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LABORATORY OF LINGUISTICS  
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# NARRATIVE PRODUCTION, BILINGUALISM AND WORKING MEMORY CAPACITY: A STUDY OF GREEK-GERMAN BILINGUAL CHILDREN

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## Abstract

We investigate narrative production of 8-10 year old typically developing bilingual children. One group of these children grow up in Germany and attend German schools with exposure to Greek in afternoon classes only, while the other group attends the German School of Thessaloniki. Biographical data were gathered through a detailed questionnaire, allowed us to determine age of onset and input measures. A vocabulary production task was used as an independent measure of language proficiency. The results reveal correlations between working memory function and type of bilingualism. Vocabulary measures seem to correlate with narrative production both in qualitative and quantitative terms.

**Keywords:** bilingual children, narratives, Telling, Retelling, working memory, character reference

## 1. Introduction

According to the literature children's narratives are found to provide an index of their cognitive, semantic and social abilities (Liles 2003). It is also suggested that narrative analyses are less biased against bilingual children than norm-referenced grammar assessment tools (Paradis et al. 2011).

Narrative production can be elicited with picture-based sequences either with no language support (story Telling mode) or with (story Retelling mode). The choice between Telling and Retelling is a matter of dispute in the literature. In Retelling children provide longer, more detailed, and grammatically more accurate language samples (Hayward et al. 2007, Schneider & Dubé 2005). Also, the Retelling mode allows the investigator to control certain aspects of the narrative, e.g. length, complexity and content as well as restrict error analysis and assessment of comprehension over a given text (see Liles 1993, and Hadley 1998, among others). In the Telling mode children have more freedom to use their imagination in story generation. As such the produced narratives are a better reflection of the children's ability use lexicon, syntax and cohesive devices. Also the Telling mode provides more information about children's independent narrative abilities than Retelling (Schneider et al. 2006).

The present study reports on the experimental investigation of narrative production by 8-10 year-old typically developing Greek-German children. The aim was to examine bilingual production in story Telling and Retelling in order to compare microstructure properties of narratives concentrating on coherence established through reference tracking. Character reference was measured in terms of appropriateness of referential forms used in each language with respect to three discourse functions, namely Introduction, Maintenance and Reintroduction (Arnold &

Griffin 2007). In addition we examine the relationship between children's working memory capacity and narrative length especially in the Retelling mode.

## 2. Research questions

Our basic research question is the examination of (bi-literate) bilingual children's narrative production in two modes, Retelling and Telling focusing on syntactic complexity and discourse reference. Specifically, we wanted to see whether the performance in these two aspects of narrative is similar in the two different modes. An additional research question was the role of language dominance in bilingual children's narrative performance. In particular, we investigate whether strong dominance in German affects performance on Greek narratives in the two groups of children (in Germany and Greece) and whether this effect is evident both in syntactic complexity measures and/or in character reference. Our final question concerns the 'distance' between vocabulary scores in the two languages of the child and whether this distance -reflecting language dominance - correlates with verbal and visuospatial working memory scores.

## 3. The study

The study was based on a sample of 38 Greek-German bilingual children, 8 to 10 years old. We divided the children into two groups according to their country of residence. Group A from Greece consisted of 24 participants (14 girls) and Group B from Germany consisted of 14 participants (8 girls). At the time of testing, Group A had a mean age of 9.2 yrs ( $S.D = 1.02$ ) and Group B a mean age of 9.4 yrs ( $S.D = 1.3$ ). The language used at home for both groups could differ, i.e. Greek only, German only or both. All children were literate in both languages, but in all schools visited, exposure to German was higher than Greek and German was the main medium of instruction. The children from Group A were recruited from the German school in Thessaloniki, where Greek is offered 4 hours per week. Children from Group B were recruited from Greek language support classes in Cologne which run twice a week for four hours in total, in the afternoon. A group of 20 monolingual Greek children (8 girls) with a mean age of 9.3 yrs ( $S.D = 1.2$ ) also participated in the study. These children were recruited from the 3rd Model Experimental Primary School of Evosmos.

All participants were recruited on the basis of a background questionnaire<sup>1</sup> that was completed by the investigator. The questionnaire included eight sections which include demographic information, age of onset questions about L1 and L2 together with amount of exposure measures at different ages, questions on literacy exposure in L1 and L2, current language use, the child's self-evaluated language abilities, language background in the family, traveling to L1, L2 countries and attitude towards bilingualism. From this set of questions we selected those concerning information about the children's language dominance. Yip et al. (2009) claim that when the input of bilinguals is less than balanced, one of the two languages may develop faster or

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<sup>1</sup> The questionnaire has been developed as part of the THALES research project "Bilingual Acquisition & Bilingual Education: The Development of Linguistic and Cognitive Abilities in Different Types of Bilingualism".

show greater complexity at a given age. This language is said to be dominant. Thus, we selected the questions about the input the children had received from their mother and father up to the age of 6 and responses to self-evaluation measures of the child's ability to speak, understand, read and write in each language. The answers for these questions were provided on a scale from 1 to 3 and the possible answers were: Greek, German, both.

All children scored between the 60th and the 95th percentile on the Raven Progressive Coloured Matrices test of nonverbal intelligence (Raven et al. 1998). Specifically, performance on Raven's<sup>2</sup> showed that the mean mental age (MA) of participants were as follows: Group A 9.24 yrs, Group B 9.1 yrs and Monolingual group 9.18 yrs. From the above measurements we observed no statistically significant differences  $t(36) = .340$ ,  $p = ns$ , for group A and B;  $t(42) = .317$ ,  $p = ns$  for group A and monolinguals;  $t(32) = .351$ ,  $p = ns$  with respect to mental age, which indicates that our groups were comparable.

### 3.1 The data

In order to establish an independent measure of language ability, we used two expressive vocabulary tasks normed for Greek (Renfrew Word Finding Vocabulary Test; Vogindroukas et al. 2009) and German (SET 5-10; Petermann et al. 2010) monolingual children. The picture-based stories used for narrative elicitation were the four picture stories (A2, B2, A3 and B3) of the Edmonton Narrative Norms Instrument (ENNI; Schneider et al., 2005). Stories A3 and B3 were used for the Retelling mode. German and Greek texts comparable in length and structural complexity were designed for this purpose. Stories A2 and B2 were used for the Telling mode. Two stories were used for Greek and two for German, one for each mode<sup>3</sup>. An analysis of microstructure and macrostructure was carried out. Furthermore, comprehension questions were also included in order to test the child's ability to follow the story's structure of episodes and the links between them.

In order to address the question of the relation between language dominance and working memory on one hand, and narrative length and working memory on the other, we assessed children with a verbal and a visuospatial task, namely a digit backwards task and the Rotating Figure Recall task (Alloway 2007).

### 3.2 Procedure

#### Vocabulary

The Greek vocabulary task (Vogindroukas et al. 2009) is an adaptation from Renfrew. It is a naming task and includes 50 pictures. The German Vocabulary task (Petermann 2010) is also a picture naming task including 40 pictures. Table 1 presents the bilingual participants' verbal age in Greek and German based on the translated raw scores:

<sup>2</sup> None of the children presented any learning difficulties as indicated by parent reports.

<sup>3</sup> In this study we will concentrate only in Greek data.

Table 1: Mean Verbal Age for Greek and German

<b>Group A</b>		
CA (Mean)	Greek (Verbal Age)	German (Verbal age)
8-9	>8.7	6.1
9-10	>6.4	<7.8
<b>Group B</b>		
CA (Mean)	Greek (Verbal Age)	German (Verbal age)
8-9	>5.2	>7.9
9-10	>5.08	>9.0

Except for the 8-9 yr old children of Group A, children's performance in vocabulary is higher in German.

### Narrative production

The four stories used were divided into two groups in terms of number of main characters; the *A2* and *B2* stories included three characters and consisted of 8 pictures each, while the *A3* and *B3* stories had four characters and consisted of 13 pictures. For the oral retell procedure complex stories were created (Andreou et al. 2013), which were controlled for comparability in terms of syntactic complexity and lexical variety.

In the Retelling mode, children were shown three colored envelopes on the computer screen and were asked to open one of them which included one of the stories. The child then listened to the story with headphones while being shown two pictures at a time on the computer screen. At the end of the story, children were asked to retell the story to the experimenter who had not been listening to the story or looking at the pictures. The Retelling mode provided information about the degree of the original model story the children could recall, including lexical items and grammatical structures.

In the Telling mode, children were presented initially with all pictures of the story and then two-by-two in order to tell a story of their own-making. Story-telling is presumed to be more difficult, since children are required to generate their own stories without the benefit of a prior model.

The elicited narratives were used to measure properties of microstructure including a wide range of linguistic features. Various means of assessing syntactic complexity have been used in studies on first and second language development (e.g., length of utterance, T-unit, proportion of complex constructions; see Ortega 2003). In our study, we calculated number of verb-clauses, number of subordinations/coordinations, and number of content and function words in Telling and Retelling. The number of clausal coordination and subordination was calculated in relation to the number of the overall number of clauses produced by the child. To this end we considered only clausal coordinations and adverbial, infinitival, complement and relative clause subordination. Length of the narrative was calculated by number of clauses (main verbs) per story.

Finally, the use of referential forms for the character reference functions of Introduction (i.e., the first mention of a character in a discourse), Maintenance (the immediately subsequent mention of a character), and Reintroduction (the reappearance of an already introduced character) was examined. The linguistic forms

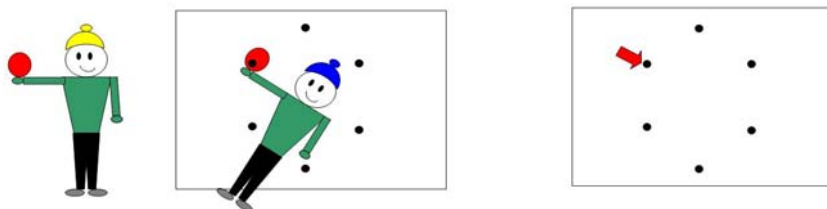
used for the above referential functions included definite and indefinite noun phrases, null and overt pronouns and pronominal clitics.

Working memory: verbal and visuospatial

Two working memory tasks, a verbal and a non-verbal, were adapted from the *Automated Working Memory Assessment* (Alloway 2007). The digit backwards task, which is a verbal working memory task, was administered in both Greek and German. In this task children listened to a series of digits that increase in length from 2 to 7 and were then asked to recall the digits in the reverse order e.g. they listen to the series 4 5 3 → and their target is 3 5 4.

The Rotating Figure task (Mister X) is a visuospatial working memory task. The children were required to respond whether Mr. X with the blue hat was holding the ball in the same hand as Mr. X with the yellow hat. Afterwards, the children had to serially recall the location of the ball that Mr. X with the blue hat was holding (6 sets of cards, max score = 42, see Figure 1).

Figure 1: Example of Mister X

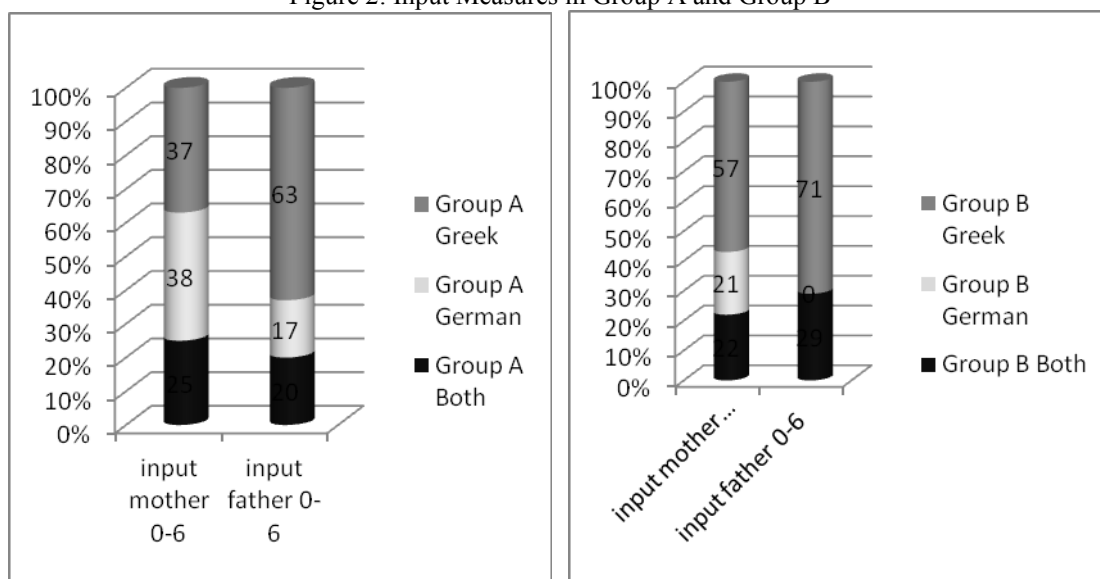


**4. Results**

*4.1 Demographic data*

As mentioned above, language dominance was measured also through some questions of the questionnaire presented to the child. Figure 2 presents in frequencies the input that Group A and Group B received from mother or father up to the age of 6 yrs.

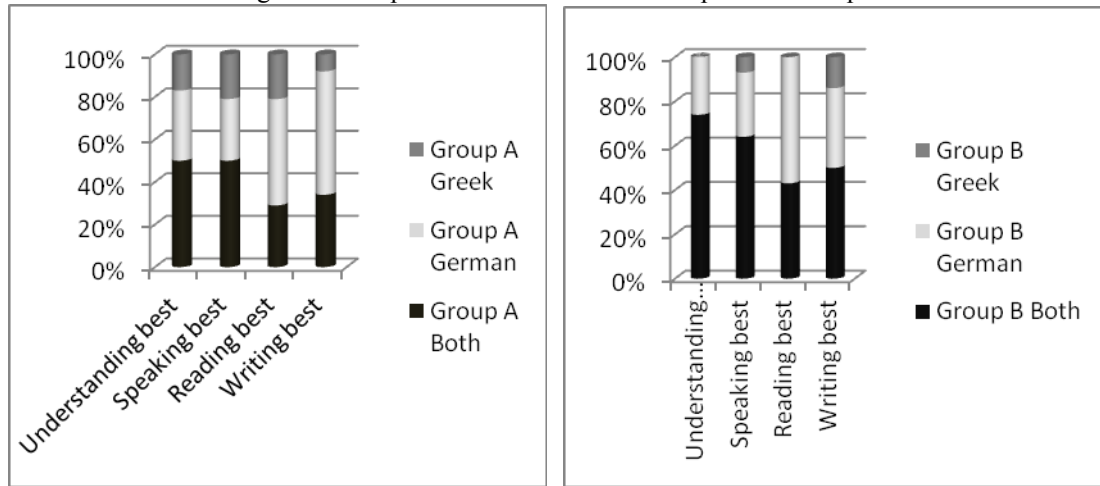
Figure 2: Input Measures in Group A and Group B



Input measurements show that Group B, namely the children living in Germany had received more Greek input in the preschool and early school ages as is usually expected from heritage speakers of a minority language. In the majority of cases both parents used Greek only at home. On the other hand, children in Group A had early exposure to German and Greek, since the majority of children come from mixed marriages with the mother being German and the father being Greek. Many children in Group A are simultaneous bilingual children, i.e. with two native languages from birth (2L1s).

The results from the self-evaluation responses are given in Figure 3. Interestingly, for both groups we observe an advantage for German in both oral and written form. Given the difference in early, home language use observed in the figures above, the similarity in the self-evaluation measures between groups indicates the role of the school setting, which, for all children, involves German as the main medium of instruction.

Figure 3: Self-perceived evaluation in Group A and Group B



#### 4.2 Narratives and working memory

We next turn to possible correlations between narrative length in the Retelling mode and working memory tasks. As mentioned previously, narrative length was measured in terms of number of clauses produced by the child<sup>4</sup>.

Table 2: Mean Length of narrative retelling and span measures for Digit Backwards and Mister X

Group A			
Chronological Age	Retelling Length (Model Story : 61)	Digit Backwards (span)	Mister X (span)
8-9	32.2	4	3
	(7)		
9-10	27.2	4	2
	(5)		

<sup>4</sup> In the A3 Greek model story the number of clauses was 60, while in B3 it was 62.

Group B			
Chronological Age	Retelling Length (Model Story : 61)	Digit Backwards (span)	Mister X (span)
8-9	26.1 (5.8)	4	2
9-10	24 (6.3)	4	2

Significant positive correlations between narrative length and Digit Backwards as well as between narrative length and Mister X were found but only in the Retelling mode. Specifically, there was a positive correlation in Group A and Group B between Length and verbal WM ( $r = .516, p < .01$ ;  $r = .681, p < .01$ ). Moreover, there was a positive correlation for both Group A and Group B between non-verbal and verbal WM tasks, ( $r = .562, p < .001$  and  $r = .581, p < .001$  respectively). However, no correlation was found between narrative length and non-verbal working memory for any group.

#### 4.3 Distance in L1 and L2 vocabulary scores and working memory capacity

In order to explore the role of the distance between vocabulary scores in L1 and L2 and the possible relationship between this distance and Working Memory capacity, we distinguished between children with a large difference in Greek (more than 30% in total accuracy) and German vocabulary scores and those with a small difference (less than 30%). Due to the small number of participants per group we ran correlations between vocabulary distance and Mister X span, as well as vocabulary distance and Digit Backwards span for all children as one group. The analyses revealed a pattern where children with a small distance between L1 and L2 vocabularies have a higher span on non-verbal and verbal tasks while children with strong dominance in German had lower working memory scores (L1/L2 vocab. distance and non-verbal WM:  $r = -.495, p < .002$ ; L1/L2 vocab. distance and verbal WM scores ( $r = -.366, p < .024$ )<sup>5</sup>. A final point to note is that the correlation between L1/L2 vocabulary distance and working memory was stronger in the case of the non-verbal than of the verbal task.

<sup>5</sup> The direction and the cause of the positive and significant correlation is unclear at the moment. It is possible that children with better WM skills become more 'balanced' bilinguals than those with not as good WM ability. Alternatively, there may be a bidirectional interaction between language and WM abilities which is more efficient with better proficiency in the minority language. Given that vocabulary development is primarily a matter of input variables in bilingualism we will remain agnostic as to the direction of the correlation found.

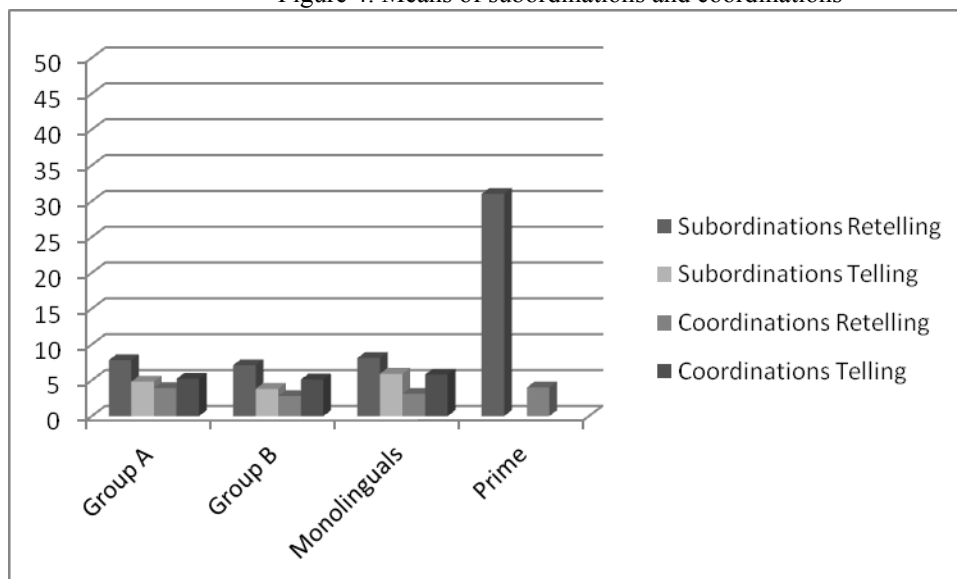


## 5. Microstructure

### 5.1 Syntactic complexity: number of subordinate vs. coordinate clauses

We next present the results from the number of subordinate and coordinate clauses in Telling and Retelling mode for Group A, Group B and monolingual children. Monolinguals were matched on age and school grade, with 10 monolingual controls per grade and age-group. In Figure 4 we present the means for subordinate and coordinate clauses produces as well the number of subordinate and coordinate clauses of the model story (prime).

Figure 4: Means of subordinations and coordinations

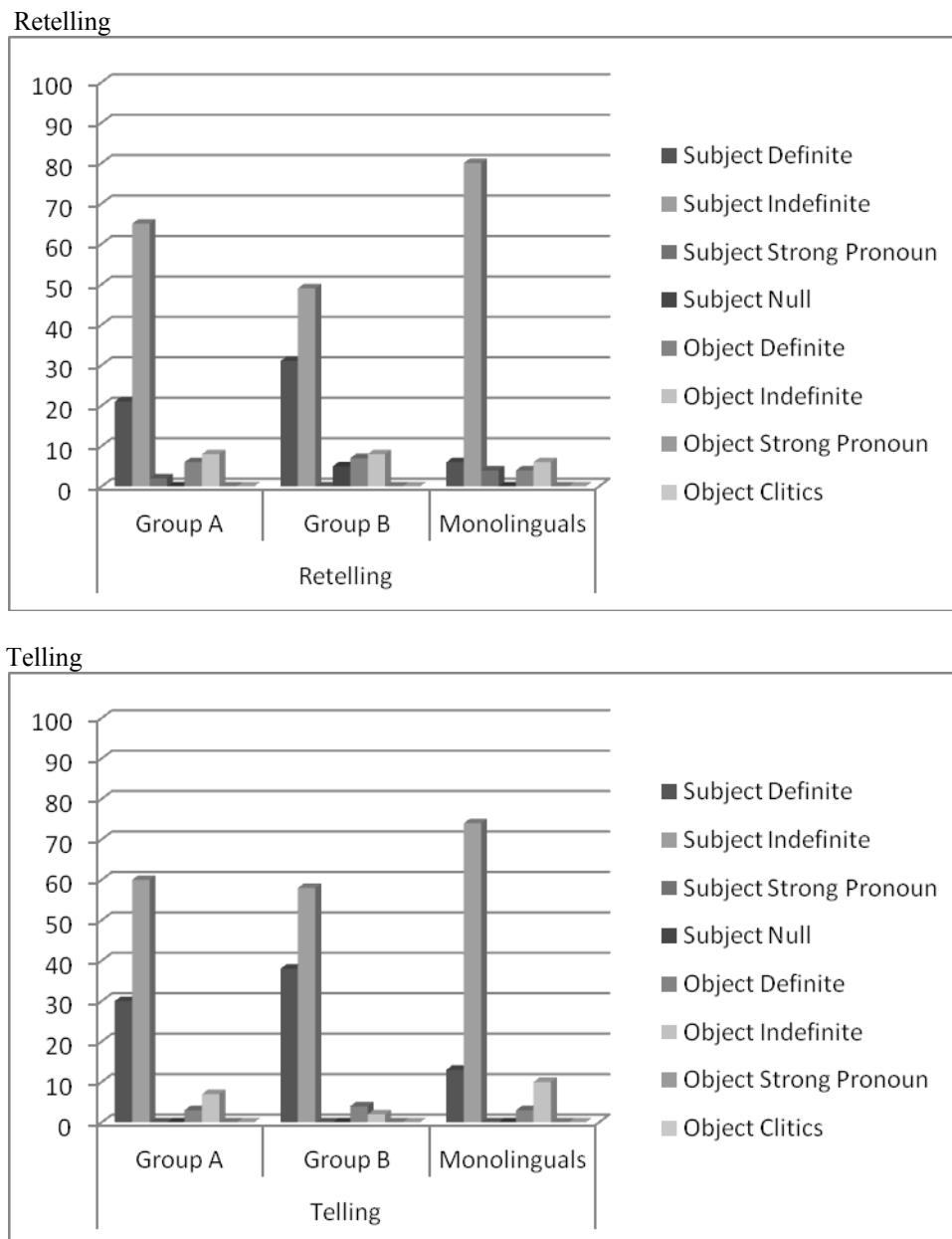


Within-group comparisons showed that there are statistically significant differences between the number of subordinations in the two modes with more subordinate clauses produced in Retelling than in Telling ( $M = 7.6$  vs.  $M = 4.8$  respectively,  $F(2, 55) = 5.6$ ,  $p < .01$ ). Furthermore, clause coordination was significantly lower in Retelling than Telling ( $M = 3.2$  vs.  $M = 5.3$  respectively,  $F(2, 55) = 10.1$ ,  $p = .001$ ). In order to compare performance between the two bilingual groups within each mode (Telling and Retelling) we ran a one-way ANOVA with bilingualism group (A, B and C (Monolinguals)) as the independent variable and syntactic complexity as the dependent variable. Significant differences were found in the number of subordinate clauses in the telling mode where Group A and Monolinguals produced more subordinate clauses than Group B (Group A (Mean) = 5.1 Monolinguals (Mean) = 5.8, Group B (Mean) = 3.7,  $F(2, 55) = 9.8$ ,  $p = .000$ ) and in the number of coordinate clauses in the Retelling mode where Group A produced more coordinate clauses than Group B and Monolinguals respectively (Group A (Mean) = 4.7, Group B (Mean) = 2.8, Monolinguals (Mean) = 3.1, with  $F(2, 55) = 9.6$ ,  $p = .001$ ).

## 5.2 Character-Reference

To examine character reference in the Introduction, Maintenance and Reintroduction functions we measured i) Definite DPs, ii) Indefinite DPs, iii) Null pronouns, iv) Overt pronouns and v) Clitics in Subject and Object positions. For character reference we calculate percentages by dividing form frequency by number of participants in each group.

Figure 5: Character introduction in Retelling and Telling

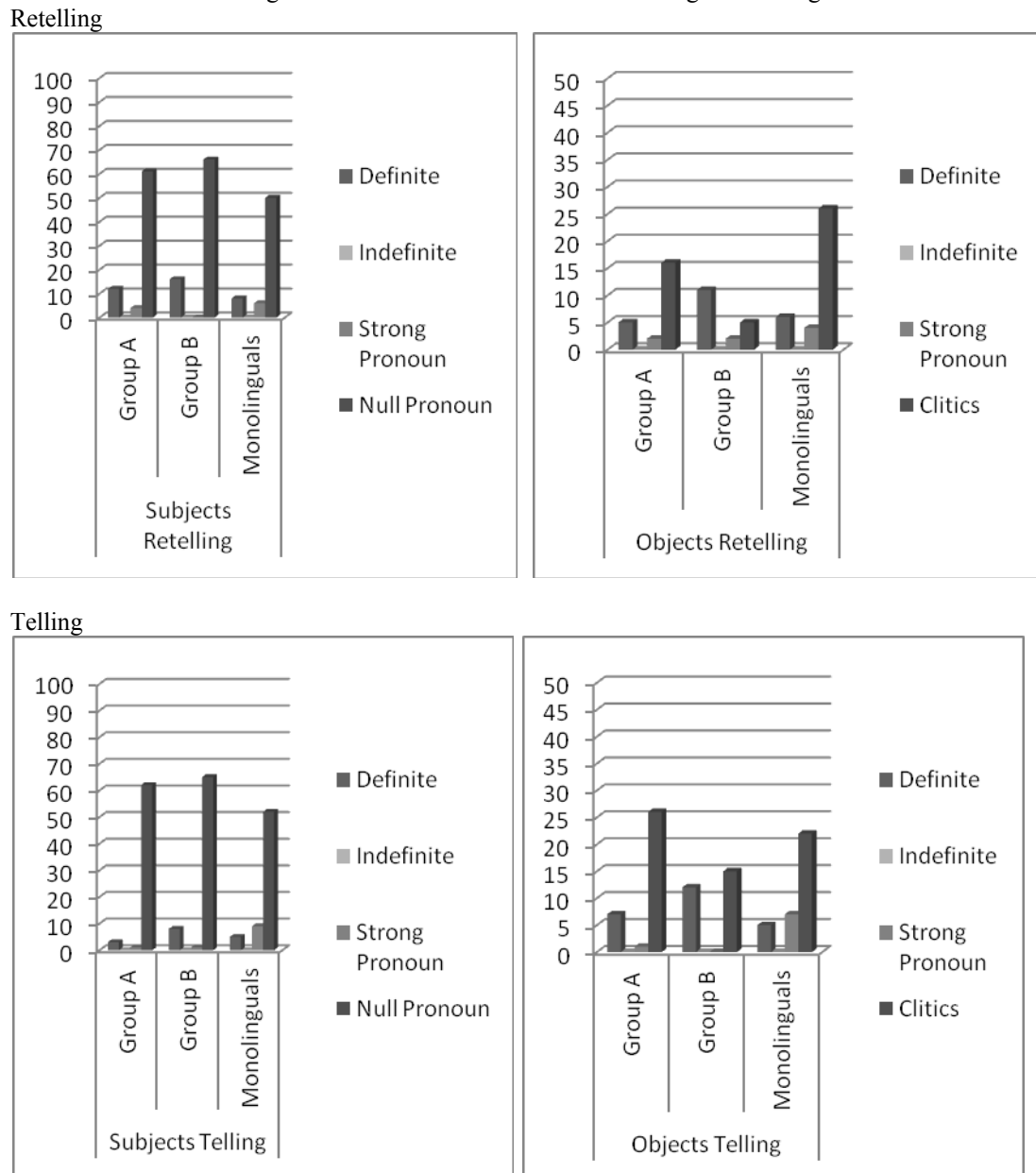


Results show that when introducing a referent both in Telling and in Retelling a story all groups prefer to use an indefinite DP followed by a definite one. A one-way ANOVA revealed that both bilingual groups use significantly more definites in Introductions [ $F(2, 55) = 9.1, p = .000$ ] than their monolingual peers in both modes [ $F(2, 55) = 8.9, p = .000$ ]. The delay in the development of indefinite for the

introduction function has been reported in previous studies with monolingual children (Hickmann 1999; Tsimpli et al., 2014). Group B children also differ from the other two groups in Retelling in (ungrammatical) null pronouns [ $F(2, 55) = 8.7, p = .000$ ] and in the use of strong pronouns [ $F(2, 55) = 8.1, p = .001$ ] in which they perform lower than the other two groups.

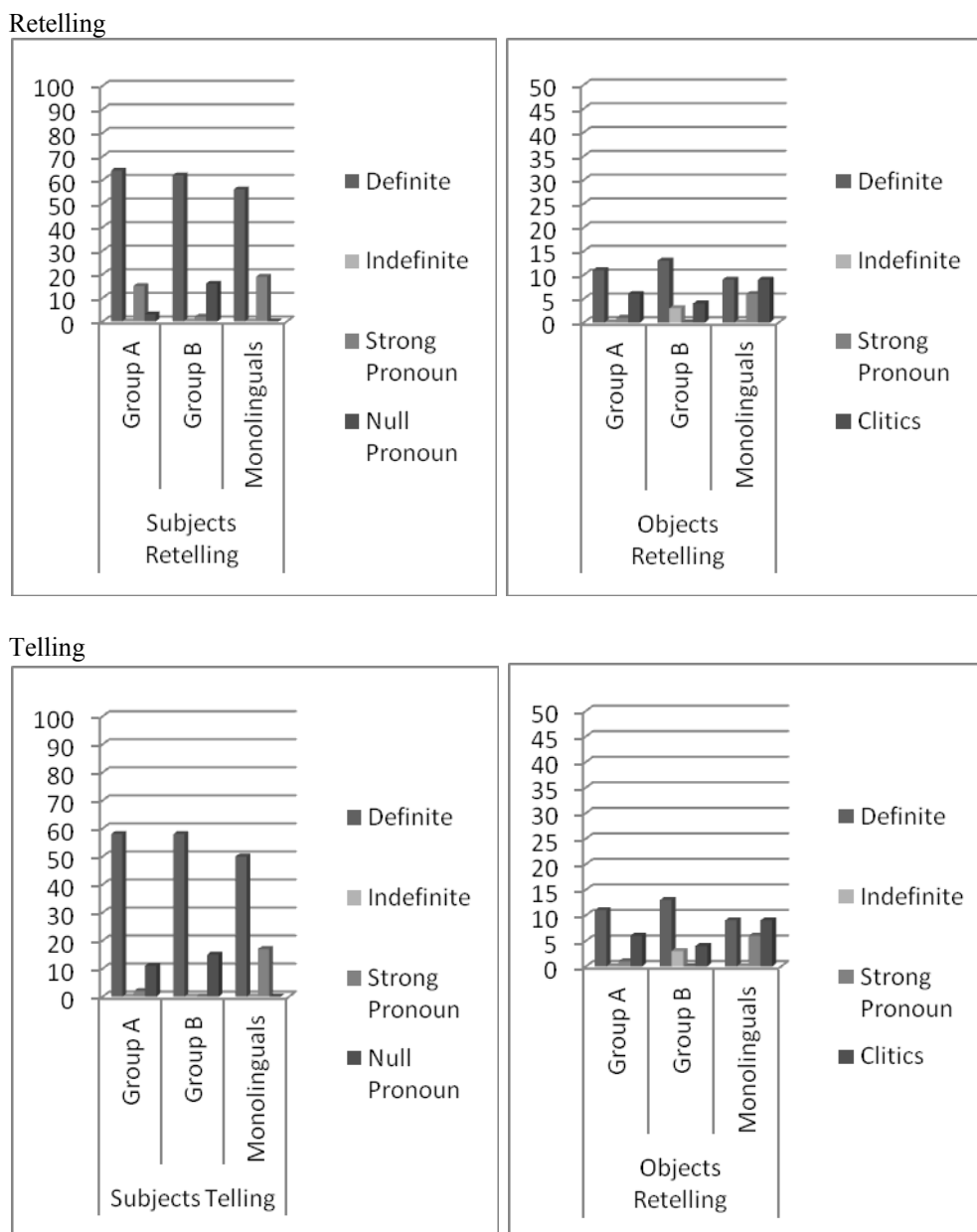
In the character maintenance function all groups tend to use null pronouns (in subject position) and clitics in object position. Importantly, Group B experience difficulty in the use of clitics, and significantly differ from the other two groups in both Retelling and Telling [ $F(2, 55) = 6.2, p = .001$  vs.  $F(2, 55) = 7.3, p = .001$ ].

Figure 6: Character maintenance in Retelling and Telling



Finally, in the Reintroduction function there is a preference for definites by all three groups. However, the monolingual controls showed a significantly higher usage of overt pronouns in both Retelling and Telling compared to the bilingual groups who preferred to use definite DPs [ $F(2, 55) = 7.1, p = .000$  vs.  $F(2, 55) = 6.9, p = .000$ ].

Figure 7: Character reintroduction in Retelling and Telling



## 6. Discussion and conclusion

The examination of the questionnaire findings in relation to children’s perceived language dominance conform to the vocabulary scores obtained from L1 and L2 expressive lexical abilities. Accordingly, most children appear to be dominant in German in particular those of Group B who, as mentioned previously, are heritage speakers of Greek. However, given that all children are primarily literate in German, German dominance is found also in many of the bilingual children in Group A.

With respect to the measures of working memory capacity and narrative length, the results suggest that length in the retelling mode is strongly influenced by working memory. On the other hand, working memory was also found to correlate with the observed distance between L1 and L2 vocabulary skills in the bilingual children. Children with high performance on working memory task (both visual and verbal)

have more even/balanced knowledge between their two vocabularies. Accordingly, children who have low working memory capacity appear to have great difference between their two vocabularies.

The syntactic complexity of the children's narratives revealed that language dominance gives rise to different performance between groups and as a result Group B in Germany with Greek as non-dominant language scores least like the monolingual control group on syntactic complexity. Finally, as concerns character reference, we saw that the Introduction mode is the most complicated and difficult one for the bilinguals. Hickmann (2003) claims that children fully master the system and use referential forms easily beyond the age of 10 for. At the same time children make overuse of DPs and avoid the use of pronouns. This is consistent with Sorace et al.'s (2009) findings showing that bilingual children avoid the use of pronouns in character reference compared to monolingual children. The fact that pronouns are more demanding than definite noun phrases has also been found in Arnold and Griffin (2007) where adult participants preferred to use lexical DPs over pronouns even when gender differences in main characters would make pronominal use an unambiguous marker of reference.

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