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THE EFFECTS OF AGE, PRESENTATION MODE (ONLINE, OFFLINE), AND SEGMENTATION OF AMBIGUOUS SENTENCES ON ATTACHMENT PREFERENCES OF FEMALE EFL LEARNERS

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Abstract:
One kind of structural ambiguity is in sentences including two determiner phrases (DP) that are followed by a relative clause (RC). One example of this type of ambiguity is "Somebody shot the servant of the actress who was on the balcony". Speakers of different languages attribute RC either to DP1 or DP2. The goal of this study was to investigate the relationship between participants' age and participants' attachment preferences, as well as different ways of presenting the material (i.e., offline vs. online) on the attachment preferences. This study also aims to see if the segmentation of experimental sentences plays any role in participant attachment preferences. To this end, a sample of 50 female native speakers of Persian ranging between 15 to 25 years participated in this study. The instruments used in the present research include an offline sentence acceptability judgment test and main tests that included the first main test, offline test, online complete presentation (timed), and an online segment-by-segment sentence. For the analysis of data t-tests and ANOVA were used. The statistics showed that participants' age affects attachment preferences, and adolescents have a tendency toward DP1 selection. Different modes of presenting ambiguous sentences also affected the results; presenting materials in a self-paced online method leads to a significant difference other two modes. Finally, segmentation plays a role in the attachment preference of RC and in resolving ambiguous sentences. The results showed that students had a preference for segmented presentation rather than a holistic mode of presentation.

Keywords: attachment preference, determiner phrase (DP), relative clause (RC), structural ambiguity, parsing

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1. Introduction

Because it isn't possible to go into everybody's mind and know what happens in it, psycholinguistics researcher uses various techniques to show the first and second language reactions to constructed statements or vocabularies and inference information for seeing the structure of a person's mind. One of many things that researchers can see while processing language, which has been given a lot of concentration is the processing of ambiguous sentences. The sentences that have more than one interpretation are called ambiguous ones. We can understand from its name that ambiguity refers to different phrase structures the sentences can have. A structurally ambiguous example is *someone shot the servant of the actress who was on the balcony.* Two determiner phrases (DPs) can be understood in the form of genitive construction, followed by one relative clause (RC) *who was on the balcony* can modify *the servant of the actress* or *actress.* Previous psycholinguistics research on this type of ambiguous sentence investigated the attachment preferences of native speakers and L2 learners with different language backgrounds in attaching RC to one of the DP1 or DP2 in genitive construction. But mixed results were yielded by these studies. For example, some of these studies have shown that adult native speakers of English prefer to associate the relative clause with the second DP (Fernandez, 1999; Gilboy, Sopena, Clifton, & Frazier, 1995, as cited in Felser, Roberts, Marinis, 2003). On the other hand, a preference for DP1 attachment has been reported for similar genitive constructions in many other languages such as Spanish (Cuetos & Mitchell, 1988, as cited in Papadopoulou & Clahsen, 2005). Previous studies on Persian have also shown an attachment preference for DP1 (Arabmofrad & Marefat, 2008). But recently, research results have shown that even speakers of a single language show variation in their preferences (e.g., Dussias, 2003; Fernandez, 2000). Implicit Prosody Hypothesis (Fodor, 1998) is a kind of hypothesis to justify the intra-lingual variation in attachment preferences. For the proponents of the universality of the human sentence processing mechanism, (Frazier, 1979) these inter- and intra-lingual variations in attachment preferences have raised some dilemmas.

1.1 The Significance of the Study

First, it is hoped that the study will clarify the interaction between age and RC attachment preferences. Second, it is hoped that the results obtained from the present study will tell us whether learners of different age process ambiguous sentences differently in different ways of presenting the ambiguous sentences. Third, it is expected that the findings of the present study tell us whether segmentation of the experimental sentences as opposed to presenting them holistically plays any role in RC attachment preferences in intermediate students and adults. Thus, provides support for Implicit Prosody Hypothesis (Fodor, 1998) which claims that prosodic phrasing affects parsing and that the differences in RC attachment preferences are the result of differences in parsing, which by itself is the result of differences in segmentation. We want to see whether Iranian female students prefer

attributing RC to DP1 or DP2 in understanding ambiguous sentences. As a result, the following questions are proposed.

1.2 Research Questions

1) Does participant age have any significant effect on attachment preferences of L2 female Persian learners?
2) Do ways of presentation (online/offline) have any significant effect on the attachment preference of learners?
3) Does the segmentation of experimental sentences have any significant effect on participant attachment preference?

2. Review of Literature

Furthermore, the concentration of psycholinguistics is on how language learner acquires, understand and produce language. In simple words, psycholinguistic researchers are interested in the processing of language in language learner's minds. A key term in psycholinguistics is "processing" which language learner linguistic behavior is explained under different situations. One of the circumstances under which processing has produced interesting findings is ambiguity in general and structural in particular. One kind of structural ambiguity is sentences including two determiner phrases that are followed by a relative clause (RC) and RC can refer to DP1 and DP2. One example of this kind of ambiguity is provided below: somebody shot the servant of the actress who was on the balcony.

2.1 Attachment Preference

Wide ranges of studies focused on the attachment preferences of both native speakers and L2 learners have been carried out in many different languages. Speakers of some languages have preferred to attach the RC to DP1, while speakers of other languages preferred to DP2. There are still some languages that speakers have not shown any preference for particularly DP1 and DP2. This inter-lingual and intra-lingual variation of attachment preferences are structurally ambiguous sentences so to describe the variation in attachment preferences, different accounts have been proposed so far.

2.2 Accounts Justifying Attachment Preferences

Different accounts have been proposed for describing the variation of attachment preferences in ambiguous sentences will be elaborated bellow.

2.2.1 Recency, Late Closure or Right Association vs. Predicate Proximity

Frazier's (1978) late closure principle, Kimball's (1973) right association, Gibson's (1991) Recency principle have done many empirical investigations. Based on late closure, the parser integrates the incoming item to the materials that have recently been processed if grammatically possible. In most of the languages such as English, Swedish and Romanian

late closure applies. On the other hand, Cuetos and Mitchell (1991) showed that the preference to attach the incoming item to recently processed materials isn't universal. They conducted a study on Spanish speakers and claim that Spanish parsers preferred attaching the incoming items to a less recent item known as high attachment. Other studies on the ambiguity of sentences have replicated their claims too (Gilboy, Sopena, Clifton, & Frazier, 1995). According to their investigations of this, inter and intra-lingual variation in RC attachment preferences in ambiguous sentences, Gibson, et al. (1996) introduced two principles. Based on the first principle called Recency, the RC is merged with the most recently processed item (DP2). According to the second principle, the subject prefers to attach the RC to the DP that is structurally near to a predicate as possible (DP1) called predicate proximity (Gibson, et al., 1996). In addition, the strength of the predicate proximity principle was hypothesized by them. If attachment preference is like a continuum depending on the attachment sites, the speakers of some languages prefer the least recent attachment sites, while the speakers of other languages prefer the most recent attachment sites as the host of the RC.

English was weaker than Spanish in this relative strength. Consequently, in English Recency dominates for ambiguity with two attachment sites for the RC and this consisted as more attachment sites are added. But predicate proximity dominates with ambiguities with two attachment sites in Spanish, while there is a shift of preference from predicate proximity to Recency when more attachment sites are added.

2.2.2 Structural Ambiguity

Harley (2001) states that most of the evidence that supports modern theories of parsing comes from studies of syntactic ambiguity. In this type of ambiguity, the grammatical structure of a sentence allows two different interpretations, that is, the sentence can be parsed in more than one way. In other words, words in such sentences have the same meanings, but different structures can be assigned to a certain string of words, each of which gives rise to a different meaning. *He wrote the letter on the table*, for example, which can be interpreted as *he wrote the letter which was on the table* (as opposed to the one that is on the armchair), or it can be interpreted as *he was sitting on the table when he wrote the letter*. This kind of ambiguity is said to be structural because each of the ambiguous sentences can be represented in two structurally different ways. In other words, attention to the only surface-level structure of the sentence cannot explain the ambiguity of the sentence and studying the deep structure is required.

2.2.3 Attachment Preferences in Adult Native Speakers

Consider sentences such as (1) in which the relative clause can be attached either high, to the first noun phrase (DP-1, *the servant*), or low, to the second noun phrase (DP-2, *the actress*): (1) Someone shot [the servant]DP-1 of [the actress]DP-2 who was on the balcony Several studies have employed acceptability judgment tasks and reaction-time (RT) experiments to examine attachment preferences in such sentences across different languages. Most studies examining native speakers of English found a DP-2 preference,

i.e. the bracketed relative clause is preferably associated with the lower DP, i.e. with *actress* (Carreiras & Clifton, 1999, Frazier & Clifton, 1996, among others). This preference has been ascribed to a general parsing strategy dubbed *Right Association* (Kimball, 1973), *Late Closure* (Frazier, 1978) or *Recency* (Gibson et al., 1996), according to which new phrases are attached to the phrase currently being processed, i.e., to the most recent phrase if grammatically possible.

2.2.3 Previous Studies on Attachment Preferences in L2 Learners

There is a small number of previous studies which have examined attachment preferences in L2 learners. Other studies have explored attachment preferences in bilinguals; see Fernández (2000) for a review of these studies. Our focus here will be on studies examining adult learners who acquired L2 after puberty. In two eye-tracking experiments, PP-attachment and main/subordinate clause ambiguities were examined in advanced French learners of English and English learners of French. In the first experiment, Frenck-Mestre & Pynte addressed the question of whether L2 learners' parsing strategies differ from the ones native speakers use when the structures under investigation are identical in the native and the second language. Their materials consisted of temporarily ambiguous sentences involving the attachment of a PP either to a VP or to a DP, such as *Brutus hit the gladiator with the shield with his bare hands*. This sentence is ambiguous up to the PP *with the shield*, since this PP could be attached either to the entire VP or to the DP-object. It is the PP *with his bare hands* that disambiguates the sentence towards DP-attachment. It was found that for both native speakers and L2 learners attachment preferences were dependent on the argument structure of the verb; ditransitive verbs (such as *hit*) VP-attachment was preferred, while with monotransitive verbs (e.g. *reject*) DP-attachment of the PP was preferred. This was interpreted as supporting a lexically-driven parser in both L2 learners and native speakers in which subcategorization information of the verb affects parsing decisions. Frenck-Mestre & Pynte also found differences between native speakers and L2 learners. Specifically, L2 learners exhibited processing difficulties in sentences that were disambiguated towards VP-attachment. There was no such effect in the native speakers. This difference is taken to indicate that L2 learners prefer to attach incoming material locally, i.e., to the most recent constituent, thus favoring DP-attachment over VP-attachment.

The second experiment examined whether L2 learners transfer lexical properties from their L1 when processing temporarily ambiguous L2 input. Sentences such as *Every time the dog obeyed the pretty little girl showed her approval* was used with verbs such as *to obey* (= *obéir*) that are optionally transitive in English and obligatorily intransitive in French. Consequently, whereas in English the DP *the pretty little girl* can be parsed either as the direct object of the verb or as the subject of the subsequent main clause, in the French translation of the above sentence (*Chaquefoisque le chienobeissait la joliepetitefillemontraitsa joie*) the DP *la jolie petite fille* cannot be constructed as a direct object of the embedded verb. These kinds of sentences were compared with parallel sentences in which *obéir* and the like were replaced by verbs such as *aboyer* 'to bark' which are most

typically intransitive in both English and French. The experimental results indicated that French learners of English took longer to read sentences with verbs such as *to obey* than corresponding sentences with verbs such as *to bark*. Frenck-Menstre & Pynte interpret this finding as an effect of the L1 transfer; the L2 learners took extra time 'to reflect upon a verb's usage in cases where information from their native language conflicted with that from their second language' (p.141f.). Note, however, that there is an alternative explanation for this finding which does not rely on L1 transfer. Optionally transitive verbs make available a greater number of structural options for online processing than intransitive verbs, and it is possible that this difference caused the longer reading times for sentences with *obey*-type verbs. This account is also compatible with the fact that a similar (albeit smaller) difference in reading times was found for native speakers. Moreover, the L2 learners were tested in French and English in the same experiment, which required them to switch back and forth between L1 and L2, and such a design may have produced arbitrary effects. This study examined RC attachment preferences in English in two groups of Spanish L2 learners and in adult native speakers using an offline questionnaire. The experimental materials consisted of ambiguous sentences such as *Roxanne read the review of the play that was written by Diane's friend* containing RCs preceded by complex DPs linked by the prepositions *of* or *with*. There were 15 'early' learners, Spanish speakers who started to learn English before the age of 10, and 15 'late' learners who started to learn English after the age of 10. A clear low-attachment preference was found in the native speakers, but not in the L2 learners. Instead, both early and late learners produced more high-attachment answers than native speakers. Fernández interprets this as a result of L1 transfer, reflecting the fact that Spanish prefers high attachment in cases in which English prefers to attach low. Note, however, that whereas native speakers of Spanish exhibit a clear low attachment preference for DP-*con*-DP (see e.g., Cuetos & Mitchell 1996), the L2 learners showed no clear preference for either high or low attachment (see Fernández, Tab.1, p.227), indicating that the L2 learners' responses *cannot* be accounted for in terms of L1 transfer. It should also be mentioned that a direct comparison between the two conditions (*of* vs. *with*) is not possible, since the DPs used in both conditions were different.

This study examines RC attachment preferences in temporarily ambiguous sentences of French in native speakers and 'beginning' adult L2 learners with English or Spanish as L1. RC antecedents contained complex DPs with non-prepositions (DP*de*- DP). An overall high-attachment preference was found for native speakers and Spanish L2 learners, and no preference for English L2 learners. Thus, we cannot rule out the possibility that the Spanish and the English participants are at different proficiency levels in their L2 and therefore not directly comparable with each other. Moreover, most studies of native speakers of English have a low-attachment preference; L1 transfer in the case of English learners should therefore produce a low-attachment preference (rather than no preference).

Summarizing, the studies mentioned above do not provide clear answers to the question of whether adult L2 learners are able to employ the same parsing mechanisms

as native speakers, and to the question of whether L2 learners transfer parsing mechanisms from their L1. Results from previous studies are also hard to interpret because the L2 learners' proficiency in the second language, and particularly, their grammatical knowledge of the constructions under study was not independently assessed. It is therefore possible that differences observed between native speakers and L2 learners in the experiments are, at least in part, due to the L2 learners' incomplete acquisition of the relevant grammatical constructions.

3. Method

3.1 Participants

A total of 50 female native speakers of Persian ranging in age between 15 to 25, participated in this study. They were studying English at an institute. Some of them were high school students and the others graduated from different universities. A general proficiency test, was used to put the participants who were at the same level of knowledge were together. All the participants were unexperienced regarding the purpose of the study. In order to gain the results of this study, the participants were divided into two groups according to their age, namely the adolescent group (n=23) and young adults (n=27).

3.2 Instrumentations

The instruments used in the present research included: an offline sentence acceptability judgment test, and main tests that included a first main test for discovering the significant relationship between age and participants' preferences, offline test, online complete presentation (timed), an online segment by segment sentence. The tests were given to the participants in each group separately by the test taker. It should be noted that for the sake of validity and reliability of the used instruments, they were elicited from another thesis with a roughly similar topic. What follows is a detailed explanation of the used tests.

3.2.1 Offline Sentence Acceptability Judgment Test

An offline sentence acceptability judgment test consisting of 12 (grammatical and ungrammatical) sentences was used in which the participants were supposed to rate the sentences on a scale from 1 (least acceptable) to 6 (most acceptable) was used. The goal of this judgment test was to find out whether the participants were familiar with the structure of the sentences used in the main experiment or not so that any possibility that their lack of grammatical knowledge obliged them to the selection of an option was excluded. The reason why the participants were asked to rate the grammaticality of sentences from 1 to 6 is that if the questions were multiple choice, they would answer the questions by chance. This possibility was ruled out this way.

3.2.2 The Main Test

Totally 40 sentences, including 5 practice sentences, 15 experimental sentences and 20 filler sentences were used in the main phase of the study. All the experimental sentences were made up of both (Noun Phrase) DP1 and (Noun Phrase) DP2, followed by (Recency/ Closure) RC that referred to both DP1 and DP2. All the DPs were functioning as objects and all the RCs were functioning as subjects. All the practice, experimental and filler sentences were controlled in complexity and length. The practice sentences acted as warm-up up and in order to prevent the participants to use any particular strategies for choosing DPs, the experimental sentences were interspersed with filler sentences. Each practice, experimental and filler sentence was followed by two choices in order to find out which DPs were preferred by the participants. Almost in half of the sentences, the first option referred to DP1 and the other choice referred to DP2.

Examples of the experimental and filler sentences and options following them are provided below:

3.3 Experimental Sentences & the Options:

The doctor recognized the nurse of the pupil who was feeling very tired.

A) The nurse was feeling very tired.
B) The pupil was feeling very tired.

3.4 Filler sentences& the options:

The logic explained during the lecture was quite complicated.

A) The lecture was quite complicated.
B) The logic was quite complicated.

3.5 Procedure

At first, before the main test, the sentence acceptability judgment test was given to both groups intermediate and adults. Each group was tested separately. The sentence acceptability judgment test consisted of 12 sentences that were supposed to be answered in 10 minutes, the participants were asked to rate the sentences from 1 to 6 to rule out the possibility of answering just by chance. The numbers "1" and "2" were interpreted as ungrammatical, and the numbers "5" and "6" were interpreted as grammatical. In addition, numbers "3" and "4" were interpreted as either "I don't know", or as a sign that the participants had answered haphazardly. This kind of test was taken to make sure that they could deal with the structures used in the main experiment. The participants were asked to select the correct number either by circling or ticking their choices on the test paper.

In the same session, the participants took other tests right after the first one was the main test. The main test, including ambiguous sentences of the aforementioned type, practice, filler and experimental sentences, was presented in 4 different ways that are explained in detail below:

a. First Test

In the first main experiment, the participants were divided into two groups according to their age, namely the adolescent group (n=23) and young adults (n=27). The participants started with 5 practice sentences, as a warm-up, and continued with 20 filler and 15 experimental sentences. Each practice, experimental and filler sentence was followed by two choices in order to find out which DPs were preferred by the participants and at the same time to discover the significant relationship between participants' preferences and participants' age. Almost in half of the sentences, the first option referred to DP1 and the other choice referred to DP2.

b. Offline Test

In the offline main experiment, the participants began with 5 practice sentences, as a warm-up, and continued with 20 filler and 15 experimental sentences. Each sentence in the test was followed by 2 options, which were in the form of statements about the truth value of their previous sentences. The participants were asked to select one option in their test papers. Before administering the test, the participants were told that there was no time limitation for answering.

c. Online Complete Sentence Presentation (Timed)

The sentences were presented on the laptop screen completely. In this kind of test, each sentence remained for 5 seconds on the screen and all the sentences were presented on black and white background. One slide was allocated for each number from 1 to 35 and their options were presented in a separate slide and each sentence remained on the screen for 5 seconds. All the sentences and the options were piloted before the main experiment, and the decision to devote 5 seconds to each sentence was made based on a pilot study. The options were presented in the form of statements which showed the true value of the sentences. The participants were asked to answer the questions just by saying "A" or "B" and then the test taker herself transferred the answers to a pre-developed answer sheet.

d. Online Segment-by-Segment Sentence Presentation (Self-Paced)

In this type of test, all the sentences were presented in segments. The participants were asked to read each segment carefully and go to another segment by pressing the "Enter" key until they reach the full stop. Again, by pressing the "Enter" key they could see the options segment by segment and after that, the participants were told to choose "A" or "B". In this type of online test, there was no time limitation and was told to the participants beforehand. In the previous online test, the options were in the form of statements which were about the truth value of the previous sentence but in this online one is self-paced. In order to make the students familiar with the process of the test first they were asked to answer practice sentences as a warm-up activity. For avoiding the participants not using any particular strategy in their choice, the experimental sentences were combined with filler sentences randomly and the options were presented randomly and their

position of them were changed again randomly. Their answers to the sentences showed the participants paid attention carefully to understand the sentences.

3.6 Scoring System

3.6.1. Attachment Preference

This study used the method employed by Kim and Christianson (2013), for determining the attachment preferences of the participants. Kim and Christianson (2013) assigned a score of zero to DP2 and a score of one to DP1 which was chosen by the participants. They added up all the ones and zeroes and divided this number by all the ambiguous sentences then if the number was more than .5 and close to one, the attachment preference was regarded as DP1 and if the number was less than .5 and close to zero, the attachment preference was regarded as DP2. For example, if one participant chose 13 DP1 and 2 DP2 for 15 ambiguous sentences, then determining the formula of the attachment preferences of the sentences would be as bellow:

$$(13\times1) + (2\times0) = 13:15 = .86$$

In this example the attachment preference is more than .5 and close to one, so the attachment preference is regarded as DP1.

4. Results

4.1 The Results of the Grammaticality Judgment Test

At the onset of the study, in order to ensure that the participants could manage the structures used in the main experiment, a grammaticality judgment test was run. This way the participants' performance could not be attributed to their unfamiliarity with the structure in question. In this way, any participant whose comprehension score was low, was to be deleted from the study. Table 4.1 presents the descriptive statistics of the results of the grammaticality judgment test.

Table 4.1: Descriptive Statistics for the GJT (N=43)

sss	N	Minimum	Maximum	Mean	Std. Deviation
GJT scores	50	8.00	12.00	10.4000	1.03016

According to the descriptive statistics given in Table 4.1, the mean score of the grammaticality judgment test was calculated to be 10.40. This shows a fairly high level of comprehension. Therefore, none of the participants was excluded since they were all familiar with the structure under investigation.

4.2 Results for Analyzing the Fillers

As was stated in chapter 3, 20 unambiguous fillers were included in the test. The purpose was to check if the participants answer ambiguous sentences by chance and haphazardly or if they have provided the answers on purpose and knowingly. Table 4.2 shows the results.

Table 4.2: Descriptive Statistics for the Unambiguous Fillers (N=20)

	N	Minimum	Maximum	Mean	Std. Deviation
Filler	50	17.00	20.00	19.0600	1.01840

As the results presented in Table 4.2 show, the mean score for comprehension accuracy was 19.06, which is more than 90% and indicates a high comprehension accuracy. This shows that all the participants answered the questions on purpose. Therefore, none of the participants was excluded.

4.3 Investigating the First Research Hypothesis

The first hypothesis of the present study which was formulated based on the first question was that participants' age does not affect the attachment preferences of L2 female Persian learners significantly. Therefore, the following steps were taken in order to test the hypothesis and find the answer to the first question of the study. A group of 50 female native speakers of Persian was chosen based on their performance in a general proficiency test. An offline sentence acceptability judgment test consisting of 12 statements was used to find out whether the participants were familiar with the structure of the sentences used in the main experiment or not. Then, the first main test was administered by each age group to obtain the needed data. For the purpose of finding evidence to test the first null hypothesis of this thesis, the participants were divided into two groups based on their age, namely, adolescents (n=23) and young adults (n=27). Then their scores were compared. Table 4.3 presents the results.

Table 4.3: Descriptive Statistics for the Young Adult and Adolescents

	VAR00001	N	Mean	Std. Deviation	Std. Error Mean
Scores	Young adults	27	.3370	.15893	.03059
	Adolescents	23	.5417	.08799	.01835

According to the figures presented in Table 4.3, the mean score of the young adults (*X=0.33*) is less than that of the adolescents (*X=0.54*). In order to be more exact about the significance of the existing difference, *an independent samples t-test* was administered the results of which are presented in Table 4.4.

Table 4.4: The Results of the Independent Samples Test between the Mean Scores of the Young Adults and Adolescents

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Scores	Equal variances assumed	6.851	.012	-5.496	48	.000	-.20470	.03725	-.27959	-.12981
	Equal variances not assumed			-5.739	41.696	.000	-.20470	.03567	-.27670	-.13271

As shown in Table 4.4, the amount of t-observed value is 5.49 and the critical t-value at 48 degree of freedom is 2.01. In statistical terms, the amount of t-observed, i.e. 5.49 at 48 degree of freedom is higher than the critical t-value of 2.01. To put it simply, when t-observed is bigger than the critical t value it can be concluded that there is a significance difference between two means. So, the first null hypothesis can be rejected. On the other hand, the observed level of significance is higher than the identified level of significance (*df =48, P=.000< .05*). This means that participants' age affects the attachment preferences of L2 female Persian learners significantly. Differently stated the mean for DP1 preference is .54 which is more than the chance level (.5). So, adolescent participants have a clear DP1 preference.

4.4 Investigating the Second Research Hypothesis

The second research hypothesis claimed that participants' attachment preference does not vary depending on whether the experimental sentences are presented online or offline. In fact, the attachment preference of the participants was the dependent variable and the mode of presentation was the independent variable. To test this hypothesis, the research materials were presented to the participants in three modes, namely online (timed), offline and online (self-paced). Then the scores of the participants were compared, the results are presented in Table 4.5.

Table 4.5: Descriptive Statistics for Different Ways of Presenting the Materials

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Offline test	16	**.3694**	.12439	.03110	.3031	.4357	.20	.66
Online timed test	17	**.2065**	.19975	.04845	.1038	.3092	.00	.60

Online self-paced test	17	**.5512**	.08964	.02174	.5051	.5973	.40	.70
Total	50	.3758	.20254	.02864	.3182	.4334	.00	.70

Table 4.5 compares the performance of the participants who were exposed to different modes of presentation of materials. As shown, the mean score for the offline test was .36 and the mean for the online timed test was .20, while the mean score for the group who took the online self-paced test was .55. As Table 4.5 shows, the offline and the timed online methods have means lower than .5 (chance level), but the self-paced online method has a mean above .5. It is clear that a mean difference exists between the mean of the three modes of presenting of materials; however, it is not clear whether this difference is statistically significant or not. To ensure the significance of the difference a one-way ANOVA was administered, and the mean scores of the three modes were compared. Table 5.6 presents the results.

Table 4.6: One way ANOVA for Different Ways of Presenting the Materials

	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	1.011	2	.505	23.780	**.000**
Within Groups	.999	47	.021		
Total	2.010	49			

According to the results presented in Table 4.6, there is a statistically significant difference among the three modes of presenting the materials (*F= 23.78, p=.000<.05*). This analysis led to the rejection of the second research null hypothesis, according to which participants' attachment preference does not vary depending on whether the experimental sentences are presented online or offline. Therefore, the mode of presenting materials has a significant effect on participants' attachment preferences. Still, it is not clear where the difference exists. In order to locate the difference a post-hoc test was run the results of which are presented in Table 4.7.

Table 4.7: Post Hoc Results for the Different Ways of Presenting the Materials

Scores LSD						
(I) VAR00001	**(J) VAR00001**	**Mean Difference (I-J)**	**Std. Error**	**Sig.**	**95% Confidence Interval**	
					Lower Bound	**Upper Bound**
Offline test	Online timed test	.16290	.05078	.002	.0607	.2651
	Online self-paced test	-.18180*	.05078	.001	-.2840	-.0796
Online timed test	Offline test	-.16290	.05078	.002	-.2651	-.0607
	Online self-paced test	-.34471*	.05001	.000	-.4453	-.2441
Online self-paced test	Offline test	**.18180***	.05078	.001	.0796	.2840

	Online timed test	**.34471***	.05001	.000	.2441	.4453
*. The mean difference is significant at the 0.05 level.						

Asterisk beside the mean value shows significance, the figures in Table 4.7 shows that presenting materials in the self-paced online method leads to a significant difference between the two other modes.

4.5 Investigating the Third Research Hypothesis

The last research hypothesis of the present thesis stated that segmentation of the experimental sentences does not play any role in participants' attachment preferences. In order to gather data to accept or reject this hypothesis, the materials were presented in the segment and holistic mode, and then the scores were compared. Table 4.8 presents the results.

Table 4.8: Descriptive Statistics of Segmented Presentation

	VAR00001	N	Mean	Std. Deviation	Std. Error Mean
Scores	Holistic	33	.2855	.18449	.03212
	Segment	17	.5512	.08964	.02174

According to the statistics presented in Table 4.8, the mean score of the holistic mode of presentation is .28 and that of segmented presentation is .55, the difference between which seems to be significant; however, to be more objective *an independent samples t-test* was run, the results of which are given in Table 4.9.

Table 4.9: Independent Samples Test of Materials with Segmented presentation

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Scores	Equal variances assumed	9.613	.003	-5.588	48	.000	-.26572	.04755	-.36133	-.17011
	Equal variances not assumed			-6.851	47.922	.000	-.26572	.03878	-.34370	-.18774

Based on the results presented in Table 4.9, there is a significant difference between presenting the material holistically and in segment (*df =48, P=.000<.05*). The just mentioned statistical analysis provides evidence for rejection of the third null hypothesis of the research. Differently stated, it was found out that segmentation of the experimental sentences plays a significant role in participants' attachment preference.

5. Discussion of the Results

According to the data gained from this study and the statistics presented in chapter four and based on the treatment administered to the participants, it is obviously clear that participants' age affects the attachment preferences of L2 female Persian learners. In fact, adolescents outperformed young adults. Differently stated the mean for DP1 preference is .54 which is more than the chance level (.5). So, adolescent participants have a clear DP1 preference. With regard to age, the findings of this study to some extent lend support to the study by Frenck-Mestre and Pynte (1997) who examined RC attachment preferences in temporarily ambiguous sentences of French in native speakers and 'beginning' adult L2 learners with English or Spanish as L1. RC antecedents contained complex DPs with non-theta assigning prepositions (DPde- DP). An overall high-attachment preference was found for adult native speakers and Spanish L2 learners, and no preference for English L2 learners. They interpret this finding in support of L1 transfer, reflecting the fact that a high-attachment preference is found in L1 Spanish but not in L1 English. Thus, we cannot rule out the possibility that the Spanish and the English participants are at different proficiency levels in their L2 and therefore not directly comparable with each other. Moreover, most studies of native speakers of English have a low-attachment preference; L1 transfer in the case of English learners should therefore produce a low-attachment preference (rather than no preference).

The second research question sought to investigate whether the mode of presenting sentences affects the attachment preferences of EFL learners. To find the answer to this research question, some experimental questions were presented online while there was a time limit, some were presented offline and some others were presented online without a time limit. The findings showed that the online self-paced mean score was higher than the other modes. In addition, the mean score was .55 and higher than.50, it was concluded that the attachment preference is DP1. In this respect, the results of the present study are in line with the study conducted by Papadopoulou and Clahsen (2005), in which the results from acceptability judgment and self-paced reading experiments were reported; they examined relative clause attachment preferences of Greek native speakers. These results revealed a consistent picture showing that lexical and/or thematic properties of the antecedent affect the attachment of the RC, i.e., there is no absolute tendency for one of these attachments.

The last question addressed the issue of whether the segmentation of the experimental sentences plays any role in participants' attachment preferences. To answer t is the question, some experimental sentences were presented once holistically (in complete form) and once separately, in chunks. The results showed that when the sentences are presented in segments, better results are gained. Differently stated, it was found out that segmentation of the experimental sentences plays a significant role in participants' attachment preference.

As for the segmentation of the experimental sentences, this study showed that segmentation does play a role in resolving ambiguous sentences, thus providing further

support for the prediction of the IPH (Fodor, 1998). In this study, the experimental sentences were presented both holistically and in a segment-by-segment fashion to see whether participants show different parsing behaviors in these conditions or not. In the segment-by-segment condition, the genitive construction (i.e., DP1 of DP1) was always presented as one chunk, as in the previous studies on ambiguous sentences. This segmentation, according to the IPH, might have caused the participants to insert a pause after the second DP. The insertion of this pause might have created a prosodic boundary which blocks the attachment of the RC to DP2. As a result, since DP1 of DP2 is one chunk headed by DP1 and not ambiguous at all by itself, the participants have associated the RC to the head of this chunk, which is DP1. Therefore, the syntactic disambiguation of structurally ambiguous sentences might be the result of the prosodic packaging of different elements of a sentence. Consequently, we cannot deny the fact that there are variations in parsing in general and ambiguity resolution in particular and these variations might be the result of differences in segmentation.

Finally, the results of the present study revealed that participants' attachment preferences vary significantly depending on whether the data are presented online or offline. Thus, the different ways of data presentation may partly account for the aforementioned inter- and intra-lingual variation in attachment preferences.

The results are in line with Marefat and Mehrjoo's (2005) study in which they attempted to investigate parsing preferences (early vs. late closure) of native and L2 learners of both English and Persian when they read ambiguous relative clauses. The purpose is to find out if L2 learners process L2 linguistic input in the way monolingual speakers of that language do. The participants took tests including 10 test sentences plus 10 distractors, each followed by a comprehension question. Monolingual speakers of Persian and English were provided with tests in their own language, while bilinguals were provided with tests in their second language. Results showed a significant preference for monolingual Persian speakers for high attachment to relative clauses (early closure), whereas monolingual English speakers showed a high preference for low attachment (late closure). The results also indicated that bilinguals adopted the same parsing strategy used in their L1, suggesting that their L1 might be influencing their L2 processing. The results are discussed in terms of the implications they may have for ultimate attainment in L2.

6. Conclusion

Since this study was done among Iranian EFL learners and may reveal the effect of integrating activities to improve the attachment preferences of EFL learners, in order to enhance English language teaching and learning, it can be a starting point to improve the quality of teaching English in this country, especially for the students of TEFL who are going to become language teachers. It must be noted here that in order for the findings of this study to be pedagogically valid and applicable, first of all, they must be subjected

to replication and empirical validation. It is then and only then that the results and findings can be generalized to other populations.

As this study showed different modes of presenting materials to EF learners can affect the attachment preference of EFL learners, The findings may well suggest that incorporating the best mode of presenting materials to EFL learners is of great importance. The results can encourage language teachers to take a more systematic approach to teaching ambiguous sentences and planning their programs in classrooms. It should be mentioned that the findings of this study could enrich the literature in the area of psycholinguistics.

Based on the results, the findings of the present study revealed, the variations in attachment preferences in ambiguous sentences might have been partly the result of methodological artefact since both segmentation and different ways of presenting the material (online vs. offline) did have an impact on participants' attachment preferences. On the one hand, the results of the present study showed segmentation of the experimental sentences partly explains the variation in participants' attachment preferences, which lends support to the predictions of the IPH (Fodor, 1998). On the other hand, the results of the present study showed that part of the variation in attachment preferences may be a function of whether the experimental sentences are presented online or offline. Furthermore, from an L2 proficiency perspective, the results obtained from the present study showed that the role of proficiency in determining attachment preferences is inevitable.

The results of the present study showed that the limitation of memory resources manifests itself in L2 sentence processing, which is in line with the prediction of the SR model of working memory capacity. Therefore, it is expected that L2 learners behave differently as a result of the different memory resources they have at their disposal. Consequently, the pedagogical implication, as long as memory span is concerned, is that providing linguistic input for L2 learners without taking their working memory capacity into consideration results in a mismatch between what students can process and what teachers want them to process. That is, providing low-spans with the same amount of linguistic input which is provided for high-spans is like expecting them to bite off more than they can chew. So, language teachers are strongly suggested that they take working memory capacity into serious account while presenting the linguistic input in their classes since the nature of their students' comprehension is constrained by their working memory capacity.

With regard to foreign language learners' age, language teachers are strongly recommended to take the age of their students into serious account. Although it is not possible to exactly organize the age of the language learners to have homogeneous classes, they must know that L2 learners at lower ages transfer the structure of their already acquired language, i.e. their L1, to their L2 learning, and this may be the source of many of their errors. The pedagogical implication for English teachers is that they must adopt teaching strategies appropriate to each age level.

Conflict of Interest Statement

The authors declare no conflicts of interest.

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