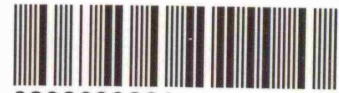An investigation of performance of typically developing Saudi children

on a sentence repetition task

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In partial fulfillment of the requirements for MSc Human Communication Sciences

September, 2006

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UMI Number: U593858

UMI

Dissertation Publishing

ProQuest

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Abstract:

Thirty Arabic speaking Saudi children participated in the study and range in aged between three to five years. The main aim of the study was to investigate the effects of age and gender on the repetition of grammatical morphemes. Results revealed a significant effect of age with an increase in total repetition scores as age in creased. No significant effect of gender was found. Irrespective of age, past tense was found to be more difficult then present tense. Suffix verb agreement was found to be more difficult then prefix verb agreement. Gender adjective agreement was found to be more difficult then adjective article agreement and finally no significant difference was found between overall feminine and masculine gender agreement. A qualitative analysis of errors for each age group revealed a reduction in the percent of omission errors as age increased with an increase in the percent of substitution and addition errors. A qualitative analysis of the degree of difficulty of various grammatical categories was also conducted. The clearest differentiation was in the three year old age group, Articles were the most difficult category followed by prepositions, tense, overall gender agreement and lexical words, respectively. In both the four year old and five year old age groups there is no clear differentiation with regards to order of difficulty. The findings are interpreted in the context of previous studies in investigating Arabic language development and cross-linguistic studies. In the absence of normative data in Arabic sentence repetition provides a potentially useful screening tool for in screening for SLI in Arabic speaking children.

INTRODUCTION

Sentence repetition is a task that is commonly used by both speech language pathologists and language researchers. In the field of speech language pathology it is commonly utilized as a subtest of diagnostic assessments for language impairments such as the Clinical Evaluation of Language Fundamentals-Revised (CELF-R) and the Test of Language Development-Primary (TOLD-P) (Newcomer & Hammill, 1997; Semel, Wiig, & Secord, 1989). It is included in these tests based on the notion that it reflects the child's mastery of grammatical structures. Occasionally, it is utilized on its own as an evaluation tool for the productive control of grammar such as the Carrow Elicited Language Inventory (CELI), (Carrow, 1974). Also, it is utilized as a method of informal language assessment to probe grammatical structures that do not commonly appear in spontaneous language (Fujiki & Brinton, 1983).

In the field of language research, several studies have recently investigated its usefulness as a clinical marker of Specific Language Impairment (SLI) (Conti-Ramsden, Botting & Faragher, 2001; Stokes, Wong, Fletcher & Leonard, 2006). Also, it has been utilized to assess the processing abilities of normally developing children, children with SLI and other developmental language disorders in an attempt to investigate whether its usefulness as a clinical marker is unique to SLI or a common feature of language impairments in general (Botting and Conti-Ramsden, 2003; Conti-Ramsden et al, 2001; Eadie, Fey Douglas & Parsons, 2002; Redmond, 2005).

The study will focus first on the relevant literature regarding the relationship between sentence repetition, spontaneous language production and language comprehension, the use of sentence repetition as a clinical marker of SLI and the factors that influence sentence repetition. It will then present an introduction on the

Arabic language and the aspects of morphology investigated in this study, followed

by morphological acquisition data in Arabic and cross linguistic studies.

The aims of the study are to investigate the repetition of grammatical morphemes by

Arabic speaking children and how this ability changes over the age range

investigated (three to five years), to possibly provide a potentially useful clinical tool

in screening for SLI in Arabic speaking children since there are no standardized tests

that assess language impairment in Arabic and finally to improve the understanding

of the relationship between short term memory and long term linguistic knowledge

through error analysis of different age groups.

The Relationship between Sentence Repetition, Spontaneous Language Production and Language Comprehension:

Sentence repetition has several advantages as an elicitation tool over spontaneous

language sampling. It is less time consuming to administer and analyze (Fujiki

&Willbrand, 1982). It can be utilized to probe language structures that do not

commonly occur in spontaneous language samples. Also, according to Fujiki and

Brinton (1983), three repetitions of a syntactic structure is adequate enough to obtain

a reliable prediction of performance on ten repetitions of the syntactic structure

investigated.

With these advantages in mind, there is wide debate over the degree to which sentence

repetition reflects spontaneous language production and language comprehension.

Some studies support a relationship for example Sturner, Kunze, Funk and Green

(1993) found that sentence repetition was a useful screening tool, predicting receptive

and expressive language abilities as well as articulation in both normally developing

children and children with a speech or language impairment. Fay (2003) found a

significant correlation between sentence repetition scores of normally developing

children and their scores on three standardized language assessments measuring

receptive grammar, receptive vocabulary and a composite measure of expressive

vocabulary and grammar. Ervin's (1964) qualitative analysis revealed a relationship between grammar used by children in their repetition of adult utterances and their spontaneous speech. Based on the studies mentioned above, it can be assumed that when children perform a sentence repetition task they will omit or substitute grammatical structures that have not been acquired in their spontaneous speech production.

Some studies suggest that sentence repetition may underestimate the ability of language impaired children to produce grammatical structures in comparison to their spontaneous language because they lack contextual cues and communicative intent found in spontaneous speech (McDade, Simpson & Lamb, 1982; Nelson & Weber-Olsen, 1980; Slobin & Welsh, 1973).

On the other hand, some studies point to the possibility that sentence repetition may overestimate a child's ability to produce grammatical structures in comparison to both spontaneous speech and language comprehension (Lovell & Dixon, 1967; Smith, 1970). One possible explanation for the overestimation is that certain grammatical structures are on the verge of acquisition but not yet fully acquired (Ramer, 1976 as cited in Sturner et al, 1993; Smith, 1970). An alternative explanation is that sentence repetition reflects the difference between the child's linguistic competence, exhibited in the child's knowledge of grammatical structures, and linguistic performance, exhibited in the child's production capabilities (Adams and Gathercole, 2000; Peterson, 2004).

Some studies do not point to a relationship between sentence repetition and spontaneous language production. Rosenblum and Stephens (1981) found that sentence repetition was a valid screening tool in identifying children with language impairment but was not able to identify which aspects of language were impaired. Also, Fujiki and Willbrand (1982) revealed that the correlation between sentence

repetition scores of children with language impairment and spontaneous language

varied for different grammatical structures.

Contrary to the studies mentioned above, Newcomer and Hammill (1997) view that

sentence repetition is not related to comprehension or production of language but

rather it is reflects the function of the organizing linguistic system involved in

mediating between the linguistic systems of listening and speaking.

Even though the exact nature of the relationship between sentence repetition and the

production and comprehension of language is not clear, it still offers a potentially

useful method for language screening because it is brief and more precise then

spontaneous language sampling and has proven to be a useful clinical marker for SLI

(Conti-Ramsden et al., 2001; Fujiki & Willbrand,1982).

Sentence Repetition as a Clinical Marker of SLI:

Conti-Ramsden et al. (2001) compared the performance of eleven-year-old English

speaking participants with SLI to age matched controls on four potential clinical

markers of SLI: third person singular, past tense marking, nonword repetition and

sentence repetition. Sentence repetition was the best identifier of SLI with highest

values of sensitivity (90%) and specificity (85%). It was also able to identify with

50% accuracy participants whose overt language impairment resolved at the time of

assessment. Conti-Ramsden et al. (2001) argue that even though the data cannot

provide a definite answer with regards to the underlying deficit tapped by sentence

repetition, the significant correlation found between nonword repetition and sentence

repetition supports the notion that impairments in these two tasks involve common

mechanisms which are likely to involve limitations in phonological STM.

Several studies have investigated the degree to which sentence repetition is a unique

psycholinguistic marker of SLI or a common feature of developmental language

impairments in an attempt to move away from diagnosing SLI on the basis of

exclusionary criteria (Redmond, 2005). Botting and Conti-Ramsden (2003) found that

sentence repetition was more effective than nonword repetition and past tense

marking in differentiating between participants with SLI, autism spectrum disorders,

pragmatic language impairments and typically developing age matched controls

(Botting and Conti-Ramsden, 2003). In a study by Redmond (2005), sentence

repetition was able to distinguish participants with SLI and Attention Deficit

Hyperactivity Disorder (ADHD) from typically developing age matched peers but it

was unable to distinguish between participants with SLI and ADHD. The inability of

the sentence repetition task to distinguish between participants with SLI and ADHD

was argued to be ether as a result of an overlap between ADHD and SLI in areas of

working memory and or language processing or that participants with ADHD

performed poorly on the task as a result of difficulties with impulsivity and

distractibility. Furthermore, sentence repetition was able to distinguish between

participants with SLI and Down's syndrome from MLU matched controls but did not

distinguish between participants with SLI and Down's syndrome (Eadie et al., 2002).

However, the authors state that the study's sample size is small and may not reflect

the populations they were drawn from.

A study by Stokes et al. (2006) provided cross linguistic evidence supporting sentence

repetition as a clinical marker of SLI. The study compared the performance of 14

Cantonese speaking participants with SLI,15 typically developing age matched

controls and 15 younger typically developing children with similar Mean Length of

Utterance (MLU) as participants with SLI on both sentence repetition and nonword

repetition. Results revealed that sentence repetition distinguished between participants

with SLI and aged matched controls but did not distinguish between participants with

MLU matched controls. On the other hand, the nonword repetition task did not

distinguish between participants with SLI and their typically developing age matched

controls. Since the SLI group performed better then their typically developing MLU

matched controls on the nonword repetition task the authors argue that Cantonese

speaking children do not have an underlying limitation in phonological STM.

Furthermore, the study also investigated the reliability of different sentence scoring

methods in differentiating between participants with SLI and typically developing age

matched controls. Awarding points according to the number of errors per sentence

was found to be the most effective method in comparison to awarding points only

when the entire sentence was repeated correctly.

The finding that sentence repetition is a clinical marker of SLI in two languages that

differ significantly in structure is an encouraging finding for cross-linguistic research.

Further application to other languages will aid in gaining a better understanding of the

factors that influence sentence repetition and the underlying cognitive processes in

SLI.

Factors that Influence Sentence Repetition:

Phonological STM is a factor that is associated with the ability to recall sentences.

STM is defined as a limited capacity system which allows the temporary storage and

manipulation of information necessary for complex task such as language

comprehension, learning and reasoning (Baddeley, 2000). Baddeley and Hitch (1974)

proposed a three-component model of working memory which consists of the "central

executive", an attentional control system aided by two subsidiary slave systems, the

"phonological loop" and the " visuospatial sketchpad". The phonological loop is

assumed to consist of a short term store which holds verbal and acoustic information

and an articulatory rehearsal system.

Some studies maximize the role of phonological STM in sentence recall abilities, for

example, Fay (2003) found a strong correlation between measures of phonological

STM and sentence repetition scores of normally developing children. This is

consistent with the finding that typically developing children with high phonological

STM ability obtained higher repetition scores then children with lower phonological

STM ability (Willis & Gatercole, 2001). Furthermore, Hanten and Martin (2000)

reported that a participant with a phonological STM deficit was able to detect

semantic anomalies in sentences but was impaired in repeating sentences while a

participant with a semantic STM deficit was able to recall sentences but was impaired

in sentence comprehension tasks. Sentence repetition was also found to be influenced

by memory related factors such as word length and number of words in a sentence

(Baddeley, 1966). Normally developing children obtained better repetition scores for

sentences containing short words in comparison to long words (Willis & Gatercole,

2000).

Other studies state that the interaction between phonological STM and language skills

plays an important role in recalling sentences. McCarthy and Warrington (1987) argue

that while word lists primarily tax the phonological STM, sentence repetition involves

an integrated memory system with access to linguistic knowledge, based on their

finding of a double dissociation between the repetition of three word lists and

sentences in three adult participants. Two participants with severely impaired

phonological STM were able to repeat sentences but not word lists, while a participant

with an unimpaired phonological STM was able to recall word lists and not sentences.

Miller and Isard (1963) also support an interaction between linguistic knowledge and

phonological STM based on the finding that grammatically incorrect sentences were

the most difficult type of sentences for adults to repeat followed by semantically

anomalous sentences and normal sentences. This finding was replicated by Cohen

(2005) with typically developing children.

Slobin and Welsh (1973) suggest that this interaction between STM and linguistic

knowledge is determined by the capacity of STM. If sentences fall within the capacity

of children's STM, they would be able to correctly repeat sentences even if they are

ungrammatical or anomalous without the influence of linguistic knowledge. However,

if sentences exceed the capacity of the children's STM, their repetition will be influenced by their linguistic knowledge.

The interaction between phonological STM and linguistic knowledge is further supported by the recent addition of the episodic buffer to the model of working memory (Baddeley, 2000). The episodic buffer is a limited capacity temporary storage system that allows the integration of information from the phonological loop and the visuospatial sketchpad with linguistic knowledge and it is controlled by the central executive. In an attempt to identify the functional organization of cognitive measure that have been linked with children's ability to acquire knowledge Alloway, Gathercole, Willis and Adams (2004) assessed on measures associated with three components of the working memory (central executive, phonological loop, episodic buffer), phonological awareness and nonverbal ability. The episodic buffer was tested using a sentence repetition test based on the notion that sentence repetition involves an interaction between short term memory subsystems and language processing systems and the episodic buffer provides the space which allows these two systems to interact. The revised model of working memory by Baddeley (2000) provided the best fit for the data in comparison to other models tested since the sentence recalling ability of children was distinct from but highly associated with measures of the phonological loop and central executive.

Other researchers minimize the role of phonological STM in sentence recall. Marshall and Nation (2003) found that the sentence recall ability of children with poor comprehension ability but intact phonological STM was worse than their typically developing controls. A qualitative analysis of errors revealed that errors which changed the structure of the sentence were equal in both groups of children while children with poor comprehension made more errors that changed the meaning of practice sentences. Furthermore, Potter and Lombardi (1998) claim that sentence recall ability does not involve phonological STM but rather sentences are regenerated

from three sources: the conceptual representation of the meaning of the sentence heard, lexical items activated and syntactically primed structures.

Another factor that may influence sentence recall ability is an interaction between vocabulary and phonological STM through a process of redintegration. This occurs when an incomplete trace of the stimulus is retrieved and the long-term memory language store is utilized to establish lexical and phonotactic information to complete the trace (Stokes et al, 2006).

Intonation and rate are other factors that are viewed to influence sentence repetition ability in children. Bonvillian, Raeburn and Horan (1979) found that the sentence recall ability of nursery school children improved when normal intonation was used and the rate was similar to their own speech rate in comparison to sentences with flat intonation or speech rates that were slower or faster then their own rate. The results of Cohen's study (2005) were consistent with this finding, a significant reduction of sentence recall ability was observed in typically developing children when experimental sentences were presented in flat prosody in comparison to normal prosody.

Hemingway, Montague and Bradley (1981) report that dialect can also be a significant factor that influences sentence repetition scores. The study utilized a screening modified version of the CELI with 57 African American participants ranging in chronological age between six to eight years; no consideration was given for dialectal variation. The modified version of the CELI identified three distinct subgroups based on error type and frequency, participants who spoke Standard English, participants who spoke Black English vernacular and language impaired participants. The authors highlighted the importance of taking into account dialectal variations when scoring sentence repetition tasks to prevent misdiagnosis of typically developing children and suggest developing instruments specifically targeting different dialects.

Arabic:

Arabic is a Semitic language that belongs to the Arabo-Canaanite subgroup (Gadallah, 2004; Ruhlen, 1987; Watson, 2002). There are three main varieties of Arabic that can be distinguished in the Arab world today (Gadallah, 2004; Watson, 2002):

- Classical Arabic: the form of Arabic that is used in religious ceremonies and is found in the holy book of Islam, the Qur'aan.

- Modern Standard Arabic: the form of Arabic that is used in formal speeches, news broadcasts and academic settings and is found in contemporary literature and journalism.

- Colloquial or Regional Arabic: the form of Arabic that is used in everyday conversations.

Colloquial Arabic differs from Modern Standard Arabic in phonology, morphology syntax and lexicon (Watson, 2002). There are several Regional Arabic used in different countries such as Egyptian Arabic (spoken in Egypt) and Chadian Arabic (spoken in Chad) and different regions of the same country such as Najdi Arabic (spoken in the central region of Saudi Arabia) and Hijazi Arabic (spoken in the western region of Saudi Arabia). Children are not exposed to Modern Standard Arabic until they start formal schooling and their mother tongue is usually the regional dialect they learn in their environment.

Aspects of Arabic Morphology Investigated:

Arabic, like other Semitic languages such as Hebrew, is rich in inflectional morphology which plays a vital role in word formation (Dromi, Leonard & Shteiman, 1993; Gadallah, 2004; Watson, 2002). Verbs, most nouns and adjectives are formed using what is known as the root and pattern morphology. The root usually consists of three consonants that convey the semantic core such as K-T-B meaning 'to write', and a phonological pattern consisting of a sequence of vowels that is inserted into the root forming the stem.

Past and present tense verbs are formed by alterations in the vowel pattern while the

future tense is marked by the insertion of the prefix /sa-/ or the auxiliary verb /sawfa/.

Verbs are marked for agreement in three categories, person (first, second, third),

number (singular, dual, plural) and gender (feminine and masculine). Agreement

morphology in Arabic is fusional therefore the e. Agreement in the past tense is

marked by the insertion of suffixes for example /-at/ marks third person, singular,

feminine in the past tense. Agreement in the present tense is marked by the insertion

of prefixes and suffixes for example, /ta-...-u/ marks third person, singular, feminine

in the present tense. It is important to note that for both tenses dual number agreement

for first person is not marked and gender for first person and second person dual is not

marked. Table 1-2 illustrate tense and agreement morphology in Modern Standard

Arabic for the past and present tense forms of the consonantal root K-T-B

(International Phonetic Alphabet (IPA) symbols used for Arabic transcription and

abbreviations for English gloss can be found in Appendix I).

Table 1: Agreement morphology for the past tense of *write* in Arabic

Person	Gender	Singular	Dual	Plural
3rd	f	katab-at	katab-atā	katab-na
3rd	m	katab-a	katab-ā	katab-ū
2nd	f	katab-ti	katab-tumā	katab-tunna
2nd	m	katab-ta		katab-tum
1st	Ø	katab-tu	Ø	katab-nā

Table 2: Agreement morphology for the present tense of *write* in Arabic

Person	Gender	Singular	Dual	Plural
3ʳᵈ	f	ta-ktub-u	ta-ktub- ā	ja-ktub-na
3ʳᵈ	m	ja-ktub-u	ja-ktub- ā	ja-ktub-ū
2ⁿᵈ	f	ta-ktub-ī	ta-ktub-ā	ta-ktub-na
2ⁿᵈ	m	ta-ktub-u		ta-ktub-ū
1ˢᵗ	Ø	ʔa-ktub-u	Ø	na-ktub-u

Nouns are marked for gender, number and definiteness (Gadallah, 2002). As a general

rule, feminine nouns are differentiated from masculine nouns by the insertion of the

suffixes /-a/, /-āʔ/ or /-ā/ to singular nouns for example   /mudaris-a/ "teacher-fsg"

while /mudaris/ refers to "teacher.msg" and the suffix /-āt/ for plural feminine nouns

for example /mudaris-āt/ refers to "teacher.fpl" . However, there are exceptions; some

feminine nouns semantically refer to a female without the feminine marker such as

/bint/ "girl". Indefinite nouns are not marked while definite nouns are marked by the

insertion of the prefix /ʔal-/ such as /ʔal-kitāb/ "the-book" and this is assimilated if it

is attached to a noun starting with a coronal sound such as /ʔasˤ-sˤabur-a /

"the-board-fsg".

Attributive adjectives agree with the nouns they modify in gender, number and

definiteness with the exception of some adjectives that are not marked for gender.

These are mainly adjectives that express color such as /ramādī/ "grey". Gender

agreement is mostly marked by the insertion of the suffixes /-a/, /-āʔ/ or /-ā/ to

singular forms for example, /kibīr/ "big.msg" and /kibīr-a/ "big-fsg". Other forms of

adjective gender agreement include changes in word-initial position as well as the

insertion of the suffix /-āʔ/. This is frequently used with adjectives that express color

or bodily defects such as /ʔaswad/ "black.msg" and /sawd-āʔ/ "black-fsg".

The typical word order in Modern Standard Arabic is Verb Subject Object. However,

it has been argued that it is shifting towards Subject Verb Object (Watson, 2002).

Within a phrase, qualifiers such as adjectives always follow the nouns they qualify for

example: /ʔal-ward-a ʔal-dʒamīl-a/ "the-flower-fsg the-beautiful-fsg".

Acquisition of Arabic Morphemes:

To date there are no normative data on Arabic language development. There are very

few published studies which have investigated the acquisition of Arabic. A study by

Omar (1973) investigated the phonological, morphological syntactic and vocabulary

development of 37 participants (aged between 6 months to 15 years) who lived in the

village of Shiekh Mubarak and spoke the Northern Sa'idi dialect of Arabic.

An imitation task of adult utterances and spontaneous conversations were used to

investigate the morphological and syntactic development of 16 of the 37 participants

(aged between 2.8 to 7 years). Inflections were noted to be the last aspect of language

mastered; the overall mastery of language was not achieved until the age of six or

seven years; and the order of acquisition was determined by the regularity of

morphemes and how essential they were for conveying meaning.

Participants were observed to begin the use of inflections in their spontaneous

conversations when they reached a constant Mean Length of Utterance (MLU) equal

to 1.75 and this was usually reached at (2 to 2.6 years). Regular noun and adjective

agreement inflections for gender and number were mastered by the age of three while

the irregular plural adjective agreement was not mastered until age 6 or later with

errors found in the spontaneous speech of participants as late as 15 years.

Participants produced fewer syntactically complex sentences and inflections in their

spontaneous conversations in comparison to imitation tasks. No significant

differences were observed between the performance of male and female participants,

however, individual differences were noted with regards to age of mastery of

inflections. Errors in the imitation task were mainly omissions of verb agreement

inflections, the definite article and prepositions and they decreased in frequency as

age increased. In the participants' spontaneous conversations, a preference was noted

for the unmarked masculine gender forms of both verbs and adjectives.

It is important to note that it is difficult to make generalizations based on Omar's

study (1973) due to dialectal differences and the fact that the experimental sentences

used in the imitation task were not identical for all participants.

Al-Akeel (1998) investigated the acquisition of Arabic language comprehension of

120 Saudi children in the city of Riyadh (aged between 3 to 7 years). Age of

participants was found to be a significant factor affecting the comprehension of verb-

subject agreement, which increased as age increased. However, gender of participants

was not found to be a significant factor. The comprehension of present tense was

acquired by the age of three years and it was acquired before the past tense.

Cross-linguistic Studies of Morphological Development:

Brown (1973) found that the developmental order of 14 morphemes in samples of

uncontrolled spontaneous speech of three English speaking children was very similar.

The present tense progressive was the earliest morpheme acquired followed by past

irregular forms, articles and finally past regular forms. However, the rate at which

children mastered the various morphemes differed. Brown concluded that a

combination between age and MLU were the best predictors of morphological

development. Brown's (1973) findings were consistent with de Villiers and de Villiers

(1973) investigation of morphological development of 21 English speaking children

aged between 16-40 months. Furthermore, Berko (1966) investigated the development

of English morphemes through the use of nonsense words to insure that children were

not simply imitating adult speech. Mastery of morphemes was found to increase with

age with basic morphemes learned by the age of four or five. Gender of participants

was not found to be a significant factor. These findings were consistent with an

investigation of morphological development in Spanish speaking children using the same task (Kernan & Blount, 1966).

The age of mastery of morphological inflections varies between languages due to differences in the complexity of inflectional systems and the importance they carry in conveying meaning (Omar, 1973).Within the category of gender agreement morphemes, Slobin (1966) reported that in Russian gender agreement morphemes for adjective and verb were mastered by the age of three years and they were mastered earlier then gender agreement morphemes for nouns. Kahne, Kahne and Saporata's (1966 as cited in Omar, 1973) analysis of data in English, French and German revealed that children acquired inflections for verbal categories by the age of three years old.

<u>**Research Questions and Hypotheses:**</u>

In the absence of normative data on Arabic language acquisition and on the basis of cross linguistic evidence presented on the potential usefulness of sentence repetition as a clinical marker of SLI, this study was conducted to investigate the repetition of grammatical morphemes by Arabic speaking children across. Based on the previous research on Arabic development and other languages it was hypothesized that:

1. Total repetition score will be significantly higher for older participants then younger participants.

2. Total repetition score will not significantly differ between female and male participants.

3. Repetition scores of each for the following grammatical categories: lexical words, verb tense, prepositions, overall gender agreement and articles will be significantly higher for older participants then younger participants.

4. Irrespective of age the degree of difficulty will be significantly differ between the following :

- Past and present tense

- Overall feminine and masculine gender agreement

- Prefix and suffix verb agreement

- Gender and article adjective agreement

METHOD

In order to address the hypotheses 30 children aged three years (n=10), four years (n=10) and five years (n=10) were instructed to repeat a total of 14 sentences read out to them by the researcher. The participants' repetitions of the 12 experimental sentences were transcribed and counted towards the participant's score of correct repetitions and error types.

Design

In the study, there were three Independent Variables (IVs). The first IV was participant's age with three levels (three, four and five year olds). The second IV was participant's gender with two levels (female and male). The third IV was grammatical category with five levels (lexical words, verb tense, prepositions, overall gender agreement and articles). The dependent variable was the number of items repeated correctly. A qualitative analysis of error type for each age group was conducted. Also, a qualitative analysis on the degree of difficulty of the five grammatical categories was conducted for each age group.

Participants

Participants were recruited through teachers in two nurseries in the city of Riyadh, Saudi Arabia who were informed of the study's purpose and selection criteria. Teachers identified children belonging to the three age groups of interest (three four and five year olds) with an equal number of children in each age group who met the following criteria: typically developing Saudi children who spoke Najdi dialect of Arabic as a first language; did not have a known sensory or neurological impairment; did not have known speech, language or learning impairments.

Parents of children meeting the above criteria received the Parent Information Sheet outlining the nature and purpose of the study. Children were included in the study only if their parents provided signed consent for their children to participate in the

study and to be audio-recorded (See Appendix II and III for Arabic and English

Parent Information Sheet and Consent Form).

Thirty participants were included in the study. Participants were equally divided

between three age groups, three years (M = 34.3 months, range 31–36 months) four

years (M = 43.60 months, range 41– 48 months) and five years (M = 59 months,

range 54 –60 months). Participants were matched for gender with five female and

male participants in each age group.

Materials

Sentences

Each participant was asked to repeat a total of 14 sentences. Two practice sentences

were administered first. They were three words in length and their syntactic structure

consisted of a verb followed by two noun phrases for example:

?kal il-walad il-tufaHa
eat.pf.3mg the-boy the-apple

These sentences were followed by 12 experimental sentences which were controlled

for verb tense and overall gender agreement and contained:

- Six verbs in either the past or present tense third person singular forms with

  equal number of feminine and masculine forms for each.

- 16 adjectives equally distributed between masculine and feminine forms.

  Eight sentences contained one adjective and four sentences contained two

  adjectives.

- 32 definite article prefixes

- Syntactic structure consisted of a verb followed by a noun phrase and a

  prepositional phrase with at least one adjective inserted in the noun and/or

  prepositional phrase.

- Eight sentences were (six words in length) and four sentences were (five words in length). The number of morphemes in each sentence varied between (8-13 morphemes).

A list of all the sentences used in the study with both the phonetic transcription and the English gloss can be found in Appendix IV.

Since the study's participants would use the Najdi dialect of Arabic spoken in the central region of Saudi Arabia at home, and they have not yet attended formal schooling, sentences were presented in this dialect of Arabic rather then the Standard Arabic forms. The main difference between Najdi Arabic and Standard Arabic forms that would influence scoring is in agreement morphology. With regards to number agreement in both past and present tense, Najdi Arabic does not distinguish between dual and plural forms employing plural markers to refer to dual subjects where Standard Arabic would distinguish between these forms. With regards to gender agreement in both tenses, Najdi Arabic employs the masculine plural markers of Standard Arabic to refer to both masculine and feminine plural subjects. Therefore, in order to investigate gender agreement, experimental sentences included only verbs in the third person singular form and adjectives referring to singular masculine or feminine nouns. Tense was limited to the past and present because the future tense is not commonly used by young children. Within the category of third person singular forms, the masculine past tense form is not marked for gender, taking the simplest form of the verb, which consists of the consonantal root and the vowel template. Also, both the masculine and feminine forms of the present tense are marked by prefixes only, with the elimination of suffixes used in Standard Arabic. The main differences between the third person singular inflection forms in Najdi Arabic and Standard Arabic are summarized in Table 3. IPA symbols used for Arabic transcription and abbreviations for English gloss can be found in Appendix I.

Table 3: Difference between third person singular forms in Najdi Arabic and Standard
Arabic

Tense	Referent	Najdi Arabic	Standard Arabic
Past	3msg	Ø	-a
	3fsg	-at	-at
Present	3msg	ji-...-Ø	ja-...-u
	3fsg	ti-...-Ø	ta-...-u

Adjective gender agreement consisted of the most common form in Najdi Arabic

which differentiates between masculine and feminine singular forms by adding the

suffix /-a/ to adjectives referring to feminine nouns, for example, /Kibīr/ meaning big

refers to a masculine noun while /Kibīr-a/ refers to a feminine noun. Another

difference between Najdi and Standard Arabic is that the definite article prefix is

pronounced /il-/ rather then /ʔal-/.

A pilot study was conducted in order to asses the appropriateness of both the

vocabulary used in the sentences and Najdi dialect of the researcher. Five native adult

Najdi speakers judged all the sentences to be appropriate. Furthermore, in order to

insure that the sentences were developmentally appropriate, five six year old children

(3 female and 2 male) performed the task and where able to repeat the sentences with

100% accuracy on all measures.

Procedure

Testing was conducted in a single session for each participant and lasted

approximately 30 minutes. Testing took place in a quiet area without breaks since

none of the participants requested one. Participants were instructed to repeat a total of

14 sentences that were read out to them by the researcher in the Najdi dialect of

Arabic. The researcher told each child at the beginning of the session "I will say

some sentences, after I finish saying each sentence I want you to say exactly what I

said". Two practice sentences were presented first to insure that the participants

understood the task. These sentences did not contribute towards the repetition score or

error analysis. These sentences were followed by 12 experimental sentences that were

presented in an order that would prevent the succession of two sentences containing

the same verb tense and verb gender agreement as shown in Appendix V. Keeping the

verb tense and verb gender agreement in mind the order was otherwise random. The

experimental sentences were presented once unless a repetition request was made by

the participant with only a single repetition allowed. Responses were audio-recorded

using a Sony ICD-P210 digital recorder with an internal microphone to allow for later

transcription.

Scoring

Scoring of experimental sentences took place after the transcription of the

participant's recorded responses. A point was given if the exact target was repeated. If

a repetition was granted only the response to the second presentation of experimental

sentences was utilized for scoring. Responses were recorded on two different scoring

sheets showing the maximum scores for each category

(Appendix VI).

On the first scoring sheet separate scores were obtained for the number of correct

repetitions of five grammatical categories: lexical words, prepositions, overall gender

agreement, articles and tense. Also, a total score was obtained based on the

cumulative score of the above identified categories. On the second scoring sheet

scores were obtained for the correct repetition of adjective agreement which consisted

of a separate score for gender and article agreement, overall gender agreement which

consisted of a separate score for feminine and masculine forms, tense which consisted

of a separate score for present and past and finally, morphological agreement which

consisted of a separate score for prefix and suffix agreement. The score of prefix and

suffix verb agreement included only the feminine forms of the present (prefix) and

past tense (suffix) without the masculine forms since the masculine past form is not

marked for gender by the insertion of a suffix and consists of the infinitive verb form.

Finally, the number and type of errors were also noted. Error categories consisted of

omission, substitution, addition and refusal. A refusal was noted when a participant

provided an "I do not know" response.

The following response from a participant is provided as an example followed by how

scores were recorded on both scoring sheets as shown in Tables (4-6):

Experimental sentence:

ji-ʇtɪrī   ɪl-walad ɵūb   dʒdīd   fi-l-ʕīd
imp3msg-buy the-boy thoob.Nm new.m   in-the-Eid
The boy bought a new thoob in Eid
(Thoob is the national attire for men in Saudi, Eid is a national holiday)

Participant's response:

ji-ʇtɪrī   ɪl-walad ɵūb   il-dʒdīd
imp3msg-buy the-boy thoob.Nm the-new.m

Table 4: Example of how scores were recorded on scoring sheet 1 with
maximum possible score shown between brackets

Lexical	Preposition	Overall Gender	Article	Tense	Total
(5)	(1)	(2)	(1)	(1)	(10)
4	0	2	1	1	8

Table 5: Example of how scores were recorded on scoring sheet 2 with maximum
possible score shown between brackets

Adjective agreement		Verb Agreement		Overall Gender		Tense	
Gender	Article	Prefix	Suffix	M	F	Present	Past
(1)	(1)	(0)	(0)	(2)	(0)	(1)	(0)
1	0	0	0	2	0	1	0

Table 6: Example of how errors were recorded on scoring sheet 2

Error Type	Substitution	Omission	Addition	refusal
Number of Errors	0	3	1	0

Transcription Reliability

Intra-rater and inter-rater reliability of the transcription were conducted on 10% of the

data. One participant from each age group was selected at random. Reliability was

measured based on morpheme to morpheme agreement. The second transcriber was a

speech-language therapist who spoke Arabic as a first language. The percentage of

intra-rater agreement was 93% and the percentage of inter-rater agreement was 90%.

RESULTS:

Hypothesis 1: Total repetition score will be significantly higher for older participants then younger participants.

Hypothesis 2: Total repetition score will not significantly differ between female and male participants.

One point was given for each item correctly repeated in the five grammatical categories of lexical words, prepositions, overall gender agreement, articles and verb tense. The total repetition score was calculated based on the cumulative score of these five categories with a maximum possible score of 144 points. The means and standard deviations for total repetition score according to gender and age are shown in Table 7.

Table 7: Means and standard deviations for total repetition scores for the independent variables of gender and age with a maximum possible score of 144

	Gender		Age		
	Female	**Male**	**3**	**4**	**5**
N	15	15	10	10	10
M	85.93	74.53	33.10	90.10	117.5
SD	38.56	40.56	14.47	20.85	14.73

A two-way Analysis of Variance (ANOVA) with independent measures on the variable of age and gender could not be conducted because the total repetition scores of female participants were not normally distributed (D (15) = .232, p <.05) and the transformation of data did not rectify this problem. Therefore, a Mann-Whitney test was used to analyze the main effect of gender while a one-way ANOVA was used to analyze the main effect of age. Results showed no significant effect of gender, female (*Mdn* = 106) and male (*Mdn* = 69) participants did not significantly differ with regards to their total repetition scores (U = 96.5 *ns*, r = -.12). Figure 1 shows a boxplot of total repetition scores for female and male participants.

Figure 1: Boxplot of total repetition scores for both male and female participants
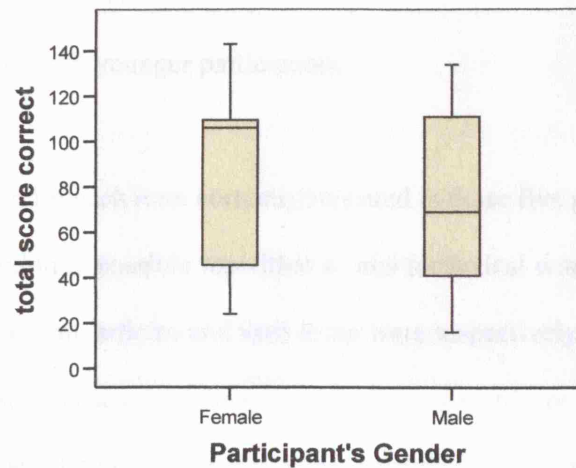
Results showed a significant effect of age ($F (2, 27) = 64.6$, $p < .001$, $r = .91$).

Bonferroni post hoc tests were used to follow up this finding. A Bonferroni correction

was applied and so all effects are reported at a .0167 level of significance.

Comparisons revealed a significant difference between all age groups with older

children obtaining significantly higher total repetition scores than younger children as

shown by the error bars in Figure 2.

Figure 2: Error bar chart of total repetition scores for all age groups
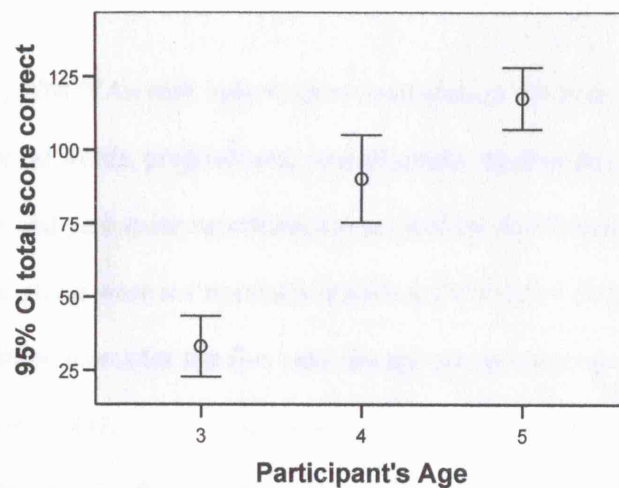
Hypothesis 3: Repetition scores for the grammatical categories of lexical words, verb

tense, prepositions, overall gender agreement and articles will be significantly higher

for older participants than younger participants.

One point was given for each item correctly repeated in these five grammatical

categories. The maximum possible repetition scores for lexical words, prepositions,

overall gender agreement, articles and verb tense were respectively 60, 12, 28, 32 and

12 points. The means and standard deviations for lexical words, preposition, overall

gender agreement, articles and verb tense scores according to age are shown in

Table 8.

Table 8: Means and standard deviations for lexical, preposition, overall gender agreement, article and verb tense scores for the independent variable of age

		Lexical		Prepositions		Overall Gender Agreement		Articles		Verb Tense	
Maximum score		**60**		**12**		**28**		**32**		**12**	
Age	**N**	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
3	10	18.90	6.79	1.60	1.71	7.80	2.78	2.30	2.50	2.50	2.51
4	10	40.60	7.32	4.80	2.04	18.20	5.41	17.70	7.12	8.90	2.47
5	10	50	5.08	7.40	2.63	22.80	3.19	25.50	4.93	11.80	.42

Multiple one-way ANOVAs with independent measures on the variable of age were

conducted for lexical words, prepositions, overall gender agreement repetition scores

but not for article and verb tense repetition scores. Article repetitions scores for the

three year old age group were not normally distributed (D (10) = .229, p <.05) and

verb tense repetitions scores for the five year old age group were not normally

distributed, (D (10) = .482, p <.001) and since transformation of the data did not

rectify this problem the Kruskal-Wallis test was used to analyze the data on article

and verb tense repetition. Results for the one-way ANOVA showed a significant

effect of age on lexical word scores (F (2, 27) = 60.83, p < .001, r =.90). Bonferroni

post hoc tests were used to follow up this finding. A Bonferroni correction was applied and so all effects are reported at a .0167 level of significance. Post hoc tests revealed a significant difference between all age groups with older children obtaining significantly higher lexical word repetition scores than younger children. Results for the one-way ANOVA for preposition scores across age groups show a significant effect of age (F (2, 27) = 18.03, $p < .001$, $r = .76$). Bonferroni post hoc tests were used to follow up this finding. A Bonferroni correction was applied and so all effects are reported at a .0167 level of significance. Post hoc tests revealed a significant difference between the three year old age group and both the four year old and five year old age groups with older children obtaining significantly higher preposition scores. However, no significant difference was found between the four year old and the five year old age group. Results for the one-way ANOVA for overall gender agreement scores across age groups showed a significant effect of age (F (2, 27) = 37.53, $p < .001$, $r = .85$). Bonferroni post hoc tests were used to follow up this finding. A Bonferroni correction was applied and so all effects are reported at a .0167 level of significance. Post hoc tests revealed a significant difference between the three year old age group and both the four year old and five year old age groups with older children obtaining significantly higher overall gender agreement scores. However, no significant difference was found between the four year old and the five year old age group. The increase with age in lexical, preposition and overall gender agreement scores can be observed in the error bars in Figure 3.

Figure 3: Error bar chart of lexical, preposition and over all gender agreement scores for all age groups
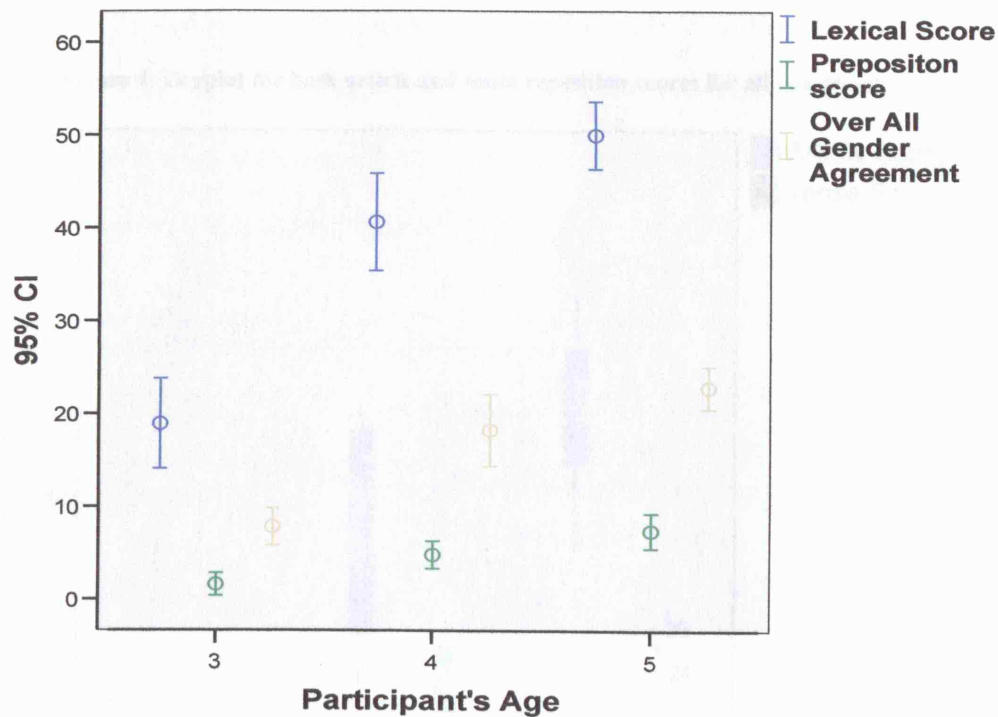
Kruskal-Wallis test results revealed a significant effect of age on article repetition scores ($H(2) = 22.02$, $p < .001$)., Jonckheere's test revealed a significant trend in the data (a Bonferroni correction was applied and so all effects are reported at a .0167 level of significance): as age increased, the median article repetition score increased ($J = 281.5$, $z = 5.013$, $r = .92$) . Also, a significant effect of age on tense repetition scores was found ($H(2) = 23.53$, $p < .001$). Jonckheere's test revealed a significant trend in the data (a Bonferroni correction was applied and so all effects are reported at a .0167 level of significance): as age increased, the median tense repetition score increased ($J = 287.5$, $z = 5.322$, $r = .97$). The increase in median article and tense repetitions scores as age increases can be observed in the boxplot in Figure 4. Also, it can be observed from the boxplot in Figure 4 that most five year old participants obtained the maximum score of 12 for correct tense with the exception of two participants who obtain a score of 11 (referred to as 24 and 26): the median

represented in the horizontal bar was equal to 12 and the absence of the interquartile

range illustrates the lack of variation in scores.

Figure 4: Boxplot for both article and tense repetition scores for all age groups
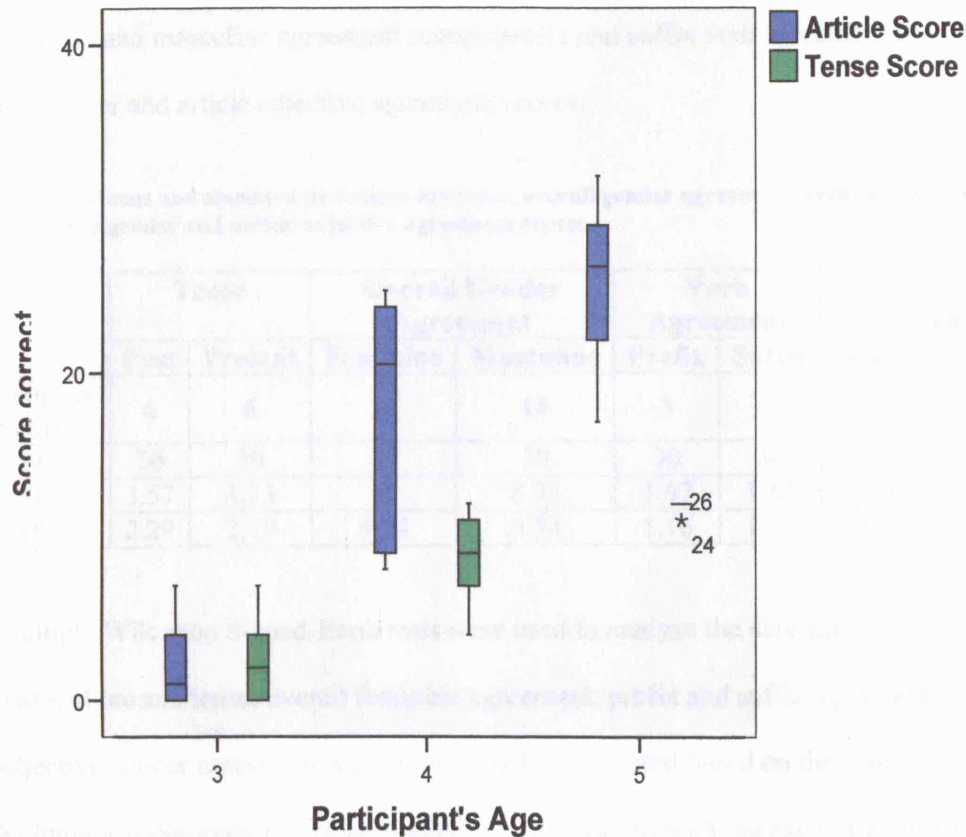
Hypothesis 4: Irrespective of age the degree of difficulty will be significantly

different between the following:

- Past and present tense

- Overall feminine and masculine gender agreement

- Prefix and suffix verb agreement

- Gender and article adjective agreement

One point was given for each item correctly repeated in the past tense and present

tense with a maximum possible score of 6 for each; overall feminine and overall

masculine agreement with a maximum possible score of 14 for each; prefix and suffix

agreement with a maximum possible of 3 points for each; and finally gender and

article adjective agreement with a maximum possible score of 16 for each. Table 9

shows the means and standard deviations for past and present tense scores, overall

feminine and masculine agreement scores, prefix and suffix verb agreement scores

and gender and article adjective agreement scores.

Table 9: Means and standard deviations for tense, overall gender agreement, verb agreement scores and gender and article adjective agreement scores

	Tense		Overall Gender Agreement		Verb Agreement		Adjective Agreement	
	Past	**Present**	**Feminine**	**Masculine**	**Prefix**	**Suffix**	**Gender**	**Article**
Maximum Score	**6**	**6**	**14**	**14**	**3**	**3**	**16**	**16**
N	30	30	30	30	30	30	30	30
M	3.57	4.13	8	8.33	1.97	1.53	9.40	6.80
SD	2.29	2.19	4.24	3.54	1.16	1.28	3.85	5.09

Multiple Wilcoxon Signed-Rank tests were used to analyze the data since the data on

past and present tense, overall feminine agreement, prefix and suffix agreement and

adjective gender agreement were not normally distributed based on the results of

Kolmogorov-Smirnov test of normality ($p < .05$ for all) with the exception of the

adjective article agreement(D (30) = .117, ns) and the overall masculine agreement

(D (30) = .123, ns).The transformation of the data did not rectify the problem.

Results revealed that participants had significantly higher present tense scores (*Mdn* =

5), in comparison to past tense scores (*Mdn* = 4), $T = 95, p < .01, r = -.50$. Participants

had significantly higher adjective gender agreement scores (*Mdn* =9) in comparison to

adjective article agreement scores (*Mdn* =8), $T = 4, p < .001, r = -.75$. Also,

participants had significantly higher prefix verb agreement scores (*Mdn* =2) in

comparison to suffix verb agreement scores (*Mdn* =1) $T = 0, p < .001, r = -.57$. There

was no significant difference found between overall feminine (*Mdn* = 8.5) and

masculine (*Mdn* = 8.5) adjective agreement scores, $T = 124.5, ns, r = -.13$. The four

comparisons between the medians discussed above are illustrated in the boxplot in

Figure 5.

Figure 5: Boxplot for past and present tense, overall feminine and masculine gender agreement, prefix and suffix verb agreement adjective gender and article agreement scores
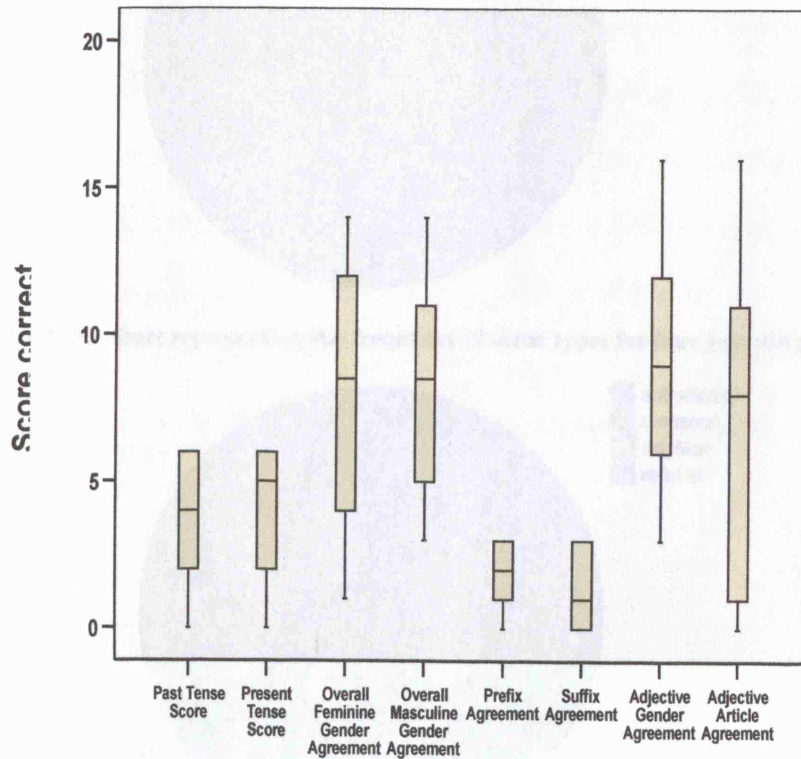
Qualitative Analysis of Error Types for Each Age Group:

Each item incorrectly repeated was categorized according to error type in one of the

four categories of omission, substitution, addition and refusal. Figures 6-8 show a

reduction in proportion of omission errors and an increase in proportion of

substitutions and addition errors as age increases. Irrespective of error type, the error

rate was reduced as age increased.

Figure 6: Pie chart representing the frequency of error types for three year old participants

- substitution
- omission
- addition
- refusal
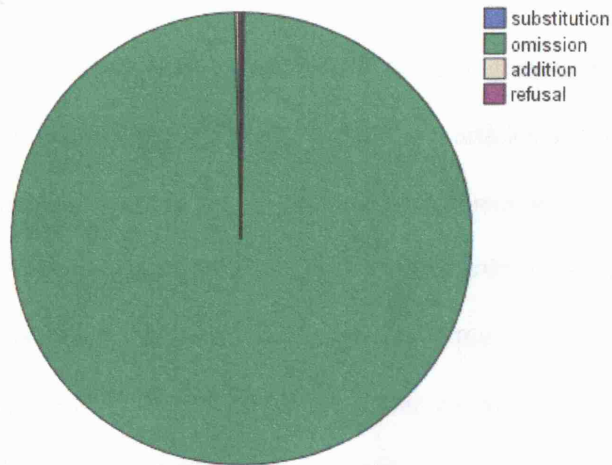
Figure 7: Pie chart representing the frequency of error types for four year old participants

- substitution
- omission
- addition
- refusal
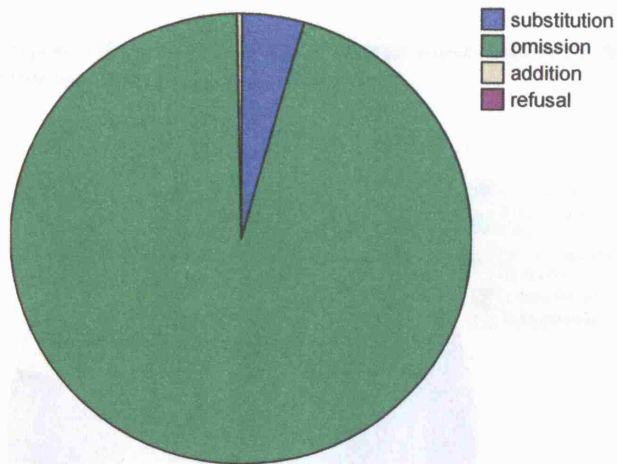
Figure 8: Pie chart representing the frequency of error categories in five year old children
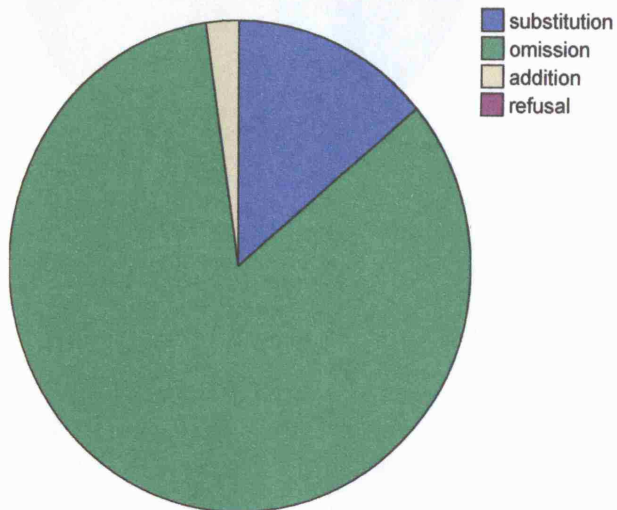
- substitution
- omission
- addition
- refusal

Qualitative Analysis of the Degree of difficulty of Grammatical Category for Each Age Group:

The proportion of the correctly repeated items in the five grammatical categories of lexical words, prepositions, overall gender agreement, articles and tense for each age group are represented in Figures 9-11. The clearest differentiation between categories according to difficulty can be observed in the three year old age group. Articles were the most difficult category followed by prepositions, tense, overall gender agreement and lexical words, respectively. In both the four year old and five year old age groups there is no clear differentiation with regards to order of difficulty.

Figure 9: Pie chart representing the proportion of correct repetitions of the five grammatical categories for three year old participants.

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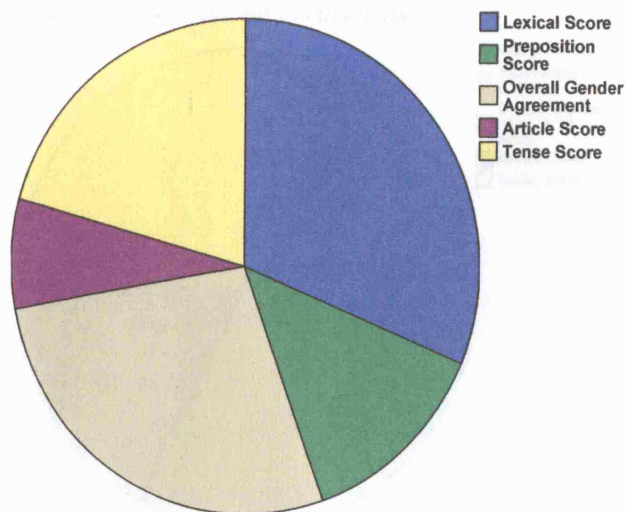
Figure 10: Pie chart representing the proportion of correct repetitions of the five grammatical categories for four year old participants.

Legend:
- Lexical Score
- Preposition Score
- Overall Gender Agreement Score
- Article Score
- Tense Score
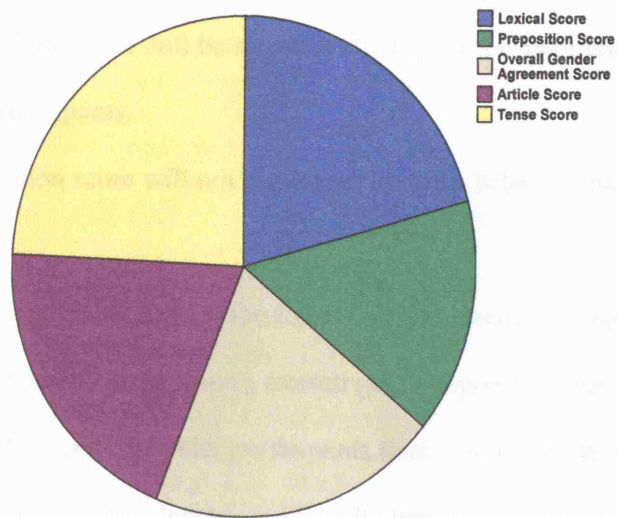
Figure 11: Pie chart representing the proportion of correct repetitions of the five grammatical categories for five year old participants.

Legend:
- Lexical Score
- Preposition Score
- Overall Gender Agreement Score
- Article Score
- Tense Score
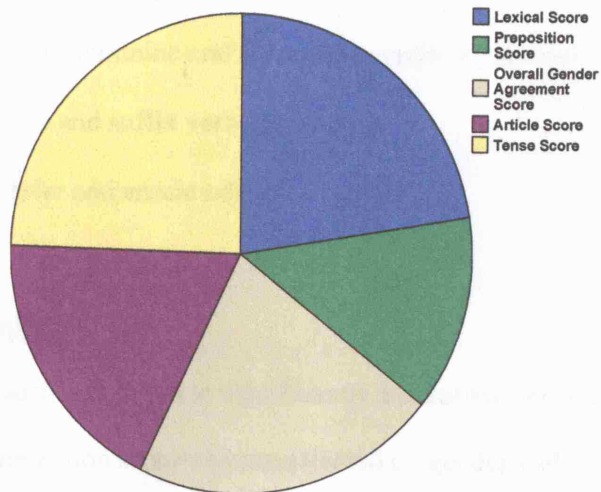
DISCUSSION:

Revisiting the Research Hypotheses:

1. Total repetition score will be significantly higher for older participants then younger participants.

5. Total repetition score will not significantly differ between female and male participants.

6. Repetition scores of each for the following grammatical categories: lexical words, verb tense, prepositions, overall gender agreement and articles will be significantly higher for older participants then younger participants.

7. Irrespective of age the degree of difficulty will be significantly differ between the following :

   - Past and present tense

   - Overall feminine and masculine gender agreement

   - Prefix and suffix verb agreement

   - Gender and article adjective agreement

Summary of Findings:

Total repetition score was found to significantly increase as the age of participants increased. Total repetition score was not affected by gender with no significant difference found between the scores for female and male participants. The repetition scores for the grammatical categories of lexical words, verb tense, prepositions, overall gender agreement and articles were also found to significantly increase as age increased, however, repetition scores for prepositions and overall gender agreement did not differ between the four and five year old group . Irrespective of age, the past tense was found to be significantly more difficult than the present tense. Suffix verb agreement for the past tense was found to be significantly more difficult than prefix

verb agreement for the past tense for example, significantly higher scores were

obtained for the insertion of the prefix /ti-/ in /ti-ktub/ "imp3fsg-write" in comparison

to the suffix /-at/ in /katab-at/ "write-pf3fsg" . Adjective article agreement was found

to be significantly more difficult than adjective gender agreement for example in the

phrase /il-bint il-Hilw-a/ "the-girl the-pretty.fsg" scores for the insertion of the suffix

/-a/ were higher then scores for the definitive article prefix /il-/. No significant

difference in difficulty was found between overall feminine and masculine gender

agreement which included both verb and adjective gender agreement. A qualitative

analysis of errors for each age group revealed a reduction in the percent of omission

errors as age increased with an increase in the percent of substitution and addition

errors. Also, a qualitative analysis of the degree of difficulty of various grammatical

categories was also conducted. The clearest differentiation was in the three year old

age group, Articles were the most difficult category followed by prepositions, tense,

overall gender agreement and lexical words, respectively. In both the four year old

and five year old age groups there is no clear differentiation with regards to order of

difficulty.

Effects of Age:

The finding that both total repetition scores and scores for all the grammatical

categories increased as age increased is consistent with Omar's (1973) finding that

errors on the imitation task decreased as age increased. It is also consistent with the

finding of Al-Akeel (1998) that comprehension of verb subject agreement increased

as age increased. Furthermore, it is consistent with the cross-linguistic study by Berko

(1966) which found that the ability to use inflections with nonsense words increased

as age increased and the finding of Fay (2003) that sentence repetition scores of

typically developing English speaking children increased as age increased. The

repetition scores for the grammatical categories of articles and tense are of particular

interest. The youngest age group showed a lack of variance in their article repetition

scores producing a floor effect. This is consistent Brown's cross linguistic evidence

that articles are one of the later morphemes acquired in English. This may be a result

of articles not playing an essential role in conveying meaning (Omar, 1973). Another

possible explanation is that they involve the insertion of the prefix /il-/ which

according to one element of "universal operating system" proposed by Slobin (1973)

is not phonologically salient therefore difficult for children to acquire. The oldest age

group showed a lack of variance in their tense repetition scores producing a ceiling

effect. This may be a result of tense playing an important role in conveying meaning,

therefore it is acquired early. The fact that the oldest age group did not obtain

maximum repetition scores of grammatical morphemes with the exception of tense

may reflect the effect of the complexity of the inflectional system in Arabic on the age

of mastery of morphemes. The finding that overall gender agreement scores did not

significantly differ between four and five year old participants may be a result of both

groups obtaining near ceiling scores. This may be due to the fact that Overall gender

agreement is mastered before the age of four years. This is consistent with the finding

of Al-Ajroush's study (2006) which investigated the acquisition of Arabic subject

verb agreement and tense in four and five year old children using as adaptation of the

nonsense word task used by Berko (1966). Results revealed that age of the

participants was a poor predictor of tense and subject agreement morphemes and

stated that this might be due to the fact that these grammatical morphemes were

mastered in spontaneous speech by the age of four years.

Effects of Gender:

The finding that gender is not a significant factor affecting total repetition scores is

consistent with Omar's (1973) finding that gender of participants did not influence

their performance on the imitation task. Also, it is consistent with Al-Akeel's (1998)

finding that gender of participants did not affect the acquisition of Arabic language

comprehension. Furthermore, it is consistent with the finding of Berko (1966) that the

gender of participants did not affect the mastery of grammatical morphemes.

The finding that past tense repetition is more difficult than present tense is supported

by Al-Akeel's (1998) finding that the comprehension of present tense was acquired

before past tense in Arabic speaking Saudi children. This is also supported by the

cross-linguistic evidence that present tense morphemes in English are the earliest

morphemes acquired (Brown, 1973; de Villiers and de Villiers, 1973).

Comparison Between Morpheme Categories:

The finding that prefix verb agreement was easier than suffix verb agreement is

inconsistent with one element of the "universal operating system" proposed by Slobin

(1973). This system states that when children are acquiring their first language they

pay more attention to word endings which are more salient and therefore acquire

suffixes earlier the prefixes. The suffix and prefix verb agreement scores consisted of

only feminine forms of the past tense which involved the insertion of the suffix /-at/,

and present tense forms which involved the insertion of the prefix /ta-/. One possible

explanation is that prefix agreement is associated with the present tense which is

supported by the semantic salience element of "the universal operating system".

Prefixes are associated with semantic saliency of the present tense and are there for

acquired early semantic. It may be possible that in this case semantic saliency

overrides the phonological saliency of suffixes.

The finding that article adjective agreement is more difficult the article gender

agreement is consistent with Omar's (1973) finding that participants frequently

omitted the definite article in the imitation task as late as old as five years while

omission of adjective gender agreement was not a common error and with this type of

agreement mastered in participants' spontaneous speech by the age of three. This may

be due to the fact that articles play less of an important role in conveying meaning in

comparison to adjective gender agreement. Another possible explanation is that article

adjective agreement involves the insertion of the prefix /il-/ which according to one

element of "universal operating system" proposed by Slobin (1973) is not

phonologically salient therefore difficult for children to acquire.

The finding that overall feminine and masculine gender agreement for adjectives and

nouns were equal in difficulty is inconsistent with Omar's (1973) finding that

participants showed a preference for the unmarked masculine forms of verbs and

adjectives in their spontaneous speech. However, this may be due to the fact that

regular adjective gender agreement was mastered by age of three according to Omar

(1973). It may be that younger participants who did not master agreement morphemes

may show this preference in their spontaneous speech but not older participants. The

comparison between feminine and masculine forms in the present study was

conducted irrespective of age, so it is possible that the preference for unmarked forms

in younger children was masked by patterns in the group as a whole.

Qualitative Analysis of Error Types for Each Age Group:

The results of the qualitative analysis of errors for each age group sheds some light on

the possible underlying factors affecting sentence repetition. The youngest age group

showed a high frequency of omissions with no additions or substitutions. This may be

a result of a reduced phonological STM capacity. Another possible explanation is that

it may be the result of a lack of linguistic knowledge available which in turn hinders

the children's ability to recognize all elements in a sentence on the basis of

established linguistic knowledge. Also, it may be a result of an interaction between

both a reduction in phonological STM capacity and a lack of linguistic knowledge to

support it. The reduction in omissions as age increases may be a result of an increase

in the capacity of the phonological STM with age or in linguistic knowledge

supporting phonological STM. The decrease in omissions is also accompanied by an

increase in addition and substitution errors which may be associated with an increase

in the effect of established linguistic knowledge on sentence repetition. The difference

in error type and frequency across ages may be a result of an interaction between

phonological STM and established linguistic knowledge and that the degree that each

of them affects sentence repetition may vary with age.

Qualitative Analysis of the Degree of difficulty of Grammatical Category for Each Age Group:

The finding that there is no clear differentiation with regards to order of difficulty in

both the four year old and five year old age groups on the basis of the correct

proportion of scores for the five grammatical categories may be a result of the

participants in both groups obtaining near ceiling scores and post hoc tests did not

reveal a significant difference between the two age groups with regards to preposition

and overall gender agreement. One possible explanation is that these morphemes are

mastered before the age of four. This is consistent with the finding of Al-Ajroush's

study (2006) that age of the participants was a poor predictor of tense and subject

agreement morphemes and stated that this might be due to the fact that these

grammatical morphemes were mastered in spontaneous speech by the age of four

years.

Limitations and Direction for Future Research:

There are three main limitations to the study. One is that the lack of normative data

and standardized tests on Arabic language development prevented the investigation of

the association between expressive and receptive language development with sentence

repetition scores. The second limitation is that there were relatively small numbers of

participants in each age group, and the means for age groups was not evenly spread

with the mean age for the four year old age group closer to mean age for the three

year old age than the five year old age group. However, all age related scores showed

a significant difference between the three and four year old age group.

The third limitation is that the study did not utilize a measure for phonological STM such as word span to investigate the association between word span scores and sentence repetition scores.

The finding that the sentence repetition measures clearly differentiated between the three age groups supports the possibility of using sentence repetition as a screening tool. It would be useful to administer the task to a larger cohort of typically developing children to establish normal range of scores and identify possible cut off points for deficits. Furthermore, the degree that linguistic knowledge affects sentence repetition could be investigated through the use of semantically anomalous and ungrammatical sentences. Moreover, an investigation could be conducted on whether sentence repetition is a clinical marker of SLI in the Arabic speaking SLI population as it has been found in Cantonese and English speaking children with SLI.

Conclusion:

The ability of sentence repetition to clearly differentiate between the three age groups investigated in the study and in the absence of normative data and standardized tests, sentence repetition is potentially a useful clinical tool in screening for SLI in Arabic-speaking children.

Acknowledgments

Word count: 9500 words

REFRENCES

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Appendix I

IPA Symbols for Arabic Consonants and Vowels and Abbreviations for English Gloss

Arabic Consonant Phonemes

		Bilabial	Inter-dental	Dental		Post-alveolar	Palatal	Velar	Uvular	Epiglottal	Glottal
				plain	emphatic						
Stop	Voiceless			t	tˤ			k	q		ʔ
	Voiced	b		d	dˤ	dʒ					
Fricative	Voiceless	f	θ	s	sˤ	ʃ		x		H	h
	Voiced		ð	z	zˤ			ɣ		ʕ	
Nasal		m		n							
Lateral				l							
Trill				r							
Approximant		w					j				

Arabic Vowel Phonemes

Description	Symbol
Open back unrounded short	a
Open back unrounded long	ā
Near close near front unrounded short	i
Close front unrounded long	ī
Near close near back rounded short	u
Close back rounded short	ū

Abbreviation

3,3rd	third person	2nd	second person
1st person		N	noun
f	feminine	P	perfect, past
imp	imperfect, present	pl	plural
m	masculine	s	singular
Ø	not marked	-	morpheme boundary
..... stem (root and vowel pattern)			

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Jane Maxim
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Appendix II   PARENT INFORMATION SHEET

Project title: An investigation of the role of language knowledge in providing 'top-down' support for short-term memory as measured in sentence repetition tasks

Investigators: Dr Shula Chiat and Miss Ashwag Al-Wallan
Department of Human Communication Science,
University College London, Chandler House,
2 Wakefield Street, London. WC1N 1PF
Telephone 020-7040-8238

I am an MSc student in Human Communication Science at University College London. As part of my studies, I am carrying out a research project in which I am investigating the contribution of language knowledge to performance on a sentence repetition test in Arabic.

In order to carry out my study, I hope to see approximately 30 children, aged 3-5 years old, in their school for a session lasting about 20 minutes. During the session I will present a novel sentence repetition task, in which children will be asked to copy sentences I say. I will carry out these tasks at the child's pace, taking breaks as appropriate and spreading the tasks over two sessions if necessary. The sessions will be audio recorded so that I can write down the child's responses after the session. The audio recording will be destroyed at the end of the study (September, 2006).

The results of each child's assessments will be anonymous, identified by number only. However, I will be happy to give you your child's results should you wish. You will also be welcome to read the final report of the study. Apart from this, there is no direct benefit to your child. However, we hope that the findings from this study will contribute to our understanding of how children repeat sentences and how sentence repetition can be used in the assessment of children who have problems with language.

I will only include children who are happy to join the sessions. If they show distress at any point in the session, I will terminate the session.

Your child does not have to participate in this study if you do not want them to, and even if you agree to your child taking part, you may withdraw them at any time without having to give a reason. If you are willing for your child to participate in this study, I would be grateful if you could fill in the attached consent form and return it to your child's teacher.

If you have any further concerns or questions, please do not hesitate to contact my supervisors, Dr. Shula Chiat.

Many thanks for giving this your consideration.

Yours sincerely,

Ashwag Al-Wallan
MSc Human Communication Science student, University College London

UCL

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كلية علوم التواصل الانساني
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بيان معلومات للأهل

عنوان المشروع: تحري دور المعرفه اللغوية في دعم الذاكرة قصيرة المدى عبر استخدام مهمة تكرار الجمل
الباحثون: د. شولا شيا ت، الآنسة أشواق الوعلان
كلية علوم التواصل الإنساني
جامة كلية لندن
هاتف: 00442070408238

أنا طالبة في مرحلة الماجستير في كلية علوم التواصل الإنساني التابعة لجامعة كلية لندن وكجزء من دراستي أقوم بتنفيذ بحث لدراسة الدور الذي تلعبه المعرفة اللغوية في أداء الأطفال باختبار تكرار الجمل باللغة العربية.

آمل أن أطبق هذه الدراسة على 30 طفلا تتراوح أعمارهم بين 3 إلى 5 سنوات في مدارسهم. جلسة الاختبار ستستغرق 20 دقيقة غالبا. خلال الجلسة يطلب من كل طفل تكرار مجموعة من الجمل باللغة العربية. سيتم المضي في الاختبار بما يتوافق مع سرعة الطفل و قدراته ستعطى فترات للاستراحة في الأوقات المناسبة بالإضافة إلى إمكانية توزيع المهام على جلستين إذا تطلب الأمر. مع العلو أن الجلسات تتضمن تسجيلات صوتية لكي أتمكن من كتابة استجابة الطفل بعد انتهاء الجلسة. سوف أقوم بإتلاف التسجيلات بعد الانتهاء من الدراسة في شهر سبتمبر 2006 إن شاء الله.

وبالنسبة إلى نتائج الأطفال فإنه سيتم التعامل معها بسرية تامة دون التطرق لأسماء الأطفال وإنما سيشار إليهم بأرقام محددة. وطبعا سأكون سعيدة باعطائكم نتائج أداء طفلكم إذا أردتم ذلك، مع ترحيبي برغبتكم في قراءة نتائج البحث النهائية. و أود أن أشير أنه لاتوجد فائدة مباشرة لطفلكم من مشاركته في هذا البحث إلا أننا نتمنى أن يساهم هذا الاختبار في توصلنا إلى فهم عملية تكرار الطفل الجمل اللغوية وإمكانية استخدام هذه المهمة في تشخيص الأطفال الذين يعانون من مشاكل لغوية.

سوف أدرج بالبحث فقط الأطفال الراغبين بالمشاركة في الجلسات. وإذا لاحظت على أي طفل عدم الرغبة في اتمام المشاركة سأقوم بانهاء الجلسة.

ليس على طفلكم المشاركة عند عدم رغبتكم بذلك بالإضافة إلى امكانية سحب طفلكم من البحث بعد الموافقة في اي وقت، دون إعطاء مبررات لذلك.   في حالة موافقتكم على مشاركة طفلكم سأكون ممتنة إذا تفضلتم بتعبئة النموذج المرفق بالموافقة و تسليمه إلى معلمة الطفل.
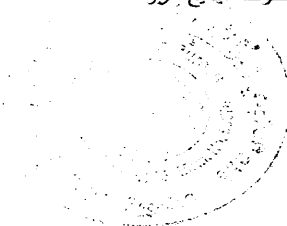
إذا وجد لديكم أي استفسار أرجو أن لا تترددوا في الاتصال على مشرفة بحثي د. شولا شيات.

شاكرة لكم على حسن تعاونكم
أختكم

أشواق الوعلان
طالبة ماجستير في علوم التواصل الإنساني، جامعة كلية لندن

تمت الموافقة على مشروع البحث من قبل لجنة كلية جامعة لندن لأخلاقيات البحوث الإنسانية مع العلم أن الطالبة استوفت جميع شروط اللجنة

نموذج 2 ، فبراير 2006

</div>

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Appendix III   Informed Consent Form

*This form to be completed independently by the parent.

Title of Project: An investigation of the role of language knowledge in providing 'top-down' support
for short-term memory as measured in sentence repetition tasks

Investigators: Dr Shula Chiat and Miss Ashwag Al-Wallan

	YES	NO
Have you read the Parent Information Sheet?		
Have you had the opportunity to ask questions and discuss the study?		
Have you received satisfactory answers to all your questions?		
Have you received enough information about the study?		
Do you agree to your child participating in this study?		
Do you give permission to audio record the session with your child and keep the recording until the end of the study (September 2006)?		
Do you understand that you are free to withdraw your child from the study without penalty at any stage?		
Do you agree with the publication of the results of this study in an appropriate outlet/s?		
Do you give permission for any assessments of your child to be made available to your child's teacher or speech and language therapist?		

Comment or Concerns During the Study
If you have any comments or concerns you should discuss these with the Principal Researcher.
If you wish to go further and complain about any aspect of the way you have been approached
or treated during the course of the study, you should email the Chair of the UCL Committee for
the Ethics of Non-NHS Human Research (gradschoolhead@ucl.ac.uk) or send a letter to: The
Graduate School, North Cloisters, Wilkins Building, UCL, Gower Street, London WC1E 6BT
who will take the complaint forward as necessary.

Signed:...

Date:......................................

Full Name in
Capitals: ....

Signature of Witness:...

Date:....................................

Appendix IV   List of Experimental Sentences

1. ti-sbaH   Nora   fi-l-masbaH   isˤ-sˤiɣir   kil   jūm
    imp3fsg-swim   Nora   in-the-pool.m   the-small.m   every day
    Nora swims in the small pool every day

2. ti-lʕab   il-bint   il-Hilw-a   bi-l-ʕarus-a   il-dʒdīd-a
    imp3fsg-play   the-girl   the-pretty-f   with-the-doll-f   the-new-f
    The pretty girl plays with the new doll

3. ji-s?al   il-walad   il-ˌatˤir   ʕan   sˤidīɡ-a   il-marīdˤ
    imp3msg-ask   the-boy   the-smart.m   about   friend.m-his   the-sick.m
    The smart boy asks about his sick friend

4. ji-ˌtirī   il-walad   θūb   dʒdīd   fi-l-ʕīd
    imp3msg-buy   the-boy   thoob.Nm   new.m   in-the-Eid.N
    The boy buys a new thoob in Eid
    (Thoob is the national attire for men in Saudi & Eid is a national holiday)

5. ti-ʕīˌ   iz-zarāf-a   itˤ-tˤwīl-a   fi-l-ɣāba
    imp3fsg-live   the-giraffe-f   the-tall-f   in-the-forest
    The tall giraffe lives in the forest

6. ji-ˌrab   il-walad   il-ɡuwī   il-Halīb   min   il-kās
    imp3msg-drink   the-boy   the-strong.m   the-milk   from   the-glass
    The strong boy drinks milk from the glass

7. ?axaθ   ?Hmad   il-kur-a   il-kibīr-a   min   asˤ-sˤundūɡ
    take.pf3msg   Ahmad   the-ball.f the-small-f   from   the-box
    Ahmad took the small ball from the box

8. ?aʕtˤˤ-at   il-mudaris-a   ɡalam   mlawan   li-l-bint   il-mu?adab-a
    give.pf-3fsg   the-teacher-f   pen.m   colored.m   to-the-girl   the-polite-f
    The teacher gave a colored pen to the polite girl

9. rasam-at   Hīnd   ward-a   dʒamīl-a   bi-l-lūn   iz-zahrī
    draw.pf-3fsg   Hind   flower-f   pretty-f   with-the-colour.m   the-pink.m
    Hind drew a pretty flower with the pink color

10. katab-at   il-bint   il-ˌatˤr-a   isma-ha   ʕala   isˤ-sˤabur-a
    wite.pf-3fsg   the-girl   the-smart-f   name-her   on   the-board-f
    The smart girl wrote her name on the board

11. nām   MHammad   ʕala   as-sirīr   il-murīH
    sleep.pf.3msg Mohammed   on   the-bed.m   the-comfortable.m
    Mohammed slept on the comfortable bed

12. gara   ʕadil   gisˤ-a   gisˤīr-a   ʕan   il-sʔad

read.pf.3msg   Adil   storey-f   short-f   about   the-lion

Adil read a short storey about the lion

Appendix V
Order of Presentation of Experimental Sentences

1. ti-sbaH   nora   fi-l-masbaH   isˁ-sˁiɣir   kil   jūm
   imp3fsg-swim nora   in-the-pool.m   the-small.m   every day
   Nora swims in the small pool every day

2. nām   mHammad   ˁala   as-sirīr   il-murīH
   sleep.pf.3msg mohammed on   the-bed.m   the-comfortable.m
   Mohammed slept on the comfortable bed

3. ti-lˁab   il-bint   il-Hilw-a   bi-l-ˁarus-a   il-dʒdīd-a
   imp3fsg-play the-girl   the-pretty-f   with-the-doll-f   the-new-f
   The pretty girl plays with the new doll

4. ʔaxaθ   ʔHmad   il-kur-a   il-kibīr-a   min   asˁ-sˁundūg
   take.pf3msg ahmad   the-ball-f the-small-f from   the-box
   Ahmad took the small ball from the box

5. ti-ˁīʃ   iz-zarāf-a   itˁ-tˁwīl-a   fi-l-ɣāba
   imp3fsg-live the-giraffe-f   the-tall-f   in-the-forest
   The tall giraffe lives in the forest

6. gara   ˁadil   gisˁ-a   gisˁīr-a   ˁan   il-sʔad
   read.pf.3msg adil   storey-f   short-f   about the-lion
   Adil read a short storey about the lion

7. ji-ʃtirī   il-walad   θūb   dʒdīd   fi-l-ˁīd
   imp3msg-buy the-boy   thoob.Nm   new.m   in-the-Eid.N
   The boy buys a new thoob in Eid

8. rasam-at   hīnd   ward-a   dʒamīl-a   bi-l-lūn   iz-zahrī
   draw.pf-3fsg hind   flower-f   pretty-f   with-the-colour.m the-pink.
   Hind drew a pretty flower with the pink color

9. ji-sʔal   il-walad   il-ʃatˁir   ˁan   sˁidīg-a   il-marīdˁ
   imp3msg-ask   the-boy   the-smart.m   about friend.m-his   the-sick.m
   The smart boy asks about his sick friend

10. katab-at   il-bint   il-ʃatˁr-a   isma-ha   ˁala   isˁ-sˁabur-a
    wite.pf-3fsg   the-girl   the-smart-f   name-her   on   the-board-f
    The smart girl wrote her name on the board

11. ji-ʃrab   il-walad   il-guwī   il-Halīb   min   il-kās
    imp3msg-drink the-boy   the-strong.m   the-milk   from   the-glass
    The strong boy drinks milk from the glass

12. ?aʕtˤ-at   il-mudaris-a   galam   mlawan   li-l-bint   il-mu?adab-a
    give.pf-3fsg   the-teacher-f   pen.m   colored.m   to-the-girl   the-polite-f
    The teacher gave a colored pen to the polite girl

Appendix VI   Scoring Sheets

Scoring Sheet 1

Sentence	Lexical	Preposition	Overall Gender	Article	Tense	Total
Maximum score	60	12	28	32	12	144
تسبح نوره في المسبح الصغير كل يوم	5	1	2	2	1	
نام محمد على السرير المريح	4	1	2	2	1	
تلعب البنت الحلوه بالعروسه الجديدة	5	1	3	4	1	
أخذ أحمد الكوره الكبيرة من الصندوق	5	1	2	3	1	
تعيش الزرافة الطويلة في الغابة	4	1	2	3	1	
قرأ عادل قصة قصيرة عن الأسد	5	1	2	1	1	
يشتري الولد ثوب جديد في العيد	5	1	2	2	1	
رسمت هند وردة جميلة باللون الزهري	6	1	3	2	1	
يسأل الولد الشاطر عن صديقه المريض	5	1	3	3	1	
كتبت البنت الشاطرة اسمها على السبورة	5	1	2	3	1	
يشرب الولد القوي الحليب من الكاس	5	1	2	4	1	
أعطت المدرسة قلم ملون للبنت المؤدبة	6	1	3	3	1	

- **Maximum possible score for each sentence is in red**

Scoring Sheet 2

Sentence	Adjective agreement		Verb Agreement		Overall Gender		Tense	
	Gender	Article	Prefix	Suffix	M	F	Present	Past
Maximum Score	16	16			14	14	6	6
تسبح نوره في المسبح الصغير كل يوم	1	1	1		1	1	1	
نام محمد على السرير المريح	1	1			2			1
تلعب البنت الحلوه بالعروسه الجديدة	2	2	1			3	1	
أخذ أحمد الكوره الكبيرة من الصندوق	1	1			1	1		1
تعيش الزرافة الطويلة في الغابة	1	1	1			2	1	
قرأ عادل قصة قصيرة عن الأسد	1	1			1	1		1
يشتري الولد ثوب جديد في العيد	1	1			2		1	
رسمت هند وردة جميلة باللون الزهري	2	2		1	1	2		1
يسأل الولد الشاطر عن صديقه المريض	2	2			3		1	
كتبت البنت الشاطرة اسمها على السبورة	1	1		1		2		1
يشرب الولد القوي الحليب من الكاس	1	1			2		1	
أعطت المدرسة قلم ملون للبنت المؤدبة	2	2		1	1	2		1
Total								

*Maximum possible score for each sentence is in red

Error Type	Substitution	Omission	Addition	refusal
Number of Errors				