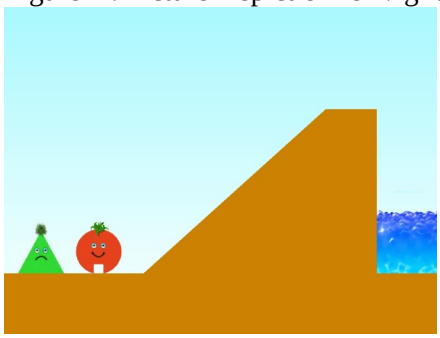


Figure 2 - Layout of the with-picture not visible to listener condition

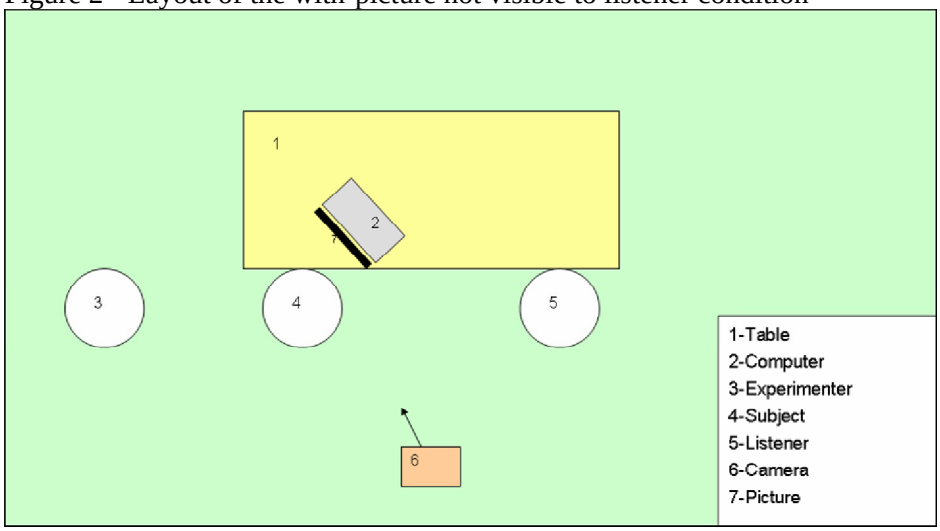


Figure 3- Layout of the with-picture visible to listener condition

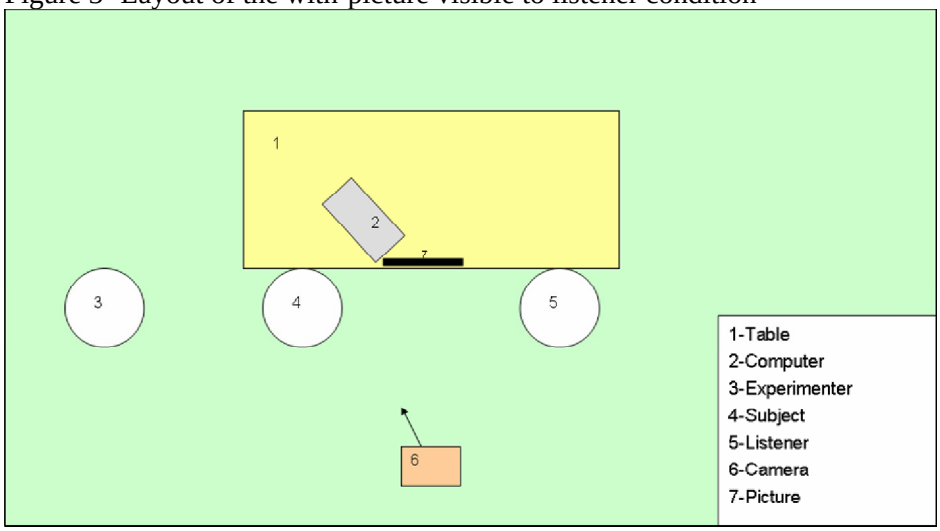
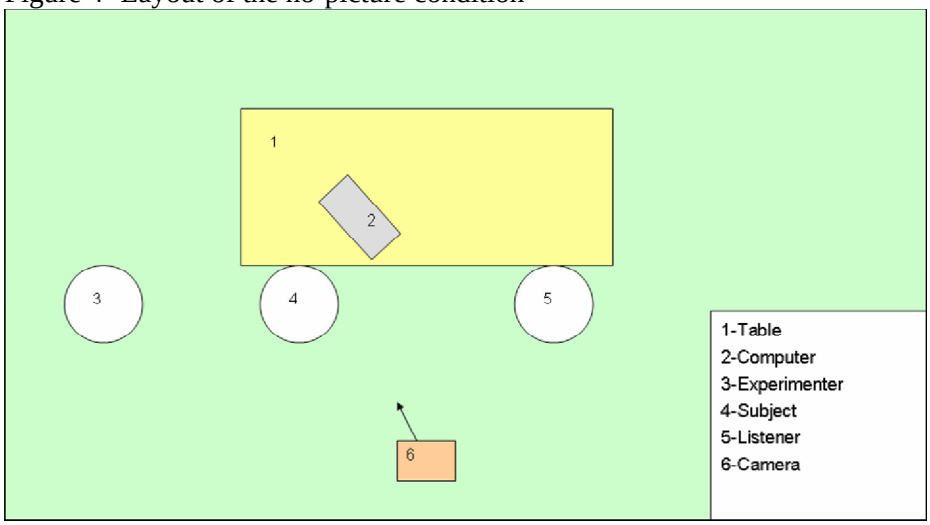


Figure 4- Layout of the no-picture condition



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