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30th Anniversary

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These proceedings include paper and poster presentations from the Child Language Seminar 2007 (CLS2007), which took place at the University of Reading from the 18th to the 20th of July in 2007.

CLS started in 1977 as a national UK conference, but within 30 years it evolved into an international conference covering a wide range of topics on typical and atypical child language development. CLS2007 received a record number of abstracts from researchers from 31 different countries and offered a high quality and a varied programme covering issues of monolingual and bilingual language acquisition and language disorders including a number of different languages.

CLS2007 marked the 30th anniversary of the first Child Language Seminar. To commemorate the 30 years of CLS, CLS2007 included an additional half day with two special sessions, and proceedings which were published electronically and on a CD-ROM.

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Verb Innovations
In Spontaneous Speech of Children

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Abstract

This paper is devoted to the acquisition of English verb morphology by English-speaking children aged 5-7. We also use data from Russian language acquisition. Child mistakes (or innovations as we call them) in formation of verb forms are studied. Special attention is paid to the factors that influence the choice of a verb paradigm in child speech. These factors are type and token frequency, cumulative frequency and phonological properties of a verb. The following claims are being tested: a) innovations and semantic errors are more frequent in narratives than in dialogues as narration requires longer planning. Therefore, less effort can be spent on grammar; b) occurrence of innovations in child speech is determined by token and type frequency as well as phonological properties of a verb.

1 Introduction

Acquisition of verb morphology is one of the main points in the development of a language system. Current interest in verb acquisition is supported by the existence of two controversial approaches: dual-system and single-system. They give different assumptions as to whether irregular and regular past forms of verbs are generated by one mechanism or by two distinct mechanisms (lexicon and grammar). Depending on the solution of the described issue two approaches draw different conclusions concerning the organization of mental language. That is why regular and irregular verb formation is an important issue to study.

In section 2, I will address theoretical questions raised in the research. Section 3 describes the data used for the study. Section 4 deals with the analysis of English and Russian data. These sections are followed by conclusions.

2 Theoretical background

2.1 Dual-system and single-system approaches to verb formation

The analysis of regular and irregular past forms has become an important tool used for understanding processes and mechanisms underlying cognition and language (Huang & Pinker: 2005). Marslen-Wilson and Tyler notice that regular and irregular past forms of verbs have been in focus of attention for more than 40 years already (Marslen-Wilson & Tyler 2006: 264). It probably happens so because the contrast between regular and irregular past forms is evident in English.

Modular or dual-system approach has been the leading one for several decades. Its main points are described in Pinker's work "Words and Rules" (Pinker 1991). According to Pinker, irregular and regular past forms are processed by two distinct mechanisms. Regular verbs are generated in the module of grammar, while irregular forms occur due to the mechanisms of

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the lexicon. Forms of irregular verbs are stored in pairs. If a verb has a past form stored in the lexicon regular marking is blocked. Otherwise a rule applies. A rule is defined as an abstract operation of adding a suffix to a variable (root). Any time when access to a ready form is blocked for some reason the rule applies. The expansion of this rule on a wider variety of objects results in innovations, such as *goed*. Pinker notes that innovations built on irregular patterns are also possible yet very infrequent. Pinker shows that irregular patterns are phonologically dependent whereas regular suffix is employed disregard of phonological properties of a word. For example, it is usually added to newly created verbs and onomatopoeias.

Points discussed above are elaborated on in a later work by Steven Pinker and Michael Ullman "Past and Future of the Past Tense" (Pinker & Ullman 2002). First, clarifications are made concerning the term "rule" which was used to describe generation of regular past forms. It is noted that the theory does not proclaim the existence of an explicit rule "in order to make a past form it is necessary to ad *–ed*" (Pinker & Ullman 2002). The only thing that it does assume is that there is a past tense morpheme *-ed*, a variable (verb) and an operation of merger.

Second, Pinker and Ullman specify their position as for what types of verbs are stored in the lexicon and generated by the application of the symbolic rule. The initial theory viewed irregular forms as stored in the lexicon and regular past forms as generated by grammar. Now Pinker and Ullman qualify the assumption, saying that high frequency regular forms can also be stored in lexicon as well as all irregular forms.

Finally, Pinker and Ullman admit that lexicon in dual-system theories is characterized by some of the properties attributed to pattern associator which is a single-system model. The pattern associator model was first introduced by Rumelhart and McClelland (Rumelhart & McClelland 1986). Lexicon as well as pattern associator is able to generalize patterns. Input data are grouped according to various grounds. Then certain generalizations are made in the lexicon concerning morphological characteristics of units such as past tense building. Despite all common properties of lexicon and pattern associator model, they are not identical as lexicon in the understanding of the dual-system approach has certain morphological, phonological, semantic and syntactic features which are not taken into consideration in the connectionist model (a single-system model).

The single-system approach is represented in 2 types: connectionism (Rumelhart & McClelland 1986; MacWhinney & Leinbach 1991; Plunkett & Marchman 1991, 1993) and net model (Bybee 1995). Within the connectionist model interdependence of grammar and lexicon is underlined. The single associative mechanism processes incoming data and is able to generalize patterns. The stability and productivity, i.e. the ability to apply to new words are influenced by frequency effects and phonological properties of units.

It was noted above that connectionist models of pattern associator are limited as they do not take into consideration semantic and syntactic information. The argument about the limited character of single-system connectionist models is probably true only of early models of connectionism. Modern variants of connectionism take into consideration phonological features as well as semantics and argument structure. Language representation in modern connectionist theory is viewed as interconnection of three maps: phonological, semantic and argument. The key notion here is the notion of competition which refers to relationship between language units activated during speech perception or production. On the phonological map compete auditory and articulate images; on the semantic map – meanings ascribed to sound signal (or articulatory sequence); and at last on the argument map compete arguments of a predicate and variants of word order. Competition of auditory images can be seen in self-correction, i.e. correction of slips of tongue including replacement of sounds similar in their articulation parameters or words that are phonologically similar (Ovchinnikova 2006).

Both modular and connectionist approaches correctly predict types and number of innovations. But the mechanisms underlying occurrence of innovations within modular and connectionist approaches are substantially different. The modular approach interprets innovations such as *comed* as a result of symbolic rule application. Innovations such as *brang* are viewed as a result of work of associative mechanisms in lexicon. On the contrary, single system approach regards all types of innovations within the same mechanism.

Within the connectionist approach the choice of a pattern occurs as a result of competition of various patterns. In this paper we will study what factors influence competition on the morphosyntactic arena.

2.2 Verb morphology

English verbs are generally divided into two groups: regular and irregular. Among irregular verbs there exist certain patterns or form building models. To the same pattern belong, for example, *ring-rang* and *sing-sang*. We can group verbs into a pattern disregard of their forms token frequency. Such method would be appropriate if we dealt with language as a system in general.

In our paper, we will adopt another approach. For us, it is important if a child is likely to hear a verb form. That is why we used frequency lists to determine token frequencies of verbs. We only took those verb forms which had a frequency not less than 1 item per million words. We will describe the process of grouping verbs into patterns in section 2 devoted to data description.

Russian verb morphology is more complicated. There are several productive and unproductive classes. Moreover, in Russian linguistics there are different classifications of verbs. In present research we adhere to approach presented in "Russian Grammar" (Shvedova 1980). There verb inflection types are defined as "groups of verbs belonging to the same conjugation type and having the same relation between present and past stems" (Shvedova 1980). Depending on the relation or changes between present and past stems 10 inflection types are discriminated. Among them we can see productive classes which present an active pattern in modern Russian and unproductive patterns which do not generate new verbs today.

Productive classes and subclasses are:

- class I:

  subclass 1: *a-aj* alternation (igrala-igrajut 'she played- they play')

  subclass 2: *e-ej* alternation (belela-belejut 'she whitened-they whiten'),
- class II: *ova-uj* alternation (risovala-risujut 'she drew-they draw'),
- class III: *nu-n* alternation (prignula-prignut 'she jumped-they will jump'),
- class X:

  subclass 1: *i-ø* alternation (milila-milyat 'she washed with soap-they wash with soap').

Other subclasses and classes are unproductive.

2.3 Child language innovations

Verb acquisition is often described as U-shaped development. Dan Slobin (Slobin 1984) describes the following stages: 1) no marking - *break, drop*; 2) marking exists but in a limited number of cases - *broke, drop*; 3) overgeneralization of marking - *breaked, dropped*; 4) acquisition of standard marking - *broke; dropped*. Gradually, filters apply and a child masters a language.

The development of a morphological system is a gradual process. Unevenness of morphology acquisition results in innovations which tell us about the stages of system formation. Mastering a morphological category includes two stages: mastering its semantics and plane of expression (or marking). Semantics and form of expression have relative independence (Tseitlin 2000: 88). It is necessary to take into account this distinction as it allows classifying all mistakes into two types: those connected with mastering: 1) semantics - we will refer to them as errors; 2) form of expression - innovations. Under the term "innovation" (Tseitlin 1989) we understand forms which do not exist in standard language. We refer to forms like *goed* as innovations, not mistakes because a child does not yet know the whole system of a language and simply tries to fill in the gaps in the grammatical system creating new forms.

To the first group belong the cases of a wrong choice of tense or number in a certain context, for example, when a child does not take into consideration the sequence of tenses. The second group includes cases of building a past from according to a wrong paradigm, such as *maked*. We will regard in detail only the second group here.

The mechanism underlying innovations is generalization, i.e. the expansion of a pattern on a wider class of objects. It makes possible such forms as *goed* or *brang*. Dan Slobin (Slobin 1984) mentions the following rule governing generalization: "Avoid irregularities". It means that a child will try to apply the same grammatical marking for one grammatical meaning. For example, if a child has noticed that *–ed* usually applies to past tense forms he or she will use such marking for other forms of verbs be they regular in standard language or irregular. Though the "knowledge" of the rule "avoid irregularities" is mostly subconscious, some children produce forms that seem to them more regular and refuse to admit exceptions that exist in standard language. Children even "explain" to adults that the invented forms sound better (Tseitlin 2000).

To sum up, innovations are the result of children's creativity. These innovations are a valuable source of information as they show us the stages of language system development. In what follows we provide an analysis of factors determining innovations. Such analysis will give important material for discussion concerning dual and single-system approaches to verb formation.

3 Data

The data for our study was collected from several sources. First, we used a collection of monologues named "The Folk Stories of Children" (Sutton-Smith B. (ed.) 1981). This book contains narratives by children. To collect the narratives experimenters asked children to tell a story. Stories were recorded by an experimenter and later transcribed. From the whole set of stories we chose those narrated by 5-7 year-old children. Then all mistakes were extracted and put in a list. The list included a mistake, the sentence where it was registered and information about a child (age, sex). Later we classified all types of mistakes into errors (semantic mistakes) and innovations (non-standard forms of expression of grammatical meaning).

Second, we used corpus data from the CHILDES database. Transcripts of speech of two English-speaking children were employed. The first one was a 7-year-old boy Christopher and the second was a 6-year-old boy First. The recordings contained their talks with parents. The procedure was the same as described above. As a result we got a list of errors and a list of innovations.

Evaluation of the influence of input on child speech is a complicated matter as it is raises the issue of adequacy of input modeling. For current purposes we need to determine the character of input for children in the age of 5-7.

For children aged 5-7 input is basically oral speech, both child-directed and non-directed one. For estimation of the impact of input we used two frequency lists based on oral corpora. List 1 was based on the oral part of the British National Corpus (BNC) (Leech, Rayson & Wilson 2003), while list 2 was based on parents' speech from CHILDES (http://childes.psy.cmu.edu/topics/parentfreq.cdc). One of the purposes of the study is to compare various frequency lists.

We will use frequency lists to measure token frequency, type frequency and cumulative frequency. Token frequency is the frequency of a form in input per million words. Type frequency is a number of verbs having the same pattern. For instance a pattern including such pairs as *bind-bound, find-found* has a type frequency of 2. Cumulative frequency is counted by addition of token frequencies of past forms of one pattern.

Let us now describe briefly the frequency lists. BNC includes a collection of written and spoken texts of various genres. It comprises 100 million words. The list contains items with frequency over 1 item per million words (ipm). Out of the big list we made a small list containing verbs in the simple past form. Then the list was divided into 2 groups: regular and irregular verbs. Irregular verbs were then grouped according to patterns. Patterns have different type frequency and cumulative frequency. For example, the pattern *get-got* includes only 2 pairs: *get-got, forget-forgot* but the cumulative frequency of forms *got* and *forgot* is high. Pairs *throw-threw, blow-blew, grow-grew* make up a pattern with a higher type frequency.

The CHILDES list is based on parents' speech extracted from the CHILDES database. The corpus basically contains talks during meals, telling stories, talks accompanying games etc (MacWhinney 2000, Li & Shirai 2000). From the frequency list we collected verbs in the past simple form. Later we grouped verbs according to classes (regular and irregular) and patterns as it was described above.

As Russian data we used a list of innovations collected by S.Tseitlin (Tseitlin 1989) and a "Dictionary of Child Language" edited by V.Kharchenko (Kharchenko 2005). Tseitlin's list contained all types of innovations so we extracted from it innovations in verb formation. Kharchenko's dictionary included both lexical and grammatical innovations of all parts of speech. We made a list of grammatical verb innovations.

4 Analysis of form building innovations

4.1 Narratives vs. Dialogues

We had two types of English data: monologues and dialogues. It has been noticed that in dialogues innovations were considerably less frequent. We have registered only one form *holded* that was built in the regular type and no innovations built on irregular patterns. It confirmed our initial assumption that the number of innovations is connected with the complexity of a cognitive task. For young children, monologues were more challenging than dialogues because monologues required longer planning. That is why innovations were more numerous in monologues.

4.2 Innovations connected with the choice of a paradigm and factors which determine them in English.

The question in focus is: what factors can determine the choice of a certain paradigm? It is also necessary to find out how these factors interact. Among possible factors we regard token and type frequency, cumulative frequency of past tense forms of one pattern and phonological

features of a verb.

The most widespread innovation was building of a past form of an irregular verb within a paradigm of regular verbs (*stealed, knowed*). Children chose a model with a higher index of regularity, i.e. type frequency.

Our BNC list contains 224 past tense forms of regular verbs. They occur in total 7699 times so it is their cumulative frequency. Let us compare this figure with cumulative frequency of some irregular groups. For example, *got* and *forgot* occur together 8097 times, while *was* – 5068 times. Regular verbs class has a very high type frequency. The cumulative frequency is also relatively high.

Type frequency of regular verbs is even higher in CHILDES: it contains 500 different verbs. Their cumulative frequency is 7244. The distribution of regular verbs in two frequency lists is shown in table 1:

Table 1. Number of regular verbs in the CHILDES list and the BNC list

	BNC	CHILDES
number of verbs	**224**	**500**
cumulative frequency of Simple Past forms	7699	7244

High type frequency of the regular class is probably the reason explaining why the majority of innovations are built according to this model. According to the regular type the following forms were constructed: *flied, breaked, holded* etc. This model may be considered the basic model.

Type frequency becomes a leading factor when a child deals with low frequency past forms. Our data confirm that such forms as *stole, fed, ran* (that might become *stealed, feeded, and runned* in child speech) have very low token frequency in adult oral speech (from 0 to 40 ipm, i.e. items per million words). We suppose that high type frequency determines the type of innovations, while low token frequency shows which forms are prone to innovations.

On the other hand, high token frequency can not guarantee successful resistance of an item to the influence of the regular pattern (Tseitlin 2000). For example, *knew* has a frequency of 168 ipm in adult speech, still there occurs a form *knowed* in child speech. Other studies report innovations like *comed* (Pinker 1991), cf. *came* – 473 ipm.

However, it is impossible to interpret all kinds of innovations as the result of type frequency effect. Several children used the form *brang* instead of *brought.* It seems to be very important to analyze this form as it occurred in speech of several children of different age. We can probably see here the influence of the model *ring-rang* (Pinker 1991).

The analysis of type frequency on the basis of the BNC list shows that the class *bring-brought* has 3 items (past forms: *brought, taught, and thought*). Other possible members are infrequent (less than 1 ipm). The class *ring-rang* has only 1 item (others infrequent). Type frequency does not work here.

According to the CHILDES list classes *bring-brought* and *ring-rang* have almost equal type frequency. The pattern *ring-rang* has higher regularity in parents' speech than in the BNC. It includes 4 verbs: rang, sang, drank and sank. The pattern bring-brought includes 3 items.

All past forms of *ring-rang* pattern have low token frequency: 4-20 ipm (see table 2). The token frequency of *brought* is 175 in the CHILDES list (see table 3) and 143 in the BNC list. This difference is considered to be unimportant.

Table 2. Token frequency of verbs of *rang-rang* pattern according to the CHILDES list

verb	ipm
drank	20
sang	17
rang	12
sank	4
total	53

Table 3. Token frequency of verbs of *bring-brought* pattern according to the CHILDES list.

verb	ipm
brought	175
taught	32
thought	583
total	790

The cumulative frequency of *ring-rang* pattern is 53 ipm. The cumulative frequency of "brought" group is 790 ipm (see tables 2, 3).

The factor of regularity does not seem to be important in the competition between two paradigms. It is not token frequency that plays the role either. In the BNC frequency list *brought* occurs 143 times, whereas *rang* – 40 times. In the CHILDES list token frequency of *brought* outnumbers even the cumulative frequency of "*ring-rang"* class (see tables 2, 3). It generally agrees with the data obtained from the BNC list.

The degree of regularity of classes "*ring-rang"* and "*bring-brought"* is practically the same though "*bring-brought"* has a higher type frequency. Nevertheless, even high type frequency cannot provide greater stability of *brought* in child speech. Children still make innovations such as *brang.*

A possible explanation can be presented in terms of phonology. Words *ring* and *bring* are very close phonetically. Input from the phonological map serves as a resonance factor and makes the child choose a certain paradigm. It can also be a version that *ring* and *bring* form the same analogy like *come* and *become, stand* and *understand.*

A certain possibility is still left that a child could have heard a form like *brang* in adult's speech. Elena Lieven (personal communication) notes that though the form *brang* does not belong to standard English it might be heard in Southern English dialects. Yet, even in these dialects it is rare. The form *brang* is possible in the Glaswegian dialect (Michael Kerins: personal communication). Nevertheless, it has never been registered in CHILDES or BNC. So the possibility of its occurrence could not affect the results of our research. Elena Lieven mentions, that in adult's speech *brang* is possible as a linguistic joke. This probably is an indirect sign of the productivity of a pattern.

Preliminary results show that high token frequency is not a guarantee of a successful acquisition of an item. Type frequency does not always determine mastering of a pattern as well. Token and type frequency are important factors for discrimination of regular and irregular patterns, i.e. the patterns where the difference in type frequency is substantial. But these factors are not influential when a child deals with various irregular patterns. In other words, if a child feels that some irregular pattern should be employed, he/she needs to make choice between irregular models. But this choice will not be governed by frequency factors. Our data show that phonological features of verbs would be the most influential.

4.3 Evidence from Russian

English has always been chosen to test single- and dual-system approaches (see Pinker & Ullman 2002 for discussion) to language acquisition. It has given us evidence for understanding the nature of cognitive processes. Yet, some typological characteristics of English prevent us from getting certain type of data. First, English morphology is not as rich as of some other languages. Second, as mentions Eva Dabrowska (Dabrowska 2001), the mechanisms underlying formation of regular and irregular forms are different. Regular verbs form their past forms by adding a suffix while derivation of irregular verbs involves vowel changes which are cognitively more complex than adding an affix. Dabrowska supposes that it explains to us the fact that English verb innovations are mostly built on the regular pattern. Third, the existence of only one productive class does not allow investigating relations between several productive models.

Studying acquisition of morphology of languages such as Russian might give us new data. Several attempts have been made in research devoted to acquisition of verb morphology in Russian, e.g. Gor & Chernigovskaya 2003. As it has been described above, Russian has several productive and unproductive classes. Productive are the following classes and subclasses:

- class I:

subclass 1: *a-aj* alternation (igrala-igrajut 'she played- they play')
subclass 2: *e-ej* alternation (belela-belejut 'she whitened-they whiten'),

- class II: *ova-uj* alternation (risovala-risujut 'she drew-they draw'),
- class III: *nu-n* alternation (prignula-prignut 'she jumped-they will jump'),
- class X:

subclass 1: *i-ø* alternation (milila-milyat 'she washed with soap-they wash with soap').

Other subclasses and classes are unproductive. Besides, the difference in type frequency between productive and unproductive classes as well as within different productive classes is not as evident as in English. Is it possible therefore to use dual or single-system approaches to account for Russian data? To answer this question we need to see if innovations are influenced by more that one productive class.

The data suggest that most innovations exhibit the influence of productive class 1: *risovaju* instead of *risuju* 'I draw'. Alongside with innovations of class 1 there exist innovations influenced by other productive and unproductive classes. Such forms as *priviknul* instead of '*privik*' 'got used to' are the result of productive class 3 influence. Traces of unproductive class 4 paradigm (ø-n) are seen in forms *otdoh* instead of *otdohnul* 'had a rest'; *str'oh* instead of *stryahnul* 'shook of'.

We have found out that there exist innovations influenced by more than one productive class. Classes are not distinguished on semantic basis but are the result of tradition in language. There are no direct rules how to learn which class a verb belongs to. It means that dual-system approach cannot fully account for Russian data as it does not regulate the relations between several productive (or regular) classes.

The existence of several productive classes in Russian also implies that for a child the choice of a proper paradigm will probably be governed by various factors including token frequency, type frequency, cumulative frequency of verb forms and phonological features of a verb. If this is the case, it is an argument in favor of single system approach to morphology acquisition, where various factors cooperate.

To estimate if the enumerated factors act for Russian as well as for English we need to use data from a frequency list based on the oral part of some Russian corpus. Unfortunately, today there are no such lists as existing frequency dictionaries are based on written corpora of Russian. As a future goal of the research we see the creation of such a dictionary.

5 Conclusion

Dual-system and single system approaches give right predictions concerning the number and the proportion of innovations on the regular and irregular types in English. Yet, they have different interpretation of the mechanisms producing innovations. The dual system approach is not fully applicable to languages with several productive classes.

We have found out that there are certain factors that influence the choice of verb paradigm. These are type and token frequency, cumulative frequency and phonological properties. Our analysis gives right predictions concerning the types of innovations and the ratio of innovations based on regular and irregular types. Properties of lexical units such as frequency and phonological shape allow us to account for innovations built on the regular and irregular type not using the notion of rule. To measure frequencies we used two independent dictionaries. We did not register differences in their data that could affect the results of our study.

Most innovations of English children belong to the regular type. According to our data it is explained by high type frequency of regular class. Other factors may become more influential for the choice of a paradigm within irregular patterns. Thus, in the case of *brang,* phonological similarity between *ring* and *bring* were the strongest factor.

English data have shown that innovations are more frequent in monologues. It happens because more effort is spent on planning and less effort is left for language control.

We have confirmed the assumption that a child tries to find logic and regularity in a language both in regular and irregular classes of verbs and, therefore, he/she builds his/her own language system.

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Variables and Resumption in Child Spanish

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Abstract

We present results from two pilot experiments investigating resumption in questions in Child Spanish. We tested the production and comprehension through an elicitation and an acceptability task respectively. The subjects were monolingual Spanish children, age 3-6, and a group of adult controls. Our results show that resumption is not attested in production by either group of subjects. Children, however, accept pronominals in embedded positions or in d-linked questions introduced by *cuál*, conditions which have independently been shown to favour resumption. Our results contrast with previous studies that have established productive use of non-target resumption in relative clauses in Child Spanish (Pérez-Leroux 1995). In particular, our results disconfirm Pérez-Leroux 's 1995 hypothesis that overproduction of resumption in relative clauses is due to an underspecified [+/-variable] value for the pronominal, leading children to use pronouns as variables in quantificational chains (Lasnik & Stowell 1991). According to this hypothesis overproduction of pronominals is expected not only in relative clauses, but also in questions, a prediction not borne out in our results. We conclude that children do know that pronouns are not legitimate variables in quantificational chains and, in this respect, their grammar is not qualitatively different from that of adults.

1 Introduction

We present results from two pilot experiments investigating resumption in questions in Child Spanish. Previous studies have established productive use of non-target resumption in Spanish child relative clauses (Pérez-Leroux 1995). Pérez-Leroux 1995 takes such overproduction to be the consequence of an underspecified [+/-variable] value for the pronominal. Thus, children use pronominals as variables in quantificational chains (Lasnik & Stowell 1991). While they master movement, they have not acquired the [-variable] value of pronominals. A crucial aspect of this hypothesis is that overproduction of pronominals is expected not only in relative clauses, but also in questions. The main aim of the reported studies is to test the validity of this hypothesis.

2 Elicitation of questions

2.1 Experimental design and materials

The central issue is whether resumption is indeed attested in Child Spanish. It is, therefore, necessary to take into account factors that are known to affect resumption, such as embedding and d(iscourse)-linking. Embedding has been shown to improve the acceptability of resumptive questions and relative clauses (Alexopoulou & Keller 2007, Erteschick-Shir 1992, McKee & McDaniel 2001). We, thus, included questions extracted from embedded positions, one from an infinitival clause like (1) and one from a finite clause like (2).

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(1) ¿Qué quieres comer?
What want-2sg eat-inf
What do you want to eat?
(2) ¿Quién piensas/crees que mandó Winnie a buscar la pelota?
Who think/believe-2sg that sent-3sg Winnie to find the ball
Who do you think Winnie sent to find the ball?

Questions headed by d-linked wh-phrases like *which X* have been argued to tolerate resumption, in contrast to non d-linked questions introduced by *who* (Cinque 1990, Anagnostopoulou 1994). We tested whether the contrast between d-linked *cuál* and non d-linked *qué* has an effect on the production of resumptive questions.

The design crossed the following factors: Embedding (matrix, infinitival, finite) X D-linking (cuál,qué), which resulted in 6 cells. English translations of sample targeted questions are given below. Two tokens of each condition were targeted, resulting in 12 experimental items.

S1: What does Kanga carry in her belly? (**Qué, matrix**)
S2: Which ice cream did Winnie eat? (**Cuál, matrix**)
S3: What do you want to play? (**Qué, infinitive**)
S4: Which juice do you want to drink? (**Cuál, infinitive**)
S5: Who do you think Winnie sent to find the ball? (**Qué, finite**)
S6: Which car do you think Tiger hid in the house? (**Cuál, finite**)

2.2 Methodology

The elicitation task was modelled on Thornton 1996. The experimenter introduced children to a puppet, Pingu, who came from the fictional far away "childrens' land". During the warm-up phase children were encouraged to find out things about Pingu and his country by asking questions to Pingu. During the experimental phase a story was acted out with toys and witnessed by the child. The puppet was either assumed to not always pay attention or was prevented from watching the story developing (by covering his eyes). The children were then encouraged to ask the puppet questions to ascertain its comprehension of what was going on. The puppet was furthermore said to talk only to children and not to adults. An example of such interactions is given in (3).

(3) Small acted out story: Winnie is with Piglet and looking for honey; they find two ice-creams, one vanilla and one strawberry. Piglet chooses vanilla and Winnie strawberry.
Experimenter: Let's find out if Pingu understood what happened.
En esta historia habia dos helados, uno de vainilla y uno de fresa.
In this story there were two ice creams, a vanilla and a strawberry one.
Winnie comió uno de ésos. Pregúntale a Pingu cuál.
Winnie ate one of the two. Ask Pingu which.

Experimental items were presented in random order and interspersed with 2-4 fillers. Note, finally, that all the referents of wh-items were contextually salient since they had been introduced in the story or in the space of interaction.

2.3 Subjects

The participants were 15 monolingual Spanish children, age 3-6. They were divided into 3 groups according to age, namely 3-4, 4-5 and 5-6. The data collection was carried out at a school in Madrid, in November 2006. In addition, we had a control group of 4 adult speakers of Spanish.

2.4 Results

Table 1 presents the results of the elicitation task in raw numbers and percentages. The task aimed at obtaining two sets of the items illustrated in S1-S6. In Table 1 we ignore the d-linking condition. Thus, results for S1&S2 type items are given in the left column (matrix), results for S3&S4 in the middle column (infinitival embedding) and results for S5&S6 in the right column (finite embedding). The top row for each age group indicates the total of elicited utterances in each condition. For example, 3-year olds produced 35 items in the matrix condition, 26 in the infinitival embedding condition and 45 in the finite embedding condition. The reason the numbers vary across conditions is because in some cases the experimenter would make the puppet give answers which were wrong in the context of the story, and the child was encouraged to ask again, giving the puppet "one more chance". The second row indicates the number and percentage of elicited wh-questions. For instance, of the 35 elicited utterances of 3-year olds, 7 were wh-questions in the matrix condition while of the 35 elicited items of the 4-year olds in the finite embedded condition, 30 were wh-questions. The 3rd and 4th row indicate the number and percentage of matrix and embedded questions in each condition. For example, of the 17 items elicited from 4-year olds in the infinitival embedding condition, 10 were wh-questions; of those 10 questions, 2 were matrix (like S1/S2) and 8 were embedded (like S3/S4).

Table 1. Wh-questions (matrix, embedded) elicited in matrix, infinitival and finite embedded conditions, in raw numbers and percentages.

		matrix	**infinitival embedding**	**finite embedding**
3yr olds	total of elicited items	35	26	45
	wh-questions	7 (.20)	5 (.19)	24 (.53)
	matrix	7 (1.)	3 (.60)	24 (1.)

	embedded	0	2 (.40)	0
4yr olds	total of elicited items	15	17	35
	wh-questions	4 (.27)	10 (.59)	30 (.86)
	matrix	4 (1.)	2 (.20)	30 (1.)
	embedded	0	8 (.80)	0
5yr olds	total of elicited items	37	22	59
	wh-questions	24 (.65)	22 (1.)	57 (.97)
	matrix	24 (1.)	6 (.27)	40 (.70)
	embedded	0	15 (.68)	17 (.30)
adults	total of elicited items	27	17	27
	wh-questions	27 (1.)	17 (1.)	27 (1.)
	matrix	18 (.67)	3 (.18)	11 (.41)
	embedded	9 (.33)	14 (.82)	16 (.59)

Consider the adult controls. Their responses involve 100% wh-questions. In addition, their questions match the experimental condition: 67% matrix questions in the matrix condition, 82% embedded questions in the infinitival embedding condition and 59% embedded questions in the finite embedding condition. The production of embedded questions in the matrix condition is traceable to clefts as in (4) produced mainly when questions were cued by *cuál.* The adult controls sometimes use matrix questions in embedded conditions, which are not infelicitous: they just represent alternative ways of asking an appropriate question in that particular context, as for instance in (5) where the target is "which animal do you think you have heard?" Despite such instances of matrix questions, the crucial point is that the adults are able to ask complex questions involving extraction from a finite embedded clause in this condition.

(4) ¿qué es lo que llevan los canguros en la barriguita?
what is it that carry.3pl the cangaroos in the tummy.diminutive
What is it that kangaroos carry in their tummy?´

(5) Experimenter: *Hemos escuchado un animalito. Pregúntale a Pingu qué animalito piensa él.*
We have heard an animal. Ask Pingu which animal he thinks.
Adult: *¿qué animalito has escuchado?*
which animal have you heard?

Turning to children, it is noticeable that not all of the elicited material consists of wh-questions and the proportion in which they produce wh-questions varies. 5-year olds approach the adult standard, with the proportion of questions in their elicited utterances ranging from 65% to 100%. By contrast, for 4-year olds the proportion of questions ranges from 27%-86% and drops to 20%-53% for 3-year olds. In addition, age groups differ in the proportion of embedded questions they produce in the relevant conditions. It is striking that 3- and 4-year olds fail to produce any embedded questions in the finite embedding condition. This contrasts with 5-year olds who produce 30% embedded questions in the finite embedding condition and adults who produce 59%. Instead, 3- and 4-year olds only produce matrix questions. Most of them reproduce the cue offered and change the agreement, as in example (6) below. Non-

finite embeddings as in (7), on the other hand, are more productive. Note also that although 5-year olds produce embedded questions in the finite condition, the majority of their questions are matrix.

(6) Experimenter: *Hemos formado un animalito. Pregúntale a Pingu cuál piensa él.*
We have formed a little animal. Ask Pingu which one he thinks.´
Child: *¿cuál piensas tú?*
which one think.2s you
Which one do you think?

(7) ¿a qué quieres jugar? (Celia, 4 yrs)
what want.2s play.infinitive
´what do you want to play?´

Table 2 shows the types of responses children produce when they do not produce the targeted wh-questions. Children may use intonation, a yes-no question (e.g. Winnie ate strawberry ice cream or vanilla ice-cream?), repeat the cue or answer the question themselves. This last response is dominant in 3- and 4-year olds but fades away with 5-year olds. Interestingly, it is pronounced in the matrix condition, (60% and 53%) but is less frequent in the embedded conditions (27% and 36% for 3-year olds and 24% and 9% for 4-year olds). Another frequent response is cue repetition. In this case they use the cue as a basis for a question, but since the question is addressed to the puppet, they change agreement from 3rd to 2nd person, as in example (6). An exact repetition of the cue is fairly rare. Despite the high proportion of answers in the matrix condition (which deserves further investigation), in the majority of cases children attempt to formulate questions, indicating that they do understand the task. This is particularly evident in the embedded conditions where most items are attempted questions; the absence of the targeted long distance questions from the production of younger children indicates a genuine difficulty in formulating such complex questions.

Table 2. Alternatives to wh-questions produced by children

		matrix	**infinitival embedding**	**finite embedding**
3yr olds	total of elicited items	35	26	45
	intonation	4 (.11)	0	1 (.02)
	answers	21 (.60)	7 (.27)	16 (.36)
	yes-no questions	2 (.06)	8 (.31)	0
	cue repetition	1 (.03)	5 (.19)	4 (.09)
	matrix	7 (.20)	3	close to cue 24 (.53)
	embedding	0	2	0

4yr olds	total of elicited items	15	17	35
	intonation	0	0	2 (.06)
	answers	8 (.53)	4 (.24)	3 (.09)
	yes-no questions	2 (.13)	1 (.06)	0
	cue repetition	1 (.06)	1 (.06)	
	no answer	0	1 (.06)	0
	matrix	4 (.27)	2 (.12)	close to cue 28 (.80) other 2 (.06) (.86)
	embedding	0	8 (.47)	0
5yr olds	total of elicited items	37	22	59
	intonation	5 (.13)	1 (.05)	1 (.02)
	answers	5 (.13)	0	0
	yes-no questions	0	0	0
	cue repetition	3 (.09)	0	1 (.02)
	matrix	24 (.65)	6 (.27)	close to cue 23 (.39) other 17 (.29)
	embedding	0	15 (.68)	17 (.29)

2.5 Discussion

Neither the adult controls nor the children produced any resumptive structures. Recall that on the basis of Pérez-Leroux´s (1995) hypothesis of an underspecified [+/-variable] value for pronominals, one should expect overproduction of pronominals in interrogatives, similarly to what happens in relative clauses. This prediction was not borne out in our data. Note further that we found no difference between structures which were expected to favour resumption, e.g. extraction out of finite embedded clauses, and those which don´t, such as matrix clauses.

We observe age-related differences. While all the material elicited from the adults consists of wh-questions, this is not so for the children. Younger children, particularly the 3-year olds, produce considerably fewer wh-questions than adults, and these are mainly matrix questions. 4-year olds produce not only matrix questions, but also questions involving extraction from embedded positions in infinitival complements. 5-year olds are much closer to adults in this respect.

With respect to the *cuál/qué* distinction, we observe that it is absent from 3-year olds who produce only *qué*-questions. This differentiation is available to 4-year olds. There is a contrast between children and adults: while children can combine both *qué* and *cuál* with an N, *cuál*+N clusters are not attested in the adults. Adult production appears to obey the prescriptive ban on *cuál*+N in Peninsular Spanish. Finally, adults, as opposed to children, are quite productive with clefts as an expression of d-linking.

As a next step, it is necessary to explore the possibility of resumption being available in comprehension, for which we tested the acceptability of the structures.

3 Acceptability of questions

The elicitation task established that children do not produce any pronominals in their questions. However, younger children in particular had difficulty producing longer questions involving extraction from embedded positions. The purpose of the second experiment was to approach the status of embedded questions and resumption through the acceptability of the relevant structures. In addition, McDaniel and McKee 2001 found that English speaking children accepted more resumptive pronominals in relative clauses than they produced in an elicitation study. We, therefore, wanted to find out whether a similar discrepancy exists in questions of Spanish speaking children.

3.1 Experimental design and materials

The experiment investigated the same factors with the elicitation study with the additional factor of resumption: Resumption (gap or pronominal) x D-linking (qué, cuál) x embedding (no-embedding, infinitive, finite)**.** This resulted in 12 cells. Due to practical limitations only one token was used for each experimental condition. The tested items are listed below. All items with pronominals are ungrammatical in the target language, thus, experimental items were balanced for grammaticality.

S1g: ¿Qué empujó Kanga? (**Gap, matrix, qué**)
What pushed-3sg Kanga?
What did Kanga push?
S1p: ¿Qué lo comió Piglet? (**Res, matrix, qué**)
What it ate-3sg Piglet
What did Piglet eat?
S2g: ¿Cuál pelota golpeó el cerdito? (**Gap, matrix, cuál**)
Which ball kicked the piggy?
Which ball did the small pig kick?
S2p: ¿Cuál helado lo comió Winnie? (**Res, matrix, cuál**)
Which ice-cream it ate-3sg Winnie
Which ice-cream did Winnie eat?
S3g: ¿Qué quieres hacer? (**Gap, infinitive, qué**)
What want-2sg do-inf
What do you want to do?
S3p: ¿Qué quieres comerlo? (**Res, infinitive, qué**)
What want-2sg eat-inf-it
What do you want to eat?
S4g: ¿Cuál zumo quieres tomar? (**Gap, infinitive, cuál**)
Which juice want-2sg drink-inf
Which juice do you want to drink?

S4p: ¿Cuál cochecito quieres cogerlo? (**Res, infinitive, cuál**)
Which car want-2sg take-inf-it
Which car do you want to take?
S5g: ¿A quién pensas que mandó Winnie a buscar la pelota? (**Gap,finite,qué**)
A who think-2sg that sent-3sg Winnie to look-for-inf the ball
Who do you think Winnie sent to look for the ball?
S5p: ¿A quién piensas que lo pusimos en la casita? (**Res, finite, qué**)
A who think-2sg that it put-1pl in the house
Who do you think we put in the house?
S6g: ¿Cuál piensas que escondió Piglet? (**Gap, finite, cuál**)
Which think-2sg that hid-3sg Piglet
Which one do you think Pigle hid?

S6p: ¿Cuál muñequito piensas que lo pusimos en la casita? (**Res, finite, cuál**)
Which doll think-2sg that it put-1pl in the house
Which doll do you think we put in the house?

3.2 Methodology

The acceptability task was modelled on McDaniel and Smith-Cairns 1996. Data were collected over two sessions, a training and an experimental one. During the training session children met their familiar character, *Pingu*, and were asked to help him with his Spanish by telling him if his sentences were good or bad. Training items involved judgements of words, declarative sentences and questions. Ungrammatical items involved word order and agreement errors. Children picked up the task easily. When they rejected an item the experimenter encouraged them to give the correct version. In most cases children did this easily. The test session included a warm-up phase with a subset of items from the training session and then the set of the 12 experimental items interspersed by 4 ungrammatical fillers. All fillers involved wh-questions, on a par with the experimental items and were all ungrammatical to control against a potentially high rate of positive responses to ungrammatical experimental items. Each item was preceded by a small story as illustrated in the following example.

S4p: [Context: two cars]
Pingu: *Acá tenemos dos cochecitos, un rojo y un azul. Si Eli quiere coger uno de ésos y yo quiero saber cuál, ¿está bien preguntar a Eli:* ***Eli, ¿cuál cochecito quieres cogerlo?***
Here we have two cars, a red and a blue one. If Eli (= the experimenter) wants to take one of these and I want to know which one is it o.k. to ask Eli: Eli, which car you want to take it?

3.3 Subjects

Subjects came from the same school in Madrid as in the elicitation study. Data were collected in April 2007, approximately 5 months after the elicitation study. 11 children completed both the training and test session. Of those, 3 children were excluded from analysis.[1] Of the remaining 8 children 6 had completed their 5th birthday and 2 their 3rd at the time of data collection. All 8 children picked up the ungrammaticality of the 4 filler items. The test session was also completed by 4 adult controls.

3.4 Results

Results from all 8 children are tabulated in Table 3. Children systematically judged gap structures as acceptable. They are also clearly sensitive to resumption, but there is more variability in their responses depending on the condition. Resumptive items range from ungrammatical (S1p, S3p) to essentially acceptable (S4g, possibly S6g). Children's responses are split for S2p and S5p.

Table 3. Number of acceptable questions per condition. Gap structures are on the left (S1g-S6g) and resumptive structures on the right (S1p-S6p).

S1g	**7**	**S1p**	**0**
S2g	**8**	**S2p**	**4**
S3g	**8**	**S3p**	**2**

[1] One did not understand the task; one was evidently tired and distracted during the test session and one gave an uncharacteristically high number of negative responses during the test session indicating he possibly enjoyed over correcting the puppet.

S4g	**8**	**S4p**	**7**
S5g	**7**	**S5p**	**4**
S6g	**7**	**S6p**	**6**

Embedding has an effect on the acceptability of resumptive structures. As indicated in Table 4, embedded resumptive structures are judged as acceptable more than twice as often as corresponding non-embedded structures. For both types of embedded structures this effect is more pronounced in the *cuál* condition. It would appear that this is more so for infinitival embedding.

Table 4. Number of acceptable resumptive questions in non-embedded and embedded conditions.

Matrix (S1p&S2p)	**Infinitival Embedding** (S3p&S4p)	**Finite Embedding** (S5p&S6p)
(0+4=) **4**	(2+7=) **9**	(4+6=) **10**

Resumptive structures headed by *cuál* were judged acceptable more often than resumptive structures headed by *qué* (Table 5). This appears to be the strongest factor affecting the acceptability of resumption. While children unanimously reject S1p, only half of them reject S2p. The combination of *cuál* and embedding results in resumptive questions with the highest scores, S4p and S6p, which receive scores comparable with the corresponding gap structures.

Table 5. Number of questions judged acceptable in the *cuál* and *qué* conditions.

Cuál resumptive questions (S2p,S4p&S6p)	**Qué resumptive questions** (S1p,S3p&S5p)
(4+7+6=) **17**	(0+2+4=) **6**

All 4 adult controls rejected all resumptive questions. They accepted all gap questions introduced by *qué* but rejected gap questions introduced by *cuál* (S2g, S3g).

3.5 Discussion

The results clearly indicate that children are sensitive to resumption in questions and do not treat pronominals as variables on a par with traces. In addition, while they accept more resumptive questions than adult controls, this is clearly linked to two specific conditions, embedding and d-linking. This is true for the youngest children as well. In this respect, their grammar does not appear to be qualitatively different from the adult grammar in having an underspecified representation of the variable value of pronouns as hypothesised by Pérez-Leroux. Underspecification would result in random optionality between pronominals and gaps, clearly not the case in our results.

Adults tend to reject the sequence *cuál*+N in both gap and resumptive questions and tend to correct to *qué*+N. *Cuál*+N is productive in Latin American Spanish but prescriptively banned in Peninsular Spanish. There is no sign that children disprefer *cuál*+N. We believe that adults are being prescriptive in their judgement of *cuál*+N while children of preschool age offer more genuine judgements on this. Children accept all *cuál*+N gap questions and many *cuál*+N resumptive questions. The contrast between questions introduced by *qué* and questions introduced by *cuál* indicates that children are aware of known interactions between discourse linking and pronouns (Cinque 1990). Note, however, that it is impossible to

properly evaluate whether adults are also sensitive to these interactions since adults always reject *cuál*+N sequencies irrespective of whether a gap or a pronoun is involved.

Finally children accept resumptive structures more often in embedded conditions. This result patterns with findings from adult grammars and can be explained as a consequence of the processing complexity involved in such structures (Alexopoulou and Keller 2007, Dickey 1996, Erteschick-Shir 1992).

4 Elicitation vs. acceptability results

In the elicitation task we found no evidence of resumption under any condition. However, children do accept pronominals in some questions, even though they do not produce them. McKee and McDaniel 2001 report a similar discrepancy between production and acceptability in relation to resumption in relative clauses of English children. The replication of this result for Spanish questions indicates a more general and systematic phenomenon. Following McKee and McDaniel 2001, we attribute the discrepancy to higher complexity involved in comprehension, as opposed to production. Indeed the fact that pronominals were accepted in embedded positions indicates their involvement in easing the processing load of long distance questions (see Dickey 1996 and Alexopoulou and Keller 2007 on this). Recall that, as indicated by the results of the elicitation study, younger children in particular have difficulty in formulating complex questions involving extraction from embedded clauses. The contrast between matrix and embedded questions observed in the elicitation study is also present in the acceptability study. The only difference is that in the acceptability study, the additional complexity of comprehension yields acceptance of resumptive elements which were not produced in the elicitation study. By contrast, adults showed no difficulty producing embedded questions; their data from the acceptability study are, thus, on a par with their elicitation data in showing no contrast between matrix and embedded questions. Under this view, child grammars are essentially target-like. The contrast with adults lies in the increased complexity of long-distance questions for young children.

5 Conclusion

We have explored the availability and nature of resumption in Spanish child grammar, focussing on the production and comprehension of questions. Contrary to expectations based on an underspecification account of pronominals, we did not find generalised resumption in wh-interrogatives. The cases of resumption we find are consistent with a last resort strategy to ease processing load at an early developmental stage. Further, resumptive questions are subject to a d-linking condition. A number of interesting questions arise. What is the source of the difficulty children have in formulating long distance questions? Are adults really insensitive to interactions between d-linking and resumption? As this was only a pilot study, such questions as well as the precise nature of the interactions between the various investigated factors will only be clarified with a further large scale investigation.

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Verb inflections as indicators of Bilingual SLI

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Abstract

This paper examines the verb inflectional system of 15 English-Hebrew preschool bilinguals: 6 typically developing (TD) bilinguals who attend regular preschools and 9 who attend "language preschools" following a prior assessment for language impairment. Using a case studies approach and multiple tasks (sentence completion, sentence imitation and enactment), we found that all bilinguals had the same root infinitive error types in their L1 English. Those diagnosed with impairment in both languages as well as those diagnosed with impairment only in L2 Hebrew had significantly more errors than TD bilinguals. In Hebrew, all bilinguals had difficulty using person morphology in past tense, with a significant difference between TD bilinguals and the other bilinguals. A qualitative difference in the type of errors was found between bilinguals impaired in both languages and those impaired only in L2. Those impaired in both languages, like typically developing bilinguals and monolingual SLI children, had more substitutions while those impaired only in L2 tended toward omission errors. This error is unusual for monolingual Hebrew typical and impaired acquisition, but reflects difficulties with uninterpretable person features which are not available in their L1 English. We argue that the quantitative and qualitative differences when found in both languages can be indicative of SLI, while a qualitative difference only in the second language is not.

1 Introduction

This paper reports on part of a larger study which examines the linguistic production of bilingual children, ages 4-7, placed in "language preschools" following a prior assessment for language impairment. The purpose of the study was to evaluate the relative contribution of the bilingual situation and the language impairment to the child's linguistic representations and underlying processes. In the overall effort, we look at the interface of SLI and bilingualism, exploring the use of morpho-syntax, pragmatics, and discourse, as well as lexical, phonological, and sub-lexical processing. The present paper focuses on the use of the inflectional verbal system by English-Hebrew bilingual children. The findings point to specific errors which, when very frequent, might serve as indicators of SLI in "emerging" and "sequential" bilingual children. It is also suggested that not all children in "language preschools" who have been diagnosed as having language impairment in their L2 are necessarily SLI.

1.1 Definitions

The bilingual children studied in this paper are children from bilingual backgrounds who are able to function in two languages (carry a conversation and understand) at a near native level (typical or impaired). Both simultaneous bilinguals and sequential bilinguals are included. Children are diagnosed for Specific Language Impairment (SLI) when they have normal performance IQ, score either 12 months or 1 SD below chronological age on

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standardized language tests, and have no: hearing disabilities, emotional or behavior problems, observed neurological deficit, or severe articulation/phonological deficit (Tallal & Stark 1981).

1.2 Linguistic Measures: Inflection

While English inflects its verbs for past tense and for third person singular in the present, Hebrew makes use of a wide array of verb inflections. In addition to tense, verbs are inflected for gender and number in the present tense and for gender, number and person in the past and future tenses. Studies of monolingual SLI (Bishop 1994; Clahsen 1991; Gopnik & Crago 1991; Rice & Wexler 1996) and typically developing bilinguals (Paradis, Crago, Genesee & Rice 2003) show that both populations use root infinitives (RIs) in English, e.g. David play ball. In Hebrew, however, SLI children do not omit inflections, but find past tense 2nd person inflection more difficult (Dromi, Leonard, Adam & Zadunaisky-Ehrlich 1999, Dromi, Leonard & Blass 2002). The present study focuses on past and present tenses only. Future tense, which is considered a feature of later acquisition and is marked in English by a modal rather than an inflection, was not studied. In English, the present study targets the production of past tense –ed and present tense 3rd person –s. In Hebrew, we look at the use of the four present tense forms: singular masculine (which has no overt inflection), singular feminine, plural masculine and plural feminine as well as eight past tense forms.

2 Method

2.1 Subjects

The subjects for this study were preschool children from bilingual or monolingual English-speaking homes, who attend regular preschools and special "language preschools" and have been exposed to Hebrew for at least two years. All children come from the same neighbourhood and same (middle-high) SES. Children are screened for both languages and are categorized in accordance with their linguistic abilities as diagnosed by standardized tests: CELF Preschool for English (Wiig, Secord & Semel 2004) for English and Goralnik (1995) for Hebrew. As for monolinguals, typical development (TD) is measured by a score of less than 1 SD below norm on the CELF in English and a score of less than 1.5 SD below norm on the Goralnik in Hebrew (following Dromi et al. 1999). This yields a division into children with typical development in both languages (TD), children with English typical development (E-TD), and children with atypical development in both languages (A-TD). Both E-TD and A-TD children attended the "language preschools", while the TD children attended regular preschools.

This paper presents six case studies of TD children, four case studies of E-TD bilinguals and 5 case studies of A-TD bilinguals. The TD bilinguals are 3 boys (Im605, Nm509, Em506) and 3 girls (Ef601, Mf602, Af509), ages 5;5-6;5, three of whom were simultaneous bilinguals and three sequential bilinguals (two with 3 years of exposure to Hebrew and one with two years of exposure to Hebrew. The E-TD bilinguals are 2 boys and 2 girls, ages 4;1-6;6, all sequential bilinguals and the A-TD bilinguals are 3 boys and 2 girls, ages 5;5-6;9, 3 sequential bilinguals and 2 very early sequential bilinguals. Table 1 presents the E-TD and A-TD children's length of exposure to Hebrew and scores on CELF and the Goralnik (the pseudonyms contain the gender (male/female) and age information (years; months):

Table 1. Demographic information for E-TD and A-TD children

	Child	**Age**	**Exposure**	**CELF**	**Goralnik**
E-TD	Rf606	6;06	4	100	140
	Bm509	5;08	3	91	99

	Cm506	5;06	2	90	122
	Mf401	4;01	3.5	98	82
A-TD	Af609	6.9	2	63	148
	Of602	6.2	3.5	80	147
	Dm606	6.6	2	73	130
	Sm506	5.5	4 (Sim)	69	135
	Am506	5.6	4 (Sim)	67	121

2.2 Tasks

Data were collected using three controlled tasks: a sentence completion task within a story context, an enactment task (both based on Dromi et al. 1999), and an elicited imitation task. The **sentence completion** task targets production of 3rd person singular and plural, in present and past tense and examines children's ability to mark agreement. Three storybooks were used in Hebrew and two in English. In English, the stories tested the use of past tense –ed (as in 'Here grandpa helps; yesterday grandpa _____ (helped)') and present tense –s (as in 'Here the cats eat, and here the dog ____ (eats)'). In Hebrew, the stories tested the use of gender and number in the third person in past tense (e.g. 'ha-yeled raca likfoc; az hu ____(kafac)' the boy wanted to jump; so he jumped) and present tense (e.g., 'kan ha-kelev mexapes oxel, ve-kan ha-xatulot _____(mexapsot) oxel' here the dog [masc. sing.] look for [masc. sing] food, and here the cats [fem.] look for [fem. pl] food). The **elicited Imitation** task tested for the use of 3rd person singular and plural, in present and past tense in English and for person inflections in the past tense in Hebrew, targeting 5 inflections: 1st singular, 2nd singular masculine, 2nd singular feminine, 1st plural, and 2nd plural, in order to tap into children's knowledge of agreement. The **enactment** task (based on Dromi et al. 1999) was intended to elicit person inflections in Hebrew only and tested the same three singular forms examined by the imitation task in Hebrew, namely 1st person singular and 2nd person singular feminine and masculine.

Data analysis was conducted on a case by case basis for each child separately looking both at the percentage of correct responses and the frequency and type of errors in each task in both languages. The analysis is presented first for the TD bilinguals, then for E-TD bilinguals and finally the A-TD bilinguals. T-tests were used when applicable.

3 Results

Our major finding is that the same kind of error is found in TD, E-TD and A-TD bilinguals, showing no qualitative difference across the three populations in English, and only a quantitative difference between the A-TD bilinguals on the one hand and the TD and E-TD bilinguals on the other hand. A qualitative difference was found, however, between the E-TD bilinguals and the other bilinguals in their L2 Hebrew, suggesting that A-TD bilinguals and E-TD bilinguals do not show the same impairment.

Figures 1 and 2 present the percentage of target responses by task and language for the TD children (Figure 1) and for the E-TD and A-TD children (Figure 2). The total number of target responses appears next to the label for each of the tasks. TD children had no errors in the Hebrew enactment task, and a very low error rate in the other tasks, mostly less than 10% and never more then 20% (on the sentence completion task) (Figure 1). Figure 2 shows the within-subject variability for the language impaired children, as reflected in the different height of the bars for each child. Only one ETD girl achieved an 80% success level on all the tasks and another girl achieved this level on the three Hebrew tasks. All ETD children scored significantly better on the English imitation task (three achieving 80% success), and were on average better on the English sentence completion task. On the other hand, three of the four received the lowest scores on the Hebrew enactment task and were very weak on the Hebrew

sentence completion task. There is a clear quantitative difference between the TD children and A-TD children in both languages, and between TD children and E-TD children in Hebrew.

Figure 1. TD Percentage of Target Responses by Task and Language

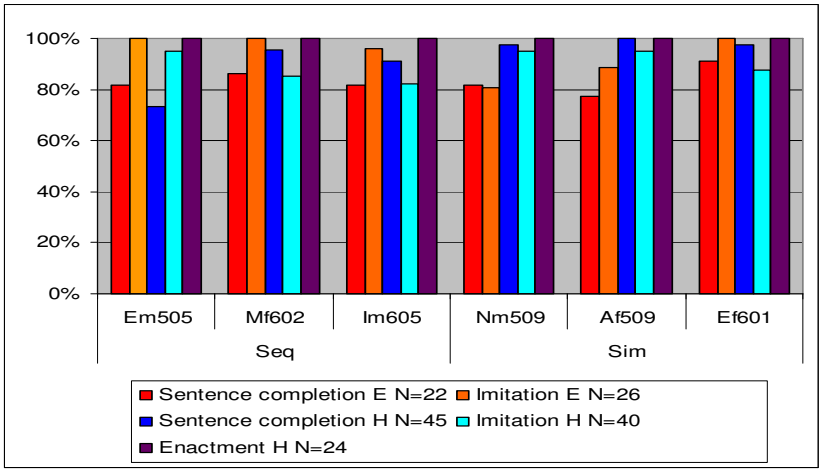
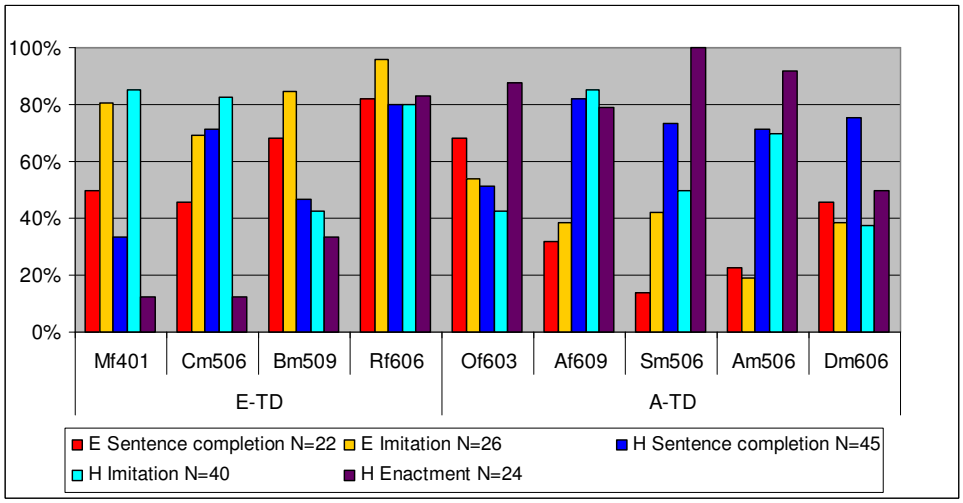


Figure 2. E-TD and A-TD Percentage of Target Responses by Task and Language



In addition to the rate of errors which distinguishes TD bilinguals from E-TD and A-TD bilinguals, the type of errors also helps characterize the differences among these groups. Two types of errors were found in both languages (1-2), two were unique to English (3-4) and three were unique to Hebrew (5-7), as follows:

1. Wrong tense (past for present or present for past*): *Here the boy jumps and the girl jumped* [target: *jumps*]. **Kan ha-yeled kofec ve-kan hayeladot kafcu.* [target: *kofcot*].
2. Root infinitives: **The cat hops and the dog hop* [target: *hops*]. **ha-xatula kfca ve ha-kelev likfoc* [target: *kacaf*].
3. Error in 3rd person morphology with a plural subject: **The cat hops and the dogs hops* [target: *hop*].
4. V-ing without an auxiliary: **The cat hops and the dog hopping* [target: *hops*].
5. Gender error (mostly masculine substituted for feminine): **Ha-yeled kafac ve ha-yalda kafac* [Target: *kafca*]. **Ha-kelev mexapes oxel ve ha-xatulot mexapsim oxel* [Target: *mexapsot*].
6. Number error (mostly singular for plural): **Ha-yeled kafac, ha-yalda kafca, kulam kafac*. [Target: *kafcu*]. *b'yom ha-huledet cilamta et ha-buba*. [Target: *cilamtem*]
7. Person error (1st person for 2nd person or vice-versa): *etmol kafacti baxevel harbe zman* [Target: *kafact*]. *b'yom ha-huledet cilamta et ha-buba* [Target: *cilamti*]

3.1 TD Bilinguals

Figures 3 and 4 present the frequency of error types in the sentence completion task in English and Hebrew, respectively, and Figures 5 and 6 present the frequency of error types in the imitation task in English and Hebrew, respectively, for the TD bilinguals. Figures 3-6 show that very few errors are found in both tasks (up to 10% for imitation and up to 20% for sentence completion). Most English errors are Root Infinitives (13% of relevant contexts) and resulted for 3rd person with plural subjects (13% of plural subjects), while most Hebrew errors are for gender in [present, feminine, plural] forms (9 of 24 – 37%) and in [2nd person past] forms (23 of 144 – 15%).

Figure 3. TD frequency of error types in the sentence completion task - English

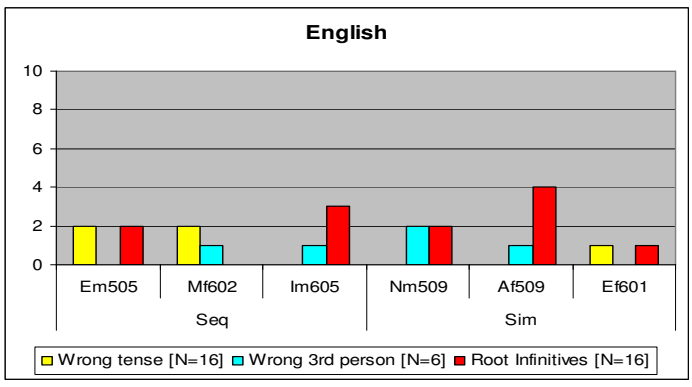


Figure 4. TD frequency of error types in the sentence completion task – Hebrew

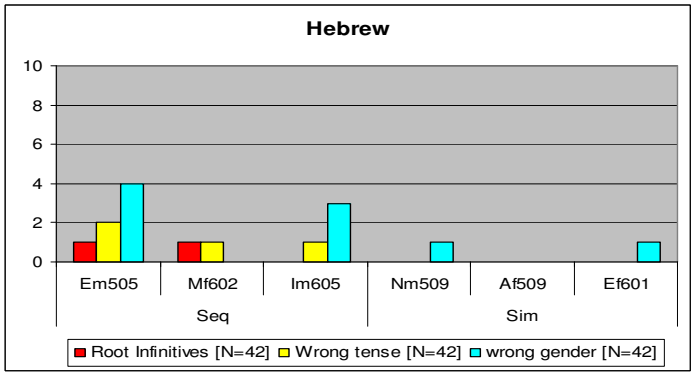


Figure 5. TD frequency of error types in the imitation task – English

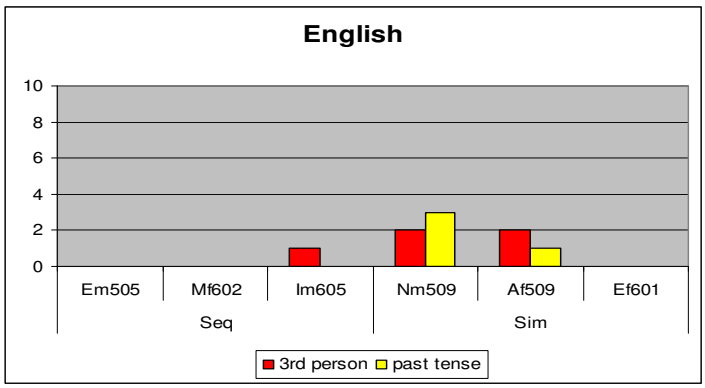
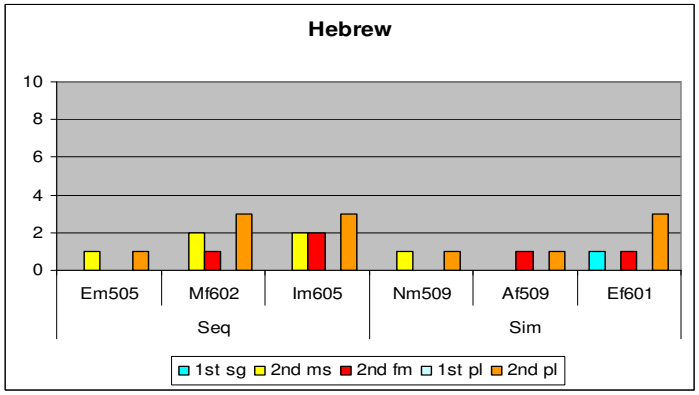


Figure 6. TD frequency of error types in the imitation task - Hebrew



3.2 E-TD Bilinguals

Figures 7 and 8 present the frequency of error types in the sentence completion task in English and Hebrew, respectively, and Figures 9 and 10 present the frequency of error types in the imitation task in English and Hebrew, respectively, for the E-TD bilinguals. Figure 11 presents the frequency of errors in the enactment task. The E-TD children show typically developing error frequencies, with a few more root infinitives in the production of the younger child (Figures 7 and 9). However, despite the typical error frequencies, all the E-TD children use 3rd person bare forms not found among the TD children (Figures 8 and 10). This latter type of error differs from the 1st/2nd person alternations found among TD children. In the enactment task, there is a very high error rate again with 3rd person bare forms (Figure 11).

Figure 7. E-TD frequency of error types in the sentence completion task – English

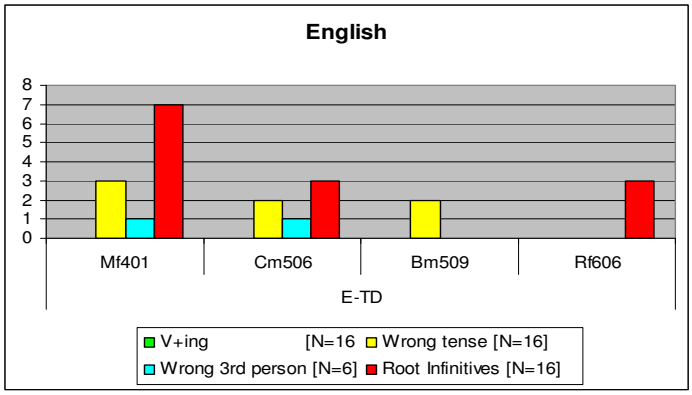


Figure 8. E-TD frequency of error types in the sentence completion task - Hebrew

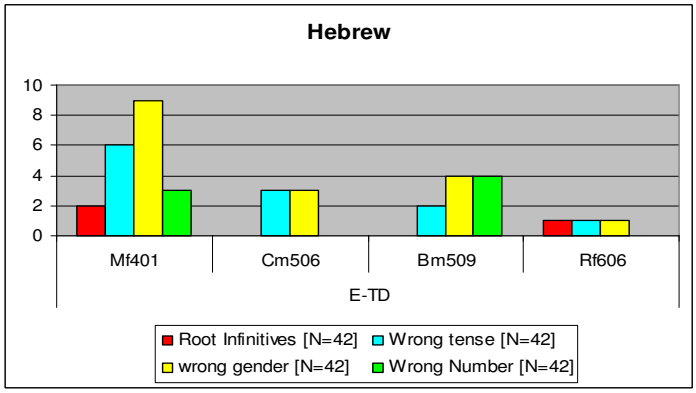


Figure 9. E-TD frequency of error types in the imitation task – English

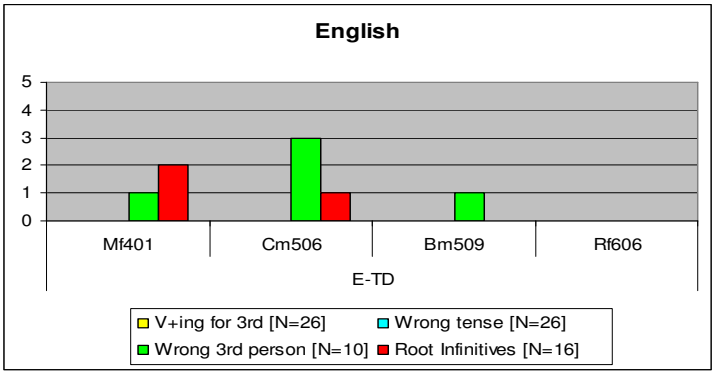


Figure 10. E-TD frequency of error types in the imitation task - Hebrew

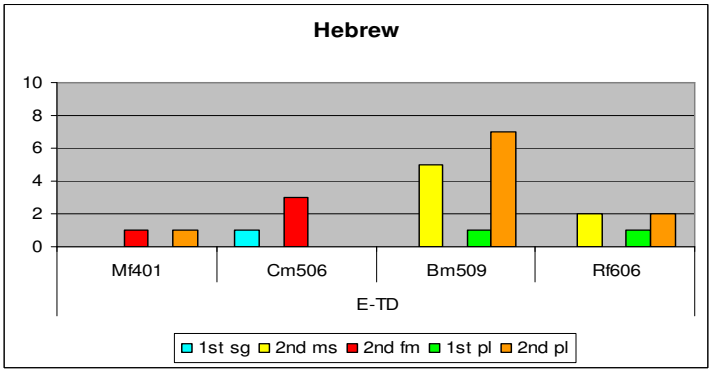
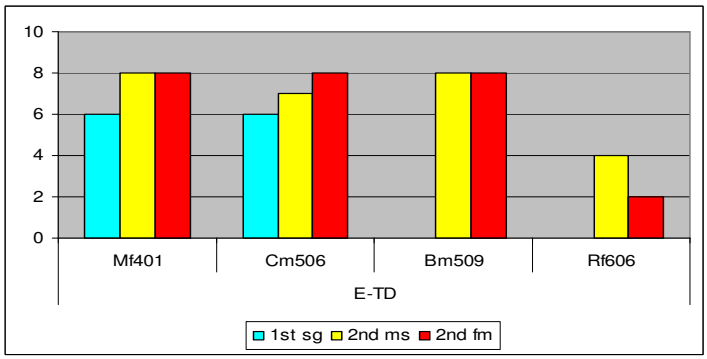


Figure 11. E-TD frequency of error types in the enactment task – Hebrew



3.3 A-TD Bilinguals

Figures 12 and 13 present the frequency of error types in the sentence completion task in English and Hebrew, respectively, and Figures 14 and 15 present the frequency of error types in the imitation task in English and Hebrew, respectively, for the A-TD bilinguals. Figure 16 presents the frequency of errors in the enactment task. While the TD bilinguals and E-TD used Root Infinitives in up to 20% of 3rd person and past contexts in English, the A-TD bilinguals used Root Infinitives in 50-60% of 3rd person and past contexts (Figures 12 and 14). All subjects showed some cases of erroneous tense and erroneous 3rd person, mostly with plural subjects.

In the Hebrew sentence completion task, A-TD bilinguals, like older E-TD and TD bilinguals had about 10% errors, showing the same variety of errors (Figure 13). The increased rate of errors for the young E-TD girl reflects her use of 3rd person bare forms. In the imitation task, 2nd person targets triggered many substitutions. While the E-TDs opt for 3rd person bare forms, the A-TDs opt for 1st person (Figure 15). However (see Figure 16) this is not the case for the enactment task in which the A-TDs have an error rate almost identical to TDs. That is, while there is a higher error rate in imitation for A-TD bilinguals (up to 70%), there is a higher error rate in the enactment for E-TD group (60%),

Figure 12. A-TD frequency of error types in the sentence completion task - English

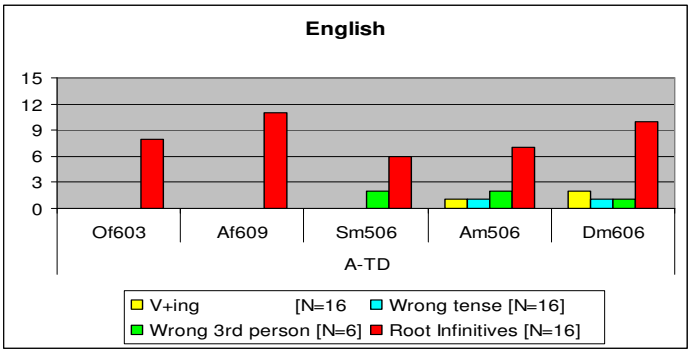


Figure 13. A-TD frequency of error types in the sentence completion task - Hebrew

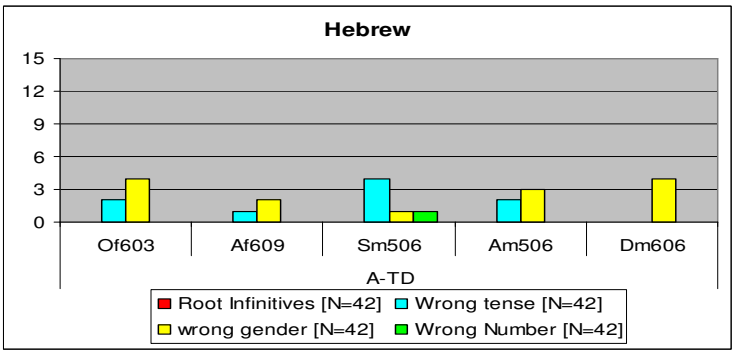


Figure 14. A-TD frequency of error types in the imitation task – English

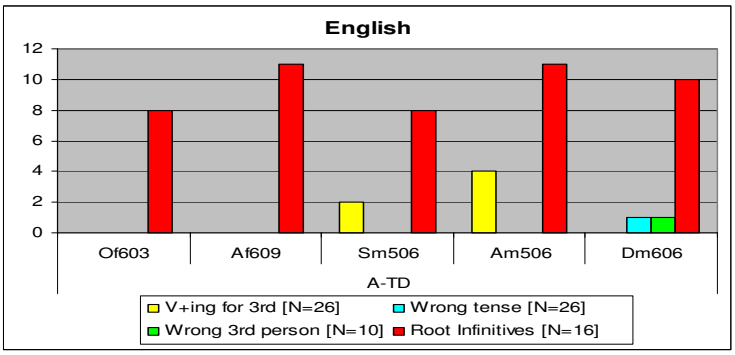


Figure 15. A-TD frequency of error types in the imitation task - Hebrew

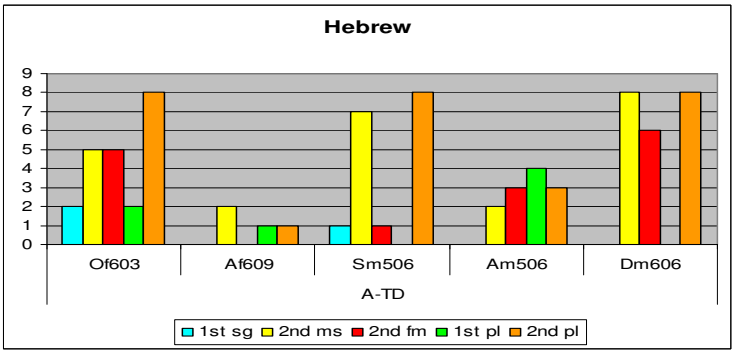
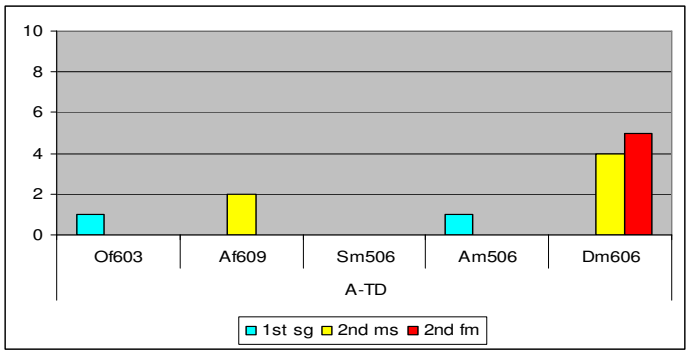


Figure 16. A-TD frequency of error types in the enactment task - Hebrew



4 Discussion and Conclusion

Studying the inflectional system of 15 English-Hebrew bilinguals, ages 4;1-6;9, we show that similar errors are found for all bilinguals, with a significance difference in quantity across the different groups ($p<0.05$). In English, TD and E-TD bilinguals tend to use root infinitives in up to 20% of the relevant contexts. By contrast, A-TD bilinguals, like younger A-TD monolinguals showed the same kind of errors in 50-60% of the relevant contexts. In Hebrew, the TD bilinguals used the wrong person inflection in 16% of the contexts, which targeted verbs inflected for 1st and 2nd person. A-TD bilinguals substituted 1st and 2nd person forms like TD bilinguals, but in 50-60% of the relevant contexts. By contrast,, E-TD children opted for the bare form, omitting the person morphology altogether in 50%-60% of the relevant contexts.

These findings raise the question as to whether quantitative differences are enough to diagnose language impairment in bilinguals. Is the high ratio of root infinitives indicative of SLI in the A-TD bilinguals? Does this mean that the E-TD group is not SLI? Is the high ratio of person substitution indicative of SLI in the A-TD group? Are the omissions of person morphology in Hebrew indicative of SLI in the E-TD group?

We propose that since the E-TD bilinguals perform like TD children in their L1, they are not SLI, but rather slow second language learners, who have not mastered the inflectional system of their L2. More specifically, we suggest that their errors reflect a strategy which is unlike Hebrew typical and impaired acquisition. The E-TD bilinguals have difficulties with the uninterpretable person features which are not available in their L1. These features are sensitive to critical period (White 2003) and so the E-TD bilinguals have an error pattern that reflects the acquisition of the L2 after the critical period. For the A-TD children, though tense-marking may not be a qualitative clinical indicator of SLI in bilingual populations, the quantity of errors, when manifested in both languages, is a potential indicator. That is, quantitative and qualitative differences when found in both languages can be indicative of SLI, while a qualitative difference only in the second language is not. Further studies are necessary to establish this distinction in other language pairs and with data from other linguistic structures. In particular, language pairs that are similar in amount of inflection (both plentiful and scarce) should be studied to determine if the focus on inflection is justified as an indicator of SLI in bilinguals.

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The Nature of Nominals Modified by Adjectives in the Input

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Abstract

Research has shown that, when assigning meaning to a novel adjective in experimental settings, young children pay close attention to the noun the novel adjective modifies. Specifically, Mintz and Gleitman (2002) found that young children are more successful in mapping novel adjectives to the correct meaning when the adjective is introduced with a referentially specific noun rather than an underspecified nominal, and Mintz (2005) found that nouns which help establish the category membership of the modified referent facilitate adjective learning. Our study examines whether adjectives in spontaneous child-directed speech do, in fact, appear in the nominal contexts which seem beneficial for adjective acquisition in artificial word learning tasks. The data are drawn from the Roger Brown corpus in CHILDES (MacWhinney, 2000). They consist of all the maternal utterances (N = 6,016) in which nouns and pronouns were modified by one of 272 frequently occurring adjectives. The analyses revealed that referentially specific nouns rather than underspecified nominals or pronouns were proportionately more prevalent (M = 56%, SD = 1%). In addition, a larger proportion of maternal adjectives modified basic level nouns rather than superordinate or subordinate terms (M = 83%, SD = 1%). The distribution of basic level and referentially specific nouns in these data did not significantly change as a function of the child's age. We argue that the finding that almost half of the adjectives a young child hears in spontaneous speech modify underspecified nominals or pronouns rather than referentially specific nouns is likely an additional reason why adjective acquisition lags behind the acquisition of nouns and verbs (e.g., Goldin-Meadow, Seligman, & Gelman, 1976).

1 Introduction

The complex nature of the process underlying the acquisition of adjectives has been the focus of several recent studies (Klibanoff & Waxman, 2000; Waxman & Booth, 2001; Mintz & Gleitman, 2002; Ninio, 2004; Blackwell, 2005; Mintz, 2005).

One line of research has focused on the referential properties of nouns modified by novel adjectives in artificial word learning experiments. For example, Mintz and Gleitman (2002) found that young children are more successful in mapping novel adjectives to the correct meaning when the adjective is introduced with a specific noun rather than an underspecified nominal. Specifically, Mintz and Gleitman conducted fast mapping experiments during which two- and three-year-old children were presented with three objects, of different basic level categories, sharing a single property (e.g., the property of being covered in stars). In one experiment, children heard the novel adjective describing the relevant property in noun phrases whose head noun was a referentially specific label, e.g., "That's a *drin* **car**. And here's a *drin* **rabbit**." In another experiment, children were presented with the identical objects, only this time the novel adjective modified the underspecified noun *thing* or the pronoun *one*, e.g., "Wow! Look at this *drin* **thing**. This **one** is really *drin*." In both experiments, children were then presented with two test objects: a new object with a matching

property (e.g., a fish covered in stars) and a new object of a matching kind (e.g., a rabbit covered in stripes). These experiments revealed that a referentially specific noun facilitated fast mapping of novel adjectives. The children were significantly more successful in selecting a property match when hearing the novel adjective with a specific noun rather than an underspecified nominal, such as *thing* or *one.* Indeed, when the training objects were referred to by means of the referentially vaguer *thing* and *one*, the children performed at chance in the test phase of the experiment.

Mintz and Gleitman's findings, when removed from the context of artificial word learning tasks and applied to lexical acquisition outside the laboratory, raise an interesting question: Does the child-directed language of caregivers reflect the linguistic contexts deemed beneficial by experimental studies for successful adjective learning? Specifically, when speaking to young children, do caregivers use adjectives as modifiers of referentially specific nouns (e.g., *cat, dog, car*) rather than underspecified nominals or pronouns (e.g., *thing, one, it*)? In addition, are the nouns modified by adjectives taxonomically basic (e.g., *dog, cat*) rather than taxonomically superordinate or subordinate (e.g., *feline* or *poodle*) in caregivers' language? Our study addresses these questions.

We hypothesized that if caregivers' language were found to be rich in adjectives modifying specific, basic level nouns, we would have evidence that caregivers are natural word teachers, as has been shown to be the case in experimental studies. Manders and Hall (2002) found that in a controlled experimental setting caregivers provide their young children with the types of contrasting environments which Waxman and Klibanoff (2000) identified as important for successful adjective learning. Under this hypothesis, we would expect that a larger proportion of maternal adjectives would modify specific nouns as well as taxonomically basic level labels. In addition, as children become more sophisticated word learners, we might expect that caregivers might also gradually use adjectives with larger and larger proportions of underspecified nominals whose referents children might more readily identify even in the absence of a specific noun given the children's growing word and world knowledge.

Alternatively, if caregivers' spontaneous child-directed speech were found to consist of equal or, possibly, larger proportions of adjectives modifying underspecified nominals and pronouns rather than referentially specific nouns, we would have new evidence to explain why adjective acquisition lags behind the acquisition of nouns and verbs (e.g., Goldin-Meadow, Seligman, & Gelman, 1976), as well as additional evidence supporting experimental findings pointing to the importance of nouns in the acquisition of adjectives (Mintz & Gleitman, 2002; Mintz, 2005).

Our research questions were the following:

(i) What is the distribution of referentially specific nouns vs. referentially underspecified nominals modified by adjectives in caregivers' spontaneous speech to children?

(ii) Does the distribution of specific vs. underspecified nominals in child-directed adjective utterances change as the children become more proficient word learners?

(iii) What is the taxonomic level (i.e., basic, superordinate, or subordinate) of nouns modified by adjectives in the input?

2 Method

2.1 Data

The data are maternal adjective utterances (N = 6,016) drawn from the language transcripts of Adam, Eve, and Sarah (Brown, 1973) available in CHILDES (MacWhinney, 2000).

The Brown corpus consists of recordings of spontaneous conversations between each of

three children and his/her mother: 133 transcripts for Sarah from age 2;3 to age 4;11, each a half-hour in length, recorded weekly; 54 hour-long transcripts for Adam from age 2;3 to age 4;11, recorded twice a month until age 4;0 and monthly thereafter; and 20 hour-long transcripts for Eve from age 1;6 to age 2;3, recorded twice a month.

We considered the Brown corpus appropriate for the purpose of this study because the conversational contexts in which maternal speech was recorded were not specifically manipulated to encourage or discourage adjective use by the caregivers. These transcripts provide a realistic account of the types of linguistic contexts in which adjectives occur spontaneously between caregivers and their young children under normal circumstances. In addition, the longitudinal nature of Adam's and Sarah's recorded conversations with their mothers enabled us to explore the extent to which the taxonomic and referential specificity of nouns modified by adjectives varies as the children become more proficient word learners.

2.2 Procedure

We created an adjective search list of 272 adjectives (see Appendix) consisting of all the adjectives in the *MacArthur Communicative Development Inventory: Toddlers* (Fenson et al., 1994) and in a random sample of 20 of Adam's, Sarah's, and Eve's transcripts. This adjective list also includes the top 100 adjectives in the Leech, Rayson and Wilson (2001) frequency list. Lastly, we included all the adjectives in the transcripts of Laurel (at 2.7 MLU), Isadora (at 3.3 MLU), Helen (at 4.3 MLU), and Susan (at 4.7 MLU) from the *Studies in the Acquisition of Communicative Competence* project (Masur & Gleason, 1980) available in the CHILDES database (MacWhinney, 2000) to ensure the inclusion of adjectives used in diverse discourse contexts (in this case, during play and storybook reading with the mother, during play and storybook reading with the father, and during dinner with both parents).

Using the *kwal* command of the CLAN program, we extracted from the Brown corpus all maternal utterances with one of the 272 adjectives. After eliminating the adjective utterances consisting of an adjective in isolation, we created a database of maternal adjective utterances for each caregiver: Adam's mother (N = 1,867); Sarah's mother (N = 3,123); and Eve's mother (N = 1,026).

2.3 Coding

We coded each maternal utterance in terms of the noun or pronoun modified by the adjective.

For the referential specificity analyses, nominals were coded as *referentially specific nouns* (e.g.,*boy, cat, toy*) or as *referentially underspecified nominals*, including pronouns (e.g., *thing, one, somebody, something, anything, that, these*).

For the taxonomic analyses, nouns were coded as *superordinates* (e.g., *thing, food, toy, building, animal*), *basic level nouns* (e.g., *chair, sandwich, doll, house*), or *subordinate/specific instance nouns* (e.g., *graham cracker, Bambi, Humpty Dumpty*) following Rosch (1978).[1]

All utterances were coded by the second author. For reliability, ten percent of the utterances (600 utterances) were also coded by the first author. Reliability between coders was 100% for a nominal's referential specificity and 95.8% for a specific noun's taxonomic level.

3 Results

Our research questions were the following:

(i) What is the distribution of referentially specific nouns vs. referentially underspecified

[1] Examples in parentheses are drawn from the data.

nominals modified by adjectives in caregivers' spontaneous speech?

(ii) Does the distribution of specific vs. underspecified nominals in caregivers' adjective utterances change as the children become more proficient word learners?

(iii) What is the taxonomic level of nouns modified by adjectives in the input?

3.1 Analysis 1

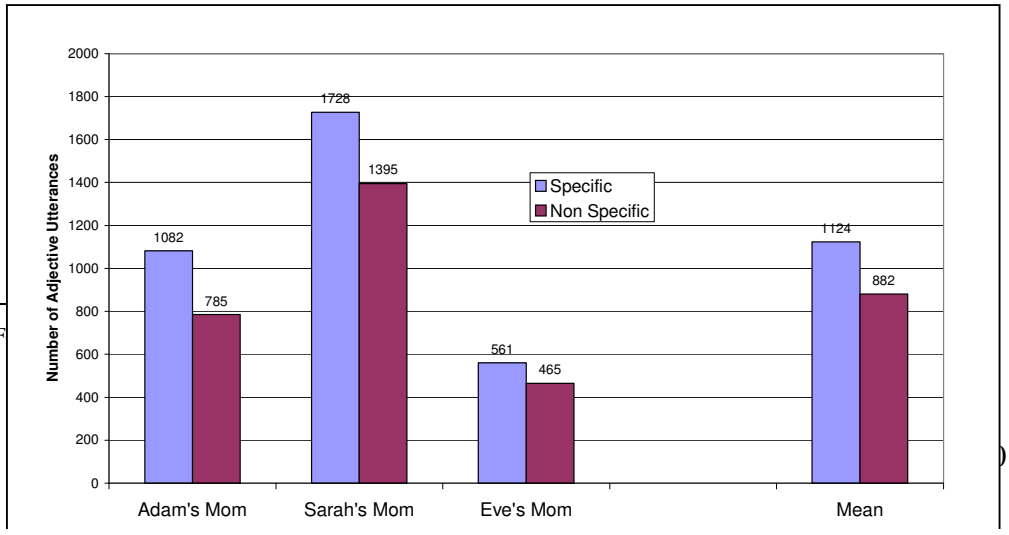
The first analysis examined the distribution of referentially specific nouns vs. underspecified nominals in maternal adjective utterances.

A larger percentage of maternal adjectives (M = 56%, SD = 1%) modified referentially specific nouns rather than underspecified nominals (see Figure 1). Chi-square analyses comparing the proportion of adjectives modifying referentially specific nouns with the proportion of adjectives modifying underspecified nominals for all caregivers were significant: all $c^2 > 8.98$ (1), all $p < 0.005$.

As illustrated in Figure 2, the majority of the underspecified nominals were pronouns. We analyzed those further for two caregivers: Adam's and Sarah's mothers. The analyses revealed that of the underspecified nominals modified by adjectives in these two mothers' data, 61% and 64% respectively were personal pronouns (with the pronoun *it* accounting for 20% and 17% of the personal pronouns); 19% and 15% respectively were demonstrative pronouns (*this, that, these, those*); 2% and 4% respectively were indefinite pronouns (*anybody, somebody, anything, something*). The forms *one* and *thing* (which were used in the Mintz and Gleitman experiments) appeared in 15% of both mothers' data and *thing* appeared modified by an adjective only in 2% and 3% of Adam's and Sarah's mothers' adjective utterances respectively.

We performed secondary analyses to determine the extent to which the large number of underspecified nominals might, in fact, be cases where color adjectives appear with one, e.g., "Here is the blue one." The results appear in Table 1. As we have shown in a study of the relationship between the order of acquisition of adjectives and the frequency of occurrence of the adjectives in the input (Blackwell, 2005), color adjectives are, in fact, quite rare in the maternal utterances in the Brown corpus. In terms of the distribution of unspecified nominals with adjectives of different semantic categories, the largest percentage of non-specific nominals (including pronouns) in maternal adjective utterances in these data occured with human propensity adjectives (e.g., smart, wise, friendly, happy, hungry, tired, etc.).[2] Less than 0.5% of these utterances consisted of color adjectives modifying one.

Figure 1. Proportional distribution of referentially specific nouns (e.g., *cat, dog*) vs. underspecified nominals or pronouns (e.g., *thing*, *one*) modified by adjectives in caregivers' spontaneous speech.



[2] F

Figure 2. Proportional distribution of types of nominals modified by adjectives in caregivers' spontaneous speech.

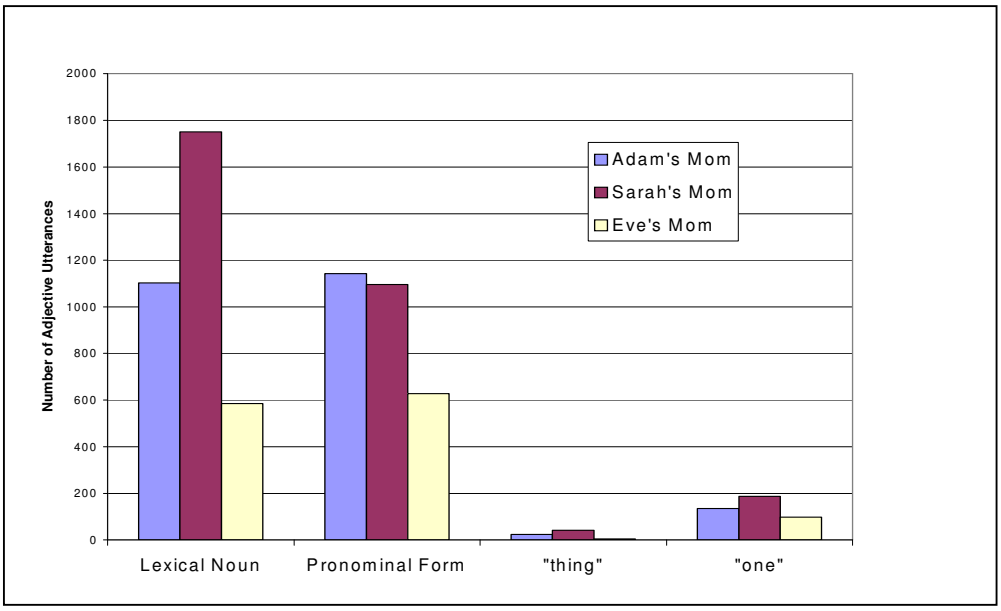


Table 1. Mean number of utterances of maternal adjectives appearing with specific nouns vs. non-specific nominals in terms of adjectival semantic types

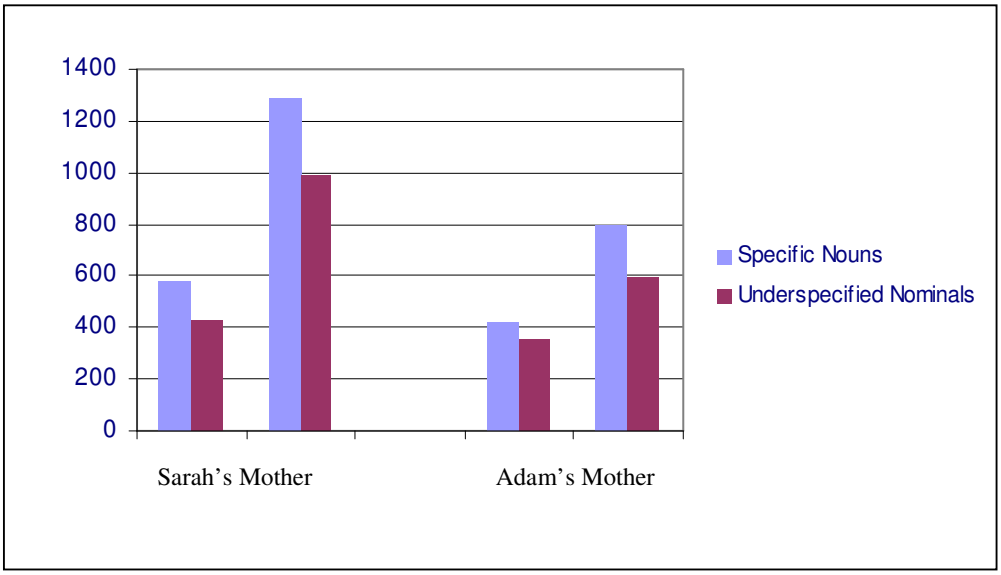
	Color	***Dimension***	***Human***	***Physical***	***Value***	***Other***
Specific Nouns	0.8%	24%	9.6%	11.8%	11.5%	42.3%
Non-specific Nouns and Pronouns	0.4%	11%	27.8%	19.9%	19.7%	21.2%

3.2 Analysis 2

The second analysis examined whether the distribution of specific vs. non-specific nominals changes as the children become more proficient word learners with larger productive and receptive vocabularies.

This analysis revealed that the proportional distribution observed in analysis 1 did not change as a function of the children's age.[3] The differences in proportional distribution of specific vs. non-specific nominals in maternal adjective utterances in transcripts recorded before vs. after age 3;0 were not statistically significant (Sarah's mother $z = .44$, $p = 0.33$; Adam's mother $z = -1.39$, $p = 0.08$) (see Figure 3).

Figure 3. Proportional distribution of specific vs. underspecified nominals in maternal adjective utterances as a function of the child's age (before and after age 3;0).



3.3 Analysis 3

The third analysis explored the distribution of the nouns modified by adjectives in terms of the taxonomic level of the noun (i.e., basic level, superordinate, subordinate).

Our analysis revealed that adjectives in maternal adjective utterances modified primarily basic level nouns.

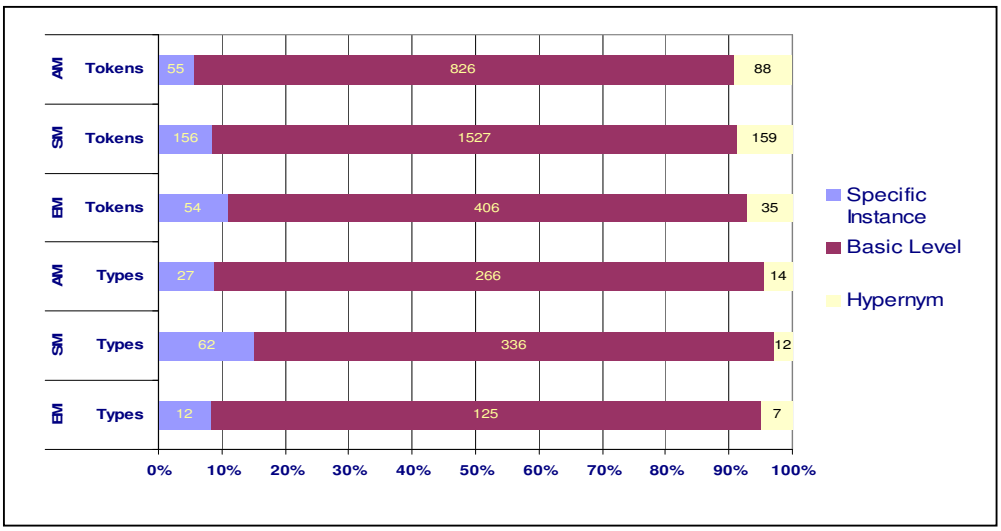
In terms of noun tokens, 82% to 85% of the mothers' modified nouns were basic level nouns ($M = 83\%$, $SD = 1\%$), whereas superordinates represented 7% to 9% of the nouns modified by adjectives ($M = 8\%$, $SD = 0.6\%$) and specific instance subordinates represented 5% to 10% of the modified nouns ($M = 8\%$, $SD = 1.5\%$).

In terms of noun types, 82% to 87% of the modified noun types were basic level nouns ($M = 85\%$, $SD = 1.6\%$), whereas superordinates represented 3% to 5% of the noun types

[3] Only Sarah's and Adam's mothers' data were included in this analysis since Eve's language transcripts end at age 2;3.

modified by adjectives (M = 4%, SD = 0.6%) and specific instance subordinates represented 8% to 15% of the modified noun types (M = 11%, SD = 2%) (see Figure 4).

Figure 4. Proportional distribution of superordinate labels (hypernyms), basic level nouns, and subordinate labels (specific instance and proper nouns) modified by the adjectives in terms of noun tokens and in terms of noun types. Note: EM = Eve's mother, SM = Sarah's mother, AM = Adam's mother.



4 Discussion

Does the child-directed language of caregivers reflect the linguistic contexts which in the Mintz & Gleitman (2002) experiments facilitated children in successfully mapping novel adjectives to properties?

4.1 Taxonomic level of specific nouns modified by adjectives

Our study revealed that the linguistic context in which young children hear English adjectives is rich in basic level nouns – precisely the type of linguistic context which seems to promote adjective learning in fast mapping tasks involving novel adjectives (Mintz & Gleitman, 2002; Mintz, 2005).

4.2 Referential specificity of all the nominals modified by adjectives

Our study revealed that only just over half of the nominals modified by adjectives in the input are referentially specific. The remaining modified nominals are taxonomically underspecified (e.g., *thing*) or pronouns (e.g., *one, it, that*). It is this linguistic context in which young children, especially children under 3;0, performed at chance when mapping novel adjectives to property concepts in experimental settings (Mintz and Gleitman, 2002; Mintz, 2005).

The fact that almost half of the adjectives a young child hears in spontaneous speech modify underspecified nominals rather than referentially specific nouns is likely one additional reason why adjective acquisition lags behind the acquisition of members of other

lexical categories: When hearing an adjective in combination with an underspecified nominal, the child has to first determine the correct reference of the nominal before he/she can even begin computing the meaning of the accompanying adjective. Ninio (2004) has shown that, indeed, when interpreting ADJECTIVE + NOUN combinations in experimental settings, young children initially ignore an attributive adjective altogether and focus solely on the head noun. Following this strategy, a young child, who approximately half of the time hears adjectives with referentially vague nouns or pronouns, is faced with a demanding word learning challenge.

It seems, however, that not all underspecified nominals are likely to present children with the same challenge. Personal pronouns, which constituted between 60% and 65% of the underspecified nominals in these caregivers' adjective utterances, are likely not as difficult to interpret (given their co-occurrence with referentially specific antecedents and in light of a supportive discourse context) as the semantically vague forms *one* and *thing* presented to children in the experimental studies. The vague noun *thing*, by contrast, occurred only in 2% to 3% of maternal adjective utterances in the spontaneous speech of these mothers. Studies aimed at teasing apart the ways in which different types of underspecified nominals interact with adjective learning in experimental settings can shed more light on these kinds of distinctions.

5 Conclusion

Our study revealed that young children hear adjectives as modifiers of basic level nouns in approximately 85% of the NOUN + ADJECTIVE combinations in the input. In addition, in just over half (approximately 56%) of the NOMINAL + ADJECTIVE combinations in the input, the nominal is a referentially specific noun rather than an underspecified noun, such as *thing*, or a referentially vague pronominal form, such as *one*.[4]

We argue that the finding that almost half of the adjectives a young child hears in spontaneous speech modify underspecified nominals or pronouns rather than referentially specific nouns is an additional reason why adjective acquisition lags behind the acquisition of nouns and verbs.

Acknowledgements

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[4] In a study which appeared since this paper was presented, Sandhofer & Smith (2007) present findings similar to ours. In their study of spontaneous caregiver speech examining the distribution of color, texture, and dimensional adjectives specifically, caregivers' adjectives appeared as modifiers of object labels in 24% of utterances and as modifiers of pronominal forms in 20% of utterances. (Note: The remaining utterances consisted of ambiguous modification relationships).

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Appendix

able
absent
absurd
afraid
alive
angry
anxious
asleep
attractive
average
awake
awful
bad
bare
basic
beautiful
big
bitter
black
blank
blind
blue
bold
bored
boring
brave
brief
bright
broad
broken
brown
busy
calm
careful
central
certain
cheap
clean
clear
clever
cold
comfortable
common
competitive
complete
complex
conscious
constant
cool
correct
crazy
creative
crummy
curious
cute
daily
damp
dangerous
dark
dead
deep
delicious
different
dirty
drunk
dry
dull
easy
eensy-weensy
emotional
empty
enormous
excellent
excited
exciting
expensive
fair
false
familiar
fantastic
fast
fat
favorite
final
fine
firm
fixed
flat
formal
free
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fresh
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funny
generous
gentle
giant
glad
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gray
great
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gross
guilty
happy
hard
harsh
healthy
heavy
high
honest
horrible
hot
huge
hungry
ideal
ill
important
impressive
incredible
independent
innocent
intelligent
intense
interesting
itsy-bitsy
junky
large
last
lazy
light
little
long
loose
loud
lovely
low
mad
mere
messy
middle
moist
musical
naked
narrow
nasty
natural
naughty
necessary
nervous
new
nice
noisy
normal
nutty
obvious
old
orange
pale
peculiar
perfect
permanent
pink
pleasant
poor
practical
precious
pretty
previous
private
proud
purple
quick
quiet
rainy
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ready
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separate
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shallow
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silly
similar
simple
sincere
sleepy
slender
slight
slow
small
smart
smooth
social
soft
solid
sorry
special
spicy
square
sticky
stiff
straight
strange
strong
stubborn
stuck
stupid
sturdy
sudden
sunny
sure
sweet
tall
tasty
terrible
terrific
thin
thirsty
tight
tiny
tired
total
tremendous
true
typical
ugly

unfair	warm	wide	wooden	yucky
unhappy	weak	wild	worried	yummy
unusual	wet	windy	wrong	
upset	white	wise	yellow	
usual violent	whole	wonderful	young	

Are Children Willing to Accept Two Labels for a Single Object?: A Comparative Study of Mutual Exclusivity in Monolingual and Bilingual Children

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University of Edinburgh

Abstract

This study compares two word-learning strategies in monolingual and bilingual children. Specifically, we examined children's behaviour when mutual exclusivity (ME), a lexical bias believed to be a default strategy in early word-learning, and a social cue from the experimenter conflict. We predicted that bilinguals will violate ME in response to the social cue more than monolinguals. We tested this prediction in six monolinguals (mean age 3;6, range 2;9-4; 4) and six bilinguals (mean age 3;4, range 2;6-4;4). The children participated in two experiments: (1) a picture-matching task which introduced novel labels for three familiar objects (the thimbles game) and (2) a representational task which tested children's willingness to accept these objects as the intended referents of the novel labels (the treasure hunt game). The results showed that while there was no difference between the groups in the thimbles game, in the treasure hunt game the bilinguals were significantly more willing to follow a socio-cognitive cue (thus violating ME) than the monolinguals ($t(10) = -3.35$, $p < 0.01$). This suggests that monolinguals follow different word-learning strategies from bilinguals. We review the results in light of two dominant accounts of lexical acquisition and discuss potential sources of bilinguals' preference for socio-cognitive cues.

1 How do Children Learn Words?

To learn the meaning of a new label successfully requires the learner to identify the correct mapping between a series of sounds and a referent in the real word. Given that the relationship between form and meaning is arbitrary and potential referents are infinite (Quine, 1960), how is it that children are able to succeed in this task? Various word-learning strategies have been proposed: some researchers suggest that word-learning is facilitated by a series of lexical biases, which limit the potential referents of a novel label (e.g. Markman, 1992). Others suggest that word-learners rely on socio-cognitive abilities, such as perspective-taking and intention-reading (Tomasello, 1999, 2003; Clark, 2003), or sensitivity to statistical regularities (Houston-Price, Plunkett and Duffy, 2006; Montague and Akhtar, 1999). There is evidence to suggest that children use all these sources of information to assign reference, but remarkably little attention has been paid to the relationships between them. Specifically, it is not clear whether one source of information may be systematically preferred. To address this question, we explore children's learning of new words in contexts where two cues conflict. In particular, we investigate the relationship between lexical biases and socio-cognitive cues in two groups of young word learners, comparing the willingness of monolingual and bilingual children to apply the Mutual Exclusivity (ME hereafter) constraint in response to a socio-cognitive cue. The results show that bilingual children follow a socio-cognitive cue rather than applying ME, but this is not the case for monolingual children. We will first outline the two

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relevant accounts of lexical learning. This is followed by the description of the experiments and the results. The paper concludes with some speculations about what can account for the differential behaviour of bilingual and monolingual children in this study.

1.1 Contrasting the Lexical Bias and Socio-Cognitive Accounts

Advocates of the role of lexical biases in word-learning tend to emphasise the learnability problem posed by the arbitrary relationship between words and their referents. This is commonly illustrated using Quine's (1960) 'Gavagai' paradox, in which a linguist in a foreign country sees a native speaker point to a white rabbit running past, and hears them shout *'gavagai!'* The linguist is then faced with the task of ascertaining precisely what the speaker is referring to. 'Rabbit!', 'Running!' and 'Look, dinner!' are just three of the infinite possibilities. This is known as the problem of referential indeterminacy. As much of children's early linguistic input is comprised of ostensive definition, it is claimed that this is precisely the problem that word-learners face as they acquire their native lexicon (Markman, 1987). In light of this, researchers have proposed a number of lexical biases which constrain the hypothesis space and reduce the potential referents of a novel label. For example, it is suggested that Mutual Exclusivity (ME hereafter) 'leads children to prefer that each object have only one category label' (Markman, Wasow and Hansen, 2003:242). This bias is believed to underlie the so-called disambiguation effect (Merriman and Bowman, 1989), whereby children initially apply novel labels to novel objects (see Davidson, Jergovic, Imami and Theodos, 1997; Merriman and Stevenson, 1997; Au and Glusman, 1990; Markman and Wachtel, 1988). ME therefore reduces the number of hypotheses a child is required to entertain by biasing them against assigning a novel label to an already labelled object.

Lexical biases are understood as representing 'violable default assumptions' (Jaswal and Hansen, 2006:163), which give children 'good first guesses about the meaning of a novel term' (Markman, 1992:69-70). As such, this account predicts that word-learners should initially behave in accordance with lexical biases, and, in principle, should thus subordinate socio-cognitive cues to lexical cues. Specifically, if early lexical acquisition is constrained by lexical biases, then children should honour ME and assume that novel labels should be assigned to novel objects, even when a socio-cognitive cue indicates that the intended referent of a novel label is, in fact, a familiar object. The lexical bias account therefore predicts that children will be 'unwilling' to violate ME in this context.

The socio-cognitive account approaches the problem of word-learning somewhat differently. Advocates of this account claim that children's early linguistic interactions with others allow the intended referent of a novel label to be identified without recourse to lexical biases. Children are argued to make use of socio-cognitive information, such as the communicative intention and knowledge state of their interlocutor, to ascertain the likely referent of a novel label in context (e.g. Tomasello, Strosberg and Akhtar, 1996). There is a growing body of evidence to support children's ability to use this type of information to assign reference (see Tomasello, 2003:43-93 for a summary). Given that on this account lexical acquisition is not guided by lexical biases, it predicts that a learner will map a novel label onto a familiar object if there is a socio-cognitive cue from the interlocutor to do so. Consequently, this account predicts that, in principle, children will appear to violate ME.

1.2 Predictions and Monolingual and Bilingual

In order to test these predictions we compared word-learning strategies in monolingual and bilingual children. We chose to compare these two populations because it is likely that they will use different strategies to assign reference when ME conflicts with a socio-cognitive cue. Children acquiring multiple languages will, by definition, assign more than one label to a single object. For example, a child acquiring Spanish and English may label their dwelling place as both '*a house*' and '*a casa*'. As such, bilingual children routinely violate ME *across*

languages and may therefore be more willing to violate ME *within* a language (see Merriman and Kutlesic, 1993, and Davidson at al, 1997) than monolingual children. Furthermore, there is considerable evidence to suggest that early bilingualism confers a socio-cognitive advantage. Specifically, young bilinguals are more aware of the intrinsically social nature of words (Rosenblum and Pinker, 1983) and are better able to understand a situation from another person's perspective than their monolingual peers (Genesee, Tucker and Lambert, 1975; Goetz, 2003). They are also highly adept at monitoring the knowledge state of their interlocutors (Lanza, 1992; Genesee, Boivin and Nicoladis, 1996). We therefore predict that these enhanced perspective-taking skills, together with the children's routine use of two labels per object across languages, will allow bilinguals, but not monolinguals, to assign novel labels to familiar referents. As such, the bilingual children are predicted to be more willing to follow a socio-cognitive cue (and thus appear to violate ME) than their monolingual peers.

2 Method

2.1 Description and Aims

The aim of this study is to investigate word learning in situations where a lexical cue competes with a socio-cognitive cue. Specifically, it compares the willingness of monolingual and bilingual children to violate ME (a lexical cue) and accept the experimenter's use of a novel label to refer to a familiar object (a socio-cognitive cue). If children honour ME and ignore the socio-cognitive cue, then they should select a novel object as the intended referent of the novel label (the disambiguation effect). If, however, the socio-cognitive cue is resistant to pressure from ME, then children should select a familiar object. We predict that monolingual and bilingual children will use different strategies to assign reference, and that bilingual children will subordinate lexical information to socio-cognitive information more than monolingual children. The experimental hypothesis is therefore that bilingual children will violate ME significantly more than their monolingual peers. The null hypothesis is that there will be no difference between the groups on this measure.

2.2 Participants

Six Danish/English-speaking bilinguals and six English-speaking monolinguals participated in this study. The bilingual participants were recruited from a Danish-speaking family-group and the monolingual participants from an English-speaking nursery, both of which met in central Edinburgh. Three of the bilingual children were tested in their homes and all other children were tested in a quiet area of their respective meeting places. Appropriate parental consent was obtained in all cases. The groups were closely matched for age and gender: the bilingual group comprised three boys and three girls (with a mean age of 3;4 and a range of 2;6 - 4;4) and the monolingual group comprised four girls and two boys (with a mean age of 3;6 and a range of 2;9 - 4;4).

2.3 Linguistic Proficiency

Before beginning the experiments it was necessary to ensure that the bilingual participants were demonstrably bilingual, the monolinguals monolingual, and that the labels for the ostensibly familiar objects used during the experiment were known by all participants in all languages. This information was obtained by means of a parental questionnaire and an experimental pre-test. The results of the questionnaire showed that all the monolingual participants spoke only English and that no other language was used in the home. Conversely, all the bilingual participants spoke and were spoken to in both English and Danish and were believed to know the names of the relevant familiar objects in both languages. The pre-test targeted the participants' comprehension and production of the familiar objects and confirmed

the results of the parental questionnaire. During the course of the experiment three objects (a hat, a sock and an apple) were given novel labels (*manna*, *buba* and *pommo*). Native speakers of English and Danish confirmed that these are non-words for both languages[1]. We assume that accepting a novel label only constitutes an ME violation if it is assigned to an already labelled object in that language. It was therefore vitally important to ensure that all participants demonstrated knowledge (i.e. either comprehension or production) of the labels for these 'target objects' (TOs) in English (for the monolinguals) and English and Danish (for the bilinguals). This was true for all the children and very few mistakes were made regarding the names of the other familiar objects. As such, these children were judged to have the requisite linguistic proficiency to take part in this study.

2.4 Materials

A 30x45cm picture board depicting twelve brightly coloured everyday objects and twelve picture cards, each illustrating one of the twelve objects on the board, were used in the training phase and the first experiment. A decorated wicker box containing real-life exemplars of the TOs (i.e. a hat, a sock and an apple), three novel objects (an egg-slicer, a honey-spoon and a ring-pull opener) and ten familiar objects acting as distractors was used in the second experiment. Audio-visual recordings were made of all experiments using a Canon XM2 digital camcorder mounted on a tripod. Stickers were used as rewards at various points throughout the experiment and each participant was given a packet of stickers at the end as a thank-you for their participation.

2.5 Training Phase and Experiment 1 – Thimbles Game

The aim of Thimbles Game was to introduce three novel labels and to provide a socio-cognitive cue revealing the experimenter's belief that these labels refer to familiar objects. During the training phase, the experimenter took a card, showed it to the child, and labelled it with either a novel label (for the TOs) or the conventional label (for all other objects). The child was then asked to place the card on top of the corresponding picture, and the object was labelled a further two times. A typical request was as follows: 'This is a *buba* [holds up the sock card], can you put the *buba* on the *buba* on the board?' The socio-cognitive cue was therefore explicit: the experimenter clearly demonstrated her belief that a sock was called a *'buba'*. The order of the cards was arranged before the start of the experiment in order to allow the child to practice the game using non-novel labels first and to ensure the TOs did not occur directly before or after each other.

The first experiment directly followed the training phase and required participants to select a picture in response to a request from the experimenter. This was done only for the three TOs which, crucially, were referred to by the novel labels assigned to them during the training phase, e.g. 'can you point to the *buba*?'. The aim of this experiment was to ensure that all children understood that the experimenter was using a novel label to refer to a familiar object and were able to respond appropriately to this social cue. Importantly, children did not have an option for mapping the unfamiliar label to a novel object. This was therefore not a test of ME in its strict sense because the search-space for an intended referent was limited to familiar referents only (though see Markman, Wasow and Hansen, 2003, for a discussion of ME use in a similar context). In fact, to succeed in this task all children were required to violate ME. This was therefore not a situation of direct cue-conflict and we do not predict a difference between the groups in this task.

[1] Even though *'manna'* is a word in English referring to 'bread from heaven', its frequency is very limited. In fact, several adult native speakers of English did not recognize it as such and none of the children responded to it as a known label.

2.6 Experiment 2- Treasure Hunt Game

The Treasure Hunt Game was a representational task designed to ascertain whether participants were willing to extend the denotation of the novel labels to stand for the entire category that the TO represents, rather than referring only to the particular token on the card/picture board. Crucially, it also examined whether children were willing to accept the experimenter's use of the novel label to refer to a familiar object in a situation where there were both familiar and novel potential referents. As such, this was a direct situation of cue-conflict, with ME predicting the selection of a novel object and the social cue predicting the selection of a familiar object. In this task the experimenter produced a decorated wicker box and asked the child to help her find some objects hidden inside. The contents of the box were then tipped out onto the floor/table top, and separated so that all objects can be seen and were within reach of the child. The experimenter then asked the child to find each of the items in turn. The order in which the children were asked to find the objects was organised beforehand and kept constant throughout. This was to allow children to practise the game with familiar labels and to ensure that requests using the novel labels did not occur one after another.

2.7 Coding

For the Thimbles Game the participants' responses were coded as either correct or incorrect. For the initial training phase, a child's response was considered correct if they correctly placed the TO picture card on the TO on the board (1 point) and incorrect in all other cases (0 points). For the first experimental phase, a response was considered correct if a child selected any of the three TOs when asked to point to the *manna/buba/pommo* (1 point). For the Treasure Hunt Game, responses were coded as either violating ME, honouring ME or neither. A child was said to violate ME if they selected a TO (1 point)[2] and to honour ME if they selected a novel object (1 point). Selection of a familiar non-TO (i.e. one of the distractors) was coded as 'neither' (1 point) and excluded from the main analyses.

One objection to the coding procedure may be raised. According to ME children assume that an object has only one name. As such, it could be argued that if a child selected any familiar object (regardless of whether that object was a TO), then they have violated ME. The problem with this construal for our present purposes is that in the Thimbles Game all the potential referents for the novel labels were familiar objects and to describe the selection of a familiar object as an ME violation in a situation where this is the only positive response possible seems unreasonable (though see Markman, Wasow and Hansen, 2003). We therefore chose to ignore the selection of non-target familiar objects in the main analysis. Note that children were not required to select the TO that the novel label had originally been applied to, and selection of any TO was considered an ME violation. The coding scheme was, however, overall conservative in what it considered to be a violation of ME. This was done to compensate for the emphasis placed on the socio-cognitive cue in the training phase and the first experiment.

3 Results

All participants scored the maximum 3 points in the training phase. This means that both monolingual and bilingual children readily accepted novel labels for familiar objects in the context of simple picture-matching. Furthermore, the results of the first experiment revealed that these two groups were equally willing to select a TO as the intended referent of the novel

[2] Two children selected the water pistol in response to a novel label and a novel object in response to 'water-pistol'. These responses suggested that the children were not familiar with the water-pistol. As such these children were said to honour ME by selecting this object in response to a novel label.

label (ML mean = 2.17, BL mean = 1.50, $t(10) = 1.265$, $p = .235$). This indicates that both populations were equally able to recall and use the novel labels appropriately. Most importantly, it suggests that all participants were able to respond appropriately to the socio-cognitive cue in a non-conflicting situation. In the Treasure Hunt Game, however, the bilinguals violated ME and selected a TO as the intended referent significantly more than their monolingual peers (ML mean = 0.333, BL mean = 1.50, $t(10) = -3.796$, $p < .01$). The reverse was not true, and monolinguals did not honour ME by selecting a novel object as the intended referent of a novel label more than the bilinguals (ML mean = 1.83, Bl mean = 1.17, $t(10) = 1.174$, $p = .267$). There was also no difference between groups in terms of the selection of familiar distractor objects in response to the novel label (ML mean = 0.83, BL mean = 0.33, $t(10) = 1.342$, $p = .209$).

No age or gender effects were found in either game or on any measure. Specifically, male and female children behaved comparably in their ability to respond appropriately to the novel label in the first experiment (male mean = 2.00, female mean = 1.71, $t(10) = .503$, $p = .626$), and performance in this task did not vary with age ($f(7,4) = 1.437$, $p = .382$). Likewise, in the Treasure Hunt Game, children's willingness to violate ME was not affected by gender (male mean = 1.00, female mean = 0.85, $t(10) = .295$, $p = .774$), nor was the tendency to honour ME (male mean = 1.60, female mean = 1.42, t(10) = .280, p = .785) and nor was the tendency to select a distractor (male mean = 0.40, female mean = 0.71, $t(10) = -.789$, $p = .448$). As before, performance in this task did not vary with age. Specifically, there was no relationship between age and violating ME ($f(7,4) = 1.010$, $p = .529$), accepting ME ($f(7,4) = 3.619$, $p = .116$), and doing neither ($f(7,4) = .365$, $p = .884$). As such, the differences between monolinguals and bilinguals cannot be attributed to the age and gender differences between those groups.

The results show that whilst both populations were equally able to respond appropriately to the socio-cognitive cue in non-conflicting situations (and hence performed comparably in the Thimbles Game), the bilingual children were more willing to violate ME in response to a socio-cognitive cue than their monolingual peers when these cues conflicted (i.e. in Treasure Hunt Game). This finding is in line with the experimental hypothesis. However, it was not the case that monolingual children accepted ME more than bilinguals.

4 Discussion

The analyses of the bilingual and monolingual data showed that the bilingual participants were significantly more likely to violate ME and accept a familiar object as the intended referent of a novel label than their monolingual peers. As such, the results of this investigation provide evidence for the differential application of ME in monolingual and bilingual populations. This indicates that in situations where lexical and socio-cognitive cues make different predictions regarding the intended referent of a novel label, bilingual children will attend to socio-cognitive cues to a greater extent than monolingual children.

It was somewhat surprising to find that although the bilinguals violated ME more often than the monolinguals, it was not the case that the monolinguals accepted ME more often than the bilinguals. This is due to the fact that whilst the bilinguals tended to either violate ME or honour ME, the monolinguals made more use of the third response category. Specifically, they frequently selected a familiar distractor object as the intended referent of a novel label (i.e. 27% of monolingual responses as opposed to 11% of bilingual responses). It is not clear at present what motivates the monolinguals to assume that the novel label refers to a distractor. One possibility is that they are simply less able to learn and remember new words in comparison to bilinguals. This needs to be addressed in future studies. Another possibility is that the socio-cognitive cue is too subtle for the monolingual population. It is important to note, however, that monolinguals did predominantly honour ME (61%). Monolinguals thus tend to rely on this lexical bias more so than bilinguals, who, in contrast, follow a socio-cognitive cue.

The results of this investigation suggest that ME is used differently by monolingual and bilingual children. Previous studies in this area have yielded controversial results. Merriman and Kutlesic (1993) investigated monolingual and bilingual children's willingness to violate ME both *within* and *across* languages. Their central finding was that whilst both populations maintained ME within a language, the bilingual children were more likely to suspend the bias between languages. Davidson et al (1997) found, however, that bilingual children did suspend the bias within a language. Crucially, however, this behaviour was found only in a group of bilinguals who were significantly older than the ones in our study (age range between 5;10; 10-6;4, mean: 6;2). In fact, their younger bilinguals did not behave differently from monolinguals. In this sense, our study is only partially in line with Davidson et al. and provides new results in this area.

How can we account for the difference between the bilinguals and monolinguals with respect to ME? Davidson et al (1997, see also Davidson and Tell, 2005) claim that repeatedly suspending ME between languages causes bilingual children to assume it less readily as a default across a language (Davidson et al 1997). This is closely related to Bialystok's (1988) claim that bilingual children's experience of two linguistic systems makes them more aware of the arbitrary relationship between a label and its referent. It is therefore possible that bilingual children's enhanced meta-linguistic awareness enables them to perform better than monolingual children in tasks where the conventional relationship between a word and its referent is changed (see also Cromdal, 1999). As such, it is possible that the bilingual children in our study would have violated ME more than monolingual children even in the absence of a socio-cognitive cue, and that their behaviour could be attributed solely to their meta-linguistic awareness. There is, however, an alternative explanation. It is also possible that bilingual children respond to a social cue more than monolinguals because of their enhanced socio-cognitive skills. As stated before, there is some evidence that childhood bilingualism confers a socio-cognitive advantage. Most importantly for our present purposes, it has been shown that young bilinguals are better able to take the perspective of others than their monolingual peers (Goetz, 2003; Genesse, Tucker and Lambert, 1975). It is therefore possible that only the bilingual participants were able to respond to the experimenter's requests ('can you point to the buba for me?') based on what they thought the experimenter thought the novel label referred to. In the context of our experiment this would lead assume that the novel label should be applied to a familiar object. The current study does not, however, tease apart which of these provides the more accurate explanation of this behaviour.

Previous studies of word-learning in situations where cues conflict have focussed on monolingual children only, and have produced inconsistent results. Specifically, Jaswal and Hansen (2006) compared children's use of ME in response to a socio-cognitive cue. They found that children overwhelmingly selected a novel object as the intended referent of a novel label even when the experimenter looked at or pointed to a familiar object. They consequently claim that ME is 'robust even in the face of some forms of usually robust pragmatic information' (Jaswal and Hansen, 2006:163). However, Grassmann, Kittel and Tomasello (2007) identified a methodological flaw with this investigation and claimed that the pragmatic cues employed were neither natural nor communicative. Once this was rectified, the reverse pattern emerged, and children tended to subordinate the lexical information to the socio-cognitive information. The results of the present study therefore add another dimension to a neglected (and yet seemingly controversial) area by suggesting that different learning strategies are employed by monolingual and bilingual word-learners in situations of cue-conflict.

The results of this experiment suggest that both socio-cognitive awareness and lexical biases are relevant to the task of word-learning. Specifically, whilst the behaviour of the bilinguals suggests that lexical cues are subordinated to socio-cognitive cues (as predicted by the socio-cognitive account), the behaviour of the monolinguals indicates, albeit somewhat less clearly, that lexical cues are resistant to socio-cognitive information (as predicted by the lexical bias account). The finding that monolingual and bilingual children use different

strategies to assign reference is not straightforwardly predicted by either of these accounts. The results of this study suggest that comparison of the word-learning strategies used by monolingual and bilingual children in situations where cues conflict is likely to be a fruitful area for further research.

5 Conclusion

This study compared word-learning strategies used by monolingual and bilingual children in situations where cues conflict. We targeted socio-cognitive cues and lexical cues by comparing children's willingness to violate ME and instead accept the experimenter's use of a novel object to refer to a familiar label. We found that in this situation bilingual children were more willing to violate ME than their monolingual peers. This indicates that in situations of cue-conflict bilingual children will subordinate lexical information to socio-cognitive information, whereas monolinguals will rely predominantly on lexical cues. As such, we have shown that these populations use different strategies to assign reference.

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A Longitudinal Study of a Chinese-Speaking Child: Some Empirical Discoveries and Their Theoretical Implications

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Abstract

Based on the spontaneous data of a Chinese-speaking child, this paper discusses some empirical discoveries and their theoretical implications with a special focus on the development of negation in relation to scope. It is found that the child is sensitive to scope at 3;2, an age much earlier than the age reported in other studies (e.g. Lee 1991).

1 Introduction

Based on the spontaneous data of a Chinese-speaking child, this paper discusses some empirical discoveries and their theoretical implications with a special focus on the development of negation in relation to scope. The child, born on Oct. 31st, 2003, is my son and has been video-taped every other week from one year up to 4+ year old for about 50 minutes each session. The majority of the data used in this study are, however, taken from my diaries about the child, which include detailed notes of how sentences were used in context.

An important observation involves an indefinite subject introduced by the auxiliary *you* 'have' (Huang 1990) and a negative marker.

(1) *You ren bu* zai. (2;11)
have person not in
'No one is in.'

In this example, the negative marker bu was correctly used to negate a state denoted by zai 'in'. The example was uttered when I was knocking at the door of my daughter's room and asking whether anyone was inside the room, using the following question.[1]

(2) *You ren* zai ma?
have person in PART
'Is anyone in?'

The combination of you ren means 'someone'. Given the same situation, the most natural answer to the question for an adult would be as follows:

[1] Abbreviations used in this paper are as follows:

BA	the object marker *ba*
CL	classifier
DE	the modification marker *de*
PART	particle

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(3) *Mei you ren* zai.
not have person in
'No one is in.'

In (3), the negative marker for the auxiliary *you* 'have' is *mei* and the combination of *mei* and *you ren* gives the 'no one' interpretation. Instead of the adult answer (3), the child responded with (1), knowing that there was no one in the room and everyone else in the family including his sister and his father were elsewhere at home. It is unlikely that the sentence was intended to mean someone was not in because the child may not deliberately use *you ren* 'someone' to refer to his sister instead of using a referring term such as *Jiejie* 'Sister'. More similar examples will be discussed below.

Several questions can be raised as follows:

(4) a. Why does the child place negation in the 'wrong' position as in (1)?
b. What do the data like (1) tell us about the child's understanding of scope?
c. When does the child's scope become adult-like?

These questions will be answered in Section 2 and the conclusion will be given in Section 3.

2 The Development of Negation and Scope

2.1 Placement of Negation

Back in the 60s and 70s, it is found that three kinds of negation appear early in the order as given in (5) and exemplified in (6) (e.g. Bloom 1970 for children between 1;6 and 2;1).

(5) nonexistence > rejection > denial

(6) a. No juice. (used to comment on an empty bottle)
b. No! (used to refuse an offered piece of food)
c. No. (used to answer a question)

The same result is claimed to hold for Tamil when the confound of including negation at the single word stage is removed (Bloom, 1991b). Despite this, when the confound and a fourth type, i.e. prohibition, are included, the order of development of Tamil negation is as follows (Vaidyanathan 1991 for children aged 0;9 to 2;9).

(7) rejection > nonexistence > prohibition > denial

In Lee's (1982) study of a Mandarin-speaking child aged 1;5-1;11, it is found that the child develops his negation in the order that is similar to (7) but not (5):

(8) rejection > nonexistence > denial

Finally, Tam & Stokes (2001) study 8 Cantonese-speaking children aged 1;5 to 3;8 and conclude that the order in (5) is generally true.

In the spontaneous speech collected in this study, a similar order like (7) or (8) is found when only the development of negation after the two-word stage is taken into consideration. Note that in general the child is a later bloomer in terms of the development of his language. He didn't show any sign of a two-word stage until he was 1;10:

(9) Yaya bəbə. (1;10)
duck swim
'The duck swims.'

Here I just focus on the use of his negative markers after he was able to combine words.

Rejection
(10) Guozi *bu yao* (2;0)
pot not want
'I don't want the pot.'

Nonexistence
(11) Zi *mei you*, *mei you* zi. (2;2)
seed not have not have seed
'No seed.'
(12) *Meiyou* tangtang. (2;2)
not.have hot
'Not hot.'

Prohibition
(13) Mother: Keyi zai limian zhuzhu.
can in inside cook
'You can cook inside.'
Child: Limian *bu yao* zhuzhu. (2;3)
inside not want cook
'Don't cook inside.'

Denial
(14) Mother: Gougou yaozou le.
dog bite-away PART
'A dog took it (the pacifier) away by biting it.'
Child: *Meiyou* gougou yaozou le. (2;3)
not.have dog bite-away PART
'No dog took it away by biting it.'

The child's sentence in (14) involves an instance of sentence-initial negation. It was used to deny a previous utterance. There are different analyses for such occurrence of negation in other languages. I will not go into details of different analyses (cf. Bellugi 1967, Bloom 1970, 1991a, McNeill 1971, Drozd 1995, among others. For our purpose here, it is sufficient to point out that this use of negation is quite distinct from the sentence-internal negation to be discussed below in terms of its position and function.

As mentioned in Section 1, the child seems to place the negation in a wrong position. An example of this is given in (1), repeated here with other similar examples.

(15) *You ren bu* zai. (2;11)
have person not in
'No one is in.'

(16) a. You ren bu hui caidao. (3;0) (cf. Mei you ren hui caidao.)
have person not will step not have person will step
'No one will step on it.'
b. You ren bu bang wo nian. (3;1) (cf. Mei you ren bang wo nian.)
have person not help I read not have person help I read
'No one read for me.'

(17) You ren zai bu zai? (3;1) (cf. You mei you ren zai?)
have person in not in have not have person in
'Is anyone in?'

Note that the child used (16b) to complain to me that no one read for him. He didn't specifically mean someone didn't read for him. Moreover, it is interesting to point out that the child forms an A-not-A question with the predicate *zai* instead of *you* 'have'.

A question that one may raise is why the child places the negation in a lower position. A possible semantic explanation is that the child's non-adult possibility of the scope comes from a representation in which the child equals the quantification of an event to that of individual objects.[2]

This, however, is not a viable analysis because the placement of negation seems to be systematic, rule-governed. Consider more examples.

(18) Mother: Zhunbei hao le mei?
prepare ready PART PART
'Are you ready?"
Child: [Zhunbei hai *mei* hao]. (cf. Hai *mei* zhunbei hao.) (2;11)
prepare still not.have ready still not.have prepare ready
'I'm not ready.'

(19) Mother: Mommy pa ni hui tiedao.
Mommy fear you will fall
'I'm afraid you will fall.'
Child: Wo pa *bu* hui tiedao. (3;0) (cf. Wo *bu* hui tiedao/wo bu pa.)
I fear not will fall I not will fall/I not fear
'I'm afraid I won't fall.'

(20) Mother: Wo pa ni hui tu a!
I fear you will vomit PART
'I'm afraid you will throw up.'
Child: Wo pa *bu* hui tu. (3;0) (cf. Wo *bu* hui tu/wo bu pa.)
I fear not will vomit I not will vomit I not fear
'I'm afraid I won't throw up.'

(21) Mother: Wo ba ta [he-*bu*-wan]. (3;1) (cf. Wo *meiyou* ba ta he-wan.)
I BA it drink-not-finish I not.have BA it drink-finish
'I didn't finish drinking it.'

(22) [Jia *bu shi* da] de. (3;1) (cf. Ni *bu shi* jia da de.)
fake not be hit DE you not be fake hit DE
'You're not faking it by hitting me.' ('You really hit me hard.')

[2] This is an idea similar to Philip's (1995) semantic explanation for the non-adult responses of children to sentences with QNPs. In a typical class-inclusion task (Inhelder & Piaget, 1958, 1964), subjects are asked of an array composed of blue squares and blue circles whether all the circles are blue. While adults answer affirmatively (all the circles are indeed blue!), children as old as 7 or 8 often answer negatively. When asked to justify their answers, they point to the fact that there are also blue squares in the array. Philip (1995) argues that children's non-adult interpretation of sentences containing the universal quantifier corresponds to a linguistic representation in which the child overgeneralizes a tendency to quantify over individual events rather than individual objects.

(23) Liang zhi *mei you* shou. (3;1) (cf. *Mei you* liang zhi shou.)
two CL not have hand not have two CL hand
'No two hands.'

Several observations can be made about the above examples. First, the delimitation between morphology and syntax does not seem to matter at all. For example, while it is possible to negate a resultative compound he-wan in (21) with the negative marker bu inside of the compound, negating the state expressed by the second verb, jia-da in (22), a compound with an adverb plus a verb, cannot be negated the same way. In adult speech, no negation can occur between the two elements in such a compound. Neither can the compound zhunbei-hao in (18) be separated by a negative marker.

The second observation about the above data is that different negative forms are used. In fact, they are the correct forms, mei, bu, and bu shi: mei(you) negates an event and bu a state. The combination bu shi, on the other hand, negates a focused element because shi is a focus marker. The only problem is that they are placed in the wrong position. For example, (21) is unacceptable for adult speakers because a preverbal object introduced by ba has to occur within the scope of negation, as also indicated in (21) for comparison. As for (23), it was used when the child wanted me to help him take off his pants because both of his hands were occupied. What the negative marker mei negates is the noun head.

From the above examples, it is clear that the semantic analysis proposed cannot be possible. What the child follows seems to be a very simple rule:

(24) Placement of Negation
Place negation in a position immediately preceding a head it negates.

2.2 Scope Sensitivity

The placement of negation in a position only immediately preceding a head it negates causes the problem of scope with respect to an indefinite subject. This brings us to the second question raised in Section 1:

(25) What do the data like (1) tell us about the child's understanding of scope?

Before we can answer this question, it should be pointed out that in a preverbal position an indefinite NP is not c-commanded by the negative marker that occurs after it. This can be clearly seen from the licensing of a negative polarity item.

(26) a. *Mei you shenme ren* xihuan zhe yang de yinyue.
not have what person like this kind DE music
'No one likes this kind of music.'
b. *(You) *shenme ren bu* xihuan zhe yang de yinyue.
have what person not like this kind DE music

As a negative polarity item, the *wh*-phrase in the above sentences has to be licensed by a c-commanding negative marker, as in (26a). The licensing is not possible when the negation is lower, as in (26b).

Then the question is what the data like (1) tell us about scope. There are two possibilities--The child is either too good at it or too poor at it. The child may have the perfect LF representations where negation c-commands the numeral NP by raising to some higher position or c-commands a trace of it.[3] Or, it may be the case that the child is insensitive to

[3] This is different from Aoun & Li (1989, 1993), where it is argued that what is relevant for scope is an A'-trace. Moreover, for Aoun & Li, Chinese does not allow subject raising.

scope yet at this stage. Here I would like to suggest that the child at this age is insensitive to scope rather than too good at it.[4] A crucial argument supporting this is that cross-linguistic data show that the scope possibilities allowed by young children are quite restricted. The study in Musolino et al. (2000) shows that even in a language that allows scope ambiguities such as English the isomorphism interpretation is the default value that children take. In other words, children tend to have a strong preference for the interpretation which corresponds to the surface structural position of the two elements. It is then perhaps safe to argue that children will start with the stage where isomorphism is the norm and allow the non-isomorphic interpretation, rather than claim that the child either start with ambiguity or a non-isomorphic interpretation. In other words, it is more likely that children start with isomorphism.[5]

If it is indeed the case that the child at the age of 2 is not sensitive to scope, this would bring us to the third question:

(27) When does the child's scope become adult-like?

As for the answer to this question, the following example shows that this may start at the age of 3;2 when two instances of negation are found as follows:

(28) *Mei you ren* bi ta *bu* yiyang. (3;2) (cf. *Mei you ren* gen ta yiyang.)
not have person compare he not same not have person with he same
'No one is the same with it.'

This sentence was used when the child pointed out that one of the buttons on a picture was different from others. The double negations in the above example do not cancel each other out. What the child intended was the negation of the indefinite subject. This doubling can be taken to be a piece of crucial evidence that the child starts to make sense of scope and places the negative marker in the correct scope position, but somehow still hasn't dropped the negation in the lower position.

After the appearance of examples like (28), the child shows no sign of producing non-adult sentences like (1). A sentence with negation scoping over the an indefinite NP that involves *ji* 'several' is found at 4;4.

(29) Shenpo jia *mei you ji jia dian* zai pangbian. (4;4)
Great:Auntie home not have several store in side
'Great Auntie's home does not have several stores by its side.'

(29) was uttered when the child was looking at a picture with a bridge. The child took the bridge to be a crossover for trains. I asked him whether he thought that was the crossover by his Great Auntie's house. In this example, negation clearly scopes over the numeral NP.

3 Conclusion

The child's non-adult scope is evidenced from his placement of negation close to a head before 3 years old. At the age of 3;2, he eventually places the negative marker in a preceding (or c-commanding) position to mark wide scope over a quantified subject, conforming to the

[4] The evidence shows that the child starts to be sensitive to scope at the age of 3;2, but it does not show that he has mastered it. In Hsieh (2008), it is shown that the child has mastered scope at the age of 4;5.

[5] The dispute between c-command and isomorphism becomes a non-issue in the sense of Kayne (1994), where it is argued that the relation between hierarchical and linear order is rigidly fixed with linear order corresponding to asymmetric c-command relations (the Linear Correspondence Axiom).

adult's speech. The finding that the child is sensitive to scope around the age of 3;2 is at variance with the age that is reported in studies such as Lee (1991), where it is reported that Chinese-speaking children is not sensitive to quantifier order until the age of 6. A possible explanation for the discrepancy between Lee's study and our study is that what Lee focuses on is the relative scope of two quantified NPs. Other factors rather than the structure may play a role in determining scope ambiguities. But as for as the structural (/linear order) requirement required for licensing quantifiers, the evidence put forward in this study shows that children may acquire it at a much younger age.

Acknowledgements

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Anaphoric pronouns for topic devices: theoretical claims and acquisitional evidence

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Abstract

West-European languages use articles to distinguish arguments as <±previously mentioned>. Besides articles there are personal pronouns that are to be indexed with a discourse antecedent. Superimposed on that system there are additional devices to indicate whether a clause has the same or a different element as its topic. If a sentence takes a topic different from the topic of the preceding sentence, there are devices with enhanced saliency to mark the sentence as <+topic-shift>. These <+topic-shift> devices vary with the type of language. The present paper will characterize the <±topic-shift> anaphoric pronouns in Germanic and Romance languages and range them upon a saliency scale. This will bring about a new analysis of the accessibility hierarchy for the antecedent. Subsequently, I will discuss the acquisition of anaphoric pronouns for <±topic-shift> in Germanic (V2nd) Dutch and Romance French. The data come from a longitudinal study of two CHILDES corpora.

1 Reference tracking devices added to argument frames

In a discourse fragment, say a story, we see a set of intended referents (for example: *a girl, an attic, a bed, a little bear*). The members of that set appear and reappear in changing configurations when the story unfolds. That is due to the fact that the head of each new predicate selects referents for a configuration according to its subcategorization/theta frame.

Language acquisition begins with learning predicate frames by means of situation-bound clauses, since such clauses are naturally supported by gesture-sustainable referents ('physically given' referents, Ariel 2001). The reference tracking devices are at first mainly 1st and 2nd person pronouns, demonstratives, bare nouns as quasi proper names and 3rd person pronouns/clitics, but the latter only in as far as they are exophorically used, accompanied by a gesture or gaze that brings in focus a referent in the situation. As soon as a minimal amount of predicate subcategorization frames has been acquired and stacked up in the lexicon, a completely new development sets in. Child language starts adding the devices that perform reference tracking in (linguistic) discourse. There is a rise in the use of articles and 3rd person pronouns/clitics. Due to this development, the language and its user become more situation-free (Van Kampen 2004).

The reference tracking devices are learned from the adult input. They indicate whether an argument is newly introduced or has already been referred to earlier. This at least is the contribution of the West-European article and pronoun system. The Dutch, French and Italian story fragments show how dense the reference tracking devices can be.

(1)a. Dutch
[De kleine beer]$_i$ ging de trap op [naar de zolder]$_k$. ***Daar***$_k$ zag *hij*$_i$ [een meisje]$_m$. *Hij*$_i$ was stomverbaasd. ***Die***$_m$ had *hij*$_i$ nog nooit gezien. *Ze*$_m$ lag in *zijn*$_i$ bedje. *Ze*$_m$ sliep.

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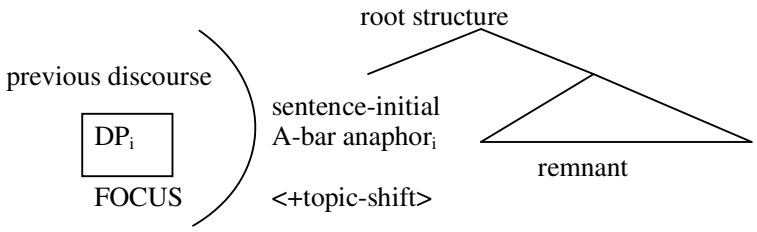
b. French
[Le petit ours]$_i$ grimpa l'escalier jusqu'[au grenier]$_k$. ***Là***$_k$, *il*$_i$ vit [une jeune fille]$_m$. *Il*$_i$ était stupéfait. ***Elle***$_m$/[***cette fille***]$_m$, *il*$_i$ ne ***l***$_m$'avait jamais vu. *Elle*$_m$ s'était couchée sur le petit lit. *Elle*$_m$ dormait.

c. Italian
[L'orsetto]$_i$ salì [in soffitta]$_k$. ***Lì***$_k$, *pro*$_i$ vide [una ragazzina] $_m$. *Pro*$_i$ fu sorpreso. ***Lei***$_m$/[**la ragazzina**]$_m$, *pro*$_i$ non ***l***$_m$'aveva mai vista prima. *Pro*$_m$ era stesa nel *suo*$_i$ lettino. *Pro*$_m$ dormiva.

(The little bear went upstairs to the attic. There he saw a girl. He was flabbergasted. He had never seen her. She was lying in his bed. She was asleep)

The reference tracking anaphoric pronouns in (1) are indicated with subscripts under the italics. In addition to that system there is a superimposed discourse device marked by ***bold*** face in (1). These are the specific anaphors that have a topic-shift function (Van Kampen 2004). They indicate that the new clause offers one of its arguments as a new point of orientation, different from the orientation point of the preceding sentence. The choice of the antecedent is not free. It has to be the argument marked as prominent in the preceding clause. The 'focus' of the preceding clause is turned into the topic of the new sentence. These anaphors are in principle sentence-initial (A-bar) and topic-shifting, see (2).

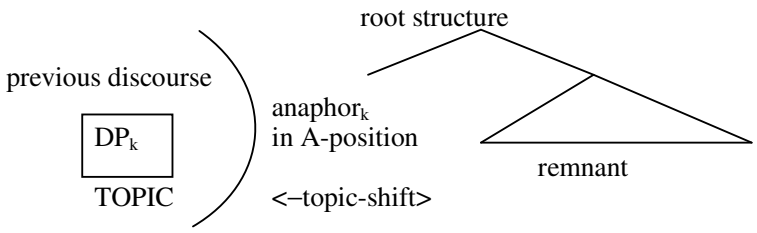
(2)



Germanic V2nd languages (Dutch/German/Swedish) use a demonstrative variant to indicate the topic-shift device (Van Kampen 1997). These *d*-pronouns derive from the article or from the demonstrative paradigm.[1] The use of the *d*-pronoun is a stylistically smooth option. Romance languages, by contrast, are more restrictive. In case of topic-shift, they may use a full, strong, personal pronoun in adjunct position, but more often they use a full DP in adjunct position. Both are doubled by a sentence-internal clitic/*pro*. The option of the *d*-pronoun is not open to Romance languages.

The use of the *d*-pronoun contrasts with the use of the 3rd person pronoun in A(rgument)-position. The latter maintains the topic (aboutness phrase) of the preceding sentence.[2] Romance languages use in case of <–topic-shift> a 3rd person single (non-doubled) clitic or subject *pro*. In this case there is no dislocated element. The discourse relation for <–topic>, the pronouns and clitics marked in plain *italics* in (1), is expressed in (3).

(3)



[1] I will represent the d-pronoun by DEM in the glosses.

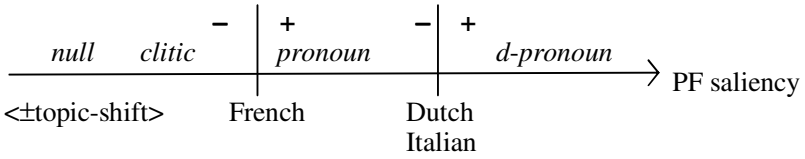
[2] I follow here Reinhart's (1981) characterization of the sentence topic as 'what the sentence is about'.

The choice of the anaphoric element will be related to the accessibility hierarchy for anaphoric pronouns as proposed by Ariel (1990, 2001), Gívon (1983), Gundel et al (1993). It seems that, in order to express the <±topic-shift> device, each language makes a binary choice from the same saliency hierarchy. The above characterization also suggests a more structural characterization of "antecedent accessibility".

2 PF saliency for LF function

The <±topic-shift> device for pronominal reference can be projected on an accessibility hierarchy. The more salient pronominal element signals <+topic-shift>. It refers to the preceding focus saliency. The less salient pronominal element signals <–topic-shift>. It refers to the preceding topic.

(4) Accessibility hierarchy for anaphoric pronouns



Germanic and Romance use the same accessibility hierarchy to express the <±topic-shift> relation, but they exploit the scale in a different way. Dutch opposes A-bar *d*-pronouns <+topic-shift> versus pronouns <–topic-shift>. French and Italian oppose full pronouns <+topic-shift> versus clitics/*pro* <–topic-shift>.

It should be noted that the present view deviates from previous studies on accessibility hierarchies in two ways. Firstly, Ariel (1990, 2001), Gívon (1983), Gundel et al (1993) propose that the form of anaphoric expressions signals the *pragmatic* accessibility of the antecedent. There is a reversed correlation between the two. Antecedents that are already very accessible need no more than a simple anaphoric expression. These anaphoric expressions are ranked high on their hierarchy scale. Antecedents that are less accessible need a more specific anaphoric expression. These anaphoric expressions are ranked low on their hierarchy scale.

I would like to argue for a more structural view on anaphoric pronouns, at least for the set of discourse devices discussed here. From a *syntactic* point of view, there is no reversed correlation between the anaphoric expression and the antecedent. The less salient pronoun refers to the preceding topic. As a topic it is syntactically non-salient and does not carry the sentence stress. By contrast, the more salient pronoun refers to the preceding focus saliency. This antecedent in focus carries the sentential stress and has a high syntactic saliency, see (5).

(5) De kleine beer zag in zijn bed een meisje liggen
The big bear saw in his bed a girl lying
(The little bear saw a girl lying in his bed)

a. *Die* keek erg verbaasd (een meisje / *de kleine beer)
DEM looked very surprised (a girl / *the little bear)
(She looked very surprised)

The constituent een meisje carries the sentential stress (Cinque 1993; Evers 2003). For that reason, *een meisje* can be picked up as the shifted topic in the next sentence. If, by contrast, the object phrase *het meisje* moves to the left as in (6), or if it were pronominalized by *haar* ('her') as in (7), it looses the focus and sentential stress. Therefore, it is no longer referred to by the salient <+topic-shift> *d*-pronoun.

(6) De kleine heeft het meisje nog **op de zolder** gefotografeerd
The little bear has the girl yet in the attic photographed
(The little bear has taken a picture of the girl in the attic)
a. *Die* was erg klein (de zolder / *de kleine beer / *het meisje)
DEM was very small (the attic / *the little bear / *the girl)

(7) Het meisje holde de trap op. De kleine beer riep **haar** nog na
The little girl ran the stairs on. The little bear called her still after
(The little girl ran up the stairs. The father of the little bear called after her)
a. **Die* luisterde niet
*DEM listened not
(She didn't listen)

Secondly, the scale in Ariel (1990, 2001), Gívon (1983), Gundel et al (1993) is of an ascending hierarchy. In the present view, there is a binary A/A-bar opposition for anaphoric pronouns. It stands for <±topic-shift> and it is based on a single opposition along the accessibility hierarchy for anaphoric pronouns. This two-way division is expressed in Table 1. Only the 3rd person masculine pronoun in Dutch, French and Italian is given in Table 1. The black/grey opposition indicates which saliency difference has to be selected to express the <±topic-shift> function.

Table 1. Hierarchy for anaphoric pronouns: less PF salient → most PF salient

	null *pro*	clitic pronoun	weak pronoun	strong pronoun	*d*-pronoun
Dutch			*ie* (subject) *'m* (object)	*hij* (subject) *hem* (object)	*die* (subject) *die* (object)
French		*il* (subject) *le* (object)		*lui, il* (subject) *lui*, *le* (object)	
Italian	pro/agr (subject)	*lo* (object)		*lui* (subject) *lui*, *lo* (object)	

For Dutch, both the strong pronouns (subject *hij*, *zij*, *het* 'he, she, it' and object *hem*, *haar*, *het* 'him, her, it') as well as their weak variants (*ie*, *ze*, *'t* and *'m*, *d'r*, *'t*) fall in the group of <–topic-shift> pronouns, see the example in (8).

(8) Het meisje met de gouden haren is ook gefotografeerd
The girl with the golden locks is also photographed
(The girl with the golden locks was taken a picture of)
a. Zij/ze (= het meisje met de gouden haren) is ooit model geweest
She (= the girl with the golden locks) is ever model been
(She used to be a model)

The grammatically defined <±topic-shift> opposition selected from a general hierarchy scale of pronominal devices is supported by experiments reported in Kaiser and Trueswell (2004). They tested the effects of the Dutch full (feminine singular) pronoun *zij* and the weak (feminine singular) pronoun *ze* in sentence-initial position. Their experiments show that both are equally used for <–topic-shift> to maintain the topic, they say 'subject', of the preceding sentence. Note how in the light of Table 1 above, they focused an opposition in the grey area for Dutch. The main <±topic-shift> opposition for V2nd Dutch is the personal pronoun versus the *d*-pronoun.

3 The acquisition of the referential system

Articles, 3rd person pronouns and topic *d*-pronouns are referential signs D° (determiners) that may be used anaphorically to refer to a previously mentioned antecedent. I counted the use of these referential markings in the speech of Dutch Sarah (Van Kampen corpus) and in the speech of French Grégoire (Champaud corpus) both in CHILDES (Mac Whinney 2006). Below, acquisition graphs of articles and anaphoric 3rd person pronouns will be given showing their simultaneous acquisition. The simultaneous acquisition demonstrates that the real acquisition step is the introduction of a referential system added to argument structure in the sense of Williams (1994).

Both Dutch and French children first establish the finite verb as a clause identifier before they grammatically mark argument structure. Articles and discourse anaphors are lacking in early child language. I make a rough division between two phases of child language. A situation-bound system before D°-marking, and a situation-free system after D°-marking.

Table 2. Referential means in early and later child language

Early child: situation-bound	Later child: discourse-bound
No <±topic-shift> device - No D (φ) all anaphors are gesture-sustained No {articles, clitics, pronouns, *pro*}	**<± topic-shift> device - D (φ)** anaphors need not be gesture-sustained {articles, clitics, pronouns, *pro*}

Early child language makes use of (what will be later) <+topic-shift> forms. These are the demonstrative *die* in child Dutch and dislocated nouns doubled by a clitic in child French.[3] This may be explained as follows. Since there is a situational context only, each sentence in the language of the child names its own topic, as if it were a first mention. The same type of evidence comes from elicited narratives with picture sequences in Hickmann and Hendriks (1999). French children up to the age of 7 use dislocated nouns doubled by a clitic for the first mentions of a new discourse topic. It shows that even older children heavily rely on a situational context simulated by pictures.

The acquisition of D°-marking realizes within half a year the introduction of articles, 3rd person clitics and pronouns in later child language, at least for the two languages considered here.

3.1 The acquisition of anaphoric pronouns in Dutch

Early child Dutch is characterized by an abundant use of 1st and 2nd person pronouns and demonstratives. This seems reasonable. The 1st-2nd person pronouns express a <±speaker> opposition and the demonstratives a <±proximate> opposition, all situation-bound oppositions. In the recordings till week 120 (7 recordings between 1;10.13-2;3.16), Sarah did not use any anaphor to mark a reference to the linguistic discourse. There was hardly any use of 3rd person pronouns (A-anaphors), and there was no use of A-bar *d*-pronouns referring to a linguistic discourse antecedent. The referent of the demonstrative was always present in the immediate speech situation. In the sentence with a finite predicate, I counted 50 examples of contrastive demonstratives. Presentationals were excluded from the count. All 50 examples were related to a referent in the situation. An example of a demonstrative referring to a referent in the situation is in (9).

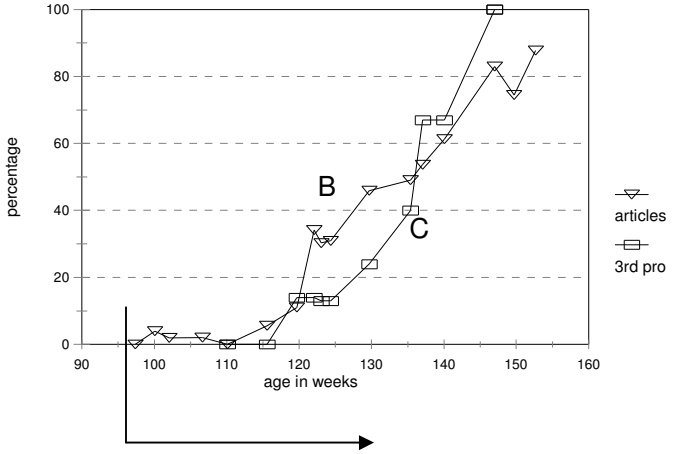
(9) a. (playing Memory; one card doesn't match) (week 107 / 2;0.17)
Sarah: *die* kan niet mee(r).

[3] See for dislocations in child French also De Cat (2002).

(that cannot anymore)

Articles, 3rd person pronouns and discourse-related *d*-pronouns are acquired in a following step. Acquisition graphs of articles and anaphoric 3rd person pronouns show that these are acquired simultaneously. See the graphs in (10) taken from Van Kampen (2004).

(10) Sarah (Van Kampen corpus, CHILDES)



Situation-bound demonstratives (present from the very beginning on)

Graph B: articles before nouns
Graph C: A-anaphors (3rd person pronouns *hij/zij/het* 'he/she/it' and *'m/d'r/'t*)

The acquisition of the referential system for articles and pronouns is at the same time simultaneous with the discourse use of <±topic-shift> by means of A-bar devices. An example of a discourse-bound 3rd person pronoun for <–topic-shift> is given in (11) and an example of a *d*-pronoun for <+topic-shift> in (12).

(11) (talking about a bird in a picture-book) (week 125/2;4.27)
mother: ja, hij heeft de schaar, de vogel.
(yes, he has the scissors, the bird)
Sarah: schaar ["] vogel ["]. teen! *hij* heb een teen, he.
(scissors ["] bird ["]. toe! he has a toe, isn't it.)

(12) (shifting the attention to a picture at a jigsaw puzzle) (week 133/2;6.18)
mother: dan past die (=stukje) misschien daar?
than fits that (=piece) perhaps there?
(then perhaps that one fits there?)
Sarah: *die* is voor pappa, die hondje
(that is for daddy, that doggie)

The <+topic-shift> *d*-pronouns in Dutch appear in the position before the finite verb (Spec,C). The finite verb in the second position (C^o) had been learned before. See Van Kampen and Pinto (2007) for a further analysis.

3.2 The acquisition of anaphoric pronouns in French

The French child uses at first a dislocated noun or demonstrative doubled by a 'shadow' clitic. Most of the time, the dislocations are to the right, as in (13).

(13) (holding a car) (Grégoire 1;11.22/week 103)
elle roule, *la voiture*
(she goes, the car)

The preference of right-dislocations seems an effect of the presence of a situation-bound gesture-sustainable referent (Van Kampen 2004, Van der Linden and Sleeman 2007).

Articles and 3rd person single clitics are acquired next. There is a twist, though, in acquiring the French system. The French acquisition of 3rd person single clitics follows the acquisition of articles, see Table 1 for Grégoire (CHILDES). The gray area in Table 3 indicates that at the acquisition point of articles (>80%) there is a sudden rise of single (non-doubled) subject clitics and object clitics. This sudden rise of single clitics can be characterized as the acquisition of discourse structure.

Table 3. French Grégoire: articles, 'shadow' clitics and single clitics

weeks	**a** articles	**b** 'shadow' clitic		**c** single clitic *il* subject	*elle*	**d** single clitic *le/la* object
94-98	5%	14	78%	0	4	0
105	14%	19	95%	0	0	0
112	53%	3	---	0	0	0
117	60%	8	61%	2	4	0
125	97%	11	37%	19	0	9
127-129	100%	51	35%	66	28	10

Unlike the pronouns in Dutch, French anaphoric clitics do not appear simultaneously, but right after the determiners. This is probably, because clitics imply the acquisition of a different argument placement in addition to the argument pronominalization. Table 2 shows no difference between the acquisition of subject and object clitics as such. It rather seems that subject clitics are more frequent. A simultaneous acquisition of subject and object clitics supports the idea that the underlying condition of this acquisition step is the presence of the argument frame of the verb.

There are some instances of a single (non-doubled) clitic in the speech of Grégoire before week 125, see the example in (14).

(14) playing the child's hand sticks to the investigators ear) (1;10.20/week 94)
investigator: tu cognes ? (you bump against?)
Grégoire: elle colle (it (=the hand) sticks)

In such instances, a gesture or a gaze accompanies the clitic. It is the gesture/gaze that brings in focus the intended referent, not the unstressed clitic (Van Kampen 2002, Going Romance presentation). The gesture/gaze directs the hearer's attention towards an object present in the utterance situation (cf. Kleiber 1994: chapter 5).

Examples of the discourse-bound devices for <±topic-shift> that appear after week 125 are given in (15).

(15) Topic-shift versus topic-maintenance
(inventing a story) (2;5.27/week 129)
Grégoire: maman, elle m'a protégé pour écraser la jeep
mummy, she me-has protected for crash the jeep
(m., she has protected me from being crashed by the jeep)
Grégoire: *la jeep, elle* a écrasé ma maman.
(the jeep, she has crashed my mummy)

investigator:	mais	qu'est ce qu'elle		faisait	cette jeep	au bord de la mer?
	but	what	she	did	that jeep	at the seaside?
	(but what did that jeep do at the seaside?)					
Grégoire:	*elle* a roulé sur la mer.					
	(she has gone on the see)					

As in the example above, later child French, as well as adult French, show a preference for left-dislocations (Gívon 1983; Ashby 1988: 206). This shift in preference, from right-dislocated topics in early child French to left-dislocated topics in later child French, reflects a growing reliance on linguistic discourse reference by means of sentential topics. Discourse reference tracking by a topic in Spec,C or in sentence adjunct position must get scope over the new sentence. This may explain its appearance at the left periphery of the sentence. See Van Kampen and Pinto (2007).

4 Conclusion

West-European languages use articles to distinguish arguments as <±previously mentioned>. Besides articles, there are personal pronouns that are to be indexed with a discourse antecedent. Superimposed on that system, there are additional devices to indicate whether a clause has the same or a different element as its topic. Topic is an argument the sentence is 'about'. If a sentence takes a topic different from the topic of the preceding sentence, there are devices with enhanced saliency to mark the sentence as <+topic-shift>. These <+topic-shift> devices vary with the type of language. Germanic V2nd languages use a *d*-pronoun in sentence-initial A-bar position. This *d*-pronoun refers to an argument in the preceding sentence that had a focus-kind of saliency. Romance languages mark the <+topic-shift> by a dislocated argument further supported by a sentence-internal clitic.

The acquisition of <±topic-shift> devices takes place more or less simultaneously with the acquisition of other pronominal devices. All these devices make the language more situation-free. The switch from the situation-bound early child language to the situation-free later child language does not take place before the discourse units, the successive sentences, have acquired an internal coherence due to argument frames of the verb and the opposition between <±finite> verb (after the "Root Infinitive" stage). There is a common point in the acquisition of the <±topic-shift> devices. Both Dutch and French children start with sentences marked by situation-bound device for <+topic-shift>. In the beginning, each utterance in the language of the child stands on its own and establishes its own topic. Later on, the child's speech enters the linguistic discourse of an actual or presupposed continuing discourse.

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Writing Development of A Bilingual Child: Japanese and English

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Abstract

Writing development is an important aspect of children's school lives. This case study examines the writing development of a third-grade Japanese bilingual child who lives in the United States by focusing on what development can be found in her writing both in Japanese and English (e.g. length, spelling, topic development, use of descriptive language, and characteristics of a bilingual child's writing). The participant's writing data included her journals, stories, and reports that she wrote as part of her school work. For the purpose of comparing her writings in Japanese and English, her journal writing of the past three years was used for analysis. The data were analyzed based on the number of words, spelling, and the development of the use of *kanji* characters. In addition, the writing development of both languages was analyzed by using the composition component of the Two-Way Immersion Narrative Writing Assessment Rubric. The analysis shows that the participant has been acquiring writing skills in both Japanese and English simultaneously. This study depicts an example of successful development of bilingualism and biliteracy. It also finds that code-switching can sometimes effectively support the learning of writing skills.

1 Introduction

Compared to the studies of bilingual children's writing (e.g. Chinese/English, Spanish/English), not much research has been conducted on how bilingual Japanese/English children develop their writing skills in two languages. Due to the global economy and more job opportunities in foreign countries, there are many Japanese children who acquire their second language while maintaining Japanese. The Japanese writing system is quite different from an alphabetic language like English. It is important to examine how children who face different writing systems develop their writing skills in two languages.

1.1 Biliteracy development

Bilingual students' writing has been examined in various ways. Bilinguals use transfer skills between two languages. According to the Linguistic Interdependence Principle examined in the Cummins' study (1991), a bilingual's academic development such as language, literacy and concept transformation is interdependent. This means that bilinguals who gained knowledge in one language use it when learning in another language. In a study of how ESL students transfer their writing skills between languages (Icelandic and English) (Berman, 1994), it was found that students who transfer their writing skills between the languages were assisted by their grammatical proficiency in the target language. A study which examined emergent English writing of kindergarteners found similar development between English L1 and English L2 children. It suggests that the relationship between oral and written language is transactional, giving benefit to English L2 children. Kenner (2004)

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points out that bilingual children have more than one language to use for writing and for communication. In her study, she found that bilingual children (Chinese-English, Arabic-English, Spanish-English) understood the differences between their two writing systems, but they also looked for ways to connect them to transform meaning across the languages.

The role of teachers, families, and communities has been reported in the writing development of bilinguals. In examining how young children learn how to write in English in a Spanish-English dual language kindergarten program, the importance of trained bilingual teachers and committed administrators was emphasized (Riojas Clark, 1995). Similar developmental patterns were found in Spanish-English bilingual children's writing samples compared to monolingual Spanish children's writing. However, bilingual children may use both English and Spanish in one sentence or paragraph to send their message (Rubin & Carian, 2005). This study also suggests that teachers should give bilingual students many opportunities to write in two languages for the teachers to understand their students' writing development. In the family stories projects, Dworin (2006) suggests that bilingual children should use two languages for communicating, reading and writing in school. Teachers should use topics from children's homes and communities, making children aware of the outside school world. Also, written translation can foster bilingual children's metalinguistic awareness. In the English-Spanish two-way immersion program, in which equal regard is given to English and Spanish, family atmosphere, student-centered instruction, and strong parent-community partnership helped limited-English students score high in English reading and writing (Senesac, 2002). Kenner et.al (2004) found that young emergent biliterates interpreted different writing systems (Chinese-English, Arabic-English, Spanish-English). In spite the limited input in Chinese, Arabic, and Spanish compared to the time committed to learning English, the children understood key concepts of Chinese, Arabic, and Spanish writing systems. They showed their own interpretations supported by their family and teachers.

1.2 Research Questions

The purpose of this case study was to explore how a bilingual child develops writing skills both in Japanese and English. The following questions guided the study:

1. What development can be found in my participant's writing in both languages?
2. Are there any differences between her Japanese writing and English writing?
3. Are there any characteristics of a bilingual child's writing?

2 Method

2.1 Participant

The participant in this case study is a third-grade Japanese bilingual child who is growing up in the US. Hikari has attended a Japanese Saturday school since she was in the first grade. As the Japanese school starts in April, she began to receive formal literacy instruction at Japanese school five months prior to receiving literacy instruction at her American school. She has been in the mainstream classroom since she was in the first grade. She returns to Japan and does visiting enrolment in a public school in Japan every summer.

2.2 Data sources

The participant's data included her journal, stories, and reports that she wrote as part of her school work. For the purpose of comparing her writings in Japanese and English, I focused on her journal writing of the past three years because she spent an equal amount of time on her journals in Japanese and English.

Table 1. The number of journals analyzed

	Japanese	English
First grade	14	14
Second grade	15	15
Third grade	13	14

2.3 Procedure and Analyses

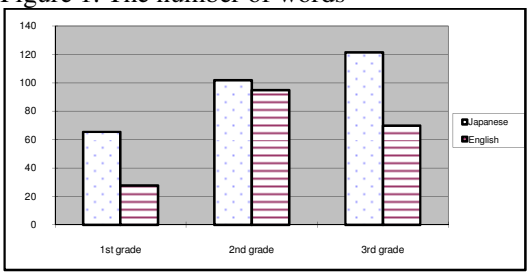
First, I counted the number of words used in her journals, and compared the number used in her Japanese and English journals. Then, I analyzed information about her orthographic theories (phonetic transcription, overgeneralization, and mastery of conventional spelling) for her English writing. I also analyzed the development of the use of *kanji* characters in her Japanese journals. Then, I compared the writing development of both languages by using the composition component of the Two-Way Immersion Narrative Writing Assessment Rubric developed by Howard (2003). It includes topic development, sentence formation, use of supporting details to elaborate a topic, and use of descriptive language. Finally, I examined the characteristics of a bilingual child's writing.

3 Results

3.1 The number of words used

The number of words used in Hikari's journal increased on average in Japanese and in English as shown in Figure 1. Although the number of words used increased drastically from the first grade to the 2nd grade journal, it decreased in the third grade journal in English. This is because she has had other assignments to work on and did not spend much time on her journals. In contrast, the number of words used in her Japanese journal has continued to increase since the first grade.

Figure 1. The number of words

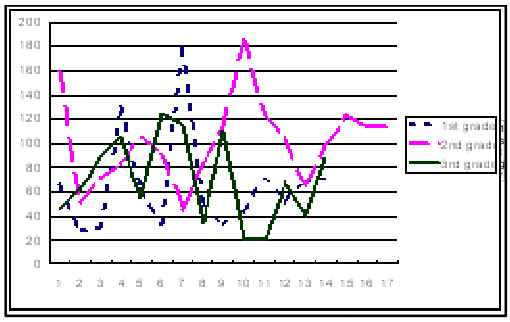


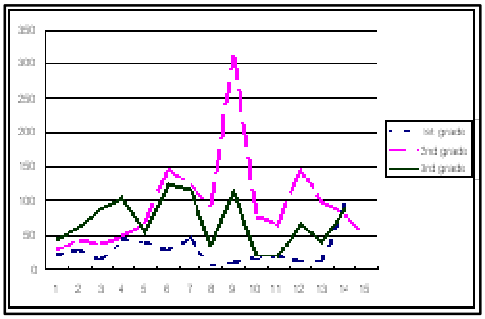
Although the number of words used on average in her Japanese journal increased, it did not steadily increase as shown in Figure 2. The number of words used changed over the three years, and it shows that whenever she had a good topic to write about, she wrote a lot.

The same trend can be seen in her English journal as shown in Figure 3. The number of words used in the beginning of a school year is fewer than that of the rest of the year, but it did not steadily increase throughout the school year. She spent every summer in Japan to attend a Japanese school for a full month, but it did not influence her negatively much in her English writing. She kept a good English journal while she was in Japan.

Figure 2. The number of words in Japanese

Figure 3. The number of words in Japanese





3.2 Spelling errors

In examining Hikari's first-grade journal, there is only one spelling error: mathmatic. She used conventional spelling for both regular and irregular words (see Table 2). As she began to use more words in her second- and third-grade journals, there were several spelling errors which can be categorized in phonetic transcription and overgeneralization. Compared to the conventional spelling she used, these spelling errors, however, are minor ones. She mastered most of the conventional spelling.

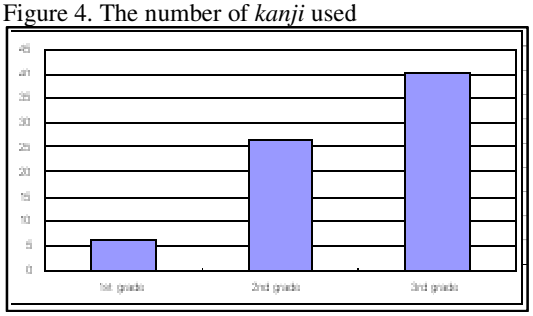
Table 2. Spelling errors in English

	First grade	Second grade	Third grade
Phonetic transcription	mathmatic	explaine, treager(treasure) graffics, cattuplilar, prtending, butiful nurvos gise (guys) chimney to (too)	squint (squid), exept, musium, stumch, ice-cream sunday, velt, stroller, nevos, sopposed, tought, dizzyness
Overgeneralization	n.a.	drived, taked, tided (tied), falled, putted	fishes suspention

3.3 Mastery of kanji

The mastery of kanji characters is as important as that of English spelling. The number of *kanji* characters used in her journals increased from first- and to third-grade. Figure 4 shows the change of the number of *kanji* characters in her journal.

Figure 4. The number of *kanji* used



3.4 Writing development (topic, sentence formation, supporting details, use of descriptive language)

To examine the development of Hikari's writing, the Two-way Immersion Narrative Written Assessment Rubric developed by Howard (2003) was used. Three journals written in the beginning, middle, and end of the school year in each grade were chosen for analysis. In examining these pieces of journal writing, she has shown development in each area examined in both Japanese and English[1] (see Figure 5 and 6). Figure 3 below shows the assessment of Hikari's writing in Japanese. The assessment shows that some improvement can be observed from first- to second-grade writing. The same trend can be seen in her English journal writing shown in Figure 6. Her writing in the end of the school year in second and third grade were assessed more negatively because they became shorter and the contents were content was not developed well. One of the limitations of this study is that journal writing is not a formal writing, and her writing could have been assessed based on the same topics assigned in both Japanese and English.

Figure 5. Writing assessment in Japanese

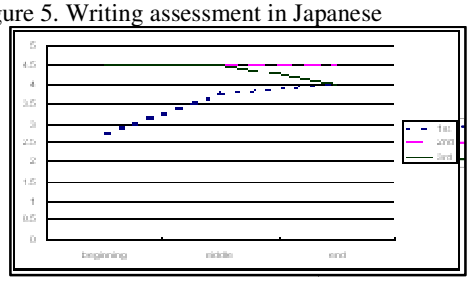


Figure 6. Writing assessment in English

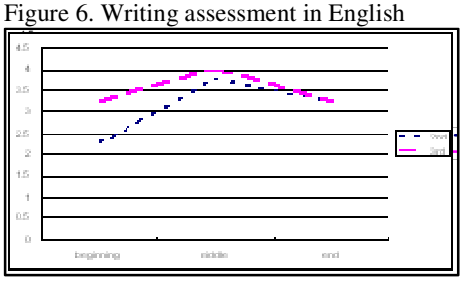
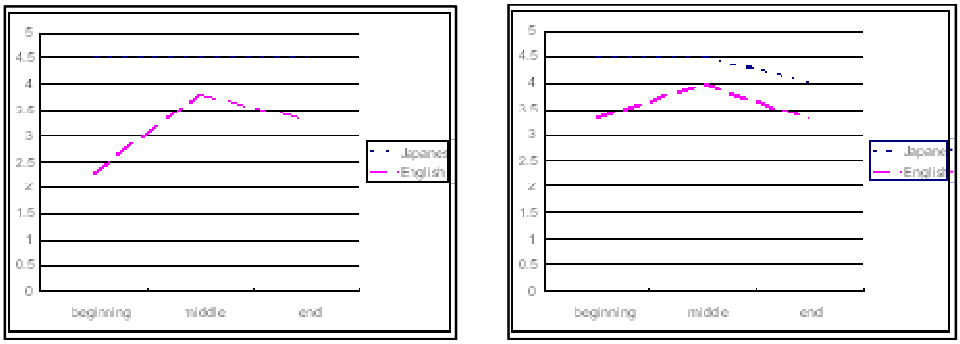


Figure 7 and 8 show the comparison of English writing in second and third grade. Her Japanese writing is assessed more positively in both grades. Figure 8 shows the assessment of writing in the third grade. Her writing does not improve much from the second-grade writing and became worse in the end because the contents of the last piece of her Japanese and English were not developed well.

Figure 7. Second grade writing assessment

Figure 8. Third grade writing assessment

[1] For the English data, first grade writing data were excluded from the analysis because only writing in the end was available.



3.5 Are there any differences between her Japanese writing and English writing?

To answer this question, I picked a topic Hikari wrote about both in Japanese and English, "Gabriel's birthday party." I translated her Japanese into English and compared whether there was a difference between the two pieces. There is no major difference. She omitted subjects in Japanese, which is grammatically correct in Japanese. She did not specify the name of the game she played last in her English piece, but she used the word "imitation game" in Japanese. She probably did not know how to say imitation in English. Although I did not find any major differences in these pieces, she precisely described what happened in her Japanese writing with references and reasons. This seems redundant in Japanese, and I speculate that she has learned to describe events or things in detail in English and has transferred this into Japanese.

3.6 Are there any characteristics of a bilingual child's writing?

Code-switiching was found in Hikari's writing. She used several English words using *katakana*, which is used for foreign words in Japanese, such as birthday party and sleep over. Interestingly, she used Japanese characters in English when she did not know the word such as used bookstore. After she used *kanji* characters in her English journal, she wrote asking whether her teacher knew this Japanese word.

An example of code-switching

Today I just spended my time in the こたつ[2][*kotasu*]. (I didn't know how to say the word.) Then, me and my one of my cousin went to 古本屋[3] [*furuhonya*]. (Do you understand this word?) There, we could buy old books and that good, because you don't had to pay that much. I love古本屋 [*furuhonya*]。

4 Discussion

This case study shows that it is possible to acquire two different writing systems simultaneously. This section discusses how schooling in both languages has helped the participant to be biliterate. It also discusses the code-switching for communication as a characteristic of a bilingual child writing.

4.1 Schooling in both languages

[2] small table with an electric heater underneath and covered by a quilt

[3] used bookstore

Relationships between positive home environments and children's literacy development have been emphasized by many scholars. Even though Hikari is growing up in the US and has been in the mainstream classroom since the first grade, English is her second language. She has been exposed to English literacy more than Japanese. She learns to read and write in English five days a week. Hikari's parents send her to a Japanese Saturday school, which has helped her to maintain Japanese in the US. Many Japanese children living in the US go to a Saturday Japanese school. Most of the children are not immigrants to the US, and they are expected to return to Japan after spending a couple of years in the US. Many parents send their children to this weekend school to have them maintain their Japanese as well as keep up with the contents of subjects taught in Japan. The ministry of Education sends free textbooks used in schools in Japan to children living overseas. Hikari is one of such Japanese students who goes to a Japanese Saturday school. Even though this schooling is only once a week, it helps Japanese children to use their first language in school. To foster biliteracy, Sanborn (2005) suggests that children should be educated in their first language by teachers, not by parents, even if it is only once a week. There are several benefits to this kind of school. One of them is that student are given homework, an important part of the learning process. Hikairi was given homework from her Japanese Saturday school, which includes a number of *kanji* practices and writing in Japanese.

Hikari's parents also gave her a chance to experience a Japanese school life using a visiting enrolment program in Japan during the US summer vacation time. This gives her an opportunity to be fully exposed to the language monolingual Japanese children use in school. Another advantage she had during her summer in Japan is her American school teacher's encouragement. One of the agreements between her teacher and her parents when she goes to Japan is to keep a journal in English so as not to forget English. Hikari kept this promise and her mother checked if she was writing in English. Schooling in both languages has helped her to write in Japanese and English successfully.

4.2 Code-switching for communication

Whenever Hikari did not know an English word when she wrote in English, she put in Japanese words. Instead of considering this as a deficit in writing, some researchers consider this as benefit of bilingual children because the purpose of writing is for communication (Rubin & Carian, 2005; Kenner, 2004). Hikari used such strategy to communicate with her teacher, who does not know Japanese. As seen in her code-switching example, she asked her teacher if she knew the Japanese word to consider the reader of her journal. Another interesting point of her code-switching, she finished her journal with a Japanese word. She used a Japanese writing period, 。, instead of an English writing period. This shows that she understands the different writing systems clearly. In a study which examined code-switching of bilingual children's writing, Gort (2006) found that developing bilingual children used code-switching to express themselves for things they care about. In examining Hikari's code switches, she used things she liked in Japan such as *kotatasu* and *furuhonya*. *Kotatsu* is a small table with an electric heater underneath and covered by a quilt. When she visited Japan for the New Year's holidays, she liked sitting in the *kotatstu*. She also liked *furuhonya*, used bookstores, where she could buy Japanese *manga* [comics]. In this context, she wanted to tell her American teacher the things she enjoyed in Japan. It is important to note that there is no equivalent word for *kotatsu* in English. Therefore, the only thing she could do was to send her message out using the Japanese word.

5 Conclusion

Although this study is limited in the number of participants, it makes a case for the importance of schooling in both languages. It shows that it is possible to acquire two different writing systems simultaneously and successfully. It also finds that code-switching can

sometimes effectively support the learning of writing skills. Further research should examine the writing assessment in a more appropriate way. In free journal writing, the methodology I used could not assess her writing in both languages well. For example, the same writing topics should be given in both languages in the beginning, middle, and the end of a school year. So, we could better understand her writing development.

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Phonological awareness, letter-sound knowledge and word recognition in Greek deaf children

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Abstract

The aim of the study presented in this paper was to investigate the relation between phonological awareness and orthographic knowledge in deaf children who read in the transparent Greek orthography. Preschool and school-aged deaf children (N = 24) and two comparison groups of hearing children (N = 30) were administered measures of phonological awareness, letter-sound knowledge and word recognition at the beginning and at the end of the school year.

The results showed different patterns of performance between the deaf and hearing groups. Three main findings emerge from the deaf participants' performance. First, their performance did not follow the hypothesized developmental sequence (syllable → rhyme → phoneme); second, the participants who were above chance on phonological awareness had good letter-sound knowledge; third, some deaf children were above chance on word recognition but not on phonological awareness.

These findings confirm previous evidence from studies with English-speaking and French-speaking deaf individuals and they indicate that the origins of phonological awareness in deaf individuals are orthographic rather than phonological. Letter-sound knowledge appears to play a particularly important role in the development of phonological awareness in deaf children. The various factors that influence phonological awareness and reading acquisition in deaf children will be summarized.

1 Introduction

Phonological awareness is the ability to reflect on and manipulate the constituent segments of spoken words. It is a multi-dimensional construct which consists in the ability to identify, delete, isolate, blend or count syllables, onsets, rimes or phonemes (Høien, Lundberg, Stanovich & Bjaalid 1995; Stackhouse & Wells 1997; Yopp 1988). Evidence suggests that phonological awareness develops from the large units of syllables, onsets and rimes to the small units of phonemes (Carroll, Snowling, Hulme, & Stevenson 2003; Goswami & Bryant 1990; Liberman, Shankweiler, Fischer, & Carter 1974; Treiman & Zukowski 1996).

1.1 Phonological awareness and literacy in hearing children

Research with hearing children provides ample evidence that there is a very close connection between phonological awareness and literacy. In fact, as it has been said, phonological awareness forms a 'bridge' from speech and language to literacy (Morais 1990; Stackhouse & Wells 1997). In what follows, the focus is on the link between phonological awareness and two specific aspects of literacy: reading and letter-sound knowledge.

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To a certain extent, the relation between phonological awareness and reading is a reciprocal one. Broadly speaking, syllable awareness and onset-rime awareness develop in preschoolers whereas phoneme awareness develops as a consequence of learning to read. At the same time, however, findings from children with speech and language difficulties indicate that, if phonological awareness has not developed by a specific age, the child will have severe difficulties in reading acquisition (Carroll & Snowling 2004; Gillon & Dodd 2005; Pascoe, Stackhouse & Wells 2006). Moreover, it has been shown that rhyme awareness and, more importantly, phoneme awareness are significant predictors of reading concurrently and longitudinally (Bradley & Bryant 1978; Bryant, Bradley, Maclean & Crossland 1989; Caravolas, Volin & Hulme 2005; Hatcher & Hulme 1999; Hulme, Hatcher, Nation, Brown, Adams & Stuart 2002).

As regards letter-sound knowledge, there is evidence that this is a significant concurrent predictor of phoneme awareness in preschool children (Johnston, Anderson & Holligan 1996). Similar results are reported in Bowey (1994), who found that nonreaders with high letter knowledge outperformed nonreaders with low letter knowledge on measures of onset-rime and phoneme awareness. Extending these findings, the work of Burgess & Lonigan (1998) and Muter, Hulme, Snowling & Stevenson (2004) indicates that the predictive relationship between phonological awareness and letter-sound knowledge is reciprocal and holds true not only at a single time but across time as well, with one being a significant longitudinal predictor of the other. Further, in addition to phonological awareness, letter-sound knowledge has also been found to predict reading concurrently and longitudinally (Hogan, Catts & Little 2005; Johnston et al. 1996; Muter et al. 1998, 2004).

Coming back to the relation between phonological awareness and letter-sound knowledge, one interesting question which researchers have sought to address and which has important implications for deaf children is whether the first can develop in the absence of the second. In other words, the question posed is the following: *Is letter-sound knowledge a prerequisite for the development of phonological awareness in hearing children*?

The findings of Stahl & Murray (1994) indicate that letter-sound knowledge appears to be necessary for the child's ability to analyse spoken words into onsets and rimes. The researchers found that, out of 52 kindergartners and 61 first graders, the majority of the participants who were above chance on an onset-rime task also had good letter-sound knowledge; only one child who knew fewer than 45 letters managed to pass chance level. Similarly, Johnston et al. (1996) report that, out of 49 preschoolers, 42 had good letter knowledge and 25 of them also had good phoneme awareness. Seven children did not know any letters of the alphabet, and six of these children were also unable to delete or segment phonemes.

However, data reported by Hulme, Caravolas, Malkova & Brigstocke (2005) stand in contrast to the above findings. Hulme et al. investigated letter knowledge and phoneme isolation ability in young Czech and English children. The results showed that participants could isolate some phonemes for which they did not know the corresponding letters. In addition, four (Czech) children did not know any of the letter sounds tested. Out of these four children, one child scored zero on phoneme isolation, one child scored 10 and two children were 100% correct scoring 15. The authors concluded that it is possible for children to have some awareness of phonemes even if they do not know the corresponding letters.

In view of the above, it can be concluded that in typically developing hearing children letter-sound knowledge may not necessarily be a prerequisite for the development of phonological awareness. However, the same does not hold true for hearing children with speech and language difficulties. It has been demonstrated that these children make significant progress in the development of their phonological and reading skills when intervention focuses on making explicit links between phonological skills (particularly phonemic skills) and letter-sound correspondences than when it focuses on phonological skills only (Hatcher, Hulme & Ellis 1994; Hatcher, Hulme & Snowling 2004).

1.2 The effect of orthographic transparency

One factor that influences phonological awareness is orthographic transparency, i.e. the degree to which there are consistent correspondences between letters and sounds in an orthographic system. Although the developmental trajectory of phonological awareness is the same across different alphabetic systems, the rate of the development varies. Children who read in a transparent orthography (e.g. Greek, Italian, or Finnish) develop phonological awareness, and as a consequence reading, faster than children who read in a non-transparent orthography (e.g. English). Evidence for this comes from monolingual studies carried out with different language groups as well as from cross-linguistic studies (e.g. Aidinis and Nunes 2001; Goswami, Porpodas & Wheelright 1997; Nikolopoulos & Goulandris 2000; Patel, Snowling & de Jong 2004; Porpodas 1999; Seymour, Aro & Erskine 2003).

1.3 Phonological awareness and literacy in deaf children

In deaf individuals phonological awareness is heavily mediated by orthographic knowledge. This conclusion emerges from the consistently replicated finding that deaf children, adolescents and adults perform significantly better on phonological awareness tasks when orthographic information is consistent with phonological information, e.g. *dog – frog* vs. *hair – bear*[1] (Campbell & Wright 1988; Dyer, MacSweeney, Szczerbinski, Green, & Campbell 2003; Hanson & Fowler 1987; Hanson & McGarr 1989; James, Rajput, Brown, Sirimanna, Brinton & Goswami 2005; Kyle & Harris 2006; Sterne & Goswami 2000). Yet, research with deaf school-aged children and adults has also shown that, although performance is typically better in the congruent condition, some deaf individuals are still able to make accurate phonological judgments when they cannot rely on orthography (e.g. Hanson & Fowler 1987; Hanson & McGarr 1989; Sterne & Goswami 2000).

With respect to reading acquisition in deaf children, a correlation has been found between reading and phonological awareness (Campbell & Wright 1988; Dyer et al. 2003; Harris & Beech 1998). However, empirical evidence indicates that this correlation is no longer significant when differences in hearing loss, vocabulary and speechreading are controlled for (James 2002; Kyle & Harris 2002). To the best of our knowledge, there has been no previous study on letter-sound knowledge and its relation to phonological awareness in deaf children.

2 The present study

2.1 Research questions

The findings discussed above from typically developing and language disordered hearing children in conjunction with evidence from deaf individuals led to the motivation for the current study, which was carried out with Greek preschool and school-aged deaf and hearing children. This paper focuses on data from the deaf children.

The research questions addressed in the study were the following:

- How does phonological awareness develop in Greek deaf children?
- What is the level of letter-sound knowledge in Greek deaf children and how does it relate to phonological awareness?
- What are the word recognition skills of Greek deaf children and how do they relate to phonological awareness?

[1] For example, in the pair *dog – frog* the words have the same spelling at the end and they also rhyme. Therefore, orthographic cues are consistent with phonological cues. By contrast, in the pair *hair – bear* the words have the same rime but different spelling.

The design of the study was cross-sectional and short-term longitudinal. Data were collected at two time points six months apart.

2.2 Participants

Two groups of deaf children participated in the study. One group consisted of children who were in nursery school (N=13, CA: 6;2, range: 5;2-9;1) and the other group consisted of children who were in the first, second or third grade of primary school (N=11, CA: 8;4; range: 6;4-10;9). Participants were severely or profoundly deaf, they had sensorineural congenital or prelingual hearing loss, normal non-verbal reasoning, and no confirmed or suspected learning or motor difficulties. All participants had some degree of spoken language. Seven preschoolers had been fitted with a cochlear implant and six preschoolers wore hearing aids. All school-aged children had hearing aids.

2.3 Material

The experimental measures consisted of a) a battery of phonological awareness tasks, b) three tasks assessing knowledge of letter-sound correspondences, and c) a word recognition task. Phonological awareness and letter-sound knowledge were assessed both at T1 and at T2; word recognition was only tested at T2.

In the phonological awareness battery participants were asked to judge whether pairs of pictorially presented words were the same length (syllable awareness), whether they ended with the same sound (rhyme awareness) or whether they began with the same sound (phoneme awareness). Each task consisted of 36 main items and 4 practice items.

Knowledge of letter-sound correspondences was assessed via three tasks, each of which consisted of 22 items. These tasks were the following:

- A sound knowledge task: Participants were presented with a card showing a letter and they were asked to produce the corresponding sound.
- A sound discrimination task: Each item contained two pictorially presented words. These were named by the experimenter and participants were asked to point to the word that started with the target sound.
- A letter knowledge task: The experimenter produced a sound and participants were asked to write down the corresponding letter.

Finally, as no published reading measure was available that could be used with Greek deaf children, a word recognition task was developed. This had a matching-to-sample design. Participants saw a picture and beneath it four written words. By pressing the correct colour coded key on a response box, they were asked to indicate the word that matched the picture. In total, there were 40 main items and 6 practice items in this task.

3 Results

3.1 Phonological awareness

Based on previous evidence on the developmental sequence of phonological awareness (i.e. syllable → rhyme → phoneme), it was predicted that the two groups would score higher on the syllable task and lower on the phoneme task. According to the Binomial Test of Distribution, scores above 63.89% (raw score: 23 out of 36) differed significantly from chance level ($p < .05$). As the means in Table 1 suggest, at T1 the Nursery Group was on average below chance on all three phonological awareness tasks. The Primary Group performed above chance on syllable and phoneme awareness but they were below chance on rhyme awareness. Highest performance for this group was on the syllable task and lowest performance was on

the rhyme task. At T2 the Nursery Group passed chance level on the syllable task and on the phoneme task but not on the rhyme task. On average, they scored higher on the phoneme task than on the syllable task. The Primary Group was now above chance on all three tasks. Similarly to T1, their performance was highest on the syllable task and lowest on the rhyme task.

Table 1. Performance on the phonological awareness tasks (% correct)

	NURSERY GROUP			PRIMARY GROUP		
	Syllable	**Rhyme**	**Phoneme**	**Syllable**	**Rhyme**	**Phoneme**
T1						
Mean	61.29	52.96	51.47	76.25	53.9	67.13
SD	18.89	15.9	19.21	14.71	16.29	20.74
Range	36 – 100	35 – 80	25 – 83	48 – 100	28 – 81	40 – 94
T2						
Mean	67.37	61.71	73.49	78.48	73.91	76.07
SD	23.76	25.16	18.29	14.25	18.48	21.07
Range	31.82 – 100	25 – 92.86	46.67 – 96.30	52.38 – 100	42.86 – 100	35 – 97.22

The above analyses were carried out with grouped data. Individual data were also analysed. The criterion of passing/failing chance level was followed in this analysis. The prediction was that participants who were above chance on rhyme awareness should also be above chance on syllable awareness and participants who were above chance on phoneme awareness should also be above chance on rhyme awareness. Indeed, at T1 participants in the Nursery Group performed according to this sequence. However, in the Primary Group two participants were below chance on rhyme awareness but above chance on phoneme awareness. At T2 one participant in the Nursery Group was below chance on syllable awareness but above chance on rhyme and phoneme awareness; in the Primary Group two participants were below chance on rhyme awareness but above chance on phoneme awareness, one participant passed chance level on the rhyme task but not on the syllable task, and one participant passed chance level on rhyme and phoneme awareness but not on syllable awareness. Therefore, at both time points some children did not perform according to the hypothesized developmental pattern.

Finally, in order to examine the development of phonological awareness over time, we carried out Wilcoxon tests. These showed that the Nursery Group performed significantly better on the phoneme task at T2 compared to T1 ($z = 2.201$, $p < .05$). Although they also performed better on syllable and rhyme awareness, these differences were not statistically significant ($z = 1.540$, $p > .05$; $z = .676$, $p > .05$). The Primary Group performed significantly better on the rhyme task ($z = 2.490$, $p < .05$) but not on the syllable ($z = .255$, $p > .05$) or the phoneme task ($z = 1.245$, $p > .05$).

3.2 Letter-sound knowledge and phonological awareness

Table 2 indicates that at T1 the Nursery Group had on average good knowledge of letter-sound correspondences. Importantly, as the ranges suggest, whilst some participants in this group scored low, some participants were already near or at ceiling. With regard to participants in the Primary Group, it can be seen that they all had good letter-sound knowledge. Some participants were at ceiling whereas there were no scores at floor. At T2 the Nursery Group scored high on the letter-sound tasks and the Primary Group was on average near ceiling. At this time point, there was no participant who had no knowledge of letter-sound correspondences. Individual scores ranged from 41% and 50% to 100%.

Table 2. Performance on the letter-sound tasks (% correct)

	NURSERY GROUP	PRIMARY GROUP

	1.	2.	3.	1.	2.	3.
T1						
Mean	67.73	62.99	60.39	84.95	84.3	87.19
SD	21.53	29.97	32.54	8.73	16.43	17.70
Range	41.38-91.38	13.64-100	9.09-100	70.69-94.83	63.64-100	40.91-100
T2						
Mean	82.54	78.4	85.79	92.48	91.73	97.93
SD	9.33	24.14	13.18	6.23	16.11	6.85
Range	67.24-93.10	40.91-100	59.09-100	79.31-100	50-100	77.27-100

Key: 1. Sound knowledge; 2. Sound discrimination; 3. Letter knowledge

In order to investigate how letter-sound knowledge relates to phonological awareness in Greek deaf children, we examined performance on each phonological awareness task plotted against a composite score on the letter-sound tasks. For each participant the composite score represented the average of the scores obtained on the letter-sound tasks. This analysis showed that in both groups the participants who were above chance on the phonological awareness measures had average to good letter-sound knowledge. Lowest composite score for these participants was 40%. Therefore, contrary to the hearing children who were also tested in this study (Kyritsi 2007), there were no deaf children with good phonological awareness (i.e. above chance level) but poor letter-sound knowledge. On the other hand, it has to be pointed out that the participants who scored below chance on phonological awareness also had good letter-sound knowledge. Lowest composite score for these participants was 35%.

Wilcoxon tests showed an overall significant improvement in letter-sound knowledge over time. In particular, at T2 the Nursery Group performed significantly better on sound knowledge ($z = 2.197$, $p < .05$), sound discrimination ($z = 2.207$, $p < .05$) and letter knowledge ($z = 2.197$, $p < .05$). The Primary Group scored significantly higher on sound knowledge ($z = 2.599$, $p < .01$) and letter knowledge ($z = 2.032$, $p < .05$), whereas the difference in sound discrimination did not reach significance ($z = 1.696$, $p > .05$).

3.3 Word recognition and phonological awareness

Chance level on the word recognition task was 15 out of 40, i.e. 37.5%. As the results showed, mean performances on this task were 12.75 for the Nursery Group (SD: 5.12, range: 7-22) and 26.55 for the Primary Group (SD: 9.34, range: 15-39). It is interesting to note that three preschoolers were above chance on word recognition. As the ranges indicate, all school-aged children performed significantly differently from chance level.

The relation between word recognition and phonological awareness was also explored. It was found that the preschoolers who were above chance on word recognition were also above chance on syllable, rhyme and phoneme awareness. By contrast, in the Primary Group not all participants were above chance both on word recognition and on phonological awareness. Some children with good word recognition ability (i.e. above chance level) were below chance on at least one of the phonological awareness measures.

4 Discussion

4.1 How does phonological awareness develop in Greek deaf children?

One aim of this study was to investigate the developmental sequence of phonological awareness in Greek preschool and school-aged deaf children. Based on evidence from English-speaking deaf children (James et al. 2005; Sterne & Goswami 2000), it was predicted that in deaf children, as in hearing children, phonological awareness develops first at the syllabic and at the rhyme level and then at the phonemic level.

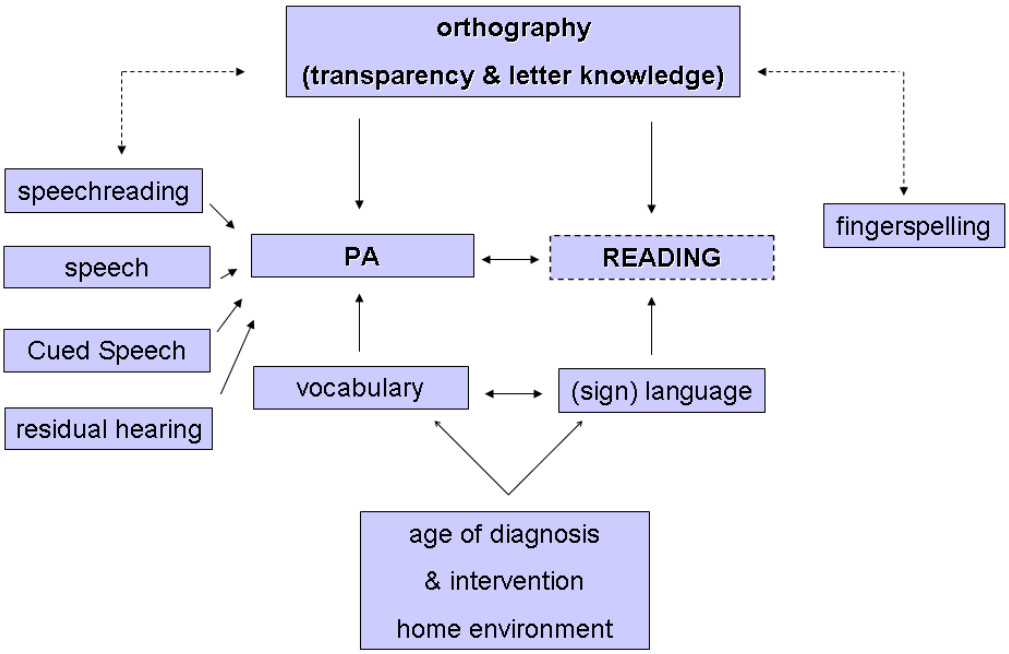
Our findings cannot support this prediction. Both grouped and individual data indicate that the rhyme task might have been more difficult than the phoneme task. Moreover, it cannot be determined from our data whether syllable awareness precedes phoneme awareness. It is likely that factors relating to task demands and intervention strategies influenced participants' performance contrary to the hypothesized direction. For example, the position of the shared segment in the rhyme task (word-finally) and in the phoneme task (word-initially) might have balanced out differences in the degree of difficulty between the two tasks. Further, during testing it was observed that speech therapists often emphasized the initial segments of words.

One argument we wish to put forward with respect to phoneme awareness, in particular, is that it is possible that the Greek orthography facilitates the development of phoneme awareness in deaf children via two main ways: first, via the consistent correspondences between letters and sounds, which allow for lexical representations to become specified at the phonemic level more quickly in Greek deaf children than, for example, in English-speaking deaf children (this would parallel the effect that has already been found for Greek and English-speaking hearing children); second, via its impact on fingerspelling which, given the one-to-one correspondence between letters and handshapes, is probably a more reliable source of information for deaf children using a transparent orthography, i.e. an orthography in which letters also map consistently onto sounds. Therefore, in addition to intervention strategies, orthography and fingerspelling are also likely to influence phonological awareness in deaf children.

4.2 What is the level of letter-sound knowledge in Greek deaf children and how does it relate to phonological awareness?

An interesting finding that emerges from our study is that, although Greek deaf preschoolers receive no formal literacy instruction, they have good knowledge of letter-sound correspondences by the time they go to primary school. This finding suggests that, similarly to hearing children with speech and language difficulties, some knowledge of letter-sound correspondences may be a prerequisite for the development of phonological awareness in deaf children. At the same time, however, the performance of the children who were below chance on phonological awareness indicates that good letter-sound knowledge does not necessarily provide good phonological awareness in deaf children. As Figure 1 illustrates, in addition to orthography, a number of other factors appear to be equally important for the development of phonological awareness in deaf children.

Figure 1. Model of factors contributing to the development of phonological awareness and reading in deaf children.



4.3 What are the word recognition skills of Greek deaf children and how do they relate to phonological awareness?

We were also interested to see that three preschoolers had not only good letter-sound knowledge but also good word recognition ability. The same three preschoolers also had good phonological awareness. They scored above chance on all three measures at T2 and on at least one measure at T1. These findings could lead one to conclude that in deaf children, as in hearing children, phonological awareness precedes word recognition. However, the data from the Primary Group do not support this conclusion. Five participants were above chance on word recognition but below chance on at least one of the phonological awareness tasks. The profile of these participants suggests that amount of training in phonological awareness and spoken language as well as age of diagnosis are factors that can partly account for the development of phonological awareness in some but not all deaf children and for the different strategies that deaf readers use (Figure 1).

5 Conclusion

In sum, our findings indicate that some letter-sound knowledge may be a prerequisite for the development of phonological awareness in deaf children. They also suggest that orthographic transparency influences phonological awareness in deaf children in various ways. These two possibilities need to be followed up in future studies as there are important implications both theoretical (concerning the development of phonological awareness and reading in deaf children) and pedagogical (regarding the education of deaf children).

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Against Hegarty's feature-based theory on the grammar of children with specific language impairment

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Abstract

Using the Leonard corpus in the CHILDES database, Hegarty (2005: 13) argues that children with specific language impairment (SLI) 'have a general deficit in their representation of functional categories'. That means SLI involves a deficit in the syntactic representation. However, using the same data, Lin (2006) proposes that the children with SLI do not have any deficit in syntax. Instead, it is suggested that these children with SLI have considerable problems in the PF component. Given that these two conclusions go against each other, this paper addresses the issue of the deficiency of the featured-based theory from three aspects:

(i) the VP-Internal Subject Hypothesis (Koopman and Sportiche 1991) assumed in the Minimalist framework goes against Hegarty's conservative counting techniques on the evidence of productivity;

(ii) the conservative counting does not take the dialectal factor and the difference between morphological case and abstract Case into consideration;

(iii) the asymmetry in the performances on Wh-movement and auxiliary inversion by the children with SLI in the Leonard corpus is not addressed in Hegarty's theory.

By showing these problems, the present study further argues that the children in the Leonard corpus do not have a deficit in their representation of functional categories.

1 Introduction

It is well known that functional elements emerge later and/or with differentiated paths in language acquisition. In particular, C-related phenomena (i.e. T-to-C movement), verbal inflection, auxiliaries, determiners and clitics are identified to be relevant domains to study the acquisition of functional categories within the generative framework. A substantial division of the debate on the acquisition of functional categories, commencing in the 90's, has been devoted to discuss whether the functional category is available in children's syntactic representation from the onset or it is subject to maturation. Many fine arguments have been advanced from both sides, making this an unsettled issue. The primary goal of this paper is to discuss the acquisition of functional categories from a certain group of children, namely, the children with specific language impairment (SLI).

Although SLI is a heterogeneous disorder and different models have been proposed to explain the nature of grammatical errors made by children with SLI, two recent studies, however, go to opposite extremes of the interpretation on the same data, the Leonard corpus on the Child Language Data Exchange System (CHILDES) website (MacWhinney 1995). One is Hegarty (2005), who argues that those English-speaking children with SLI have a deficit in their syntactic representation of functional categories, whereas the other is Lin (2006), who

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proposes that those children just have considerable problems in the PF component, the interface between syntax and articulatory-perceptual systems. Within the framework of Chomsky's (1995, 2000, 2001, 2004, 2005) Minimalist Program (henceforth MP), this paper will point out the deficiency of Hegarty's (2005) featured-based theory and further show that the children in the Leonard corpus do not have a deficit in their syntactic representation of functional categories. In the following section, the key claims and analyses made by the feature-based theory are presented.

2 Literature Review

The feature-based theory of functional categories is proposed by Hegarty (2005) to study the nature of functional elements in human languages. Following the Minimalist syntax, this approach defines and constructs functional projections in terms of morpho-syntactic and semantic features. It not only addresses the issue of child language acquisition of functional categories but also applies to the syntactic analysis of adult language data. It also provides a new perspective to the study of the grammar of children with SLI. Since this paper is concerned with the contrastive conclusions made by Hegarty's and Lin's (2006) studies on the children with SLI in the Leonard corpus, this section will mainly focus on Hegarty's research on SLI.

The method that Hegarty adopts to determine if children with SLI have a deficient syntactic representation of functional categories is to count the number of clausal functional categories exemplified in each clause. Functional categories that appear in both main and subordinate clauses are included in the count. However, incomplete and repeat utterances in the corpus are not counted. The types of functional elements counted are indicated as follows. Overt auxiliaries (modals, and *have/be* in participial constructions), infinitival *to*, and subjects with nominative case are counted as the realization of the functional head Inflection (henceforth I), shown in (1) below:

(1) a. That *could* do it. (child g)
b. He *is* closing his eyes. (child i)
c. I have *to* stir it. (child k)

Overt complementizers (i.e. *that, if, whether, so,* and *[be]cause*) and inverted auxiliaries are counted as the embodiment of the functional head Complementizer (henceforth C), as in (2) below:

(2) a. See *if* I get him to stand up. (child j)
b. *so* I see it. (child c)
c. I know *because* I don't want anymore. (child g)

Examples of *not* and the cliticized *n't* are counted as the instantiation of the functional head Negation (henceforth Neg) as in (3):

(3) a. I *not* take it back. (child k)
b. I do*n't* see stickers. (child i)

Nevertheless, in Hegarty's study, evidence of productivity is essential for these functional elements to be counted as instantiating a functional projection. In more details, it is required that productivity should contain at least a partial paradigm. This is the reason why Hegarty's method is termed as "the conservative counting techniques."

After Hegarty's examination of each child in the Leonard corpus, it is concluded that SLI can be characterized by a diminished capacity to project functional categories. In other words, the syntactic system of children with SLI involves a structural deficit in the representation of

functional categories. Yet the problems with Hegarty's feature-based theory, mainly his conservative counting techniques, will be discussed in the next section.

3 Discussion

Hegarty's conservative counting techniques, which lead to his conclusion that children with SLI have a deficit in their syntactic representation of functional categories, have three major problems in terms of recent generative framework.

First, the conservative counting is not compatible with the generally assumed Predicate-Internal Subject Hypothesis (PISH) in MP, which is proposed by Koopman and Sportiche (1991) as the VP-Internal Subject Hypothesis within a Government and Binding setting.

According to the PISH, external arguments, or subjects in the traditional term, are firstly merged in the specifier of the lexical head with which they enter into a θ-relation. Since the functional head I has a EPP feature, the subjects further move to the specifier of IP to delete the EPP feature of I and gets the nominative case feature from I.

However, when describing child h's competence, Hegarty (2005: 297) says '[t]he lack of productivity suggests that (on a conservative count) I is not productive' in (4):

(4) a. That one's not eating.
b. It's not working.
c. The person's not driving.
d. The baby's not crawling.

Given the PISH, the subjects in (4) (namely *that one*, *it*, *the person* and *the baby*) are merged with the lexical verbs (namely *eating*, *working*, *driving* and *crawling* respectively) and move across the negation marker *not* and the auxiliary *is* to the specifier of IP to get the nominative case. This is the so-called A(rgument)-movement, which is triggered by the EPP feature on the functional head I.

As shown, the functional head I is active in child h's grammar. In other words, Hegarty's conservative count underestimates child h's competence. The sentences in (4) shows that child h has the same syntactic representation of the functional category I as the typically-developing children do.

The second problem for the conservative counting is that it does not take the dialectal factor and the difference between morphological case and abstract Case into consideration.

According to Chomsky's (2000, 2001, 2004) theories of nominative case marking and A-movement, where agreement of φ-features plays a key role, the Case feature of the subjects in the following sentences is specified as nominative.

(5) a. *Them* are all good. (child a)
b. *Me* don't want it. (child c)
c. *Them* can't go in there. (child c)

The surface accusative form can be due to a gap in their mental lexicon. Therefore, it is important to determine whether or not these children have acquired the full paradigm of Case spellout forms that can be found in adult English. The complete range of pronoun spellout forms used by these children in different case contexts has been listed in the table below:

Table 1. Raw frequency of personal pronoun forms used by each child

Child	Type	Nominative	Weak genitive	Strong genitive	Accusative
a	1Sg	I = 125, me = 2	my = 39	my = 2	me = 30
	1Pl	---	our = 2	---	---
	2	you = 53	your = 10	yours = 2	you = 11

	3MSg	he = 124, him = 1	his = 18, him = 2	---	him = 14
	3FSg	she = 1	her = 1	---	her = 3
	3NSg	it = 35	its = 2	---	it = 101
	3Pl	they = 4, them = 6	---	---	them = 16
b	1Sg	I = 170, me = 2	my = 26	mine = 7, my = 1	me = 8
	1Pl	---	---	---	---
	2	you = 10	---	---	---
	3MSg	---	his = 2	---	him = 2
	3FSg	---	her = 1	---	her = 1
	3NSg	it = 20	---	---	it = 52
	3Pl	they = 2	---	---	them = 18
c	1Sg	I = 203, me = 1	my = 21	mine = 1	me = 4
	1Pl	we = 25	our = 2	---	we = 1[1], us = 4
	2	you = 67	your = 1	---	you = 5
	3MSg	he = 75	his = 45	---	him = 2
	3FSg	she = 9	---	---	---
	3NSg	it = 42	---	---	it = 69
	3Pl	hey = 6, them = 23	---	---	them = 68
d	1Sg	I = 56, me = 3	my = 27	mine = 4	me = 30
	1Pl	we = 6	---	---	us = 1
	2	you = 32	---	---	you = 7
	3MSg	he = 5, him = 1	his = 4, him = 17	---	him = 18
	3FSg	---	her = 13	hers = 1	her = 2
	3NSg	it = 7	---	---	it = 38
	3Pl	they = 5, them = 9	---	---	them = 8
e	1Sg	I = 190	my = 66, me = 2	mine = 1	me = 26
	1Pl	we = 21	our = 13	---	---
	2	you = 57	your = 19	---	you = 28
	3MSg	he = 12	his = 6	---	him = 5
	3FSg	she = 5	her = 10	hers = 1	her = 21
	3NSg	it = 37	---	---	it = 94
	3Pl	they = 9	---	---	them = 36
f	1Sg	I = 150, me = 1	my = 16	mine = 6, my = 1	me = 20
	1Pl	we = 5	our = 2	---	---
	2	you = 25	your = 2	yours = 1	you = 3
	3MSg	he = 168, him = 1	his = 32	his = 1	him = 12
	3FSg	she = 5	her = 10	hers = 1	her = 21
	3NSg	it = 38	---	---	it = 116
	3Pl	they = 9	---	---	them = 36
g	1Sg	I = 269	my = 24	mine = 2	me = 20
	1Pl	we = 40	our = 1	---	---
	2	you = 39	your = 1	---	you = 6
	3MSg	he = 2, him = 18	his = 1, him = 4	---	him = 1
	3FSg	she = 1, her = 9	her = 8	hers = 1	her = 3
	3NSg	it = 62	---	---	it = 56
	3Pl	they = 1, them = 9	---	---	them = 24

[1] This item may be a performance error because the child made a self correction immediately in the next sentence. Thus, it is excluded from the count of his performance on case-marking.

h	1Sg	I = 78, me = 4	my = 10	mine = 2	me = 8
	1Pl	we = 9	---	---	---
	2	you = 40	your = 7	yours = 1	you = 11
	3MSg	he = 14, him = 2	his = 1	---	him = 2
	3FSg	she = 1	her = 1	---	---
	3NSg	it = 36	---	---	it = 56
	3Pl	they = 6, them = 2	their = 1	---	them = 7
i	1Sg	I = 83	my = 11	---	me = 3
	1Pl	we = 1	---	---	---
	2	you = 8	your = 1	---	you = 9
	3MSg	he = 3, him = 4	his = 1	---	---
	3FSg	her = 1	her = 2	---	---
	3NSg	it = 10	---	---	it = 16
	3Pl	them = 3	---	---	them = 2
j	1Sg	I = 189, me = 1	my = 51	mine = 4	me = 17
	1Pl	we = 70	our = 3	---	---
	2	you = 35	your = 5	---	you = 12
	3MSg	him = 21	his = 1, him = 8	---	him = 12
	3FSg	she = 1, her = 3	her = 1	---	---
	3NSg	it = 7	---	---	it = 20
	3Pl	hey = 5, them = 37	---	---	them = 64
k	1Sg	I = 70, me = 2	my = 22	mine = 1	me = 18
	1Pl	---	---	---	---
	2	you = 2	your = 1	---	---
	3MSg	him = 1	his = 1		him = 6
	3FSg	---	her = 2	---	---
	3NSg	it = 1	---	---	it = 9
	3Pl	them = 5	---	---	them = 1

There are several ways to quantify the above data. One is to calculate the percentage usage of the correct adult form, which scores forms correctly used in adult terms irrespective of whether they are ambiguous in the adult grammar or not. This will lead to a very high percentage correct spellout score (above 90%). Another is to compute the percentage implementation of unambiguous adult case-forms, excluding from the count forms which are case-ambiguous in the adult grammar (viz. it/you/them[2]). A third way is to calculate the percentage implementation of the correct form for case-forms which are case-unambiguous in child's grammar, which excludes forms that are case-ambiguous in the child's grammar; however, apparent gaps in the child's paradigm make it difficult to be sure whether particular forms are ambiguous or not for the child, since it is difficult to be sure whether gaps are accidental or systematic. In this study, the second procedure is adopted. Each child's percentage usage of the correct adult case is summarised in the table below:

Table 2. Summary of each child's percentage implementation of the correct adult case

Child	Age	Sex	MLU	Nom case	Acc Case	Gen case
a	5;0	M	3.7	254/257(98.83%)	47/47 (100%)	74/78(94.87%)
b	4;3	F	3.0	172/174(98.85%)	11/11(100%)	36/37(97.30%)
c	5;0	M	4.0	318/319(99.69%)	10/10(100%)	70/70(100%)
d	4;4	M	3.5	72/76(94.74%)	51/51(100%)	49/66(74.24%)
e	4;6	F	4.0	237/237(100%)	52/52(100%)	116/118(98.31%)

[2] *You* and *it* are excluded since their nominative and accusative forms are identical. *Them* subjects are excluded due to the dialectal factor that *them* can function as personal or distal demonstrative pronoun.

f	4;6	M	3.5	337/339(99.41%)	53/53(100%)	71/72(98.61%)
g	5;3	F	4.3	313/340(92.06%)	24/24(100%)	38/42(90.48%)
h	3;8	M	3.1	108/114(94.74%)	10/10(100%)	23/23(100%)
i	5;7	M	2.8	87/92(94.57%)	19/19(100%)	15/15(100%)
j	4;11	F	3.8	255/290(91.72%)	29/29(100%)	65/73(89.04%)
k	3;9	M	2.6	71/73(97.25%)	24/24(100%)	26/26(100%)
Overall				2235/2311 (97.25%, *SD*=2.67)	330/330 (100%, *SD*=0)	583/620(94.03%, *SD*=2.90)

The mean percentage implementation of the correct nominative case is 97.26% (*SD*=2.67). These figures show that these children's performance on case marking is almost adult-like. This suggests that the few case-marking errors found among the children in the Leonard corpus are case spellout errors rather than Case assignment errors. As shown, the nominative Case assigner, the functional head I, is not absent from these children's syntactic representation.

The last problem for the feature-based theory is that the conservative counting does not include the fronted Wh-words or phrases as the instances of the C projection. It is generally assumed that the fronted Wh-words or phrases are accommodated in the specifier of CP. Therefore, they should be counted as instances of the C projection. However, Hegarty's conservative count only includes the inverted auxiliaries but not the fronted Wh-words or phrases in questions. In addition, Hegarty's conservative counting techniques cannot detect the asymmetry in these children's performances on Wh-movement and subject-auxiliary inversion.

It is found that the children with SLI in the Leonard corpus perform perfectly (100% correct) on Wh-movement but poorly on auxiliary inversion (only about 53% correct). In addition to their poor implementation of auxiliary inversion, these children are found to perform badly on tense marking (i.e. 53.87% correct for past tense marking on main lexical verbs) and agreement marking (i.e. 34.78% correct for the third-person, singular, present tense suffix *-s*). This suggests that these children have a deficit in the PF component of language faculty[3], which means they have substantial problems in spelling out certain grammatical features such as tense and agreement.

4 Conclusion

By showing the problems with Hegarty's conservative counting techniques in his featured-based theory, the current study argues that the children in the Leonard corpus do not have a deficit in their representation of functional categories. Moreover, based on these children's poor performance on tense marking, agreement marking and auxiliary inversion, this study further proposes that the children with SLI in the Leonard corpus have a PF deficit rather than a syntactic deficit.

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[3] According to Chomsky (2001), head movement, such as auxiliary inversion, is taken to be a PF operation.

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Development of answers and explanations to contextually demanding questions: A study of three- to nine-year-old Finnish children

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Abstract

This paper presents some findings about studies investigating how children's ability to answer pragmatically demanding questions and explain their correct answers develops between the ages of 3 and 9 years in Finnish children (Loukusa, 2007; Loukusa, Leinonen & Ryder, 2007; Loukusa, Ryder, & Leinonen, in press). In this paper we summarize the results concerning questions demanding processing of implicatures, routines and feelings. The results of these studies showed that the largest increase in answers to routine and implicature questions occurred between the ages of three and four. In feeling questions rapid development occurred between ages of three and five. After that development progressed more gradually until the age of eight when the children performed near the ceiling level in all of the question types. Giving explanations for correct answers developed gradually between the ages of three and nine which indicated that becoming aware of the information used in inference has a longer developmental timeframe.

1 Introduction

Communicating successfully calls for the ability to go beyond the information given linguistically. Development of pragmatic ability can be defined as children's progressing ability to use context in language comprehension and expression (Leinonen, Letts, & Smith, 2000). Children's ability to interpret the meaning that is not explicitly encoded in the linguistic expression begins to develop from an early age (e.g., Bezuidenhout & Sroda, 1998; Jaswal & Markman, 2001; O'Neill, 1996).

As children develop they become more able to utilise more diverse contextual information in their communication in a flexible way (Ryder & Leinonen, 2003). It can be shown that processing demands differ according to the pragmatic complexity of indirect utterances, and the child's performance is affected by these processing demands. In a study by Bucciarelli, Colle and Bara (2003), simple direct requests and simple indirect requests were equally easy to comprehend by children from 2;6 to 7 years. However, complex indirect utterances were more difficult for all age groups. Already young children have an ability to utilise contextual information in simple familiar situations, but they have difficulties in more complex tasks where they have to consider and connect information from different, more demanding and less familiar sources (Bezuidenhout & Sroda, 1998; Bucciarelli et al., 2003; Ryder & Leinonen, 2003).

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Ability to answer pragmatically demanding questions is dependent on many developmental factors. Linguistic ability makes it possible to understand linguistic information of an utterance and formulate a verbal answer. When utilising contextual information, a child needs the ability to pay attention to relevant factors (Buckley, 2003; Wilson & Sperber, 1988). An ability to operate and store information is essential, and development of memory is therefore one factor supporting the development of utterance comprehension (Gathercole & Baddeley, 1993; Wilson & Sperber, 1988). Inference can be seen as a cognitive process to connect information from different sources. It is an especially important ability when deriving an implied meaning of an utterance, as shown by studies about text comprehension in children (Cain & Oakhill, 1999; Oakhill & Yuill, 1986). In the interpretation of utterances children's own world knowledge and beliefs play an important role. Over time, children gradually increase their world knowledge, which they are able to utilise when comprehending later utterances (Donaldson, 1992). In interpretation of indirect utterances, also mind-reading ability is needed which is considered to be an ability to infer one's own and other's beliefs, intentions and emotions (Baron-Cohen, 2000). In general, the basic understanding of mind develops in children between the ages of three and five years (Wellman, Cross, & Watson, 2001; Wellman & Lagattuta, 2000), which is the same age when the development of pragmatic comprehension progresses actively (e.g., Bucciarelli et al., 2003; Ryder & Leinonen, 2003).

There may be situations where a child understands an utterance but he/she cannot express why or how he/she knows it. Even if the ability to explain is a verbal activity, in order to give a relevant explanation child has to use many cognitive abilities, for example, an ability to distinguish between action and intention and between pieces of evidence and conclusion (Donaldson, 1986). By studying children's spontaneous language use it has been found that children occasionally start to explain their own inferences as early as just before the age of 3 years (Bartch & Wellman, 1995). Even if 3-year-old children sometimes realise that mental states exist in their own and others' minds, the ability is not fully developed and young children lack the ability to generalise from this knowledge. Developmentally it is a long process to become fully aware of one's own processing in different situations (Donaldson, 1986; Letts & Leinonen, 2001). In a study by Donaldson (1986), it was found that although three-year-old children distinguished between cause and effect, it was only at the age of eight when they had the ability to use because and so when giving deductive explanations.

In this paper we present some findings of our earlier studies investigating how three to nine year olds Finnish children answer questions demanding processing of implicatures, routines and feelings and how they can explain their correct answers (Loukusa, 2007; Loukusa, Leinonen & Ryder, 2007; Loukusa, Ryder & Leinonen, in press). At this point we want to bring out that the above mentioned original papers contain also children's answers in different kind of question types, for example, in the study by Loukusa et al. (2007) we have investigated children's answers to implicature, reference assignment and enrichment questions of which only answers to implicature questions are summarized in this paper.

In our studies question answering is approached from a framework based on relevance theory (Sperber & Wilson, 1995). Relevance theory aims to explain how the hearer interprets speaker's meaning on the basis of contextual factors and it is based on the assumption that utterances usually have many possible interpretations that are compatible with the linguistic information. However, all of these interpretations are not equally likely to come to a hearer's mind at any one point, because comprehension is driven by a search for relevance, and the hearer therefore utilises only relevant contextual information when interpreting the meaning of an utterance. In our studies, the relevancy of the answers given by the children was assessed on the basis of relevance theory. Thus, here relevant not only means that an answer is on topic, but the answer was also expected to show that the child had utilised a part of the context that was relevant in relation to the question.

2 Method

2.1 Participants

210 normally developing Finnish children aged from three to nine years participated in the studies by Loukusa (2007) and Loukusa et al. (2007, in press). There were thirty children in each age group except 29 children in eight-year-olds and 31 children in nine-year-olds. Children's normal language development was verified by asking the children's parents to fill in a preliminary data sheet, where questions were asked about their child's developmental history and by using the Boston Naming Test (Kaplan, Goodglass, & Weintraub, 1983; Laine, Koivuselkä-Sallinen, 1997) and the auditory association subtest of the Illinois Test of Psycholinguistic Abilities (ITPA, Blåfield & Kuusinen, 1974; Kirk, McCarthy, & Kirk, 1968).

2.2 Material

The children were asked questions based on pictures, short verbal scenarios and short stories. In this paper we summarize results of answers to questions demanding processing of implicature, routine and feeling. In addition we summarize results about how children succeeded to explain their correct answers.

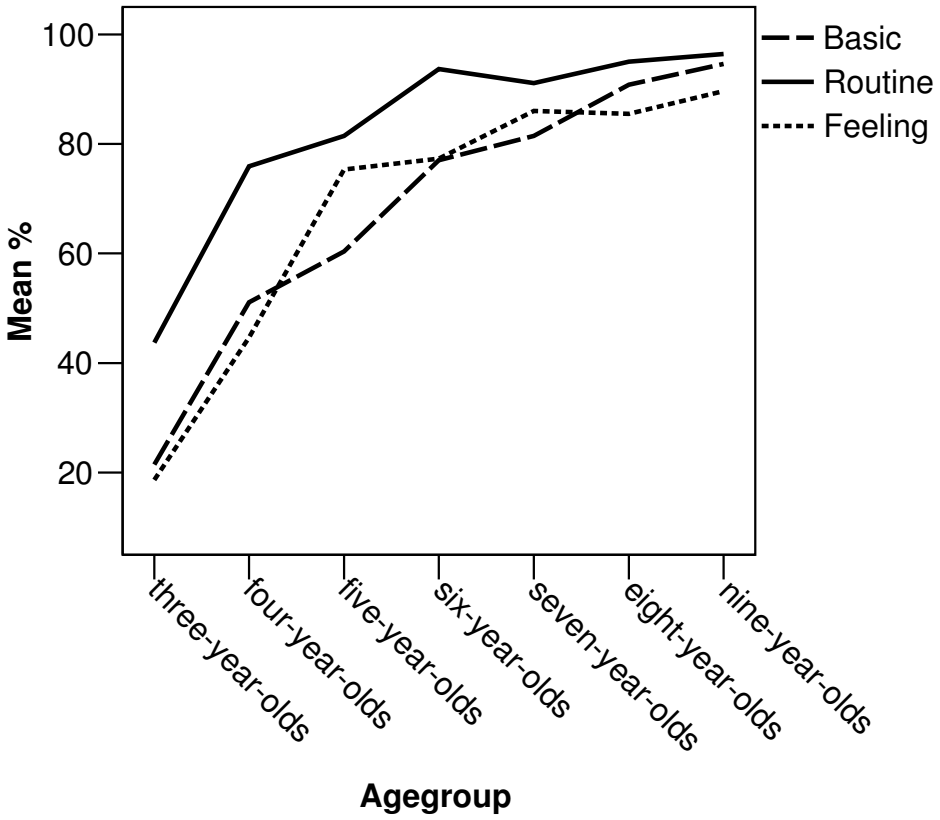
Implicature questions required the child to connect world knowledge and the given context in order to reach the intended meaning. Routine questions were otherwise similar to implicature questions, but were based on very familiar everyday context, which may lead to automatic accessing of routine answers. Feeling questions targeted the feelings of a character in the scenario. (See more information and examples of these question types in Loukusa et al., 2007, in press.)

3 Results

The results of our studies (Loukusa, 2007; Loukusa et al., 2007, in press) indicated that the greatest increase in correct answers occurred between the ages of 3 and 5. After that development progressed more gradually.

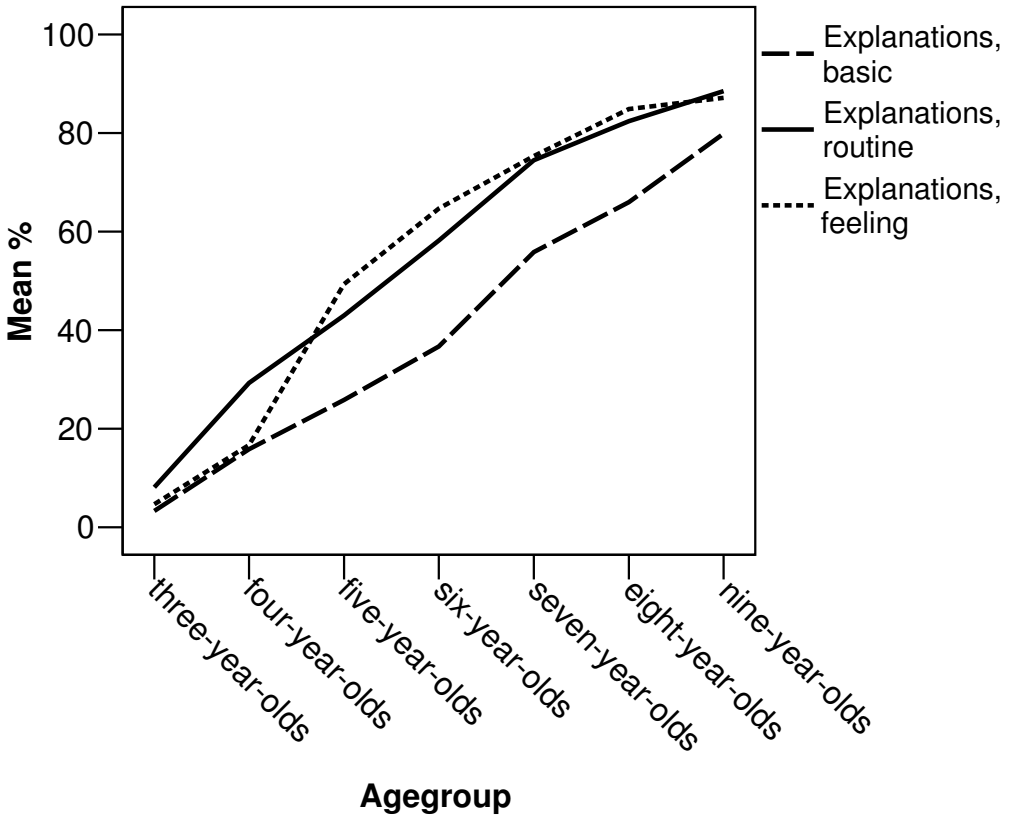
Our studies have shown that from the age of five onwards 80% of the answers were correct for routine questions; from the age of six to seven onwards 80% were correct for feeling questions and from age seven onwards 80% were correct for implicature questions (Figure 1).

Figure 1. Correct answers as a function of question type and age.



The children who gave correct answers were not always able to provide adequate *explanations* for their answers. In this study, children were fairly competent (> 80%) at explaining correct routine and feeling answers by the age of eight and implicature answers at the age of nine (Figure 2).

Figure 2. Correct explanations as a function of question type and age.



The relationship between correct answers and correct explanations was compared. It was apparent that there was a difference in the relationship between feeling answers and feeling explanations compared to the relationship between answers and explanations to routine and implicature questions (compare Figures 1 & 2). Children over the age of five had as many correct explanations for feeling questions as for routine questions. However, because there were many more correct routine answers than feeling answers, the proportion of correct explanations was greater for feeling questions than routine questions.

4 Discussion

As expected, compared to other question types routine question was the easiest question type so familiarity of context had a significant effect on young children's ability to answer questions (Loukusa et al., in press). Thus, even though young children can already perform in routine type indirect questions, through development they also become able to integrate and manipulate contextually relevant information in order to answer more demanding questions.

In our studies (Loukusa, 2007; Loukusa et al., 2007, in press) the largest increase in correct answers in answers to routine and implicature questions was seen between the ages of three and four, while for feeling questions this rapid development continued until the age of five. This remarkable developmental phase in the comprehension of contextual meanings may be related to the development of other functions at that age, such as the development of working memory (Gathercole & Baddeley, 1993), the development of inferencing skills (Bucciarelli *et al.* 2003), the ability to direct attention (Buckley, 2003), and the ability to

understand the mind of others (Wellman & Lagattuta, 2000). Between the ages of three and four children gain many new experiences and thus their world knowledge increases, which directly affects their ability to derive meanings from context (Milosky, 1992).

Although some of the younger children were able to explain a few of their answers correctly, it takes many years for the child to become properly aware of the information that he/she has utilised in the comprehension of an utterance, and to be able to verbalise this information (Loukusa, 2007; Loukusa et al., in press). Becoming aware of the processes involved in providing an answer requires metacognitive abilities showing again how cognition is connected with the development of pragmatic comprehension.

The relationship between feeling answers and feeling explanations was different from that between answers and explanations for routine and implicature questions (see Loukusa, 2007; Loukusa et al., in press). Children were more aware of the information they had used when deriving answers to feeling questions compared to the routine and implicature questions. Children aged five and more had as many correct explanations for feeling questions as for routine questions. Because there were many more correct routine answers than feeling answers, the proportion of correct explanations was greater for feeling questions than for routine questions. This meant that children were more aware of the information they had used when deriving feeling answers. One explanation for this could be that in everyday life, children have more experience of explaining feelings since they are often asked to explain reasons for their own feelings (e.g. "Why are you angry?"), and parents also quite often verbalise reasons for feelings in their everyday speech.

5 Conclusion

Developmental changes in answering questions indicate children's increasing ability to use more complex contextual information in comprehension process. The becoming aware of the information used in making inferences is a gradual process occurring between the ages of three and nine and for some children development still continues after the age of nine.

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Mutual Exclusivity in the Intermodal Preferential Looking Paradigm

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Abstract

Infants are argued to use a 'mutual exclusivity' bias to attach novel object labels to name-*unknown* objects, rather than name-known objects (Markman, 1989). In an intermodal preferential looking experiment with 22.5-month-old infants, stimulus repetition was critical for observing mutual exclusivity. On the first occasion that a novel label was presented with a name-known and name-unknown object, looking behaviour was unsystematic. Upon re-exposure to the same stimuli, the infants looked preferentially at the name-unknown object *prior* to the re-presentation of the novel label. These findings suggest a powerful memory mechanism for novel labels, enabling mutual exclusivity to emerge across multiple exposures to potential referents.

1 Introduction

During the second year of life, it is claimed that infants use a word-learning strategy called *mutual exclusivity* (e.g. Halberda, 2003; Markman, 1989), where an infant will not accept second names for name-known objects. An infant may see, e.g., a shoe and a key, but only know the word 'shoe'. If the infant hears 'key', they may decide it refers to the key by ruling out the shoe as a potential referent. There is disagreement over the nature of the underlying mechanism and the onset of the strategy (e.g. Markman, Wasow, & Hansen, 2003; Merriman, Marazita, & Jarvis, 1995).

Many investigations of mutual exclusivity have used object selection procedures (e.g. Merriman & Bowman, 1989). Halberda (2003) measured looking time, argued to be a more sensitive measure of comprehension. However, there are flaws with Halberda's study, such as potential reinforcement and item effects, and a lack of appropriate controls. Our aim is to establish whether infants will display mutual exclusivity as a looking behaviour in a well-controlled experiment. A further aim is to explore the role of processing factors. Increased stimulus exposure across trials may facilitate the use of mutual exclusivity.

2 Method

2.1 Participants

Thirty 22.5-month-olds (mean age 675 days; range 665 - 691 days; 17 male, 13 female) contributed data. A further 11 infants participated but were excluded due to experimenter error (2), fussiness or failure to complete study (8), or parental interference (1).

2.2 Stimuli

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Twelve name-known images (e.g., ball, car), twelve name-unknown images (e.g., can opener, anchor), twelve familiar labels (corresponding to name-known images), and four novel labels (*blick*, *gop*, *meb*, *wug*).

2.3 Design and Procedure

Twenty-four 6s trials each presented a name-known object and a name-unknown object within in an intermodal preferential looking task (see Golinkoff, Hirsh-Pasek, Cauley, & Gordon, 1987). There were three trial types: Familiar, where the name-known object was labelled; Novel, where a novel label was presented; Control, presenting a neutral phrase ("Look at that"). The onset of the label was at 2633ms, and trials were split into 3s pre- and post-naming phases.

The experiment was divided into two halves of 12 trials, each presenting different sets of labels and images. Each half was divided into two blocks of six trials. During the first block in each half, two trials of each type were presented in a randomised sequence (see Figure 1). The second block presented the same sequence of trials as the first (counterbalancing side of presentation). Thus, each trial had an original and repeat presentation. The labelled object for a given pair of images was counterbalanced across infants. Parents completed the Oxford Communicative Development Inventory (Oxford CDI; Hamilton, Plunkett, & Schafer, 2000) to check infants' comprehension of the familiar images. Infants' looking direction was coded every 40ms using offline coding software.

Figure 1. Example of a trial block

Trial type	Image pair		Label
Control			**"Look at that"**
Novel			**"Look at the *meb*"**
Control			**"Look at that"**
Familiar			**"Look at the *ball*"**
Novel			**"Look at the *wug*"**
Familiar			**"Look at the *key*"**

3 Results

The dependent variable was the percentage proportion of looking to the name-known image (total looking time to name-known image divided by total looking time to both images).

3.1 Preliminary analysis

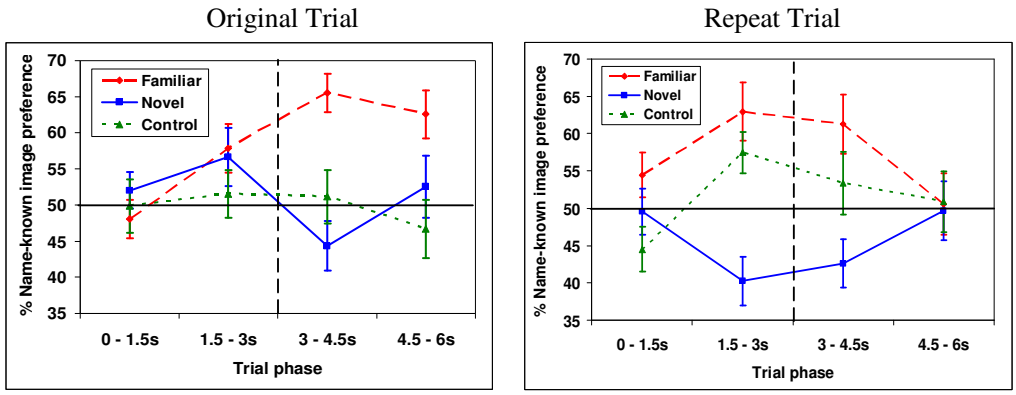
Initial analyses comparing pre- and post-naming phases found an interaction between trial type, trial repetition and naming. For the repeat trials there were significant effects of trial type for the *pre-naming* phase and the post-naming phase. Thus, a more fine-grained analysis of changes over time was conducted.

3.2 Main analysis

Trials were divided into four 1.5s phases; trial phase was entered into an ANOVA with trial type, trial repetition, experiment half, and sex. There were no effects of experiment half or sex, so the ANOVA was collapsed across these factors. There were main effects of trial repetition, $F(1, 29) = 4.2$, $p < .05$, and trial type, $F(2, 58) = 8.0$, $p < .005$. There were interactions between condition and trial phase, $F(6, 174) = 3.0$, $p < .01$, and trial type, trial phase, and trial repetition, $F(6, 174) = 3.4$, $p < .005$ (see Figure 2).

For original trials, there were no significant differences to chance in novel label and control condition. For the familiar label condition there was a name-known image preference for the pre-naming 1.5 - 3s phase ($p < .05$), and the post-naming 3 – 4.5s ($p < .001$) and 4.5 – 6s ($p = .001$) trial phases. For repeat trials, there were no significant differences to chance for any condition for the 0 – 1.5s phase; for the 1.5 – 3s phase, there was a name-known image preference in the familiar label ($p < .005$) and control ($p < .025$) conditions, but a *name-unknown* image preference in the novel label condition ($p = .005$). These preferences were maintained during the 3 – 4.5s post-naming phase in the familiar ($p < .01$) and novel label ($p < .05$) conditions.

Figure 2. Preference for the name-known image over time as a function of trial type



4 Discussion

Infants are on-task in the familiar label condition for both original and repeat trials. Yet, in the novel label condition, infants do not display a significant preference for the name-unknown object until a trial is repeated. Although this preference occurs *prior* to naming on the repeat trials, this effect must be driven by hearing the novel label on the original trial, as infants respond differently on the repeat trials in both the familiar label and control conditions. This *emergent* mutual exclusivity response may be due to infants remembering that the novel label was previously presented with the same pair of images.

5 Conclusion

These findings suggest a powerful memory mechanism for novel labels, enabling mutual exclusivity to emerge across multiple exposures to potential referents.

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The relationship between frequency discrimination skills and language development in 5-7 year olds

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Abstract

Research with infants has shown their auditory processing abilities predict subsequent language development. However, there are few studies that have investigated auditory processing skills of primary school-age children. This paper reports on a study that focused on a child-friendly method for testing auditory processing skills of children aged from 5-7 years. 36 children (M = 71.9 months) were tested on their discrimination of tone pairs that varied in frequency. Two pairs of tones were presented; one pair contained two 'same' tones (400 Hz) and the other pair contained two 'different' tones, one tone at 400 Hz and the other with a different frequency, ranging from 448 to 402 Hz. The tones were attributed to two animated frogs that appeared on a touch screen. The child was asked to identify which frog made the 'different' sound. Forward and backward masking conditions were included. The results showed variation in auditory processing skills, but differences between forward and backward masking were not significant. Significant correlations were found between auditory processing thresholds and expressive and receptive language. The findings suggest that children with poor frequency discrimination skills in the 5-7 year age range may be at risk for poor language outcomes.

1 Introduction

1.1 Language and auditory processing

Speech perception requires phoneme identification and involves rapid discrimination of formant frequencies in accordance with the rapidly changing articulations that occur in ongoing speech (Bailey & Snowling, 2002). A link between auditory processing and language proficiency has been established by a number of researchers (e.g., Benasich & Tallal, 2002; Saunders, Protopapas, Cangiano, Salz & Cerles 1998; Tallal, 2003; Tallal & Piercy, 1973). Some of this research has focussed on the auditory processing skills of individuals with specific language impairment (SLI). As argued by Benasich and Tallal (2002), crucial to language development is the ability to process and classify two or more rapidly changing auditory signals presented within a brief time frame. The temporal and spectral cues are important for discriminating the sounds of a language, and in order for language to develop, a child must be able to discriminate and categorize the sounds of their language (Kuhl, 2004).

Benasich and Tallal (2002) conducted a longitudinal study to examine the performance of infants on brief, rapidly presented auditory stimuli; the infants either had no family history of language impairment or a positive family history. Infants were initially assessed at 6-9 months

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of age and followed up at 12, 16, 24 and 36 months of age. At time 1, auditory processing thresholds were measured using a forced-choice procedure: the infant was trained to associate an auditory tone sequence with a head-turn in one direction and another auditory tone sequence with a head-turn in the opposite direction. The results of the study showed that, regardless of family history, rapid auditory processing skills in infancy were the best predictor of language outcomes at age three. That is, the children who were better able to process brief, rapidly presented tones in infancy demonstrated better language development. In contrast, children who were poor at processing brief, rapidly presented tones, demonstrated poor language development at age three.

Auditory processing has also been investigated in children with SLI. SLI is identified if a child's language is below the normal range on a standardised language assessment but performance is in the normal range on tasks measuring nonverbal IQ in the absence of hearing deficits or known neurological or social developmental delay. Tallal and Piercy (1973) suggested that SLI stems from a deficit in perceiving the acoustic distinctions among successive brief sounds in speech, termed a rapid auditory processing deficit.

Tones are typically used as stimuli in auditory processing tasks as they convey the complex frequency and temporal characteristics of speech sounds, but have no semantic interpretation as in syllables - such as /ba/ and /pa/. Using tone stimuli, Tallal and Piercy (1973) compared the auditory processing abilities of children with and without SLI on a temporal order (auditory repetition) task and a discrimination task. In the auditory repetition task children were asked to repeat the sequence of tones, separated by interstimulus intervals (ISIs) of differing durations. In the discrimination task children indicated whether two tones presented were the same or different by pressing corresponding buttons on a box. When the ISIs exceeded 305ms, that is, when there was a long time gap between the tones, the children with SLI performed equivalent to the control children. However, when the interval between the tones was decreased, the performance of children with SLI was significantly impaired on both tasks. The children were asked to discriminate along one dimension (frequency) whilst the tones were presented rapidly (rapid auditory processing). That is, rapid auditory processing deficits, auditory discrimination deficits, or a combination of both, could explain the findings (McArthur & Bishop, 2004a; Wright et al, 1997).

Hill, Hogben and Bishop (2005) examined frequency discrimination thresholds in children with and without SLI and retested a subset of the children with SLI and of the age-matched controls 42 months later. At time 1 the children with SLI had poorer frequency discrimination thresholds than age-matched controls. Frequency discrimination abilities improved in both groups between the two testing sessions but, as at time 1, the children with SLI performed significantly worse on the frequency discrimination task than controls. Thompson, Cranford and Hoyer (1999) also examined developmental trends in frequency discrimination skills among 5 to 11-year-old children and in a group of adults. Most of the 5-year-olds were unable to learn the task. The 7-year-olds performed significantly worse than the 9 and 11-year-olds but the 9- and 11-year-olds performed equivalent to adults. The results could be interpreted in two ways: either the skills required to discriminate tones are not reached until the age of 7 years, or the demands of the task were not sensitive enough to detect discrimination abilities of children below the age of 7 years.

The study raises the issue of whether reliable results can be obtained from young children with such complex psychophysical tasks. In a previous study we tested 49 children aged 4 and 5-years (mean age 54 months) on tone discrimination and syllable discrimination tasks (Bavin, Grayden, Scott & Stefanakis, under review). We repeated the tasks and found significantly high correlations between the two sets of results, indicating reliability. However, children gave verbal responses ('same' or 'different') which has disadvantages for children with poor language skills.

There is other evidence that young children can be engaged in auditory processing tasks. A recent study by Boets, Wouters, van Wieringen and Ghesquiere (2006) examined the feasibility of administering complex psychophysical tasks to preschool children. Auditory processing skills were examined in two groups of 5-year-old children, one with a high familial

risk and one with a low familial risk for dyslexia. Psychophysical thresholds were estimated using a forced-choice adaptive paradigm embedded within a computer game. The authors report reliable results, and that performance on tasks of frequency modulation and tone-in-noise detection were significantly related to phonological awareness skills.

A variation in assessing auditory perception skills is using forward and backward recognition masking. The tasks require participants to discriminate pitch differences when the target signal is preceded (forward mask) or followed (backward mask) by a comparison signal (the auditory mask; Massaro & Burke, 1991). Sutcliffe and Bishop (2005) found that adults and children had more difficulty with backward masking than forward masking. In one study, using touch screen responses, they examined frequency discrimination in children aged 6 and 8 years and a group of adults. Each tone pair contained either 2 comparison tones (400Hz) or 1 target tone of a higher frequency and 1 masking tone (400Hz). The task was to select the pair containing the target tone. Lower thresholds were found for forward than backward masking. The 6 year-olds performed significantly worse than the 8 year-olds and adults on the backward masking task, but no significant differences were found between the 8 year-olds and adults. That is, adult-level performance on backward masking tasks seems to develop later than adult-level performance on forward masking tasks (Buss et al., 1990).

1.2 The study

Auditory perception skills in infancy have been shown to be predictive of language outcome at 3 years of age (Benasich & Tallal, 2002). However, it is of value to investigate concurrent associations between auditory processing skills and language in the early school years. A study was designed to compare frequency discrimination abilities for forward and backward masking tasks in children aged 5-7 years and to investigate the relationship between auditory processing skills and language. Based on Sutcliffe and Bishop (2005), it was hypothesised that children's frequency discrimination thresholds would be lower for forward masking than for backward masking. It was also hypothesised that children with better (lower) frequency discrimination thresholds would score higher on a language assessment than those with poorer (higher) frequency discrimination thresholds.

The role of nonverbal ability in auditory processing has been investigated in only a few studies, with inconsistent findings. McArthur and Bishop (2004b), for example, found non-significant differences on nonverbal IQ between groups with poor and good frequency discrimination. In contrast, Deary (1994) found a small but significant relationship between frequency discrimination and both verbal and nonverbal performance scores. We included a matrix reasoning task to investigate this further.

2 Method

2.1 Participants

Data are reported for 36 children aged between 5 years, 2 months and 7 years, 3 months. There were 18 males (*M* age = 72.28 months, *SD* = 4.16) and 18 females (*M* age = 71.61 months, *SD* = 6.80). All children were recruited through primary schools in the regional towns of Maryborough and Ballarat, Australia. An additional four children participated in pilot testing of the stimuli and procedures. Data from six other children were excluded from analysis as their results on the auditory processing tasks indicated chance level performance:

at several levels of tone difference these children discriminated between the tones sometimes but not consistently. None of the children had been identified as language impaired.

2.2 Measures

We included a hearing task on the day of testing to ensure all children could hear the stimuli and to familiarise them with listening to sounds through headphones. Tones of 500 Hz, 1000Hz, 2000Hz and 4000Hz were presented, first to the left ear and then the right ear, in 10dB steps from 60dB HL to 20db HL. Hearing within the normal range required a 20dB hearing level at all tested frequencies.

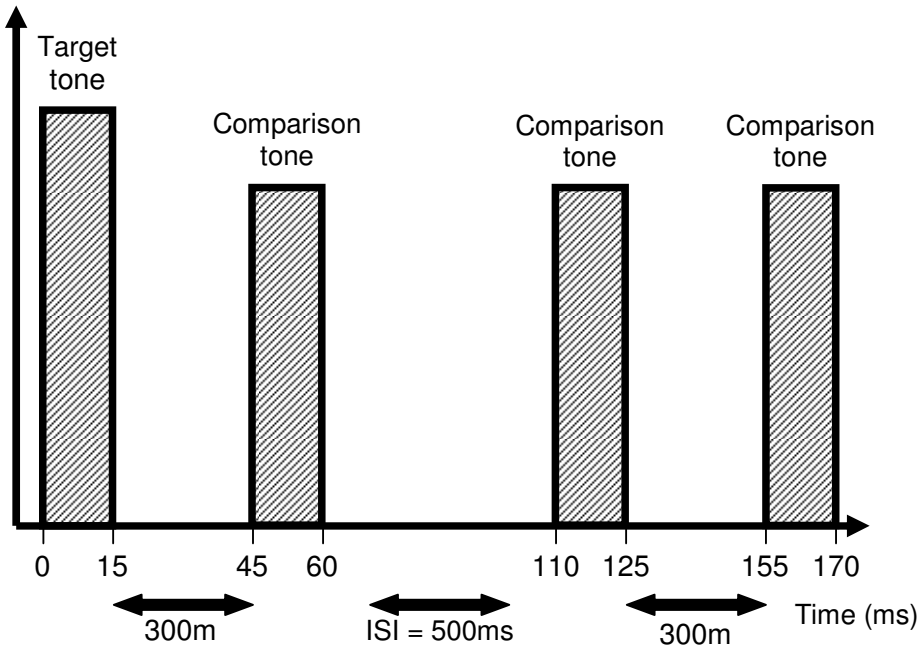
Two auditory processing tasks were used: a backward masking task and a forward masking task. In these two tasks four tones were presented (two pairs). The tasks were used to identify if children could detect a tone difference more easily if the high-pitched tone came before a low-pitched tone (backward masking) or if it came after the low-pitched tone (forward masking).

Backward masking task. In each trial, the target tone came before the comparative tone, in either the first tone pair or the second tone pair. The three comparison tones of each trial were 400Hz and the target tone was a higher frequency tone. The tones were synthesized electronically and involved a 400Hz – 400Hz tone pair and a higher frequency – 400HZ tone pair. Thus one tone pair contained two comparison tones of 400Hz, and the other contained one tone of a higher frequency and one comparison tone of 400Hz. In each pair, the duration of the tones was 150ms. Within each pair, the time between the two tones in a pair, the ISI, was 300ms. The two tone pairs were separated by 500ms (see Figure 1). The participant was required to select the tone pair that contained the higher frequency tone (the pair was referred to as 'beep-bow'). The higher frequency tone ranged from 448 to 402 Hz, beginning at 448Hz for easy discrimination and adaptively altered to become increasingly more difficult to discriminate.

Forward masking task. This task was identical to the backward masking task except the presentation order of the comparison and target tone was reversed so that the target tone came after the comparative tone in either the first or second tone pair. (The special pair to identify was referred to as 'bow-beep').

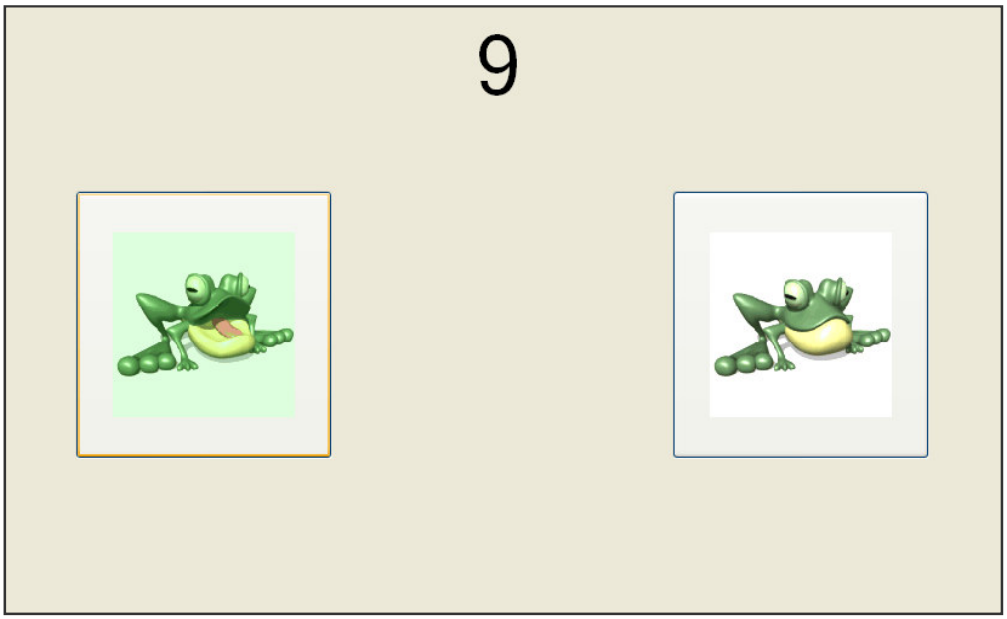
An adaptive transformed up-down procedure as described by Levitt (1971) was used. When an incorrect response was made the frequency of the different tone was increased; when a correct response was made the frequency of the different tone was decreased. The trials started with the different tone at 448 Hz. Changes were made in steps of 16Hz then 8 then 4, 2 and 1 Hz. The experiment was set up to present a fixed number of trials for each test in order to minimise differences in learning effects between children.

Figure 1. Timeline illustrating the onset and offset of stimuli in the backwards masking task with the target tone presented in the first tone pair. The height of the bars is indicative of frequency, with the target tone being higher in frequency.



For each trial, two cartoon frog images were presented on the computer screen (see appendix 2). They opened their mouths in turn, in synchrony with the tone pairs of each trial. This enabled a spatial and visual correlate of temporal order to assist the children in selecting the tone pair containing the target tone. The choice of which cartoon frog 'uttered' the tone pair with the target tone was chosen randomly by the computer for each presentation. Children were required to select which of the two animated images made the different tone (higher pitch sound) by touching it on the touch screen. Correct responses were visually and audibly reinforced with a change to the colour of the background for the frog (-> green), a friendly animated and audible croak and an advancement of a counter on the screen (See Figure 2). Incorrect responses were indicated with a red background and no advance of the counter.

Figure 2. Screen shot of the frequency threshold estimation task. With a correct response the counter advances. With an incorrect response the counter does not change.



All auditory tasks were administered through an external sound box for clear and consistent audio output. The sound box was a 24-bit Creative USB Sound Blaster (model SB0300) connected to a set of Digitor headphones (model C4116). The headphones were calibrated to 80 dB using a Bruel and Kjaer Type 2239 sound level meter for the forward and backward masking tasks and calibrated to 60 dB, 50 dB, 40 dB, 30 dB and 20 dB for the hearing task.

Language. The Clinical Evaluation of Language Fundamentals – Fourth Edition (CELF-4; Semel, Wiig & Secord, 2003) was used to measure the children's language. There are six core subtests; three provide a receptive language score and the other three provide an expressive language score

Non-verbal. The Matrix Reasoning subtest from the Wechsler Preschool and Primary Scale of Intelligence – Third Edition (WPPSI – III; Wechsler, 2002) was used to assess children's non-verbal skills.

2.3 Procedure

Testing was conducted in a quiet room in each primary school. Each child participated in two sessions of testing that lasted approximately one hour each. The expressive language subtests were audio-taped so that scoring could be completed later. In Session 1, the hearing task was administered and some of the subtests from the CELF-4 as well as an auditory processing task (forward or backward masking). In Session 2, approximately 1 week later, the other subtests from the CELF-4 were administered, the remaining frequency discrimination task (forward or backward masking task) and the matrix reasoning task. Half the children were given the forward masking task in the first session and the backward masking task in the second session; the other half were given the backward masking task in the first session and the forward masking task in the second.

For the frequency discrimination tasks the child sat in front of the touch screen wearing headphones, and was instructed to listen to the sounds. The test began when the child was attentive; the experimenter pressed a key on the key-board to start the trials. Familiarisation trials were used in each condition to ensure that the child understood the tasks. In the first set of familiarisation trials for each condition, 10 items were presented and the experimenter

performed the trials alongside the child. In the second set, 20 trials were included and the experimenter provided verbal feedback and guidance to the child. Following familiarisation the 60 test trials began. The task took approximately 10 minutes. The task was repeated to determine test-retest reliability of the threshold results.

3 Results

Auditory frequency discrimination thresholds were measured in Hertz under forward and backward masking conditions. The program generated the average threshold since the 6th change in frequency (reversal) as well as the average threshold since the 8th reversal. Correlations between average threshold values since the 6th and 8th reversal data on both forward and backward masking tasks were extremely high, with Pearson's product-moment correlation coefficients of 1.0 for forward masking and 1.0 for backward masking. Because of the fixed number of trials in each condition, 15 participants did not reach the 8th reversal on the forward masking task, and 3 participants did not reach the 8th reversal on the backward masking task. Thus we used the average threshold since the 6th reversal data in the analysis.

A Pearson product-moment correlation was conducted to determine reliability of the two testings for each condition. Auditory threshold estimates were found to be reliable under both forward ($r = .83$, $p < .001$) and backward ($r = .82$, $p < .001$) masking conditions. As the best level of performance for each participant was of interest, their lowest threshold was used for each condition. These are shown in Table 1, which also indicates whether forward or backward masking was tested in the first or second session.

Standardised indices of skewness and kurtosis of these threshold estimates fell within $z \pm 2.57$ ($\alpha = .01$) indicating that they were normally distributed. Preliminary analyses on the data revealed no gender or age effects and thus these variables were omitted from further analyses. An Analysis of Variance was conducted to compare frequency discrimination thresholds for the masking conditions, with test order as the between-subjects variable. While the means of the lowest frequency discrimination threshold values were higher on the backward masking than the forward masking task, the results of the analysis showed no significant effect of masking condition (F (1, 34) = 3.495, $p = .07$, $\eta^2 = .09$) and no significant interaction with test order (F (1, 34) = .833, $p = .368$, $\eta^2 = .024$).

Table 1. Descriptive Statistics of the Frequency Discrimination Thresholds for Forward and Backward Masking (lowest thresholds)

Auditory processing	*Order of testing*	*M*	*SD*	*Range*
Forward masking				
	1st	445.69	51.29	404.0-588.4

Backward masking	2nd	447.30	42.49	402.5-527.7
	1st	452.91	45.50	403.4-567.8
	2nd	468.30	50.19	405.3-559.9

The second set of analyses tested the hypothesis that language scores would be significantly associated with frequency discrimination thresholds. Table 2 presents the means and standard deviations of the standard scores for Receptive and Expressive language, as measured by the CELF-4, and non-verbal performance, as measured by the Matrix Reasoning task of the WPPSI-III. Correlations between auditory thresholds and language measures were computed to examine the association between auditory discrimination ability and language skills (CELF-4 Receptive and Expressive) and non-verbal skills (Matrix Reasoning).

Table 2. Standard Scores for Receptive Language and Expressive Language on the CELF-4 and the Matrix Subscale of the WPPSI-III

CELF-4	*M*	*SD*
Receptive language	100.61	14.33
Expressive language	103.42	10.40
WPPSI-III		
Matrix reasoning	10.90	2.77

In line with our predictions, there was a significant negative correlation between Receptive Language and the forward and backward masking threshold values, $r = -.35$, $p = .04$ and $r = -.41$, $p = .01$ respectively. There was also a significant negative correlation between Expressive Language and the forward masking threshold values, $r = -.38$, $p = .02$, and between Expressive Language and the backward masking threshold values, $r = -.41$, $p = .01$. That is, those children with lower frequency discrimination thresholds scored higher on receptive and expressive language.

There was also a significant correlation between Matrix Reasoning and forward masking, $r = -.37$, $p = .01$, backward masking, $r = -.61$ $p = .01$. Matrix Reasoning also correlated significantly with Expressive Language, $r = .41$, $p = .01$, but not Receptive Language, $p = .064$.

A multiple regression analysis was conducted to determine the contribution of forward masking, backward masking and Matrix Reasoning in predicting Expressive Language scores. The R^2 change was 24.6%, $p = .03$. That is, 24.6% of the variance for Expressive Language was contributed by children's auditory processing thresholds and their scores on Matrix Reasoning. However the squared semi partial correlations showed that most of the variance was shared; neither the .03 of variance contributed by forward masking or the .01 contributed by backward masking was statistically significant, and nor was the .04 for Matrix Reasoning. A second linear regression analysis was conducted to determine the contribution of forward and backward masking in predicting Receptive Language scores. The R^2 change was 19.4%, p

= .03. That is, 19.4% of the variance for Receptive Language was contributed by the auditory processing thresholds. Again, most of the variance was shared. Neither of the squared semi partial correlations was statistically significant (.02 for forward masking and .07 for backward masking).

4 Discussion

The hypothesis that frequency discrimination thresholds would be significantly lower on a forward masking task than on a backward masking task was not supported, although lower mean thresholds scores were found for forward masking and there was a medium effect size. The significant correlation found between the thresholds for the two conditions indicates that they tap into similar skills.

Hartley, Wright, Hogan and Moore (2000) found that adult-level performance on backward masking tasks develops at approximately 12 years of age while adult-level performance on forward masking tasks develops at 7 to 9 years of age. Sutcliffe and Bishop (2005) found significant differences for 6 year olds on forward and backward masking tasks. Since there is a great deal of variation in performance on frequency discrimination tasks, different samples can lead to different findings. Different experimental demands may also affect performance. Buss, Hall, Grose and Dev (1999) suggest that attentional factors may be more pronounced for backward masking tasks than for forward masking tasks. Thus it would be useful to investigate attentional factors in future studies.

A difference between Sutcliffe and Bishop's study and the current study is the method used. Sutcliffe and Bishop used the parameter estimation by sequential testing (PEST) procedure, which estimated the 75% correct point on the psychometric function (Taylor & Creelman, 1967). The rationale for adopting the adaptive Levitt procedure in the current study was that in pilot testing using the PEST, the algorithm seemed to hunt unsuccessfully for the 75% point and thus was not providing a precise estimate of the children's thresholds. A quick estimate by sequential testing (QUEST) procedure, which optimally targets discriminatory abilities by focussing on the range in which thresholds lie for individuals, would have been an alternative since it requires a smaller number of trials, 20 or 30 trials as opposed to 60, to reach a sufficiently precise threshold result. However, this would have involved preliminary testing to set a target range for individuals.

We hypothesised that children who performed better on the language measures included would have significantly better frequency discrimination thresholds. This prediction was supported. Thresholds for forward and backward masking tasks were negatively correlated with receptive and expressive language scores. That is, children with higher (poorer) thresholds had lower language scores and children with better auditory processing scores had better language scores. Together, the forward and backward masking abilities contributed significant variance to receptive and expressive language scores.

We also investigated whether non verbal performance, as measured by a matrix reasoning task, were associated with expressive and receptive language scores. Children's scores on this task were correlated with expressive language but not receptive language but, as shown in regression analyses, they contributed no significant unique variance. That is, differences in expressive language scores are not dependent on children's cognitive ability independent of their auditory processing abilities.

5 Conclusion

As found in previous studies, we found variability in auditory processing abilities. While most reports have been for adults or older children, the current study shows variability is also found in children who are beginning their formal schooling. Some previous studies have reported learning effects; however, we repeated each task in the same session and found no such effects. The correlations were high between the two testings, indicating reliability for our

measures. Nor did we find that for children of the age tested backward masking was significantly more difficult than forward masking.

The finding that frequency discrimination threshold values predict receptive and expressive language scores indicates that, even in the primary school years, auditory processing skills are related to language development. Auditory perceptual deficits might degrade the perception of the acoustic components of speech (Bishop, Carlyon, Deeks & Bishop, 1999). Given the importance of acoustic discriminations in conveying information in speech sounds, a reduced ability to discriminate frequency variations when forming phonological representations may continue to impede language development after infancy. The findings suggest that problems at the level of recognising and discriminating lower-level acoustic components may give rise to difficulties at higher level language processing. If children do not have the auditory processing skills to establish strong representations of language forms, it will affect their interpretation of the language they hear.

The procedure used in the current study was a significant improvement on much previous research. The use of visual material and touch screen responses kept the children attentive and focussed on the task. Sutcliffe and Bishop (2005) also used visual stimuli and a touch screen response. However, we believe the 'croaking' frogs in our study and the change in colours for a correct or incorrect response was an effective way of providing feedback, as was the counter showing the number of successful trials. These definitely helped maintain the children's interest and attention.

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Word Initial Clusters in Acquisition

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Abstract

In this paper, I study the acquisition of consonant clusters by testing the production of Greek-speaking children. Using a non-word repetition task, I tested the order of acquisition of word initial and word medial s-obstruent (sT), obstruent-obstruent (TT) and obstruent-sonorant (TR) clusters in 59 children. The data presented here shed new light on the nature of word initial clusters that violate the Sonority Sequencing Generalisation (sT and TT). The experimental results provide evidence against any analysis that assigns identical syllabic status to word initial sT and word initial TT, such as models of extrasyllabicity. For example, there is a clear tendency for sT clusters to be produced before TT clusters. Moreover, sT clusters were produced before TR by some children and after TR by others, in line with findings from other languages, while TT clusters were acquired later. A comparison of the initial clusters with their word medial counterparts also shows differential behaviour. Specifically, word initial TT was produced after word medial TT, while no such difference was found in sT acquisition. In the light of these findings, I explore an alternative analysis of initial cluster acquisition, based on Lowenstamm's (1999) initial ON hypothesis.

1 Introduction

Though consonant clusters have been studied extensively by acquisitionists (e.g. Barlow 1997; Demuth & Kehoe 2006; Freitas 2003; Jongstra 2003; Kirk & Demuth 2005; Pan 2005; Vanderweide 2005) the focus of the research on the word initial position has been on obstruent-sonorant clusters (TR) and s+consonant (sC) or s+obstruent (sT) clusters. Other word initial clusters, such as obstruent-obstruent clusters (TT) have been largely ignored. These clusters (for example *ft, xt*, which are attested in Greek) are problematic for phonological theory as they do not respect the regular rising-sonority pattern associated with the beginning of a syllable, a fact which has led phonologists to the assumption that these clusters are extrasyllabic. Word initial TT is generally assumed to share the same structure as sT clusters, which are problematic not only in phonological theory, but also in the study of language acquisition. Consequently, studying the acquisition of TT clusters alongside sT clusters could help us understand the behaviour of sT clusters. More generally, studying the acquisition of different clusters, for example word initial clusters alongside their word medial counterparts, can be a lot more insightful than studying the acquisition of a cluster type in isolation.

Following this reasoning, in order to examine the phonology of the clusters in question, I test the production of consonant clusters by children acquiring Greek as their first language.

The paper proceeds as follows: Section 2 contains a short discussion on the word initial clusters in question. Section 3 deals with the data collection and in section 4 general results are presented. In section 5 I proceed to the analysis; in section 5.1 some problems of the extrasyllabic theory are presented, and in section 5.2 I introduce an alternative proposal for the

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analysis of the data based on Lowenstamm's initial ON hypothesis. A short conclusion follows.

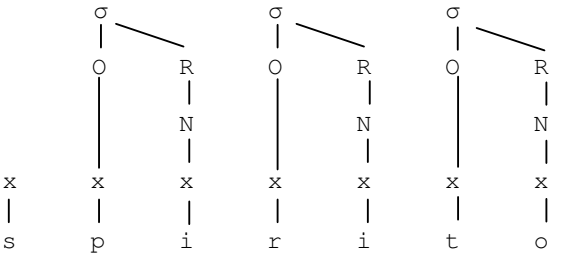
2 Word initial clusters

2.1 Word initial extrasyllabicity

Word initial sT clusters do not respect the Sonority Sequencing Generalisation (SSG, Clements (1990)) according to which sonority increases towards the syllable peak and decreases towards the edges. Initial sT breaks this generalisation, since the second member of the cluster has a lower (in the case of stops) or an equal (in the case of fricatives) sonority value when compared to the first member (*s*). This is the opposite of what the SSG dictates for onsets, namely that the second member of the cluster should be of higher sonority.

Faced with this inconsistency, several researchers have opted for a syllabification algorithm that leaves the s outside the onset: the *s* is extrasyllabic (e.g. Halle & Vergnaud (1980), Levin (1985), Steriade (1982)). An example of such a structure is given in (1) below.

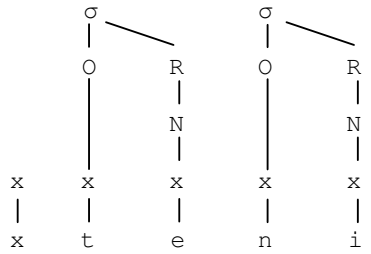
1) sT extrasyllabicity: Italian *sp∀irito* 'spirit'



Later in derivation the s may be linked to a constituent via some kind of adjunction rule. The desired effect is thus attained: at the first stage, the SSG is not violated, since the *s* is not linked to the onset, while at the same time eventual integration to the syllabic structure is achieved.

The same extrasyllabic structure has been proposed for word initial TT clusters (e.g. Rubach & Booij (1990), Steriade (1982)), which also violate the SSG.

2) TT extrasyllabicity: Greek *xt∀eni* 'comb'



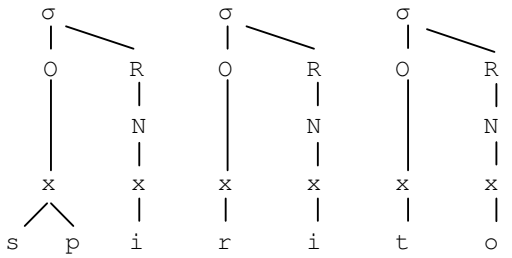
2.2 Order of acquisition

In first language acquisition, sT extrasyllabicity shows unusual behaviour: sT can be acquired after, but also before TR. Several studies have shown that children start producing

initial sT clusters after TR clusters (e.g. Chin (1996), Smith (1973)). However, other studies (e.g. Barlow (1997), Gierut (1999)) report that some children produce initial sT clusters first.

The variation in the order of initial sT-TR acquisition has long puzzled researchers and there have been a number of proposals developed in order to tackle this problem. For example, it has been suggested that the explanation for these data lies in the possibility that some children acquire branching onset structures (TR) before extrasyllabicity, while others acquire extrasyllabic structures first (Fikkert 1994). This assumes that extrasyllabicity and branching onsets (TR) are different, but equally marked structures, and the order of acquisition is therefore subject to variation. A different suggestion holds that, in acquisition, extrasyllabic clusters (and more generally consonantal sequences) may be structured like affricates (Barlow (1997), Lleó & Prinz (1997)). The relevant structure is shown below.

3) sT as an affricate: Italian *sp∀irito* 'spirit'



As seen in (3), sT clusters are represented as complex segments with a single timing slot. According to this approach, if a child does not structure sT like an affricate, s/he will acquire it after TR (i.e. as extrasyllabic, and therefore more marked). If, on the other hand, in a developing grammar, sT is structured like an affricate, it will be acquired before TR (on the assumption that complex segments are less marked than complex onsets). This optionality of structure, it is argued, can account for the variation in initial sT versus initial TR acquisition.

The acquisition of word initial TT clusters has not received much attention. From a theoretical point of view, an analysis that assumes extrasyllabicity of initial clusters of non-rising sonority will predict the same variation in TT versus TR acquisition as in sT versus TR acquisition. If TT is extrasyllabic like sT, and sT is acquired before or after TR, then TT is expected to be acquired before or after TR. Both analyses of sT versus TR acquisition outlined above (that extrasyllabicity can be acquired before or after TR, or that extrasyllabic clusters can be structured as complex segments in acquisition) would make the same prediction in this case. Moreover, word initial sT and TT are expected to be acquired at roughly the same time, under the assumption that they share the same (extrasyllabic) structure. Furthermore, a comparison of these clusters to their word medial counterparts can further test the theory. Though it is not clear from the theory of extrasyllabicity whether we should expect to find a difference between word initial and word medial sT, and if so, in what direction, whatever the relationship between initial and medial sT (i.e. whichever is acquired first), the same relationship should hold between initial and medial TT. Word initial and word medial TR, on the other hand, are expected to show no difference, since both positions involve the same structure (namely complex onset).

3 Method

3.1 Subjects

Fifty-nine monolingual typically developing Greek children were tested (21 boys and 38 girls). The age range was from 2;03 to 5;00, mean age 3;08. The experiments took place in four different nurseries in Crete (three in Rethymno and one in Iraklio) and, in the case of one child only, in a relative's house.

3.2 Materials and procedure

A non word repetition task was used. Novel, made-up words that had the desired structures were paired with pictures of novel animals. The child was asked to call the animals with their name.

The experiment consisted of six conditions: the first three conditions involved words with sT, TR and TT clusters in word initial position, and the remaining three conditions contained words with the same clusters in word medial position. Specifically, the following combinations of consonants were tested:

4) sT *sp, st, sk, sf, sx* TR *tr, kl, fl, xr, vr* TT *ft, xt, vð, ɾð, vɾ*

The construction of the nonwords used in the experiment followed the phonotactics of Greek. The words were either feminine or neuter nouns, with inflectional endings *-a* (feminine), *-i* (feminine or neuter), or *-o* (neuter). All words were bisyllabic, with a voiceless stop (*p, t* or *k*) as an onset for the non target syllable. The stimuli of the word initial conditions were the following:

5) sT *sp∀oki , st∀ipo, sk∀api, sf∀ito, sx∀ika*
TR *tr∀ika, kl∀ito , fl∀api, xr∀oki, vr∀ipo*
TT *ft∀ipo, xt∀ika, vð∀ito, ɾð∀oki, vɾ∀api*

The stimuli used in the word medial conditions were formed by reversing the syllable order. For uniformity, the target cluster always preceded the stressed vowel. This creates pairs such as *sp∀oki – kisp∀o*. Note that both members of these pairs are well-formed in Greek, which is characterised by a lexical accent system, restricted by the trisyllabic window (i.e. stress must fall in one of the last three syllables of the word).

The test items were arranged in three different pseudo-random orders so as to avoid sequence effects, and each of these orders was followed for a third of the children tested. There were four warm-up items without any clusters. Each of the selected children was tested individually in a separate room. Each session lasted about half an hour.

3.3 Transcription and coding

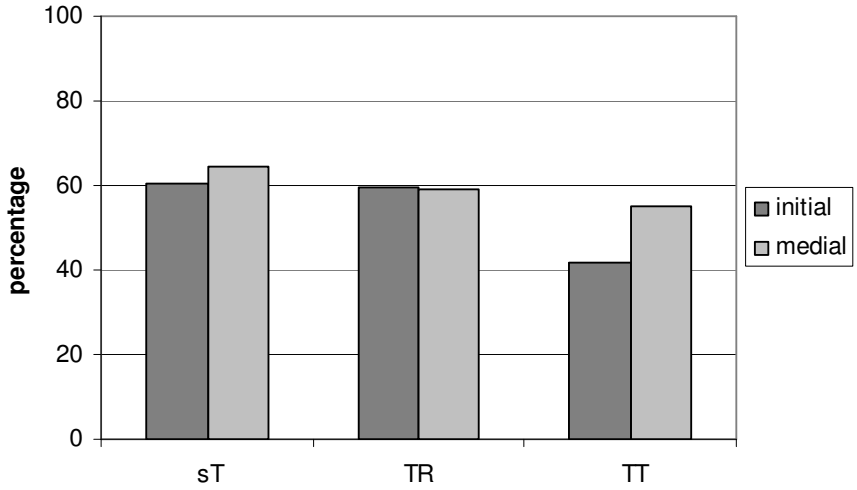
The responses were transcribed on-line by the experimenter. The sessions were also DAT recorded. The original transcriptions were then checked and amended off-line by the experimenter.

An independent transcription was made by a second transcriber, who is a Greek native speaker and is well-trained in doing transcriptions. Ten percent of the data were cross-checked. In particular, one-tenth of the responses of each child were transcribed. The consistency rate between the two transcriptions, focusing on the cluster data, was 96 percent.

4 Results

Figure 1 below contains the percentage of correct responses for each of the clusters in word initial and word medial position. Percentages were calculated on the basis of conflated raw figures. This method of calculation was possible because of the structure of the data: there was an equal amount and type of data for each child.

Figure 1. Percentage of correct responses for word initial sT, TR and TT clusters in word initial and word medial position for all children combined



A visual examination of the figure indicates that word initial TT is different from the other clusters. Detailed comparisons will be now presented for the cluster pairs that interest us, starting with word initial sT versus word initial TR.

The results for word initial sT and word initial TR are very similar, and no statistically significant difference was found (χ^2=0.034, p=0.859, DF=1) In addition, the table showing the number of correct responses for each child for the two conditions (initial sT and initial TR) is shown below (table 1). This organisation of the data allows us to look at the overall results in conjunction with the results of each individual child.

In table 1 the vertical dimension represents the number of correct responses in the word initial sT condition (from zero to five), while the horizontal dimension corresponds to the number of correct responses in the word initial TR condition (again from zero to five). One can therefore read out of the table the number of correct responses each child gave in the two conditions. For example, nine children (in the first row) gave no correct responses in the sT condition. Of these children, four (in the first cell starting from the left hand side) gave no correct responses in the TR position either, two (in the second cell) gave one correct response, two (third cell) two correct responses and so on. Children are divided into two groups, represented by the two sectors, divided by the diagonal: the top right sector contains children that performed better at TR, while the bottom left sector consists of children that performed better at sT. Children that fall on the diagonal performed the same in both conditions.

Table 1. Number of correct responses for word initial sT and TR for each child

		#TR					
		0	1	2	3	4	5
#sT	0	////	//	//		/	
	1	//			//	/	
	2	/		//		/	
	3	/	/	/	//	///	/
	4	/	/	///	////	//// /	////// ///
	5				//	///	////

A visual examination of the table shows that the top right and the bottom left sector are equally populated. No statistically significant difference was found between the two sectors (χ^2=0.095, p=0.758, DF=1). Moreover, the tally marks representing the children are scattered all over the table, showing that there is wide variation in performance. This includes children that performed almost adult-like in sT but badly at TR, and vice-versa, as well as children that were equally advanced in the two cluster types.

In a word initial TT versus TR comparison, figure 1 shows a considerable difference in the percentage of correct responses. Children performed better at the TR condition, and the difference is statistically significant (χ^2=18.337, p<0.001, DF=1). As before, the table containing the number of correct responses for each child for both conditions (initial TT versus initial TR) was drawn.

Table 2. Number of correct responses for word initial TT and TR for each child

		#TR					
		0	1	2	3	4	5
#TT	0	//// ////	//	/	//	/	/
	1		/	////	/	//	//
	2	/		//	//	///	/
	3			/	/	///	////
	4		/		///	////	///
	5				/	/	///

A visual examination of the table shows that the top right sector, corresponding to children that performed better at TR, is much more populated than the bottom left sector,

which includes children that performed better at TT. The difference is statistically significant (χ^2=14.400, p<0.001, DF=1). Several children performed well at TR and badly at TT, while the reverse pattern was uncommon.

The results for initial sT and l TT also differ significantly (χ^2= 19.866, p<0.001, DF=1), with children performing better in the sT condition.

Having examined the results in the word initial conditions, I now compare the results in the word initial position with those in the word medial position, starting with sT clusters. There was no difference between word initial and word medial sT (χ^2=1.225, p=0.268, DF=1) or word initial and word medial TR (χ^2=0.007, p<0.933, DF=1), while there was a statistically significant difference between word initial and word medial TT (χ^2=10.319, p<0.001, DF=1). As seen in figure 1, children's performance was better at word media TT.

To sum up, some children performed better at word initial sT than TR, while others performed better at TR than at sT, creating a balance in the overall results. Children's performance at word initial TT was systematically worse than at word initial sT and word initial TR. In a comparison with the word medial position, no difference was found in children's performance at sT (initial versus medial) and TR (initial versus medial), while there was a difference between word initial and word medial TT.

5 Discussion

5.1 Extrasyllabicity-problems

The results regarding initial sT versus initial TR were as expected. No overall difference was found between sT and TR clusters. These results were representative of the paradox that is found in the acquisition literature in other languages, with some of the children acquiring sT before TR and some following the opposite path.

These results, combined with the results for word initial TT and TR are particularly problematic for the extrasyllabic analysis of sT and TT. Extrasyllabicity would only be able to account for one set of data: either the TT versus TR, or sT versus TR. The TT versus TR results could be explained by an extrasyllabicity model according to which extrasyllabic structures are more marked than regular branching onsets and are therefore expected to be acquired later. This model would explain late acquisition of TT when compared to TR, but would fail to tackle the paradox of sT versus TR variation. On the other hand, the TT versus TR data would not be covered by the amended extrasyllabicity proposals discussed in section 2.2 – namely a) that extrasyllabicity can be acquired before or after branching onsets, and b) that in some children's grammar, extrasyllabic clusters are structured like affricates, and are therefore acquired before branching onsets. Any such proposal would cover the data it was designed to explain (sT-TR variation), but would have to answer the question of why the same variation is not found in TT versus TR acquisition. Either way, the results are problematic for the extrasyllabic approach. Evidence for the different nature of sT and TT was also found in the comparison with their word medial counterparts. Although word initial TT was acquired later than word medial TT, such imbalance was not found with sT clusters.

In order to account for the data, it would be possible to add an auxiliary hypothesis that assumes two different kinds of extrasyllabicity, one for initial sT and one for initial TT. However, this would not be enough: we would further have to stipulate the order of acquisition of these different structures. Specifically, we would have to stipulate that sT-type extrasyllabicity is acquired before TT-type extrasyllabicity. If TT was found to be acquired before sT, extrasyllabicity could simply stipulate that it is TT that is acquired before sT, and thus be made consistent with the opposite reality.

To make matters even more complicated, in languages that have both, sT and TT show identical behaviour in some adult language phenomena. Specifically, there is evidence from languages that have both initial sT and initial TT that the two are syllabically the same (Seigneur-Froli 2006; Steriade 1982). A well-known example is attic Greek reduplication:

perfective forms of roots beginning with sT and TT follow the same pattern, in contrast to verbs that begin with TR. The perfective forms of roots commencing with a single consonant (including s) are formed by reduplication; an initial syllable consisting of the first consonant followed by e is added (6a). In the case of roots commencing with TR clusters, reduplication also takes place (the initial syllable consists of the obstruent plus *e*) (6b). In contrast, in the case of roots commencing with TT no reduplication takes place: the vowel e is added word initially (6c). As for the perfective forms of roots starting with sT, these are formed in the same way as TT initial roots (6d).

6) Reduplication patterns

a. CV

paide ∀uoo	*pep ∀aideuka*	'bring up'
l ∀uoo	*l ∀eluka*	'loosen'
sale ∀uoo	*ses ∀aleumai*	'cause to rock'

b. TR

kr ∀inoo	*k ∀ekrika*	'pick out'
kl ∀inoo	*k ∀eklika*	'make to bend'
pl ∀eoo	*p ∀epleuka*	'sail'

c. TT

pt ∀aioo	*∀eptaika*	'make to stumble'
kt ∀einoo	*∀ektaamai*	'kill'
$p^h t^h$ ∀anoo	*∀$ep^h t^h$aka*	'come first'

d. sT

sp ∀aoo	*∀espaka*	'draw' (a sword)
st ∀elloo	*∀estalka*	'arrange'
ski ∀azoo	*∀eskiasmai*	'shade'

Such behaviour has led phonologists to conclude that sT and TT in (ancient) Greek have the same structure (Seigneur-Froli 2006; Steriade 1982). On the other hand, our experimental results demonstrate that sT and TT are different in some way crucial to first language acquisition. The question arises, if sT and TT have the same structure, why are they not acquired together?

5.2 Towards an analysis

If we try to categorise word initial clusters based on the acquisition data presented here, the division appears to be between TR and sT on one side and TT on the other side. The acquisition of TT clusters requires an extra step when compared to the rest of the word initial clusters.

Interestingly, this descriptive division corresponds to a theoretical division that has been suggested on entirely different grounds, based on adult language phenomena. Scheer (2004) divides (adult) languages into those that allow word initial TT clusters and those that do not. The theoretical distinction he proposes is the absence versus presence of an onset nucleus pair at the left margin of the word. The theoretical proposal is part of a system that defines structure according to relationships segments establish along the syntagmatic dimension i.e. governing and licensing relations with what follows and what precedes, thus eliminating vertical-branching structure.

7) Syntagmatic representations: *p ∀efto* '(I) fall', *m ∀iti* 'nose', *xt ∀eni* 'comb'

The examples in (7) show the representations of three Greek words. As may be seen, the skeleton is a sequence of onsets (consonantal positions) and nuclei (vocalic positions), which may or may not enjoy segmental instantiation. An empty nucleus Ø is allowed to exist if it is followed by a filled nucleus, which governs the empty position.

Based on Lowenstamm's (1999) proposal that the left margin of the word (traditionally noted as #), corresponds to an onset nucleus pair without any segmental content (ON), Scheer proposes a parameterisation of the initial ON. The existence of an initial ON pair in a language creates a ban on word initial TT clusters. This is because the empty nucleus of the initial ON would fail to be governed, since the following nucleus (within the TT cluster) is itself empty (8a). Absence of the initial ON in a language makes the existence of initial TT clusters possible (8b).

8) Parameterisation of initial ON and typology of initial TT clusters

On the other hand, the presence or absence of the initial ON pair does not affect the existence of word initial TR and sT clusters, which have alternative ways of governing the empty nucleus of the initial ON (for TR see Scheer (2004), for sT see Sanoudaki (2007). The proposal finds independent support in diachronic lenition and fortition phenomena (Seigneur-Froli 2003; 2006).

Extending this to first language acquisition, the presence of an initial ON pair in a developing grammar creates a ban on word initial TT clusters. Word initial TT clusters only appear when the initial ON pair has disappeared from the child's grammar. This can explain the later acquisition of initial TT when compared to other word initial clusters.

9) Acquisition stage n-1: ON present: No TT clusters
Acquisition stage n: ON absent: TT clusters

Moreover, once the initial ON pair has disappeared (in other words, when initial TT is acquired) initial sT and initial TT have the same structure, as that is defined by the governing and licensing relations in their environment.

10) Word initial TT (*xt∀eni* 'comb') and sT (*st∀oma* 'mouth') in Greek

a. b.

Thus, the discrepancy between adult language and first language acquisition whereby sT is acquired earlier, while in adult language sT and TT behave identically, is predicted.

The remaining findings are also consistent with this model. Word initial TT is acquired later than its word medial counterpart because initial TT, unlike medial TT, has the extra requirement that the ON pair be absent. There is no difference in the acquisition of sT in initial versus medial position, since no such extra requirement is involved. The same holds for initial versus medial TR. Finally, the optionality in the acquisition of sT versus TR can be attributed to optionality in the mastering of the relevant structures (government and licensing respectively, see Sanoudaki 2007).

6 Conclusion

Despite what most phonologists would think, sT and TT in word initial position are different. The existence of the difference would not have been discovered without the help of developmental data, which show that Greek children acquire TT later than sT. The nature of the difference was further examined by comparing children's production of different clusters in different positions. While word initial sT is acquired before TR by some children and after TR by others, TT is systematically acquired later than TR. Moreover, initial TT was acquired later than its word medial counterpart, while no such difference was found for word initial versus word medial sT. These findings point against existing extrasyllabic analyses of these clusters and indicate a division between initial sT and TR on the one hand and initial TT on the other hand, which is best captured by Lowenstamm's initial ON hypothesis.

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Grammaticality Judgements of Children with and without Language Delay

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Abstract

We examined the grammatical intuitions of children both with and without language delay, assessed via a task presented on computer. We targeted three grammatical structures often reported as compromised in children with language impairments (copula, articles and auxiliaries). 26 children (8 girls) with language delay were recruited (mean age 4;10, range 3;8–6;0). These children met the standard criteria for Specific Language Impairment and underwent an intervention focusing on the three targets. The intervention supplied negative evidence for target omissions, according to the precepts of the Direct Contrast hypothesis (Saxton, 1997). Each child received 20-minute therapeutic sessions daily over a six week period. Children with language delay were tested at four points: pre-intervention, mid-intervention, immediately post-intervention and again six months later. To provide a basis for comparison, we also recruited a group of 116 typically developing children (62 girls) (mean age 5;9, range 3;1-7;9). The grammaticality judgement task yielded two measures: (1) judgement of correctness; and (2) reaction time. Although clear differences were found between typical and atypical children, it was clear that even among the oldest typical children, none performed at ceiling. We also found significant improvements in the performance of language delayed children after the intervention.

1 Introduction

Surprisingly little research has been conducted on children's knowledge of grammar in the school years (for a notable exception, see Nippold, 2007). This general lack of interest is based on the assumption that there is actually very little to investigate, in the sense that the mental grammar of a five- or six-year-old is taken to be, to all intents and purposes, equivalent to that of an adult. By the time the child reaches school, therefore, the main business of language acquisition is believed, by many, to be complete. This view is promulgated, for the main part, by researchers in the nativist tradition. Thus, Lightfoot (2005, p.50) suggests that "children attain a fairly rich system of linguistic knowledge by five or six years". On this view, grammar has been taken care of by the age of five, reducing language acquisition from that point onwards to a matter of simply expanding one's vocabulary. However, the pervasiveness of this view is matched only by the lack of empirical evidence to support it.

Our own interest in the grammatical knowledge of school-age children rose out of our work on children with language delay (LD). We developed a therapeutic intervention for children with language delay, most of whom were of school age (see below). Our intervention was targeted on three grammatical structures: copula, auxiliary verbs and articles. Typically, interventions for LD children tend to focus exclusively on expressive language as a measure of intervention effects (e.g. Leonard, Camarata, Pawlowska, Brown & Camarata, 2007). It is a

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moot point as to whether receptive measures are needed. The aim of an intervention might be taken as simply to improve the child's speech output to the extent that grammatical forms are more closely aligned, in both frequency and quality, with those of children with typical language (TL). At the same time, though, speech output might improve without any appreciable change in the child's knowledge or understanding of grammar. The basis for any improvements might therefore be attributed to non-linguistic causes, such as increasing powers of attention and imitation. Alternatively, the intervention may have influenced the development of the child's knowledge of grammar. Improvements in the child's speech output would then be ascribed to a more mature system of grammatical knowledge. This latter outcome is perhaps more desirable since the end result would be a mental grammar more closely allied to that of TL children. Generally, it is apparent that improvements in the child's speech output do not necessarily equate with increases in grammatical knowledge. For this reason, we decided to include receptive measures of our three therapeutic targets, in order to gauge more thoroughly the effects of our intervention.

Intervention outcomes for children with Language Delay can also be assessed by comparing LD performance, both pre- and post-intervention, with that of Typical Language children. In fact, one might argue that such comparisons are essential. Simply finding that LD children have impaired grammatical intuitions would not, in and of itself, be especially informative. If TL children, matched for age with the LD sample, also exhibit impaired performance, then no delay or disorder could be imputed to the Language Delay group for the particular targets under scrutiny. As noted above, though, surpassingly little data on the grammatical intuitions of typical school-aged children is available. In particular, we know of no previous studies examining TL children's intuitions about our target grammatical morphemes: articles, copula, and auxiliaries. A central aim of the work reported here, therefore, was to gather baseline data from TL children. To this end, we decided to include Typical Language children from a fairly broad age range (3 to 7 years), so that any developmental trends could be more clearly discerned.

1.1 Grammaticality Judgements

A standard method for tapping into children's knowledge of grammar is to elicit their judgements on key sentences, both grammatical and ungrammatical. The ability to make such judgements is dependent on the child's metalinguistic skills and these develop only gradually. It has been argued that metalinguistic capacity with respect to grammar emerges at about seven years (Gombert, 1992). But Gombert's conception of what he calls *metasyntactic ability* carries with it the notion of conscious reflection on grammar. The interest here, though, is on a less sophisticated ability, namely the ability to distinguish sentences on their basis of their grammaticality. This latter capacity does not necessarily require conscious analytic abilities, though it does demand sensitivity to grammatical form. it is not surprising, therefore, that some studies report children making reliable judgements much earlier than seven years. For example, Crain & Nakayama's youngest participants were 3;2, while Gleitman, Gleitman & Shipley (1972) elicited judgements from children aged 2;6. In this latter study, children were asked to say if sentences like *Bring me the ball* or **Ball me the bring* were either "good" or "silly". The two-year-olds in this study considered grammatical imperatives to be "good", while rejecting about half of ungrammatical imperatives as "silly".

Unfortunately, it is not entirely clear that the basis for child responses was sentence grammaticality. The overall accuracy score for these children is very roughly 75%, a figure which is probably significantly higher than chance. However, Gombert (1992) argues that we should distinguish between responses to grammatical versus ungrammatical sentences. This follows from the view that responses to grammatical sentences cannot be taken as a reliable index of child sensitivity to grammaticality. For Gombert (1992, p.41), grammatical sentences comprise , "sound sequences ..... with which the children are customarily surrounded", that is,

they are familiar. Ungrammatical strings, on the other hand, will not be familiar and might be rejected on those grounds alone.

On this interpretation, the overall success rate of 75% noted by Gleitman et al. (1972) needs to be broken down into its component parts: roughly 100% correct for grammatical sentences; and 50% correct for ungrammatical sentences. the former figure *could* reflect a familiarity effect, while the latter figure indicates chance responding and, for Gombert, confirms his view that familiarity, not grammaticality, underpins child responses: children are reduced to chance when faced with unfamiliar sentences. An alternative, and equally plausible, basis for responding is semantic plausibility: Ungrammatical sentences are likely to be relatively difficult to assign a meaning to and are thus more likely to be rejected (de Villiers & de Villiers, 1974). One needs, therefore, to take into account the fact that child responding may depend on several factors, only one of which is, potentially, grammatical sensitivity.

Gombert provides a salutary reminder that responses to grammatical versus ungrammatical sentences should be distinguished in analysis. Unfortunately, the two kinds of sentence are often conflated (e.g., Johnson & Newport, 1989; van der Lely & Ullman, 1996). Gombert's point on this issue is pertinent. However, his argument for ignoring responses to grammatical sentences on the grounds of their familiarity is less convincing. One problem is that there is no special reason for believing that children will, in fact, be familiar with the grammatical sentences presented to them. Children do not hear all possible grammatical sentences: their limited experience with language is confounded by the infinite number of possible sentences that might be produced. If one then persists with the argument that children are prone to accept 'familiar' sentences, then one would have to couch the argument in terms of familiarity with sentence *structure*, rather than familiarity with precise sequences of words. And if that is the case, then one could, in fact, impute child responses to grammatical sensitivity (rather than familiarity, or meaning, or some other factor).

In the present study, there are two further reasons to believe that judgements may well be based on grammatical knowledge: (1) the age of our participants; and (2) the kind of errors being examined. With regard to age, we recruited Typical Language children between the ages of 3 and 7 years. Our children with Language Delay, meanwhile, were aged 3 to 6 years. A conservative view of the age at which children can make judgements on grammaticality would be four years (e.g., Bowey, 2005). Since the majority of children in our study lie above this age threshold, we can be more certain that they will be judging sentences on their grammatical merits. Second, our target structures are grammatical morphemes. Morpheme omission errors rarely have a significant impact on the semantic interpretability of a sentence. For example, the meaning of **He big man* is transparent, even without the copula (of course, many languages, including Russian, do not have the copula at all, and Russians get by just fine without it). Therefore, if a child rejects the sentence **He big man*, it is more likely to be on the basis of linguistic form rather than meaning.

1.2 Intervention

Our intervention is based on work in first language acquisition demonstrating the facilitative effects of corrective input (e.g., Saxton, Backley & Gallaway, 2005; Strapp, Bleakney, Helmick & Tonkovich, 2008). Specifically, the focus is on cases where the adult models a correct grammatical form directly contingent on a child error:

(1) Child: *He wiped him.*
[reflexive context]
Adult: *He wiped himself.*

(2) Child: All by her own.
Adult: All by herself.

The child errors in (1) and (2) can be characterised as errors of commission. But the concept of error can be extended to include cases where children omit obligatory morphemes. Such omission errors are, of course, prevalent in the early stages of typical language development (roughly from 18 months to three years), but they are also characteristic of older children who experience significant language delay (e.g., Bishop, 1997). Examples of corrective input in these cases involve the adult supplying the missing morpheme directly following the child omission:

(3) Child: We made cake.
Adult: Yes, we made a cake.

(4) Child: He tall man.
Adult: He's a tall man.

The Direct Contrast hypothesis predicts that the direct juxtaposition of child error and correct alternative has the power to function as corrective input (Saxton, 1997). In this context, then, it is predicted that the adult model signals not only that a given form is correct, it simultaneously functions to signal the rejection of the child form. Grammatical forms can be modelled in many contexts, with immediate contingency on a child error being but one of them. Non-contrastive modelling of grammatical forms is described here as *positive evidence*, with contrastive models (as in examples 1-4) falling under the heading of *negative evidence.* Children in our intervention were exposed to intensive modelling of our target structures in the form of negative evidence. We predicted that, following the intervention, the intuitions of LD children would more closely approximate those of their TL peers with respect to copulas, articles and auxiliaries.

1.3 Developmental Trajectories

The standard method for establishing a developmental disorder in a given population is to make comparisons with children of the same chronological age (CA) and also with children of the same mental age (MA). If the target group exhibits an impairment relative to the CA-matched group, but *not* to the MA-matched group, then a developmental delay is inferred. If the target group is impaired relative to both CA-matched *and* MA-matched groups, then a disorder is indicated (Hodapp, Burack & Zigler, 1990). One disadvantage with this approach is that the developmental pathways of typical and atypical groups are obscured. This follows from the use of age as a dependent variable in both CA and MA groups and the deployment of cross-sectional comparisons. There is then, an inherently non-developmental stance in the matching approach. An alternative approach seeks to derive functions relating performance to age for both typical and atypical groups and then compare the functions (using regression analyses) to see if they differ. This so-called trajectory approach provides a much clearer emphasis on change over time (e.g., Karmiloff-Smith, Thomas, Annaz, Humphreys, Ewing, Brace, Duuren, Pike, Grice & Campbell, 2004; Thomas, Annaz, Ansari, Scerif, Jarrold & Karmiloff-Smith, under review). The trajectories approach requires that children are recruited across a reasonable age range in both typical and atypical groups. This approach allows one to distinguish two aspects of development, with regard to a target behaviour: onset and rate. A difference in onset can be detected by comparing the intercepts for the regression lines for the two groups. A difference in rate of development is determined by comparing the gradients of the two regression lines. One can therefore establish at least three distinct developmental

patterns using the trajectories approach: (1) delayed onset; (2) slower developmental rate; and (3) both delayed onset and slower growth rate.

2 Method

2.1 Participants

Two groups of children were drawn from nurseries, primary schools and language support units in the South East of England. All participants were monolingual English speakers. None of the children in either group held diagnoses of auditory, attentional, behavioural or neuromotor disorders.

Group One. 30 children with Language Delay (LD) were recruited originally, but 4 of the youngest children were subsequently dropped from the study because they failed to understand the task adequately. Of the remaining 26 children, 8 were female, mean age 4;10 (range 3;8–6;0). These children meet standard diagnostic criteria for Specific Language Impairment and were included on the following basis: (1) Clinical Evaluation of Language Fundamentals (CELF) Pre-School scores at least 1.5 SDs below normal: CELF Receptive, mean score = 75.4, SD = 9.20, range 64–100; CELF Expressive, mean score = 72.1, SD = 6.86, range 62–86; (2) non-verbal IQ within the normal range. British Abilities Scale (BAS) block-building, mean T-score = 44.96, SD = 11.51; and BAS picture similarities, mean T-score = 45.15, SD = 10.26; (3) normal articulation: all children had scores on the Goldman Fristoe Articulation test above the 10th percentile; and (4) no pragmatic difficulties, as assessed using the Children's Communication Checklist II.

Group Two. 116 children with Typical Language (TL) took part (mean age 5;9, range 3;1-7;9). These children were included on the following basis: (1) no reported language difficulties; (2) no identified special educational needs; and (3) BAS naming and verbal comprehension scores within the normal range (naming T-score: mean = 52.3, SD = 11.1; verbal comprehension T-score: mean = 47.0, SD = 9.6).

2.2 Grammaticality Judgement Task (GJT)

Two versions of the task were designed (A and B) which constituted mirror images of each other. A sentence appearing as grammatical in Version A appeared as ungrammatical in Version B, and so on. Each version comprised ten practice items followed by thirty five sentences (see below). There were equal numbers of grammatical and ungrammatical sentences for each target structure.

Test sentences. Children were asked to judge 35 sentences, including 30 test sentences and five fillers. The test items comprised ten sentences for each target structure (five grammatical, five ungrammatical). The five filler sentences were based on present progressive –ING. Test sentences were rendered ungrammatical by dropping an obligatory target morpheme (e.g., *The seven dwarves looking at her*; auxiliary verb).

Sentences for each of the three targets were matched in a number of ways: mean length of utterance (MLU); number of syllables; phonological complexity; lexical frequency; and age of acquisition of lexical items. We also ensured that the target structures occurred in an approximately equal number of times in sentence-initial, mid-sentence and sentence-final positions.

Mean Length of Utterance (MLU). Sentences for each of the three target structures were matched for length in terms of three measures: MLU words; MLU morphemes; and MLU syllables. Grammatical and ungrammatical sentences for each target were also compared on these three measures, and no significant differences were found.

Phonological complexity. We ensured that test sentences were matched in terms of number of phonemes in both onset and offset for each word. Tests revealed no significant

differences when the basis for comparison was either the different target structures or grammatical versus ungrammatical sentences for each target.

Lexical frequency and Age of Acquisition (AoA): Unfamiliar or complex lexical items might cause a child to reject a sentence, so we included only those words that we could reasonably expect to lie within our participants' vocabularies. Words were initially drawn from the MacArthur Communication Development Inventories (CDI), which is administered to children up to 30 months old. Other words were taken from Bird, Franklin & Howard (2001) and all others were either proper names familiar to the children (e.g., Snow White) or concrete referents depicted in the pictures used in the task. Once the words had been selected, we controlled for lexical frequency and AoA. Frequency data were taken from Burroughs (1957) since it is the only corpus available that is based on spoken child language. Only words figuring in the 500 most common words were included in our test sentences. With respect to AoA, we drew words, wherever possible, with an acquisition age of 6 years or less.

2.3 Procedure

The task was presented to LD children on four occasions: pre-, mid-, post- and six-months-post the intervention. Versions A and B of the task were rotated through the four testing occasions for each child. A child who received Version A pre-intervention would thus be given Version A again immediately post-intervention. We did not consider that memory of the task would affect performance because the interval between these testing points was six weeks. Moreover, for this child, Version B would have been administered mid-intervention (three weeks after the start), reducing further the chances that memory for specific items would affect performance. Typical Language children completed the task on just one occasion (either Version A or version B on a rotation basis).

Children were first familiarized with the task by singing a well-known nursery rhyme with the experimenter (*Twinkle, twinkle little star*). On a second pass through the nursery rhyme, a puppet was used to sing the rhyme. At this point also red and green response cards were introduced. Based on traffic lights, which we assumed children would be familiar with, the red card was used for Stop, that is, for sentences that "sounded wrong", and the green card was used for Go, that is, for sentences that "sounded good". In these initial practice items, the word order of "red" sentences was grossly corrupted, to make errors easy to spot (e.g., *Up the high so above world*).

Children were then introduced to a computerized version of the task, prepared using DMDX software (Forster & Forster, 2003). Sentences were presented orally (recorded by an actor) and were contextualized by being paired with a picture taken from a cartoon version of a story familiar to the children (Snow White). Each was produced with normal sentence intonation (including ungrammatical versions). Children were centred on the screen prior to each item by presenting an image of a yellow star with a smiling face, accompanied by a spring-like sound. The experimenter retained control over the presentation of each item and so could be sure that the child was attending to the screen.

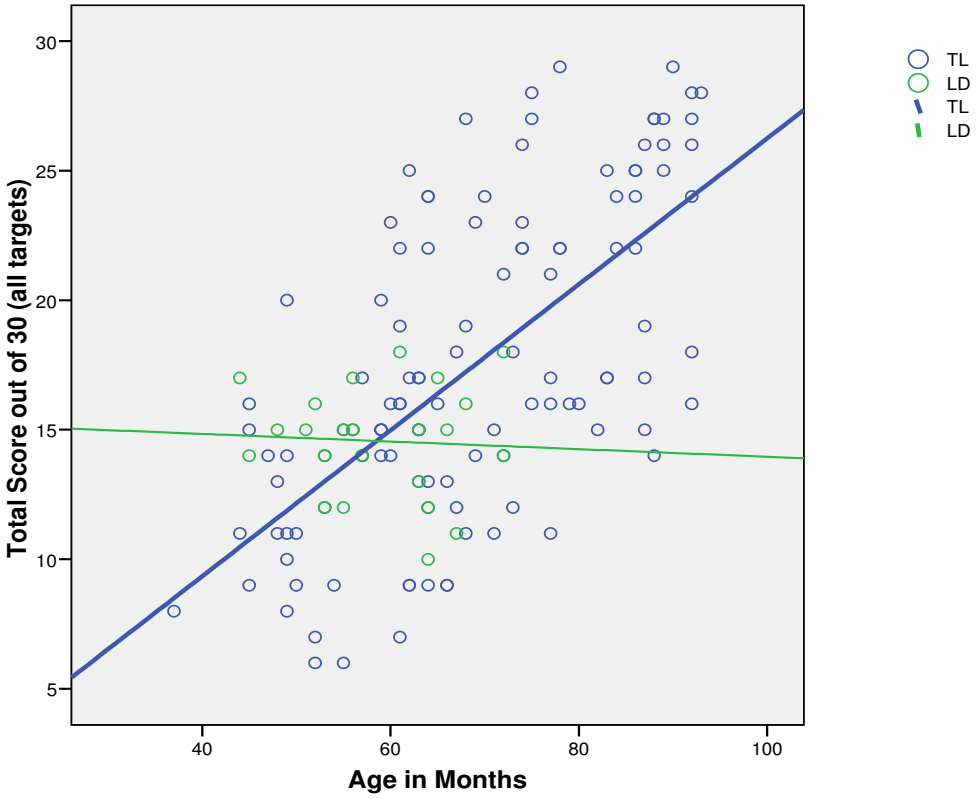
Children completed ten practice items on the computer, switching from the use of red and green cards to red and green response buttons connected to the laptop. The computer recorded child responses (red or green), as well as reaction times (RT) in milliseconds, timed from the offset of each stimulus sentence. The image depicting each sentence remained on screen until the child made a response in each case. The ten practice items included two with correct word order, two with wrong word order, plus six sentences using the target structures (two for each structure and an equal distribution of grammatical and ungrammatical sentences). Once children were familiar with the task, they proceeded to do either Version A or Version B of the task. The two versions were rotated through participants, and in either case, the presentation order of sentences was randomized for each child by the software.

3 Results

3.1 Trajectory Analyses: Accuracy

With regard to the accuracy of child judgements, performance on each target structure yielded a total score out of 10 for each target structure, or a total out of 30 for the three structures combined. We first wanted to consider the developmental trajectories of both children with Typical Language (TL) and Language Delay (LD). Results for LD children pertain to their scores prior to the intervention. Following Thomas et al. (under review), we plotted child scores against age in months, with a view to comparing the two regression lines (see Figure 1). Curve estimation confirmed that both sets of data are best described by a linear function.

Figure 1. Developmental trajectories for grammaticality judgements on three target structures for children with typical language (TL) and children with language delay (LD) prior to an intervention



LD: r^2 = -.003 TL: r^2 = .418

Since analyses of scores on individual target structures mirror the findings when all three are combined, only the latter are reported here. Overall r^2 = .57 and the model explained a significant proportion of this variance: $F(3, 135) = 33.74$, $p<.001$, $\eta p^2 = .43$. Inspection of the results for each factor revealed an overall effect of Group (LD versus TL), indicating that the intercepts of the two groups are reliably different at the youngest age of measurement for LD children (44 months): $F(1, 135) = 4.22$, $p < .042$, $\eta p^2 = .03$. Hence, LD children experience a delayed onset in development with respect to grammaticality judgements on articles, auxiliaries and the copula. With the groups combined, age significantly predicted level of performance: $F(1, 135) = 5.01$, $p< .027$, $\eta p^2 = .04$. We also found a significant interaction between Group and Age: $F(1, 135) = 6.17$, $p < .014$, $\eta p^2 = .04$. Therefore, LD children exhibit a slower rate of development when compared with TL children.

3.2 Comparisons of LD and TL Children: Accuracy

Child responses were analysed according to the precepts of signal detection theory. The aim is to establish child sensitivity to the different categories of response (grammatical versus ungrammatical) and to control for any response bias (e.g., a predilection to press Green each time).

Previous studies have noted a "yes" response bias in children (e.g., Bishop, 1997; McDaniel & Cairns, 1996). Child responses are therefore allocated to one of four categories: (1) *Hit*: correct acceptance of a grammatical sentence; (2) *Miss*: incorrect rejection of a grammatical sentence; (2) *False Alarm:* incorrect acceptance of an ungrammatical sentence; and (4) *Correct Rejection*: correct rejection of an ungrammatical sentence. So called A' scores are then calculated based on the proportions of hits (y) and false alarms (x), according to the

following formula from Linebarger, Schwartz & Saffran (1983): A' = 0.5 + (y – x) / 4y (1 – x). Perfect discrimination (performance at ceiling) would result in an A' score of 1.0. A bias towards rejecting all items (Red response) produces an A' score less than .50. A tendency to accept as correct both grammatical and ungrammatical sentences (Green response) yields an A' score of .50. Mean A' scores for LD and TL children are shown in Table 1.

Table 1. Mean A' Scores for TL and LD children on grammaticality judgements for three target structures (SDs in parentheses)

	TL Children	Intervention Phase for LD Children			
		Pre-	Mid-	Post-	Six-Months-Post
Articles	.59 *(.20)*	.49 *(.15)*	.43 *(.11)*	.52 *(.16)*	.46 *(.21)*
Auxiliaries	.55 *(.20)*	.48 *(.14)*	.46 *(.20)*	.48 *(.15)*	.60 *(.13)*
Copula	.55 *(.20)*	.49 *(.13)*	.46 *(.15)*	.57 *(.15)*	.46 *(.12)*

The use of A' scores provides a more sophisticated assessment of child sensitivity than simply reporting accuracy scores for grammatical and ungrammatical sentences conflated together (e.g., Smith & Tager-Flusberg, 1982). Accordingly, we conducted comparisons of TL and LD children based on A' scores. Comparisons revealed that LD children performed significantly worse than TL children prior to the intervention on all three target structures (see Table 2). This difference is still apparent mid-intervention for articles, but no longer obtains for auxiliaries and copula. Immediately after the intervention, there were no significant differences between TL and LD children for any of the target structures. And LD performance remained comparable to TL performance six months later for both auxiliaries and copula. The TL advantage on articles, meanwhile, re-emerged at this point. Overall, then, it is apparent that the intervention had a beneficial influence on LD children's ability to make grammaticality judgements. Moreover, these effects were still in evidence for two out of the three targets structures six months later.

Table 2. Comparisons of A' scores for TL and LD children on grammaticality judgements for three target structures

	Intervention Phase for LD Children			
	Pre-	Mid-	Post-	Six-Months-Post
Articles	t(40.0) = 2.59, p = .015	t(29.5) = 4.53, p < .001	t(130) = 1.20, ns	t(125) = 1.99, p = .049
Auxiliaries	t(41.1) = 2.13, p = .02	t(130) = 1.79, ns	t(22.6) = 1.69, ns	t(12.5) = -.10, ns
Copula	t(47.2) = 1.83, p = .037	t(130) = 1.66, ns	t(130) = -.37, ns	t(14.0) = 2.07, ns

We next explored associations between LD children's language test scores and their performance on the task. Regression analyses were not conducted owing to the relatively small number of participants. Instead, for each structure, correlations were calculated between scores on sub-components of the CELF test and scores on the grammaticality judgement task (out of 10 for each structure). Aspects of CELF that we examined included: receptive language; expressive language; recall of sentences in context; sentence structure; formulating labels; linguistic concepts; basic concepts; and word structure. Before, during and six-months-post-intervention almost no significant relationships were found between these language measures and GJT performance. Two exceptions were found mid-intervention: for the copula, significant correlations were found with expressive language: $r(14) = .61$, $p < .01$; and formulating labels: $r(12) = .56$, $p < .025$). Immediately post-intervention, however, a number of significant positive correlations were found for two of the target structures (articles and copula). For articles, significant associations were found with receptive language: $r(15) = .64$, $p < .005$; sentence recall: $r(13) = .530$, $p < 025$; linguistic concepts*:* $r(13) = .48$, $p < 05$; and basic concepts: $r(13) = .63$, $p < 01$. For the copula, significant associations were found with sentence recall: $r(13) = .52$, $p < 025$; and sentence structure: $r(13) = .68$, $p < .005$. It appears, therefore, that LD children who score higher on various language measures at the outset benefit more from the intervention, at least for two of the three target structures. For LD children, age was not associated with performance at any of the four points of data collection.

With regard to TL children, we had two measures of language ability: BAS naming and BAS verbal comprehension. We entered these two variables, together with age, as predictors in separate regression analyses for each structure. For articles, we found that the overall model was significant: $F(3, 109) = 29.97$, $p < .001$, adjusted $r^2 = .44$. Age and BAS naming were both strong predictors of child performance. For age, standardized beta = .63, $t = 8.77$, $p < .001$, while for BAS naming, standardized beta = .20, t – 2.62, $p < .01$). BAS verbal comprehension was not a significant predictor. For copula, the same pattern was found, with a significant model overall: $F(3, 109) = 23.84$, $p < .001$, adjusted $r^2 = .38$. For BAS naming (copula), standardized beta = .19, $t = 2.32$, $p < .02$, while for age, standardized beta = .59, $t = 7.79$, $p < .001$. For auxiliaries, the overall model was again significant: $F(3, 112) = 14.32$, $p < .001$, adjusted $r^2 = .26$. However, only age functioned as a significant predictor of performance: standardized beta = .52, $t = 6.31$, $p < .001$.

3.3 Reaction Time Data

Table 3 shows mean reaction times (RTs) for LD and TL children. The pattern of findings was identical for each structure, so the data for all three are combined in the following analyses. Mean RT across all 30 stimulus sentences was thus taken as the dependent variable. We first conducted a trajectory analysis to consider if the developmental path of LD children differed from that of TL children. Overall r^2 = .82 and the model explained a significant proportion of this variance: $F(3,98) = 7.28$, $p < .001$, $\eta p^2 = .18$. However, the two groups (LD and TL) did not differ significantly: $F(1,98) = 1.12$, ns, $\eta^2 = .01$, indicating that LD children were not delayed with respect to reaction time. nor was there any interaction between age and group: $F(1,98) = .68$, ns, $\eta p^2 = .01$. Hence, LD children do not differ appreciably from their TL counterparts with respect to rate of development for RT. When both groups were combined, age approached significance; $F(1,98) = 2.93$, $p < .09$, partial $\eta^2 = .03$.

Table 3. Mean reaction times (seconds) for TL and LD children for three structures combined (articles, auxiliaries, copula) (SD in parentheses)

		TL Children	Phase of Intervention for LD Children			
			Pre-	Mid-	Post-	Six-Months-Post -
All Sentences Combined		4.93 *(.73)*	4.99 *(.71)*	4.82 *(.90)*	4.69 *(.85)*	4.75 *(.53)*
Grammatical	Correct Response	4.73 *(1.04)*	4.92 *(.93)*	4.70 *(1.09)*	4.71 *(.78)*	4.69 *(.42)*
	Incorrect Response	4.93 *(.94)*	5.03 *(1.27)*	4.92 *(1.09)*	5.08 *(1.34)*	5.06 *(.60)*
Ungrammatical	Correct Response	4.85 *(1.28)*	4.87 *(.80)*	4.98 *(.78)*	4.47 *(.97)*	4.69 *(.91)*
	Incorrect Response	4.86 *(1.05)*	5.04 *(.92)*	4.84 *(.91)*	4.45 *(.96)*	4.65 *(.64)*

Separate analyses of the two groups suggest that an age effect *is* apparent for TL children, but not for LD children. For all 30 test sentences combined, mean RT is negatively correlated with age for TL children: $r(82) = -.46$, $p < .01$. As one might predict, then, TL children respond more quickly as they get older. This pattern is repeated, with one exception, when one considers different kinds of test sentence: Grammatical / Correct Response, $r(114) = -.40$, $p < .01$; Grammatical / Incorrect Response, $r(88) = -.48$, $p < .01$; Ungrammatical / Correct, $r(111) = -.33$, $p < .01$; and Ungrammatical / Incorrect, $r(108) = -.13$, ns. As can be seen, age does not confer any advantage when children erroneously accept an ungrammatical sentence (False Alarm). Of interest, RTs for LD children do not increase with age. For all 30 test sentences combined, $r(16) = -.11$, ns. This pattern is repeated for all kinds of target sentence, when considered either by target structure, grammaticality, or accuracy of response.

We also examined the relationship between speed and accuracy. For TL children, strong negative correlations between RT and GJT score were apparent, indicating that correct responses are produced more quickly than errors. Thus, the correlation of mean RT for all sentences with score out of 30 (all targets combined) was $r(82) = -.48$, $p < .01$. Breaking this down by target structure revealed a uniform pattern: articles, $r(82) = -.39$, $p < .01$; auxiliaries,

$r(82) = -.37$, $p < .01$; and copula, $r(82) = -.49$, $p < .01$. For LD children (pre-intervention), on the other hand, no relationships between RT and accuracy could be discerned: articles, $r(16) = -.38$, ns; auxiliaries, $r(16) = .08$, ns; and copula, $r(16) = .07$, ns. Therefore, for TL children,. but not LD children, children become faster with age at producing correct responses.

4 Discussion

4.1 Children with typical language

Our starting point for this study was the desire to tap the intuitions of children with Language Delay with respect to three grammatical morphemes. In pursuing this aim it became apparent that baseline data from Typical language children were not available. This study thus provides the first such data on TL children and reveals, surprisingly, that development is not complete for articles, auxiliaries or the copula, by the time children reach school. The widespread assumption that development should be complete is therefore refuted. Even if assumptions on development are confined to speech production (rather than comprehension), it emerges that very little is known about TL performance in this arena. In one of the few studies to investigate spontaneous use of obligatory morphemes in TL children, Balason & Dollaghan (2004) report that morpheme production is not, in fact, perfect in children as old as four years. Our findings on child intuitions are in accord with Balason & Dollaghan (2004) and extend the age range of non-ceiling performance up to almost eight years. It appears that children take considerably longer to approximate to adult grammatical norms than is generally believed. Moreover, the linear growth curve we found suggests that development is gradual, with child intuitions converging slowly and only after many years on adult norms.

Our findings present puzzles for both nativist and non-nativist accounts of language development. From a nativist perspective, an explanation is needed for why language development is not, in fact, anywhere near as quick and effortless as conventional descriptions would suggest (e.g., Lightfoot, 2005). On the other hand, non-nativist approaches are also presented with a challenge, in particular those that rely strongly on frequency of exposure to input forms as the basis for development (e.g., Tomasello, 2003). The usage-based notion of *entrenchment* suggests that new structures become increasingly established (entrenched) in the child system with increasing exposure to particular input forms. The problem then is one of just how much input is needed to entrench the obligatory nature of grammatical morphemes? By the age of five, children will already have been exposed to hundreds of thousands, if not millions, of exemplars of obligatory morpheme use by adults. And yet, it would seem that this is not enough to furnish the child with a set of adult-like intuitions.

In the present study, we found strong correlations between Typical Language performance and both age and language level (specifically, naming ability). Smith & Tager-Flusberg (1982) also found a strong positive correlation between age and GJT performance for Typical Language children. However, they further found that the age effect washed out when language ability was taken into account. Unlike the present study, these authors assessed TL language via sentence comprehension and receptive vocabulary tests. The two studies are also distinguished by the particular grammatical structures investigated. Smith & Tager-Flusberg looked at word order and morphology, but in the latter case, they tested for sensitivity to overt (and arguably, implausible) errors like *walky* and *chairer*.

The further main finding with respect to TL children was the negative correlation between reaction time and accuracy. TL children produce correct responses more quickly than incorrect responses. Thus, processing time is increased when the child is faced with a problematic sentence, but that does not enhance the quality of decision making. Quite the reverse, in fact. A similar pattern for RTs on a GJT is reported for adult aphasic patients by Caplan, Waters, DeDe, Michaud & Reddy (2007). The fact that correct and incorrect response are distinguished by RT suggests that the child is sensitive (if not consciously aware) of the difference between the two. Items where the child is justifiably confident are dealt with

relatively quickly. Items where the child is uncertain take longer to process and their uncertainty is confirmed by higher rates of failure.

4.2 Children with Language Delay

We found clear differences in the developmental pathways for LD versus TL children with respect to three grammatical morphemes: copula, auxiliaries and articles. Children with Language Delay exhibit a much flatter growth curve and their performance (pre-intervention) is at around chance. Arguably these LD children could be described as disordered, not simply delayed, on the grounds that their starting point (onset) is significantly lower than that for age-equivalent TL children and, moreover, their rate of subsequent growth is also significantly slower. Nevertheless, The LD group showed clear signs of susceptibility to our intervention. Performance improved for all three target structures as indexed by the non-significant differences between LD and TL children post-intervention. The improvements in grammatical sensitivity provide support for the view that direct contrasts (between child error and adult model) function as a form of negative evidence for the child.

One explanation for omissions in LD speech production is that certain factors (e.g., sentence length) increase the processing demands on the child, leading to errors. On this view, child competence might not be impaired at all, or would at least be in advance of child production abilities (e.g., Bishop, 1994). Certainly, our findings suggest that child competence is by no means perfect (neither LD nor TL). An alternative approach to child omissions suggests that production and comprehension abilities should run in parallel. For example, Rice, Wexler & Redmond (1999) provide evidence of this kind in support of their Extended Optional Infinitive account of omissions. With regard to our own findings on omissions of copula, auxiliaries and articles, we would need to make a detailed comparison of LD judgements with their productive abilities, in order to test processing limitation versus competence limitation accounts.

The standard nativist view of the input to language acquisition is that positive input only is available to the child. On this view, adults model grammatical forms for the child and the context in which they occur is irrelevant. In consequence, the only information supplied to the child is that certain, modelled forms are grammatical. However, our findings suggest that the context in which forms are modelled is, in fact, critical. When forms are modelled directly following a child error they fulfil two functions for the child: (1) they provide information on what forms are grammatical; and (2) they inform the child that their own form is ungrammatical. Error-contingent direct contrasts of this kind thus furnish a richer source of information for the child than non-contingent adult modelling. Our results bear out this interpretation of the input. The ability of children with Language Delay to make grammaticality judgements is enhanced by our intervention to the point that, statistically, it cannot be distinguished from TL ability. This suggests that their knowledge of grammar, with respect to our three target structures, is more closely allied with adult norms following an intervention programme in which negative evidence is supplied.

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Object clitics, definite articles and genitive possessive clitics in Greek specific language impairment (SLI): deficits and explanations.

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Abstract

Nine Greek preschool children with Specific Language Impairment (SLI) were compared to age-matched (CA) and language-matched (LA) typically-developing children on their production of a) third person object clitic pronouns, b) definite articles and c) genitive possessive clitics, through novel picture-based elicitation tasks. The aims were to examine whether these structures are impaired in Greek SLI, and whether the findings can be explained by domain-general or domain-specific accounts of SLI (Surface Hypothesis (SH) Leonard 1989; Interpretability Hypothesis (IH), Tsimpli & Stavrakaki 1999; Representational Deficit for Dependent Relations (RDDR), van der Lely 1998). The findings revealed a particular impairment on object clitics in the SLI group, evidenced by a significantly lower rate of correct responses and higher omission rates compared to both control groups; a relatively higher performance on definite articles, on which the SLI group differed from only the CA group; and no impairment on genitive possessive clitics. The findings are partially consistent with those of previous studies in Greek SLI. None of the accounts reviewed could fully account for the pattern of deficits. An alternative proposal combining the notions of interpretability and movement is proposed instead.

1 Introduction

Specific Language Impairment (SLI) is a developmental disorder which affects the acquisition of language in individuals, in the presence of typical functioning in other areas of development (e.g. normal neurological development, hearing, socio-emotional development, non-verbal intelligence). Current investigations focus on pinpointing the clinical features of SLI across languages and on exploring its underlying causes. There is converging evidence that children with SLI have significant limitations in the acquisition of morphosyntax (Bishop 1997; Leonard 1998), the nature and extent of which appears to vary according to the language studied. A central theoretical debate revolves around what type of account can best explain these deficits. On one hand, *domain-specific (linguistic) accounts* posit that deficits in SLI stem from a selective limitation in the language system (e.g. van der Lely 2003). In contrast, *domain-general (processing)* proposals hold that the grammatical deficits are caused by impairments in general cognitive processing mechanisms, affecting other areas of cognition as well as language (Leonard 1998). Crosslinguistic investigations in languages with different morphosyntactic properties are crucial for putting the predictions of these frameworks to the test.

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In this paper we contribute to the ongoing investigation on the characteristics and etiology of SLI by identifying certain morphosyntactic structures that pose particularly difficulties to Greek preschool children with SLI, and, by exploring implications of the findings for theoretical accounts of SLI[1]. The structures under investigation are: third person object clitic pronouns (accusative and genitive-case), definite articles and genitive possessive clitics. We will first review the properties of these in Greek and present findings from Greek SLI. We will then highlight accounts of SLI that make predictions about impairments on these structures, and present the current study.

Third person clitic pronouns in Greek are unstressed, weak forms derived from strong / full pronouns ('afton' (strong) → 'ton' (clitic; Holton, Mackridge & Philippaki-Warburton 1997). They are marked for case, number and gender, and are used frequently as direct (1a) or as indirect (1b) objects. They may also be used as genitive possessives on a noun phrase, with forms identical to the genitive object clitic forms (2). Definite articles precede nouns, and are also marked for case, gender and number. In Greek, definite articles and accusative object clitics share common features, the main one being that they are both prosodically unstressed elements and morphophonologically identical in accusative case (Tsimpli & Stavrakaki 1999, 3):

(1a) **ton** pleni — *accusative object clitic*
him,*acc.masc.sg.* washes
(he/she) washes him

(1b) **tu** dini ena potiri — *genitive object clitic*
him, *gen.masc.sg*. gives a glass
(he/she) gives him a glass

(2) to vivlio **tu** — *genitive possessive clitic*
the book his,*gen.masc.sg*.
his book

(3) **ton** elefanda = (1a) — *definite article (accusative case)*
the,*acc.masc.sg. elephant*

Object clitics and definite articles are reported to be significantly impaired and to constitute clinical markers of SLI in Romance languages (e.g. see Paradis, Crago, & Genesee 2005 for object clitics in French SLI; Bortolini, Caselli, Deevy, & Leonard, 2002 for definite articles in Italian). Similar claims have been made for Greek but the extent of impairment of the structures is unclear.

Specifically, Tsimpli & Stavrakaki (1999) observed high rates of omission of accusative object clitics and definite articles in the spontaneous speech of a 5;5 year-old girl who had been diagnosed with SLI. In contrast, no difficulties were noted on genitive possessive clitics. These findings were confirmed by other single case-studies (Diamanti 2000; Varlokosta 2000), and a study of seven children aged 3;5 -7;0 years by Tsimpli (2001) - all looking at spontaneous speech. The findings of a relatively lower performance on accusative object clitics than genitive possessive clitics were also confirmed by Mastropavlou (2006), who studied 10 preschool children with SLI aged 4;2 - 5;9 years employing age- and language-matched control groups, and elicitation tasks. However, the rate of omissions in this study was not as high as that reported in Tsimpli & Stavrakaki's (1999) study (30% compared to 95%) and substitutions of the forms were also noted. Furthermore, Tsimpli (2001) observed a higher

[1]An extended version of this paper has also been submitted to the Supplement Proceedings of the 32nd Annual Boston University Conference of Child Language Development (Smith, Edwards, Stojanovik & Varlokosta submitted). Both papers are part of a larger study (Smith submitted) which also examined S-V agreement, past tense, and phonological short-term memory (nonword repetition).

performance on definite articles than on accusative object clitics in some of her participants. Finally, Stavrakaki (2001) did not observe difficulties with these structures in eight older children with SLI (mean age 7;3 years).

The existing findings do not allow us to draw conclusions on the status of the target structures in Greek SLI. Most of the studies, have not employed appropriate control groups and are based on single cases. There is a need to study all the structures in the same group of participants, using control groups to assess the degree of impairment, and elicitation procedures, to enable the examination of structures which have not been previously examined (e.g. genitive object clitics).

If confirmed, the reported deficits can be explained by both domain-specific and domain-general proposals. A domain-specific account, the *Interpretability Hypothesis (IH),* put forth by Tsimpli & Stavrakaki (1999), attributes the high levels of omission of clitics and articles to their grammatical, uninterpretable determiner (D)-features, which are considered to render them inaccessible to young children with SLI. In contrast, genitive possessive clitics carry interpretable features / semantic information (theta role of possessor) and so are not predicted to be impaired. Conversely, a domain-general account such as the *Surface Hypothesis (SH)*, put forth by Leonard (1989; 1998), would predict similar impairment on object clitic pronouns and definite articles but for different reasons: according to the SH, children with SLI have difficulties perceiving and processing unstressed, non-salient morphemes that have a grammatical function. Both pre-verbal object clitic pronouns and definite articles in Greek satisfy these criteria and should thus be more difficult than genitive possessive clitics which are post-stress, and thus more salient elements. Differences between object clitics and definite articles would be predicted by a domain-specific account, the *Representational Deficit for Dependent Relations (RDDR)* by van der Lely (1994; 1998). According to this proposal, structures that involve long-distance movement pose difficulties and may be omitted, substituted or sometimes used correctly by children with SLI, due to the optional use of movement in their underlying grammar. If a movement-based syntactic account is posited for the generation of clitic pronouns (Kayne 1975; Philippaki-Warburton, Varlokosta, Georgiafentis, Kotzoglou 2004, 4), then the RDDR account would predict that object clitic pronouns should be more impaired than definite articles and genitive possessive clitics, which do not move[2] in the constructions tested in this study (Alexiadou & Stavrou 2000; Alexiadou 2005).

(4) ton pleni (him washes)
[Spec$_{ton}$ TP [AGRP [VP$_{pleni}$ [DP$_{\sout{ton}}$ (Philippaki-Warburton et al. 2004)

The specific aims of this paper are: (**a**) To investigate whether object clitics (accusative-case and genitive-case), definite articles and genitive possessive clitics are difficult for Greek-speaking preschool children with SLI, and (**b**) to explore whether the domain-general account (SH) or domain-specific accounts of SLI (IH, RDDR) reviewed here can explain the pattern of deficits observed. A three-way group design was employed to look at (a), comparing the SLI group's performance with that of age- (CA) and language-matched (LA) typically-developing children. A difference from the CA group would indicate performance that is below age-appropriate levels. A difference from both the CA and the LA group would show a difficulty beyond what would be expected given the children's language level, thus pointing to an area of exceptional difficulty. The predictions of the accounts for (b) are summarised below:

IH, SH: object clitics = definite articles < genitive possessive clitics

[2] Definite articles may involve a certain degree of movement (Alexiadou & Stavrou 2000) but a) they do not obtain their main features (case and agreement) through movement, and b) this movement is local as opposed to that in object clitics (see Smith submitted).

RDDR: object clitics < definite articles = genitive possessive clitics.

2 Method

2.1 Participants

SLI group: Nine children with SLI aged 4;9 to 6;9 years were selected from centres of speech therapy in Greece. All participants were enrolled in language intervention programmes for a period of eight months to three years and had received a diagnosis of SLI through exclusion of neurological impairment, autistic-spectrum difficulties, hearing impairment, and low non-verbal IQ. In addition, they scored 1.5 standard deviations or more below the mean scores of the CA group on the Greek language test, 'Diagnostic Test of Verbal Intelligence', preschool version DVIQ, Stavrakaki & Tsimpli 2000)[3].

Control groups: The participants in the SLI group were carefully matched one-to- one to two groups of typically-developing children (table 1): to nine children aged 4;11 to 5;11 years, according to chronological age (CA group); and to nine children, aged 2;10 to 4;3 years, according to language / morphosyntactic level (LA group), on the basis of raw scores on the DVIQ morphosyntactic subtests. Independent samples t-tests were carried out to ensure that the groups were matched appropriately. The following relationships were confirmed: ***Age***: *SLI=CA (t(8)=-.1, p>0.05), SLI > LA. (t(8)=9.01, p<0.001)*, ***DVIQ***: *SLI=LA (t(8)=-0.2, p>0.05), SLI < CA (t(8)=5.1, p<0.001).*

Table 1. Mean age and mean raw scores on DVIQ language test

Group (N=9)	Mean Age	Mean DVIQ score*
SLI	71 months (5.11 years)	47.4 (*SD: 23.5*)
CA	70.2 months (5.10 years)	88.2 (*SD: 4.9*)
LA	42.3 months (3.6 years)	51.1 (*SD: 23.9*)

*Composite score on three morphosyntactic subtests: sentence recall, production and comprehension of morphosyntax.

The children in all groups were also matched for gender and socioeconomic level and their non-verbal skills were found to fall within appropriate levels on the Ravens Coloured Progressive Matrices (Raven 1997) and the Mullen's Scales (Mullen 1995) ($\geq 25^{th}$ percentile).

2.2 Materials and Procedures

All the structures were tested through novel picture-based elicitation tasks.

2.2.1 Object Clitic pronouns

Procedure: The task aiming to elicit accusative and genitive object clitics was based on a procedure used widely for the elicitation of object clitics (Shaeffer 1997). The participants were shown pictures of animal characters engaging in transitive actions and were asked a question of the type "what is X doing to Y"? The target answer was: (he/she) Xs **him/her**. In

[3] The DVIQ test is in the process of standardisation; preliminary norms from 291 children exist for ages 3;5 -6;5 years. Three of the five subtests (production / comprehension of morphosyntax and sentence repetition were used in the present study for matching and assessment of the children's skills).

this context, the use of the clitic is required by discourse and is preferred over a strong pronoun or noun phrase (5):

(5) Accusative object clitic
Question: Ti kani o likos sti helona? (What is the wolf doing to the turtle?)
Target answer: **Tin** pleni (her,*acc.fem.sg* washes, he washes her)

Items: Both accusative and genitive-case object clitics were assessed, in feminine and masculine gender and singular and plural number. Each type of clitic was tested using five different verbs, transitive and di-transitive (for assessing both direct and indirect object clitics) in a total of 5x4=20 items/pictures per structure.

2.2.2 Definite Article

Procedure: For the elicitation of the definite article, a method similar to that of Jakubowicz, Nash, Rigaut & Gérard (1998) was followed. Pictures like those in the object clitics task were used but a different question was asked, aimed at eliciting nominative and accusative-case articles: 'Who is Xing Y?'(6) or for accusative-case articles: 'Whom is Y Xing'? (7):

(6) Question: Pios pleni ti helona? (Who is washing the turtle?)
Target answer: **O** likos (The**,** *nom.masc.sg* wolf)

(7) Question*:* Pion pleni i helona? (Whom is the turtle washing?)
Target answer: **To** liko (The,*acc.masc.sg* wolf)

The elicitation of a definite article instead of an indefinite article in this task was ensured by retaining the same five characters throughout the clitics and article task.

Items: 10 accusative-case and 10 genitive-case articles were assessed, in feminine and masculine gender, and singular and plural number in a total of 20 items for definite articles. The definite article and object clitics items were all tested in the same test, so that each structure acted as a distracter for the other.

Pre-tests and training items for clitics / article task: Before starting the task, the knowledge of the animal characters and verbs in the clitics / article task was checked Two training items for each structure were also carried out.

2.2.3 Genitive possessive clitics

Procedure: In the genitive possessive clitics task, the child saw a picture and was asked a question of the type 'What is X pointing to?'. The pictures involved animals pointing to body parts, to prompt the elicitation of the genitive possessive (see 8).

(8) Question: Ti dihni o likos? (What is the wolf pointing to?)
Target answer: To podi **tu** (The foot his,*gen.masc.sg*, his foot)

Items: As the previous findings on genitive possessive clitics are uncontroversial, it was decided to only use 9 items in this study. No training items were used.

Before starting the main study, the clitics pictures were shown to 14 children and adults to check for imageability and clarity. All elicitation tasks were tried out in a pilot study. The participants were tested in a quiet room, in five sessions in total.

3 Results

The participants responded well to all tasks. Statistical analyses were conducted using non-parametric procedures, due to the non-normal distribution of some of the data. Between-groups comparisons for each measure are presented first.

3.1 Between-groups comparisons: Object clitics

Correct answers in object clitics involved ones with the correct clitic form, whereas incorrect responses consisted of: a) grammatical *substitutions* of the clitic form (e.g. gender: *tin* pleni - washes her: *ton* pleni - washes him), b) *omissions of the clitic* (*ton* pleni - washes him: *ϕ* pleni - washes), c) *verb omissions* (ton pleni - washes him: banio - bath), d) *use of other structures not involving a clitic form* (e.g. a noun phrase, pleni to liko – washes the wolf), or e) *no answers*. The rates of c,d, e were very low (< 5%) so only rates of total productions, correct answers, omissions and substitutions are reported (table 2).

Table 2. Object clitics: total productions, omissions, substitutions, and correct forms (N=sums, SD=standard deviations, M%=mean percentages

Group (N=9)	**Total object clitics** (/360)						**Correct**					
	Produced		**Omitted***		**Substituted**		**Accusative** (/180)			**Genitive** (/180)		
	N	*M %*	*N*	*M%*	*N*	*M%*	*N*	*SD*	*M%*	*N*	*SD*	*M%*
SLI	232	*64*	85	*24*	*97*	*27*	77	6.8	*42.9*	57	6.1	*31.6*
LA	340	*94*	14	*4*	*78*	*22*	142	3.9	*78.8*	120	2.8	*66.6*
CA	346	*96*	14	*4*	*24*	*6.6*	168	1.6	*95.5*	154	2.4	*85.5*

*This category only refers to clitic omissions, not verb omissions, use of other structures or no answers.

As it can be seen in table 2, the SLI group followed the pattern of the typically-developing groups to an extent - e.g. in all groups, correct forms of genitive object clitics were produced at lower rates than accusative clitics. However, the SLI group produced fewer object clitics than either control group, fewer correct responses, and omitted and substituted clitics more frequently. A Kruskall-Wallis test, followed by Mann-Whitney U comparisons showed a significant difference between the SLI group and both groups for *total clitic production and clitic omission* (a Bonferroni correction was applied for the number of comparisons, adjusting the significance level at 0.05/4=0.012): *Total Production*: *H(2)= 9.5,* ***p<0.01,*** *SLI < CA, U=9,* ***p<0.01****, SLI < LA, U=15,* ***p<0.012****, Total Omission: H(2)=9.1,* ***p<0.01,*** *SLI < CA, LA, U=11.5,* ***p<0.01***.

Significant differences were also found in the *correct* responses on accusative and genitive object clitics (significance level 0.05/4=0.012): *Accusative clitics*: *H(2)=13.3,* ***p=0.001****, SLI < CA: U=7.5,* ***p<0.01,*** *SLI < LA, U=13,* ***p<0.01.*** *Genitive clitics:* ***H (2) =14.5,*** ***p=0.001****, SLI < CA: U= 3.7,* ***p<0.001,*** *SLI < LA, U=15,* ***p<0.012.***

3.2 Definite Articles

Table 3. Definite article: total productions, omissions, substitutions and correct forms

Group (N=9)	**Total produced** (/180)		**Omissions**		**Substitutions**		**Correct**		
	N	*M%*	*N*	*M%*	*N*	*M%*	*N*	*SD*	*M%*
SLI	159	*88.3*	17	*9.4*	33	*18.3*	126	6.1	*70*

LA	179	*99.4*	0	*0*	13	*7.2*	166	2.6	*92.2*
CA	180	*200*	0	*0*	0	*0*	180	0	*100*

Table 3 shows that the SLI group produced fewer correct definite articles than the control groups but their overall rates were higher than on clitics. Incorrect responses involved some omissions but mostly substitutions, as well as a very low rate of no answers (only 2.2%, not shown in the table). The control groups did not omit articles. Kruskall-Wallis tests followed by Mann-Whitney U comparisons (significance level adjusted at 0.05/4=0.012) showed that the SLI group differed significantly from the CA group on correct productions, but did not differ significantly from the LA group on any of the measures: *Total production*: *H(2)=6.5*, ***p<0.05****, SLI - CA: U=22.5, p=0.04, SLI-LA: U=25.5, p=0.093*, *Omission*: *H(2)= 8.9,* ***p<0.05,*** *SLI - CA: U=22.5, p=0.04, SLI-LA: U=22.5, p=0.029*, *Correct production****:*** *H(2)=9.3,* ***p<0.01,*** *SLI < CA: U=13.5,* ***p<0.01,*** *SLI - LA: U=23.5, p=1.15.*

3.3 Genitive possessive clitics

Table 4. Genitive possessives: total productions, omissions, and correct forms

Group (N=9)	**Total produced (/81)**		**Omitted**		**Correct**		
	N	*M%*	*N*	*M%*	*N*	*SD*	*M%*
SLI	65	*80.2*	14	*17.2*	65	2.6	*80.2*
LA	80	*98.3*	1	*1.2*	77	0.7	*95.6*
CA	78	96.3	3	*3.7*	78	0.5	*96.2*

Table 4 shows that the SLI group scored lower than the control groups on genitive possessives but this difference was not big. There were some omissions, but these were mainly made by one participant. The other incorrect responses consisted of only one substitution in the LA group and are not reported. A Kruskall-Wallis test revealed that there were no significant differences between the groups *(H(2)=2.4, p>0.05).*

3.4 Within-groups comparisons

As it was seen in the previous sections, all groups showed a higher performance on definite articles and genitive possessive clitics than on object clitics. These differences were further explored through pairwise comparisons (Wilcoxon signed ranks) within each group. The following *statistically significant* differences were noted (using an adjusted level of significance of 0.05/3=0.016):

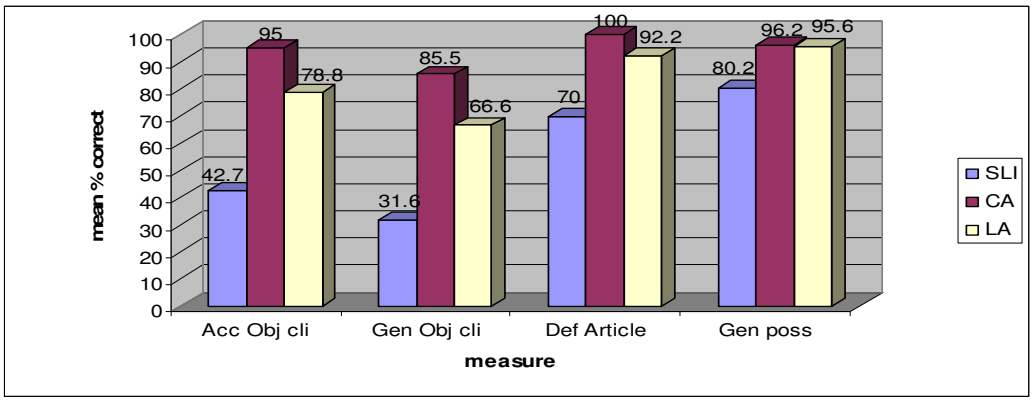
Object clitics - definite articles: all groups produced more definite articles overall than genitive object clitics (*SLI: Z=-2.7,* ***p<0.01,*** *CA:* ***Z=-2.2, p<0.016,*** *LA: Z=-2.7,* ***p<0.01*****).** The SLI group additionally *omitted* more genitive object clitics than definite articles (*Z=-2.5,* ***p <0.01***), and produced more *correct* articles than both types of object clitics *(AccClitics < Def Articles, Z=-2.5,* ***p<0.01,*** *GenCli < Def. Art****,*** *Z=-2.6,* ***p<0.01****).*

Genitive possessive clitics – genitive object clitics: A lower performance was noted on correct forms of genitive object clitics than on genitive possessives in the SLI and LA groups (SLI group: *Z=-2.5,* ***p<0.05****,* LA group: *Z=-2.6,* ***p<0.05*****).** These differences were present but not as pronounced in the control groups.

The above differences are especially important given that some of the structures (genitive object clitics - genitive possessives, accusative object clitics - accusative definite articles)

were identical in form. The performance of the groups on all measures is summarised in figure 1[4]:

Figure 1. Correct responses (M %) on accusative /genitive object clitics, definite articles and genitive possessive clitics in all groups



4 Discussion

The aims of this paper were first, to investigate whether accusative and genitive-case object clitic pronouns, definite articles and genitive possessive clitics are difficult for Greek-speaking preschool children with SLI, and second, to examine whether any of the accounts of SLI reviewed here could predict and explain the pattern of deficits. The findings presented in section 3 showed that object clitics (accusative and genitive) were an area of exceptional difficulty for the SLI group; the SLI participants produced significantly fewer clitics overall - with clitic omissions distinguishing them from the controls - and produced fewer correct forms than both control groups. They did not have as many difficulties with definite articles, on which they differed significantly from only the CA group. In addition, they did not differ from either control group on genitive possessives. A significantly higher performance was noted on definite articles and genitive possessives than on object clitics within the SLI group.

The findings of impaired performance on object clitics and the dissociation with the genitive possessive clitics agree with previous findings in Greek SLI (Tsimpli & Stavrakaki 1999; Varlokosta 2000; Tsimpli 2001; Mastropavlou 2006). Genitive object clitics have not been studied before but the relatively lower performance on these which was observed in all groups can be attributed to the later acquisition of genitive case compared to accusative case in typical development (Stephany 1997). Moreover, although the rate of clitic omissions (24%) distinguished the SLI group from the control groups, it was not as high as that reported in Tsimpli & Stavrakaki (1999) and Tsimpli's (2001) studies (approximately 96%) but was closer to that reported by Mastropavlou (2006 - 30%)[5]. This could be due to individual

[4] It should be noted that individual performance largely confirmed the findings at a group level (see Smith submitted, and Smith et al. submitted for more details).

[5] The pattern observed in the control groups in this study agrees largely with that reported in studies of typical development in Greek; omissions of clitics and articles have only been reported in very early stages of development, before the age of 2;0 years (Stephany 1997). After 2;0 years, object clitics appear to be produced at normal rates by typically-developing children (Tsakali & Wexler 2003). Similarly, definite articles are reported to be omitted even more frequently than clitics before 2;0 years but are subsequently produced at high rates (Stephany 1997; Marinis 2000). Genitive possessives and post-verbal clitics are acquired earlier than other clitic forms (Stephany 1997; Tzakosta 2004).

variability or to methodological differences between the studies. Additionally, the dissociation between object clitics and definite articles has been noted in the study of Tsimpli (2001) but is in contrast with the theoretical claims put forth by Tsimpli & Stavrakaki (1999) and Tsimpli (2001).

We now move to an evaluation of the predictions of the theoretical accounts, starting from the domain-general account, the Surface Hypothesis (SH). The main prediction of the SH (Leonard 1998) is that all object clitic forms and definite articles should be equally impaired and particularly difficult for children with SLI, due to their lack of saliency. On the contrary, genitive possessive clitics may be expected to be easier, as they are found in a lengthened, more salient position. Although better performance on genitive possessives was indeed found in the present study, the predictions of a homogenous impairment on object clitics and definite articles was not upheld, as all participants performed better on the latter. A similar pattern of performance was noted in the control groups, especially the LA group. Additionally, this pattern was observed despite the fact that some of the forms of definite articles and object clitics are morphophologically identical.

Turning to the domain-specific accounts, the same argument holds for the Interpretability Hypothesis (Tsimpli & Stavrakaki 1999; Tsimpli 2001). According to this proposal, a similarly low performance on object clitics and definite articles would be predicted on the grounds of their common uninterpretable, morphosyntactic features, whereas genitive possessive clitics are assumed to be easier, on the basis of their interpretable features. The difficulty with object clitics and a certain degree of difficulty with definite articles, as opposed to genitive possessive clitics was thus upheld by the present findings. However, what cannot be easily explained is the observed dissociation between object clitics and definite articles, present in even the youngest participants. Moreover, the pattern of errors (omissions / substitutions) does not agree with the claim that the structures are inaccessible to SLI children.

The Representational Deficit for Dependent Relations hypothesis (van der Lely 1998) predicts that grammatical elements involving movement should be more difficult than ones that do not. In this sense, if a movement-based approach is adopted for the generation of object clitics, the RDDR may explain the observed dissociation between object clitics and definite articles. The pattern of errors observed here is consistent with the claims of the RDDR; the children produced a range of omissions, substitutions, but also correct productions of the forms, which can be explained by the assumption of optionality in the use of movement (van der Lely 1998). However, the RDDR does not explain a certain extent of difficulty observed with definite articles, and the trend for a difference between definite articles and genitive possessives in the SLI group. In other words, if only moved elements are problematic for children with SLI, then it is not directly explicable why definite articles are not at age-appropriate levels, while genitive possessives are better than the other measures in children with SLI.

An alternative explanation which has not been explored would involve a combination of the IH and RDDR hypothesis. It is possible that the common morphosyntactic properties ([+D, -interpretable]) of object clitics and definite articles in Greek result in a certain extent of difficulty with these structures for children with SLI. However, object clitics may additionally have other characteristics that may render them more difficult. Thus, the additive effect of movement combined with uninterpretability could result in object clitics being even more difficult to acquire in SLI than definite articles, which involve uninterpretable features but no movement. Conversely, elements such as the genitive possessive, which do not involve either of these factors, may be easier. In this sense, it would be possible to think of movement and uninterpretability as <u>difficulty factors</u>. This would result in the following hierarchy:

High	difficulty ↓	[+movement, +uninterpretability]	object clitics
		[-movement, +uninterpretability]	definite articles

Low difficulty [-movement, -uninterpretability] genitive possessive clitics

The above model could be used for combining other linguistic or even processing factors. Finally, other possible explanations for the impairment observed in object clitics should not be overlooked. We outline three of these: a) the complex / controversial categorical status of object clitics (see Jakubowicz et al. 1998), b) discourse factors (e.g. clitic omission may be due to object drop, Marinis 2000), and c) their interface status (see Smith et al. submitted for discussion of b, c).

5 Conclusion

This paper looked at accusative and genitive object clitics, definite articles and genitive possessive clitics, to examine whether they were problematic for Greek preschool children with SLI, and by doing this to also put to the test certain theoretical proposals of SLI. By means of assessing all the structures on the same group of participants, through careful matching with control groups and controlled elicitation procedures, it was found that object clitics were the structure with the poorest performance for all groups but especially for the SLI group, clitic omissions distinguishing the SLI group from both control groups. In contrast, definite articles were not as difficult, and genitive possessive clitics yielded an even higher performance. None of the accounts reviewed here appeared to fully explain the deficits observed, so a new combinatorial approach was proposed, whereby movement and interpretability / morphosyntactic deficiency may act as difficulty factors, rendering object clitics more problematic than definite articles and genitive possessive clitics.

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Comprehension of L2 grammar in a bilingual preschool: A developmental perspective

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Abstract

This longitudinal study focuses on German (GE) preschoolers' comprehension of English (EN) grammatical structures, who were tested in a two-choice picture selection task. Its aim is to examine how these EN grammatical structures develop during a three year period in a bilingual GE-EN preschool, outside of which the children's ambient language is not EN. This study presents data from 14 GE preschool children (7 boys and 7 girls) who had been exposed to EN approximately 11, 18, 23 and 30 months at the time of the grammar comprehension task. Altogether, tested seven grammatical categories (i.e., SVO word order, determiner *a(n)/many*, +/- plural morpheme *-s*, personal pronoun *he/she*, possessive pronoun *his/her*, preposition *in/on*, and +/- negator *not*) were tested. As expected, the time of exposure to EN had a positive effect on the comprehension of L2 grammatical structures. However, children performed better on some grammatical categories than on others, a tendency which did not change as a function of increased contact duration to the L2 EN, thereby paralleling L1 and L2 acquisition processes. The large degree of inter-individual variation found in this study may be accounted for by the children's personalities and their preferences in their preschool activities.

1 Introduction

In 2003, the European Commission issued that all European children should have command of two foreign languages at a functionally adequate level (Commission of the European Communities 2003). However, this highly ambitious aim can only be reached when foreign language learning takes place as early as possible, preferably before school entry. Several preschools in Germany have therefore decided to offer bilingual programs: These programs may range from weekly courses, which last for an hour, to immersion programs, where the foreign language is used in all daily activities. As numerous studies have shown, immersion programs most effectively enable the children to learn a foreign language successfully (see review in Wesche 2002). The present study focuses on a bilingual preschool in Kiel/Melsdorf, which offers a partial immersion program: One of the two caretakers per group is a native speaker of German (GE), the other a native speaker of English (EN), and both abide by the so-called one person-one language principle (e.g. Döpke 1992, Baker 2000). The non-native language is used according to immersion principles, i.e., the children take their cues from the situation and the context and acquire the non-native language through the way it is being used. The caretakers, therefore, contextualise the use of EN as much as possible. The amount of exposure to EN is difficult to specify because the preschool in Melsdorf adheres to the "open group concept", i.e. the children do not have to stay in one room but are free to take part in activities in other rooms as well. This may reduce (or increase) the amount of intake because the children can choose whether they are exposed to EN or to GE (e.g. Wode 2001). As the children's ambient language outside preschool is German, their acquisitional situation

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is not comparable to being exposed to EN in a country where it is spoken as the first language (L1) (see e.g. Rohde & Tiefenthal 2002). To acquire a foreign language in such a bilingual preschool context therefore constitutes a special type of foreign language learning, which may pose particular problems to the learners.

Although there are studies available, which focus on the acquisition of the English lexicon in a bilingual preschool (e.g. lexical strategies, Rohde 2005, or fast mapping, Rohde & Tiefenthal 2002), hardly anything is known about the acquisition of English grammar in such a context. Because German children produce very few EN words and sentences during their preschool period (see Wode 2001, Steinlen 2008b), the focus of this study is on preschoolers' comprehension abilities with respect to certain EN grammatical structures. Using a picture pointing task, this study compares the children's performance at four points in time, namely in the first, second and third year of exposure to EN. Of special interest are the effects of sex and contact duration to EN on the children's performance in this grammar comprehension task and, moreover, their correct identification of the EN grammatical categories over time.

Intuitively, it is not surprising that increased L2 contact duration improves the grammatical understanding of a foreign language. However, it has not been documented yet whether some grammatical categories are better identified than others. Studies by Au-Yeung et al. (2000) and Howell et al. (2003) showed that monolingual EN children did not perform equally well on different English grammatical categories: For example, the identification rates for the grammatical category "preposition in/on" were higher than the rates for SVO (word order) which in turn were higher than for inflectional plural marking (see also Fraser et al. 1963, Lovell & Dixon 1967; Nurss & Day 1971). Unfortunately, there was little indication in the study as to why this was the case. Therefore, one aim of this study is to assess whether GE-EN preschoolers perform equally well on different English grammatical categories and whether their performance show similarities to native EN preschoolers.

"Girls outperform boys" – this seems to be the general finding in many studies on L1 (first language) or L2 (second language) acquisition (see e.g. Schmid-Schönbein 1978, Schlichting & Spelberg 2003, Bornstein et al. 2004, Radeborg et al. 2006). Studies concerned with foreign language performance in bilingual preschools, however, could not support such a notion (e.g. Natorp 1975, Rohde & Tiefenthal 2002, Steinlen 2008a). Since in general the gender issue in language learning has not been resolved yet, the present study also analyses whether boys and girls differ in terms of their comprehension of EN grammatical structures over time.

Moreover, this study closely examines the performance of two children with regard to how their correct identification rates of their comprehension of EN grammatical structures develop with increased L2 contact duration. One way to capture such inter-individual variations is to use data from children who were matched for sex, age, L2 contact and the preschool group that they belong to (see also Steinlen & Burmeister i. pr.), and to document their different paths of development.

Finally, with respect to the stated goal of the Commission of the European Communities that children at the end of their school career should have command of two foreign languages, this study wants to demonstrate that it is feasible to start to learn an L2 in a preschool context, using immersion methods.

2 Method

Altogether 14 GE children (7 girls and 7 boys) from the bilingual GE-EN preschool in Kiel/Melsdorf took part in this experiment. The children were tested four times – roughly half a year elapsed in between the tests. The children's age range was 3-5 years (average: 4.05 years, SD = 7 months) at the time of Test 1, 4-5 years (average: 5.00 years) at the time of Test

2, 4-6 years (average: 5.05 years) at the time of Test 3 and 5-6 years (average: 6.00 years) at the time of Test 4. The children's exposure to EN was 6-13 months at the time of Test 1 (average: 11.1 months, SD = 2.8 months), 13-20 months at the time of Test 2 (average: 18.1 months years), 18-25 months at the time of Test 3 (average: 23.1 months years) and 25-32 months at the time of Test 4 (average: 30.1 months years).

The grammar comprehension task, which was administered to these children, is a modified version of the Reception of Syntax Test (e.g. Au-Yeung et al. 2000, Howell et al. 2003). It was originally designed for children who stutter and for EAL (English as an Additional Language) children living in England to assess the children's grammatical development.

The children in the preschool in Kiel/Melsdorf were tested individually in a quiet room they were familiar with (see Crain & Thornton 1998 on the importance of a child-friendly environment during an experiment). First, the child looked at two pictures on the touch screen of a laptop computer (see Friend & Keplinger 2003 on the advantage of a computer-based test over other procedures). The child then listened to a sentence that corresponded to one of the pictures. Responses were made by touching the picture which the child thought to be appropriate to the sentence. Before testing, the children were given four training items consisting of two pictures of different objects and an appropriate single word utterance to ensure they knew how to make the responses. The pictures in the grammatical pair contrasted only in the target grammatical dimension (e.g. absence / presence of the plural inflectional marker –s: cat-cats). Each pair of pictures was tested twice, and each picture was the correct answer on one of these two test occasions.

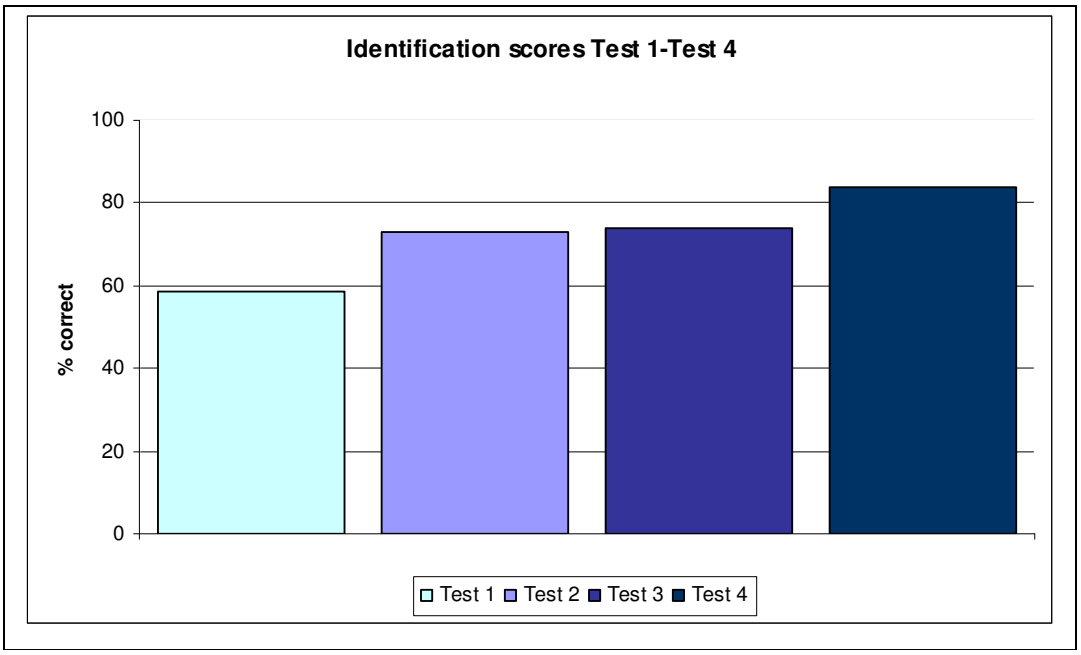
Following Au Yeung et al. (2000) and Howell et al. (2003) the children were tested on seven grammatical categories: DET (a/many), NEG (affirmative/negative sentences), PLU (+/- inflectional plural marker –s), POSS (his/her), PREP (in/on), PRO (he/she), and SVO (word order). In total, there were 42 test items (7 grammatical categories x 3 picture pairs x 2 test presentations per picture pair). The children were videotaped during the five minute session.

3 Results

3.1 General Results

A comparison of the results obtained in Test 1, Test 2, Test 3 and Test 4 (i.e. at a L2 exposure of 11, 18, 23, and 30 months, respectively) showed an increase of over 25% in the correct identification of pictures: 58.3% of the pictures were correctly identified in Test 1, 72.8% in Test 2, 73.8% in Test 3 and 83.7% in Test 4. A one-way ANOVA revealed significant differences between the results of the four tests ($F(3,55) = 15.987$, $p<0.05$). Post-hoc Tukey tests showed significant differences between the results of Test 1 and Test 2 and between the results of Test 3 and Test 4 ($p<0.05$ for each) but not between Test 2 and Test 3 ($p>0.05$). This finding suggests that the time of exposure to EN has a positive effect on the overall correct identification rate (see Figure 1). The acquisition process, though, is not necessarily a linear one, as the stagnating scores between Test 2 and Test 3 show.

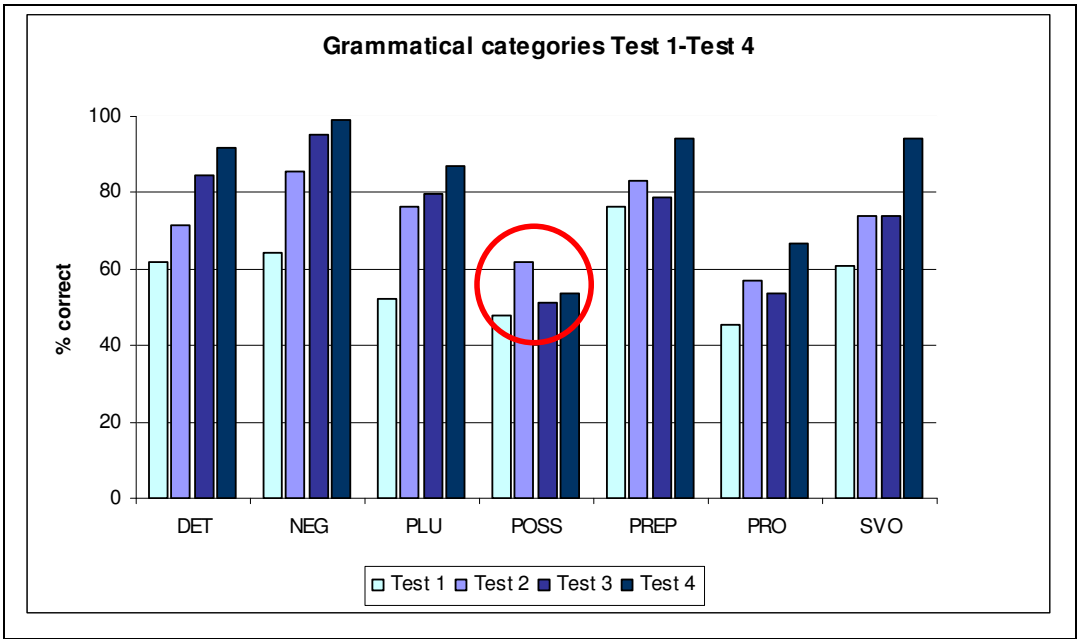
Figure 1. Percentage of correct identification for Test 1, Test 2, Test 3 and Test 4.



3.2 Grammatical categories

The data presented in Figure 2 show the percentage of correct identification according to the grammatical categories that were tested (i.e., DET, NEG, PLU, POSS PREP, PRO, SVO). Not all grammatical categories were identified with the same degree of confidence: In Test 1, the highest identification rate was obtained for the grammatical category NEG and the lowest rates for PRO and POSS. Similar results, albeit higher rates, were obtained in Test 2, 3 and 4. Four separate one-way ANOVAs for Test 1 ($F(6,97) = 3.976$), Test 2 ($F(6,97) = 3.395$), Test 3 ($F(6,97) = 9.014$) and Test 4 ($F(6,97) = 16.890$; $p<0.05$ for all) confirmed this impression. Planned post-hoc tests for Test 1 revealed significant differences between the grammatical category PREP as compared to PLU, PRO and POSS ($p<0.05$ for all). However, there were no significant differences between the scores of the other categories ($p>0.05$ for all). For Test 2, post-hoc tests showed significant differences between the grammatical categories PRO vs. PREP / NEG, and POSS vs. NEG ($p<0.05$ for all). In Test 3, significant differences were found between POSS vs. SVO, DET, PLU, PREP, NEG and between PRO vs. DET, PLU, PREP, NEG ($p<0.05$ for all). Similar results were found for Test 4, with the addition of PRO vs. SVO ($p<0.05$ for all). These results indicate that even after a longer exposure to EN, not all grammatical categories are comprehended equally well.

Figure 2. Percentage of correct identification for seven grammatical categories, as obtained in Test 1, Test 2, Test 3 and Test 4. The categories are ordered alphabetically.

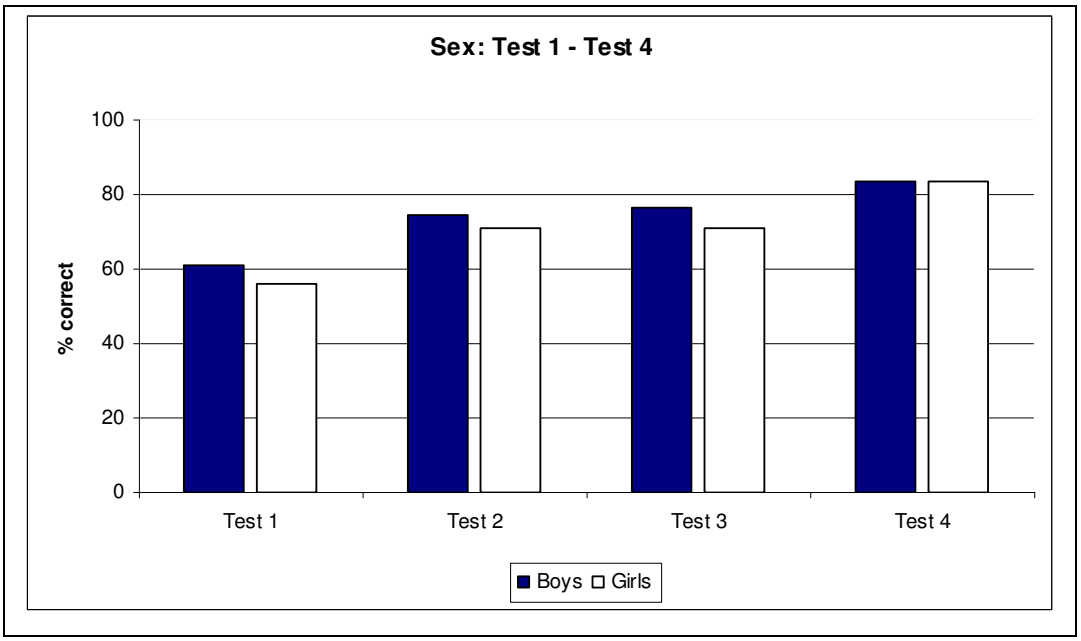


As Figure 2 also shows, the identification rates of all grammatical categories were higher in Test 4 than in Test 1. The highest increase in performance between Test 1 and Test 4 was found for the categories DET, NEG, PLU and SVO (30-35%), the other categories POSS, PREP, PRO showed an increase between 6-21%. Separate one-way ANOVAs revealed that these differences were significant for the grammatical categories DET, NEG, PLU, PRO and SVO (DET: $F(3,55) = 7.219$; NEG: $F(3,55) = 9.100$; PLU: $F(3,55) = 8.401$; PRO: $F(3,55) = 4.625$; SVO: $F(3,55) = 5.103$; $p<0.05$ for all) but not for POSS and PREP (POSS: $F(3,55) = 1.423$; PREP: $F(3,55) = 2.121$, $p>0.05$ for both). These results suggest that extended contact duration to EN improves the comprehension of many grammatical categories but not of all.

3.3 Sex

In the literature, there are divergent findings with respect to the effect of the children's sex on their performance in comprehension tasks (e.g. Fraser et al. 1963, Lovell & Dixon 1967, Natorp 1975, Schmid-Schönbein 1978, Au-Yeung et al. 2000, Howell et al. 2003). Although in the present study, boys seemed to perform better than girls in most of the tests (Test 1: 60,9%-55,8%, Test 2: 74,5%-71,1%, Test 3: 76,5%-71,1%, Test 4: 83,7%-83,7%), this impression could not be supported in separate one-way ANOVAs for each test (Test 1: $F(1,13) = 1.488$, $p>0.05$), Test 2: $F(1,13) = 0.289$, $p>0.05$), Test 3: $F(1,13) = 0.646$, $p>0.05$), Test 4: $F(1,13) = 0.000$, $p>0.05$). In this grammar comprehension task, hence, boys and girls performed equally well at all times (see Figure 3).

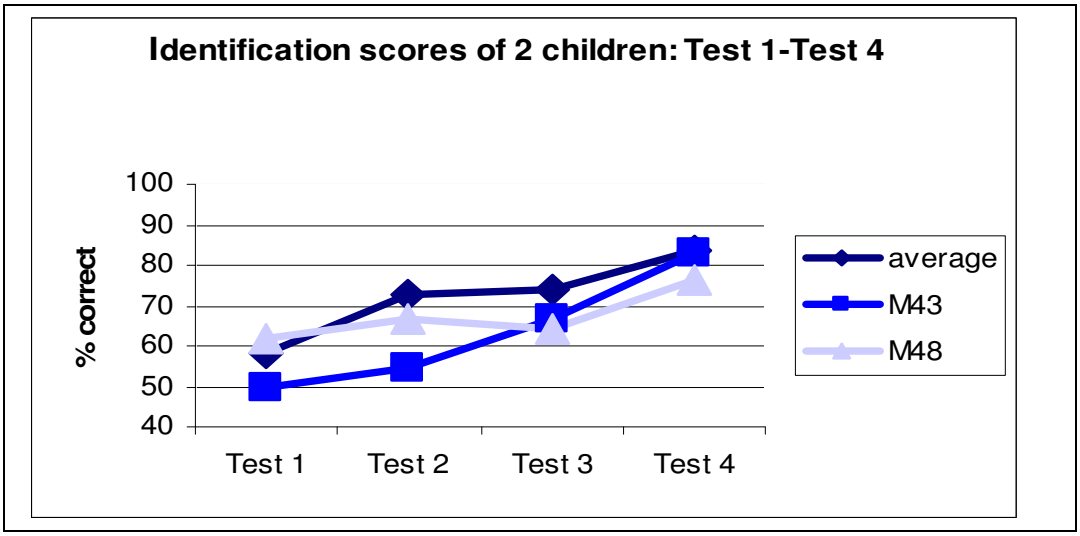
Figure 3. Percentage of correct identification for Test 1, Test 2, Test 3 and Test 4, according to sex.



3.4 Individual variation

In accordance with the literature (e.g. Wong Fillmore 1979, Tabors & Snow 1994, Paradis 2005), this study also found that children differed greatly on their way to target-like mastery of the L2. In order to describe these differences in more detail, two children of this sample were selected and matched for sex, age and exposure to EN (see also Steinlen & Burmeister i.pr. for a similar method). The children were girls, 41 months old, and exposed to EN for six months at the time of Test 1. As the general results of their test scores show, the two girls followed a very different path of development (Figure 4): At the time of Test 1, child M48 scored as high as the average of the group, even though she was younger than the average child and had less exposure to EN. However, her performance stagnated across Test 2 and Test 3. Only in Test 4 did her test scores improve, although now they were considerably lower than the group average scores.

Figure 4. Percentage of correct identification across four tests for two children, M43 and M48, who were matched for sex, age and exposure to EN. The group's average identification rate ("average") has been added.



A different picture can be drawn for child M43: She started with test scores slightly below 50%, i.e. at chance level. Her test results, though, improved consistently over time, with an increase of 8% between Test 1 and Test 2, which then went up to 15% between Test 3 and Test 4 where she fared even slightly higher than group average. These results point to individual paths of development in foreign language acquisition, which include different identification scores at the beginning and a different development over time. With regard to the latter, two distinct patterns were discernable, i.e. a constant linear progression vs. a long lasting stagnating performance and progression at the end.

4 Discussion

The results of this study clearly demonstrate that it is feasible to learn a second language in preschool, using immersion methods: The preschoolers from Kiel/Melsdorf performed significantly better in Test 4 than in Test 1 (which took place in the first and in the third year of exposure to EN, respectively). Thus, the children's ability to identify grammatical categories in a picture pointing task improved as a function of contact duration to the L2. Although similar findings have been reported for the comprehension of grammatical structures by monolingual L1 English and EAL children (e.g. Au-Yeung et al. 2000, Howell et al. 2003) as well as for the production abilities in L2 tutored and non-tutored acquisition (see Wode 1993 for an overview), this study for the first time showed such a development for GE children in a bilingual GE-EN preschool. However, this progression in the children's performance was not a linear one as no significant improvement in the children's correct identification scores was found between Test 2 and Test 3, i.e. between 18 and 23 months of exposure to EN. It is not yet clear why this is the case: It is unlikely that the children did not receive enough English input as no special events (e.g. long-term absence of staff or children) took place during that period. However, it is of importance to always supplement general results with more detailed analysis: A closer look at the grammatical categories, however, indicates that some categories were indeed better identified in Test 3 than in Test 2 (i.e. DET and NEG), whereas the correct identification rates of the majority of categories (i.e. PLU, POSS, PREP, PRO, SVO) did not improve. It is imperative, though, to keep in mind that the language learning process may not always be a linear one (see e.g. Larsen-Freeman 1997).

An additional result of this study was that children performed better on certain grammatical categories than on others. For example, in all tests, the grammatical categories PREP and NEG were better identified than PLU or DET. Similar results were obtained in a study on L2 grammatical comprehension of Turkish and Cantonese EAL children in London

(Howell et al. 2003) and in parallel tests administered to monolingual EN children (Au-Yeung et al. 2000, Howell et al. 2003). Apparently, some grammatical categories are more difficult to master than others, independent of the language acquisition setting, i.e. L1 acquisition or the acquisition of a foreign language which may or may not be the children's ambient language outside the preschool context (see also Steinlen 2008a). One possible explanation may be found in the input that the children receive: For example, the GE preschoolers in the present study performed poorly on the grammatical categories POSS and PRO, which were identified at chance level in Test 1 and which, in contrast to the other grammatical categories, showed no significant improvement in Test 2, 3 or 4. Grammatically speaking, the use of nouns instead of pronouns is a strategy for reinforcing people's names (*Laura's cat* instead of *her cat*). In the literature, such substitutions are reported for 1st or 2nd person singular pronouns (e.g. Snow & Ferguson 1977, Snow 1986) but have not been mentioned with regard to 3rd singular pronouns. Therefore, a preliminary analysis of recorded interactions between the native EN speakers and the children was conducted in Kiel/Melsdorf. It showed that the use of PRO and POSS with respect to 3rd person singular was underrepresented in the input, i.e., the native EN speakers rather referred to a person's name instead of using a pronoun. This is one of the contextualisation strategies (see e.g. Baker 2000, Burmeister 2006, Steinlen 2008b) to ensure that children actually understand who the EN speaker is referring to when talking about a third person. Based on these observations, it is not surprising that the preschoolers did not correctly distinguish between masculine and feminine personal and possessive pronouns. Moreover, the grammatical category PLU received identification rates just above chance level in Test 1. In the EN input, plural nouns are often preceded by an ordinal number or by a quantifier; the plural marker is then redundant and/or acoustically not salient for the learner. Data from L1 EN grammatical comprehension tests and from L1 and L2 EN speech also showed that the inflectional marker was identified less confidently and was produced later than other functors (e.g. Brown & Fraser 1963, Fraser et al. 1963, Brown 1973, Wode 1993, Au-Yeung et al. 2000, Howell et al. 2003). In the present study, the identification rates of PLU in Test 2, 3 and 4 were considerably higher than in Test 1. Thus, contact duration to the L2 and, possibly, variegated L2 input, increased the children' awareness with respect to the correct identification of the plural marker (see also Steinlen 2008a).

This study yielded clear results with respect to the question whether the children's performance in comprehension tasks is affected by their sex because no significant differences were found in all tests. Unfortunately, studies on L1 and EAL grammatical comprehension did not report on whether boys and girls performed differently (e.g. Fraser et al. 1963, Lovell & Dixon 1967, Au-Yeung et al. 2000, Howell et al. 2003). However, it is often claimed that girls perform significantly better than boys (e.g. Schmid-Schönbein 1978, Schlichting & Spelberg 2003; but see Natorp 1975, Rohde & Tiefenthal 2002), which is usually accounted for in terms of behavioural factors, e.g. girls' identification with female caretakers as well as their greater adaptability.

With respect to the way how children learn to comprehend grammatical categories, a large amount of individual variation was found in this study: A comparison of two children which were matched for age, sex and time of L2-exposure showed that inter-individual variation included differences regarding the correct identification rates of the grammatical categories at the beginning of the tests. Furthermore, these two girls' paths and patterns of development differed greatly: One girl followed a constant linear path (i.e. her scores increased for each test), the other girl's scores stagnated and a progression was not observed until the last test. How can these inter-individual differences be explained? Among the many factors to be considered, personality traits may serve as one explanation (see Wong Fillmore 1979): Although both girls were rather shy at the beginning of their preschool time, one of the girls developed into a more outgoing person who actively sought out the company of the English speaking caretaker. The other girl, on the contrary, remained rather introverted and did not spend much time with the English speaker. These results correspond to findings from other studies where preschoolers' foreign language abilities were assessed: For example, Paradis (2005) showed that individual English language learners were acquiring English at variable

rates, which was evident from the sizable standard deviations and ranges in the accuracy scores in the grammatical morphology test. In addition, researchers looking at other aspects of early L2 development in preschool and first grade also reported substantial individual differences between children, even between those who began and continued to learn English in the same class (Tabors & Snow 1994; Wong Fillmore 1979). It is therefore imperative to consider the child's biography, its character and its relationship to native and non-native speakers in the preschool context in order to adequately account for these individual variations (see also Steinlen & Burmeister i. pr.).

5 Conclusion

The results of this grammar comprehension task strongly indicate that preschoolers can indeed learn a new language without any conscious effort and formal instruction and that their receptive abilities improve greatly over time. These results are even more significant as EN was not the ambient language of these children and their contact to EN was restricted to a preschool context only. This study could also draw parallels to L1 acquisition and naturalistic L2 acquisition. Such a bilingual context as found in the preschool in Kiel/Melsdorf may therefore rightfully be considered a natural L2 setting: The language learning abilities that are activated in this situation seem to be the same as those activated for non-tutored foreign language acquisition.

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The Acquisition of Verb-argument Structure in German-speaking Children

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Abstract

Valian (1991) proposes that children's use of verb-argument structure is based on abstract knowledge of verb categories and limited by shortcomings of performance. Theakston, Lieven, Pine & Rowland (2001) provide evidence that children's transitive and intransitive verb use is learnt gradually and influenced by verb use in the input. The present study examines the acquisition of verb-argument structure in German-speaking children aged 1;6 to 2;10 and is based on longitudinal spontaneous speech data of a sample of six children, four girls and two boys, and their mothers (Szagun, 2004). Children's verb use was analysed at two MLU levels (MLU1: M = 1.89, MLU2: M = 2.86). On average, 171 child verb utterances (SD = 68) per child at level 1 and 333 child verb utterances (SD = 147) per child at level 2 were used. The influence of adult speech was analysed on the basis of 25 verb types. The present results suggest that children's acquisition of verb-argument structure develops gradually and is sensitive to adult use of verbs.

1 Introduction

Most of the children learning German utter a first word between the age of 12 and 20 months. At the beginning they use individual nouns, particles, demonstratives, verbs, and intonation to mark questions (Szagun, 2006). After that they combine these elements into linguistic constructions. Linguistic constructions are composed of four types of symbolic elements: words, a more or less given word order, morphological marking, and intonation contour/prosody (Bates & MacWhinney, 1982). The more elements are involved and the more these elements are interrelated, the more complex the linguistic construction becomes. For example, the English regular plural construction is relatively simple (noun + -s), whereas the German plural system is a complex one consisting of multiple regularities (Szagun, 2006). But both are abstract because they are symbolic.

1.1 Verbs and their Arguments in German

All elements in a sentence – apart from the verb – which can be exchanged or moved as a whole are called arguments. The valence of a verb is its ability to structure the syntactic field (Bußmann, 2002). The German verb *begrüßen* (*to greet*) for example needs at least two arguments, a nominative and an accusative argument: *Ich begrüße meinen Nachbarn* (*I greet my neighbour*). So verbs vary in number and character of their arguments. But the valence of a verb only depicts the "potential of verb meaning" (Schuchmacher, Kubczak, Schmidt & de Ruiter, 2004). The actual usage of a verb in conversation can differ from it. For example, the German verb *schenken* needs – as defined by grammar – three arguments: a nominative, an accusative and a dative argument: *Ich schenke dir einen Schokoriegel* (*I give you a chocolate bar*). But the potential must not be fully expressed during conversation.

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Kid: Schenkst Du mir einen Schokoriegel? (Do you give me a chocolate bar?)
Mother: Ja, schenk ich dir. (*Yes, I give you.)

The valence of a verb is not determined by verb usage in certain situations but reflects the ability of a verb to structure the syntactic field (Schumacher et al., 2004). Broadly speaking, German verbs can be transitive, intransitive, and mixed. Transitive verbs take obligatory direct object arguments, intransitive verbs do not take direct object arguments and mixed verbs can do either.

Transitive:	*Ich brauche neue Schuhe*. (*I need new shoes*.)
Intransitive:	*Mama geht nach Hause*. (*Mom is going home*.)
Mixed:	*Ich esse. Ich esse eine Banane*. (*I'm eating. I'm eating a banana*.)

1.2 Acquisition of Verb-argument Structure

The literature presents two lines of evidence about how children combine nouns and verbs into linguistic constructions. One line of evidence suggests that children's early knowledge of syntax is of an abstract and general nature and is limited by shortcomings of performance (Valian, 1991; Wexler, 1994; Pinker, 1996). Valian (1991) proposes that children understand the distinction between obligatory and facultative direct objects right from the beginning. So children are expected to produce direct objects much more frequently with transitive than with mixed verbs. Furthermore, she predicts that children produce transitive verbs only later in development because "one way the beginning speaker can lighten the burden of producing objects for verbs is to produce more verbs that do not require objects" (p.70). Valian (1991) examined cross-sectional spontaneous speech data of a sample of 21 children aged 1;10 to 2;8 who were learning American English. They were divided into four groups based on their mean length of utterance (MLU). As the largest changes occurred between Group 1 and Group 2 (MLU 1: M = 1.77; MLU 2: M = 2.49), only these stages are examined in the following analyses. There were five children in both groups. 47 to 274 verb utterances per child were analyzed. Valian (1991) found that at both MLU levels, the children provided objects much more frequently for transitive (M > 90 %) than for mixed verbs (M = 49 % in group 1; M = 66 % in group 2) and they produced few objects with intransitive verbs (M < 10 %). In addition, she found a proportional increase in the use of transitive verbs between group 1 and group 2 (M = 45 % in group 1; M = 59 % in group 2). She assumes that children "do not use a verb unless they know how it subcategorizes with respect to objects" (p.74). The increase in direct object provision with mixed verbs to the second MLU level is seen as support for a decrease in performance limitations. The longer the utterances were the more optional objects were produced. The increase in their use of transitive verbs only later in development is seen as a strategy. Valian (1991) assumes that 'the child has the option of using more intransitive and mixed verbs to get around the cognitive load that additional constituents would appear to impose' (p.75).

The other line of evidence assumes that, initially, children do not possess fully abstract syntactic schemas but learn 'concrete pieces of language', – i.e. words, complex expressions, and constructions which are both concrete and abstract (Tomasello, 2006, p. 263). Several studies with either naturalistic data or in experimental settings have shown that children's early knowledge of verb-argument structure is learnt on a verb-by-verb basis and represents only gradually more general word order patterns (for an overview, see Tomasello, 2000). Furthermore, it is assumed that all linguistic structures are acquired through 'normal' learning and abstraction (Tomasello, 2006). Theakston et al. (2001) provide evidence that children's transitive and intransitive verb use is learnt gradually and influenced by verb use in the input. They suggest that Valian's (1991) data could also be viewed as evidence in support of a performance-limited learning account. According to the learning account, the transitive frame

is expected to be more difficult for the child to acquire. So the intransitive frame will prevail at the beginning. They further suggest that the early acquisition of verb-argument structure depends on the frequency of particular lexical items and verb frames in the input. Theakston et al. (2001) investigated longitudinal spontaneous speech data of a sample of nine children learning British English who were matched on MLU to the children in Valian's (1991) study (MLU 1: M = 1.66; MLU 2: M = 2.84). On average, 353 verb utterances per child at MLU level 1 and 1504 verb utterances per child at MLU level 2 contributed to the analyses. In accordance with Valian's (1991) findings and their own predictions, the use of intransitive verbs prevailed and children's use of transitive verbs increased between MLU level 1 and 2. However, at stage 1 the children did not use a direct object with a transitive verb as consistently as did the children in Valian's study (M = 79 %). This suggests that these children may not 'know' the abstract category of these verbs at such an early stage. Theakston et al. (2001) found a shift towards greater proportional transitive use with mixed verbs, but an analysis at the lexical level revealed that at both MLU levels the majority of the children's mixed verbs (MLU 1: M = 70.5 %; MLU 2: M = 65.9 %) were produced either in the transitive or the intransitive frame. Moreover, for those mixed verbs where the children produced both frames, the transitive frame prevailed. Thus, Theakston et al. (2001) do not see evidence to suggest that children 'chose' to produce the intransitive frame for performance reasons. The proportional increase in the use of the transitive frame with mixed verbs is explained with the late acquisition of a number of mixed verbs used predominantly or exclusively in the transitive frame.

The present paper aims at answering the question of how German-speaking children combine nouns and verbs into linguistic constructions at an early age and whether they are influenced by the input. It is assumed here that they learn the grammatical categories gradually, and that they are influenced by the use and the frequency of verbs in the input.

2 Method

2.1 Design and Participants

The present analyses are based on longitudinal spontaneous speech data of a sample of six children, four girls and two boys, and their mothers (Szagun, 2004). These children were recorded during a two hourly free play situation with a parent at a five- or six-week-sequence between the ages of 1;4 and 3;8. Twenty-two speech samples per child and four data points per parent were analyzed. The children had no diagnosed developmental delays and they demonstrated age-appropriate object permanence knowledge at the start of data collection at age 1;4 (Sarimski, 1987). The children were growing up in monolingual environments and were resident in Oldenburg, Northern Germany. They were recruited from two day-care-centres and a paediatrician's practice in Oldenburg.

Children's verb use was analysed at two MLU levels (M_1 = 1.89, M_2 = 2.86) using four to seven data points per child. At these data points, children were aged 1;6 to 2;10 with a median of 1;10 at MLU level 1 and a median of 2;2 at MLU level 2. At each of the following data points 500 parental utterances were transcribed: 1;4, 1;8, 2;1 and 2;5. These were the first 500 utterances of the sessions. Usually, the mother was the child's conversational partner, but sometimes the father.

2.2 Coding of Utterances with Lexical Verbs

All main verbs in child and adult language were coded for the presence and absence of a direct object argument. Excluded from the analyses were: utterances containing forms of the copula, self-repetitions and imitations, incomplete utterances, partially intelligible utterances and routines. The verb *gucken* (*to look*) was excluded from the analysis as it predominantly occurred in the fixed phrase *Guck mal!* (*Look!*) which we classified as a routine. Verbs in

periphrastic constructions were included. According to Schumacher et al. (2004) the use of a modal does not affect the valence of the lexical verb. However, we did not analyze the use of modals without lexical verb. Verbs with detachable prefixes counted as tokens for the main lemma. For example, the type *fahren* (*to drive*) comprised the verbs *runterfahren* (**to drive down*), *rauffahren* (**to drive up*) or *wegfahren* (*to depart*).

Verbs in the input were then categorized as transitive, intransitive, and mixed based on the mother's use of these verbs. We categorized verbs as transitive if the mother used them more than 80 % of the time with a direct object argument. Verbs were coded as intransitive if they were used by the mother in less than 10 % of the utterances with a direct object argument. All other verbs were coded as mixed verbs. By choosing the 80 %-limit for transitive verbs we took into account that in a conversation an obligatory direct object argument can be left out. The 10 %-limit for the intransitive verbs allowed us to pool verbs with inseparable prefixes (e.g. *lächeln* (*to smile*) and *belächeln* (*to smile at*)) and it permitted single erroneous assignments for grammatical case in child directed speech. All coding was carried out by the first author. An additional coder coded 22.87 % of all verb utterances for reliabilities. Interrater reliability was 90.23 %, Cohen's Kappa = .814.

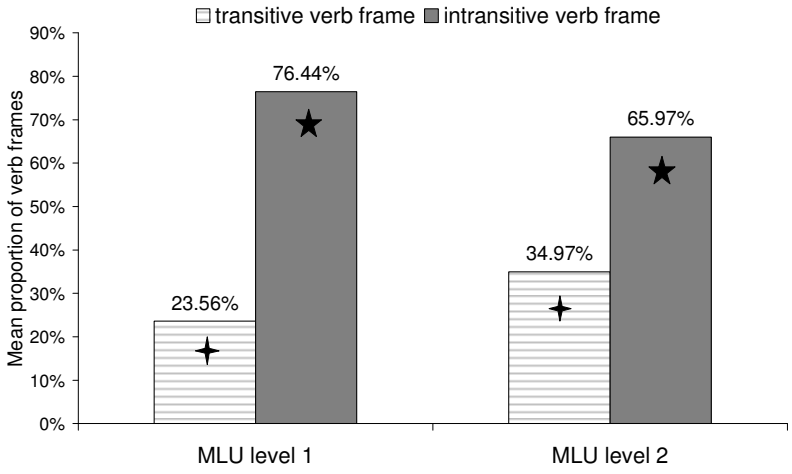
Only those child utterances contributed to the analysis that contained a verb categorized as transitive, intransitive, or mixed. An average of 171 utterances with verbs per child (SD = 68) were used at MLU level 1 and an average of 333 utterances with verbs per child (SD = 147) were used at MLU level 2. At the level of individual verbs, 28 verb types (SD = 6) at MLU level 1 and 39 verb types (SD = 7) at MLU level 2 contributed to the analysis. Verb use was coded as unclear in 139 utterances as grammatical case of the argument was unclear. On average 696 parental verb utterances (SD = 101) and 69 verb types (SD = 2) contributed to the analysis. We analyzed whether the mothers' proportional transitive verb use was comparable over the four data points. For each mother, each data point and each verb, we calculated the relative frequencies of transitive verb use. The correlations between these four frequency distributions per mother ranged from $r_s = .486$ ($p < .05$, $N = 25$) to $r_s = .870$ ($p < .01$, $N = 31$). Only one correlation did not reach significance, but pointed in the same direction. Maternal verb use was regarded as consistent over time. We therefore summed up the four data points per mother in order to have one sample per mother.

3 Results

3.1 Child Verb Use

Figure 1 shows the average relative frequencies (N = 6) of transitive and intransitive sentences at each MLU level calculated with respect to verb tokens. It is clear that intransitive verb frames are more frequent overall. But relative frequencies of transitive verb frames increase significantly from the first to the second MLU level, while intransitive verb frames decrease (Wilcoxon, p = .028, Z = -2,201). The increase of direct object arguments is accounted for by an increase of transitive and mixed verb use and a decrease of intransitive verb use. Anyway, the dominance of the intransitive frame corresponds to mean length of utterance in child speech. At MLU level 1, 45 % (SD = 14 %) of the intransitive frames consist of only one word. This proportion decreases to 19 % (SD = 4 %) at MLU level 2.

Figure 1. Average relative frequencies of transitive and intransitive verb frames in child language (N = 6). p = .028 (Wilcoxon, Z = -2.201); p = .028 (Wilcoxon, Z = -2.201)



3.2 Comparison with the Input

In child directed speech, transitive verb frames were as frequent as intransitive verb frames with respect to verb tokens (M = 50 %, SD = 5).

Figure 2 shows the children's average proportional use of direct objects with each verb type that was used in a reasonable number of utterances (N ≥ 6). As predicted by Valian (1991), children produced a lower proportion of direct object arguments with their mixed verbs than with transitive verbs and there was an increase in the proportional use of direct objects with mixed verbs between MLU level 1 and 2 (see Fig. 2). The increase in direct object provision between MLU level 1 and 2 was significant for transitive verbs (Wilcoxon, Z = -2.845, $p < .05$) but not for mixed verbs. However, at both MLU levels children's use of transitive verb types did not correspond to the grammatical category of a transitive verb. Furthermore, at MLU level 1, 69 % of the mixed verb types are used in a single frame only. At MLU level 2, still 18 % of the mixed verb types are used in a single frame only. Thus, the children showed little evidence that they know that these verbs are in fact mixed in adult language.

Figure 2. Mean proportion of direct object arguments used with transitive, intransitive, and mixed verbs in child language (N = 6). $p < .05$ (Z = ★845, Wilcoxon)

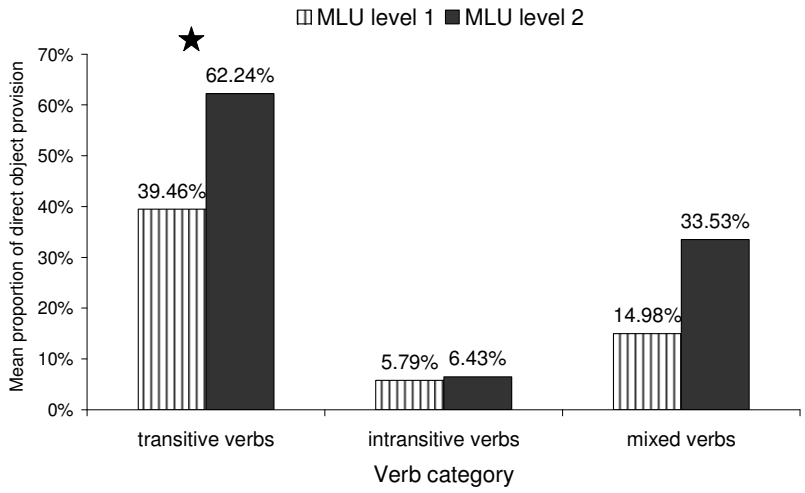
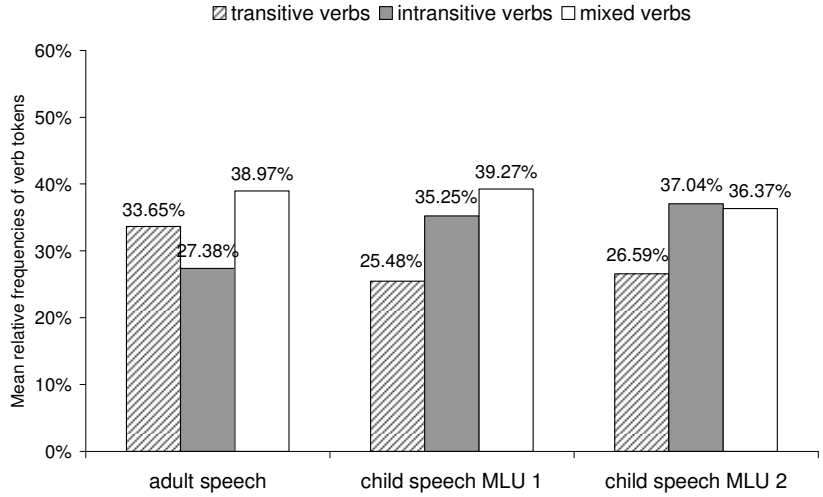


Figure 3. Mean relative frequencies of transitive, intransitive, and mixed verb tokens in adult and child language at both MLU levels.



As predicted by Valian (1991), the children in our corpora used more mixed verbs than transitive verbs. But there was a close correspondence between relative frequencies of transitive, intransitive, and mixed verbs with respect to verb tokens in adult and child speech (see Fig. 3). Mann-Whitney tests showed no differences between the mean relative frequencies of transitive, intransitive, and mixed verb tokens in child speech (both MLU levels) and adult speech.

3.3 Influence of Child Directed Speech

In order to examine the effects of the use of verb frame in the input on children's use of verb frame we analyzed verb use for each mother-child dyad separately. An average of 9 verb types (SD = 4) at MLU level 1 contributed to the analysis. An average of 13 verb types (SD = 4) was analyzed at MLU level 2. The correlations between the average proportional use of the transitive frame with individual verbs in the input and in the child's speech were found to be significant for all mother-child dyads at MLU level 2 but only for two mother-child dyads at

MLU level 1 (see Table 1). Thus, in principle, the more often the mothers used a verb with a direct object argument the more often the children used a verb transitively and vice versa.

Table 1. Correlations between the average proportional use of the transitive frame with individual verbs within individual mother-child dyads.

Dyad		MLU level 1	MLU level 2	Dyad		MLU level 1	MLU level 2
Child 1 – Mother	r_s	.573	.746	Child 4 – Mother	r_s	.638	.710
	p	.020	.000		p	NS	.004
	N	16	20		N	8	14
Child 2 – Mother	r_s	.928	.856	Child 5 – Mother	r_s	.201	.878
	p	.008	.001		p	NS	.000
	N	6	11		N	9	11
Child 3 – Mother	r_s	.426	.771	Child 6 – Mother	r_s	.364	.755
	p	NS	.025		p	NS	.044
	N	8	8		N	8	12

Furthermore, the child data were scanned for all verbs used at MLU level 1 and for all verbs occurring as new verbs at MLU level 2. Eight verbs are used by all children at MLU level 1: *essen (to eat), gehen (to go), haben (to have), holen (to catch), machen (to make), stehen (to stand), ziehen (to pull)*. We found no verb occurring as new verb and used by all children at MLU level 2. But there were six verbs (*baden – to bath, bringen – to bring, glauben – to think, lesen – to read, räumen – to clear, stellen – to put)* that were used by at least three of the children not until MLU level 2. First, we examined whether the mothers differ with respect to the relative frequency of the use of individual verbs. For each mother we therefore calculated the relative frequency of the above mentioned 14 verbs. The majority of pairwise correlations (73 %) was found to be significant ($p < .01$; $p < .05$) with coefficients ranging from $r_s = .687$ to $r_s = .917$. We therefore calculated the average frequency for each verb across the input data. A Mann-Whitney test showed that the eight verbs used by the children at MLU level 1 were significantly more frequent in mothers' speech than those verbs children used from MLU level 2 onwards ($p < .05$).

4 Discussion

The present study was aimed at answering the question of how German-speaking children aged 1;6 to 2;10 combine nouns and verbs into linguistic constructions. It is assumed here that children learn the grammatical categories gradually, and that they do not use verbs in abstract syntactic schemas right from the beginning. We analyzed child directed speech as an influencing factor.

As in the studies by Valian (1991) and Theakston et al. (2001), children of the Oldenburg corpora used more transitive verb frames at the second than at the first MLU level. At the same time, at both MLU levels intransitive verb frames prevailed. Children increased their use of direct objects with transitive verbs significantly from the first to the second MLU level. These results seem to support the limited-learning account. In addition, there is evidence for the influence of adult input. This concerns verbs use at the lexical level and frequencies.

The present results show that children do not seem to differentiate between obligatory and facultative direct objects. Although they provide direct objects more often with transitive verbs than with mixed verbs, verb usage is still far away from being grammatically correct

with the transitive category. Moreover, many of the mixed verb types are produced in only one single frame providing little evidence that children know the direct object to be facultative. There was also little evidence to suggest that the children avoid ungrammatical utterances by producing more verbs with facultative than obligatory direct objects. While they used more mixed verb tokens than transitive and intransitive verb tokens, the reason for this may not be because they prefer verbs with facultative objects in order to avoid ungrammatical sentences. Such verb use simply reflects adult use, as relative frequencies of transitive, intransitive, and mixed verb tokens in child directed and child speech corresponded closely.

The results show clearly that children seem to be sensitive to verb use in the input. The verbs the children used at the first MLU level were significantly more frequent in adult speech than those verbs which they did not use until the second MLU level. So, the relative frequencies of particular lexical items seem to play a role in the acquisition of linguistic constructions. However, adult and child verb use with respect to frequency of direct object use did not correlate for every mother-child dyad at the first MLU level but only for two mother-child dyads. At the second MLU level, the children's verb use correlated significantly with that of their mothers.

Perhaps, it is useful to consider that, whether a verb is produced in the intransitive or transitive verb frame is not only affected by the grammatical category of the verb. As was pointed out earlier in the introduction, the discourse context of the utterance is another determining factor of whether an intransitive verb use is acceptable or not. Using a transitive verb without the obligatory direct object highlights verb meaning and might prevail in situations where action is in the centre of attention. Moreover, as discussed by Theakston et al. (2001), the choice of verb frame with mixed verbs is determined by the speaker's intention to convey general or specific information. In this sense, differences in verb use between adults and children may be due to differences in the roles adults and children play in a conversation.

In contrast to the findings of Valian (1991) and Theakston et al. (2001), the children of our corpora were much more reserved with respect to direct object use for both transitive verbs and mixed verbs. They were no way near the level of direct object use the English learning children showed in both studies. One explanation could be that children in the two languages were matched on MLU. As German is a moderately inflecting language, German-speaking children's MLU level may be higher due to use of inflections, although their overall grammatical development may be less advanced than that of English-speaking children. In particular, they may be less advanced at the syntactic level and this would affect their use of direct objects and sentence frames with direct objects.

Other reasons for the differences in results are of a methodological nature. Thus, we included imperatives and verbs taking sentential complements, whereas Valian (1991) did not. In comparison to the study by Theakston et al. (2001) our study is based on less verb use by the children.

5 Conclusion

The present results show that, initially, German-speaking children have limited knowledge of verb-argument structure. They do not differentiate between obligatory and facultative direct object arguments, and contrary to Valian's (1991) findings, they do make mistakes with transitive verbs. Thus, the conclusion that children have abstract knowledge of verb categories seems unwarranted. Our results show clearly that children are sensitive to the patterns of verb use in the input. This is so on the lexical and the frequency level. Thus, it appears that verb-argument structure is acquired gradually by children and under the influence of adult use of verbs and sentence frames.

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The Younger the Better? Variability in Language Development of Young German-speaking Children with Cochlear Implants

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Abstract

The influence of age at implantation and experiential factors on language development in young children with cochlear implants was examined. There were two samples, one cross-sectional with 41 children, and one longitudinal with 26 children. Age at implantation in both samples ranged from 6 to 47 months, with children evenly distributed in the age groups: 6-12, 13-24, 25-42 months at implantation. Linguistic progress was assessed by parental questionnaire, and for the longitudinal sample additionally, by one-hourly spontaneous speech samples. Data were collected 12, 18, 24 and 30 months after implantation. Measures of vocabulary and grammar were taken, including number of word types, MLU, inflectional morphology and sentence complexity. In both samples there was extensive variability in linguistic progress. Children's linguistic progress was significantly related to social class, measured by parental education, but not age at implantation. Maternal dialogue variables were analyzed in the longitudinal sample and found to be related to children's linguistic progress. Thus, experiential factors account for the extensive variability in children's linguistic growth rather than age at implantation. The data support an epigenetic rather than a maturational concept of 'sensitive phase'.

1 Introduction

A cochlear implant (= CI) is an electronic microprothesis replacing the function of the cochlea in the inner ear. Cochlear implantation provides access to audition for profoundly deaf individuals. It has become increasingly popular with young profoundly deaf children and enables them to acquire spoken language.

Studies in different languages have observed extensive variability in the linguistic progress of children with cochlear implants (Fryauf-Bertschy et al., 1997; Szagun, 2001, 2004a, Schauwers et al., 2002). Such variability far exceeds the variability found in typically developing children, even if the children receive their cochlear implant before the age of four years (Szagun, 2001). In the study by Szagun (2001) with 22 children the average age of implantation was 27 months, with a range of 14 to 46 months. A control group of 22 normally hearing children was included. Children in both groups were matched for initial language level and had an initial MLU of < 1.25. The first three years of language development were studied. Results showed that 45 % of the children with CI acquired language within the range of variability of normally hearing children, whereas 55 % remained far below this range.

How can such variability be accounted for? Medical approaches tend to favour an explanation in terms of age at implantation suggesting, in particular, that children implanted below 24 months of age display faster language learning due to 'sensitive phases' for neural

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organization of auditory systems and for language learning (Svirsky et al., 2004; Tomblin et al. 2005; Nicholas & Geers, 2007). However, it is far from clear in what way sensitive phases for learning contribute to the differential progress in children with CI. What research on 'sensitive phases' has shown is that deaf children who receive a cochlear implant before the age of 42 months display auditory evoked response latencies equivalent to that of normally hearing children, but children implanted after the age of 84 months do not (Sharma et al., 2002). With respect to neural systems processing language Neville & Bavelier (2002) showed that the biological bias for left hemispheric neural systems to process grammar is only fully expressed, if language learning starts during the first years of life. This being the case, left hemispheric neural systems will get established to process grammar, regardless of modality, spoken or signed.

There is a tendency at present – often evoking 'sensitive phases' – to assume that the quality of CI children's language development is linearly inversely related to chronological age at implantation during the early years of life. Thus, Nicholas & Geers (2007) who found that children implanted by 24 months catch up with their normally hearing peers by 4 ½ years of age, suggest that research should focus on finding out if children implanted by 12 months achieve age-appropriate language even earlier. In a preliminary analysis Lesinsky-Schiedat et al. (2004) suggest that children implanted in the first year of life outperform children implanted in the second year of life.

In my view, the evidence for a strong effect of age at implantation in children implanted before the age of 48 months is not as convincing as it might look. The cited studies consider only the influence of age or time-related factors, and no experiential factors. Consequently, they cannot find their effect. However, as Tomblin et al. (2005) point out, in their study age accounted for 14.6 % of the variance in children's linguistic progress. So, there must be other factors which influence children's linguistic growth.

Developmental psycholinguistic approaches have taken into account cognitive and experiential factors as possible sources of variation in addition to age at implantation (Szagun, 2001; Willstedt-Svensson et al., 2004). When the joint influence of age at implantation and pre-operative hearing with hearing-aids is analyzed, quality of pre-operative hearing accounts for a larger proportion of the variance in grammatical and lexical development than age at implantation (Szagun, 2001). When the combined influence of age at implantation, quality of pre-operative hearing and adult dialogue characteristics is analyzed, age of implantation loses its significance altogether, and maternal speech characteristics gain in importance over time (Szagun, 2004a). Similarly, Willstedt-Svensson et al. (2004) found that time variables, such as age of implantation and time with implant predict grammatical development only when they are considered in isolation. When the influence of working memory is analyzed jointly with time variables, however, age of implantation loses its significance and working memory is a strong predictor of grammatical development (Willstedt-Svensson et al., 2004).

Thus, when a conceptual approach is taken which integrates age, cognitive, and experiential factors in the analysis, it is evident that variability in the linguistic development of children with cochlear implants is explained to a larger extent by cognitive and experiential factors than by age at implantation.

In the present study the influence of age at implantation and experiential factors on the linguistic progress of children with CI is investigated in children implanted between the age of 6 and 47 months. The aim is to find out if age at implantation gains in importance as a predictor of children's linguistic progress when the sample of children contains a substantial proportion of children who were implanted before the ages of 12 and 24 months. This would confirm the claim that, the younger children are when they receive their implant the better their language development will be (Svirsky et al., 2004; Tomblin et al., 2005; Nicholas & Geers, 2007). It is hypothesized here that, even when children are implanted in their first year of life, age at implantation as well as environmental factors influence children's language development. As environmental factors, social class and the type of language input children receive from their parents are chosen. Both factors have been shown to influence typical and non-typical language development (Gallaway & Richards, 1994; Clark, 2003; Szagun, 2004a).

2 Method

2.1 Participants

There were two samples of children. One was a longitudinal sample with 26 children, 12 girls and 14 boys. The children's mean implantation age was 20 months, (SD=11 months, range 6 to 42 months). At the time of implantation 8 children were between 6 and 12 months, 10 children between 13 and 24 months, and 8 children between 25 and 42 months. The other sample was a cross-sectional sample. Data collection for this sample is still ongoing. A sample of 150 children is aimed at. For present purposes, the data from 41 children at 30 months after implantation will be analyzed, because only in this group is the data base sufficiently large at this point in time. The average age at implantation in this sample was 24 months, (SD = 12 months, range 6 to 47 months). At the time of implantation 11 children were between 6 and 12 months, 14 children between 13 and 24 months, and 16 children between 25 and 47 months.

Children in both samples were pre-lingually deafened and had no other diagnosed impairments. They are growing up in a monolingual environment with spoken German. Most of the children attend Cochlear Implant Center Hannover for rehabilitation. A smaller number attend Cochlear Implant Rehabilitation Centers in Essen, Halberstadt, Berlin and Tübingen, respectively.

2.2 Design, Language Measures and Procedure

For both samples measures of language were taken at four data points: 12, 18, 24 and 30 months after implantation. Language was assessed by parental questionnaire (Szagun et al., 2006) in both samples, and in the longitudinal sample, additionally, by one-hourly spontaneous speech samples at the same four data points.

For the questionnaire data language measures were: Vocabulary, inflectional morphology, sentence complexity. The parental questionnaire used (Szagun et al., 2006) is modelled on the CDI (Fenson et al., 1994) but contains a scale on inflectional morphology which captures inflectional knowledge in the paradigms: Noun plurals, gender marking on articles, case marking on articles, verb markings and auxiliaries. The questionnaire also contains a section on demographic data.

Language measures based on the spontaneous speech data were MLU and number of word types. Parental speech was also assessed. Measures of parental language were MLU and dialogue characteristics.

The questionnaires were posted to parents via the Cochlear Implant Centers and were returned by post. Sixty-seven percent of the questionnaires were returned. Spontaneous speech samples were collected in a free play situation in a playroom at Cochlear Implant Center Hannover. Digital auditory recordings were made.

2.3 Data Transcription and Analysis

Spontaneous speech samples were transcribed and analyzed using CHILDES CHAT and CLAN programmes (MacWhinney, 2000). MLU was calculated using rules for calculating MLU in German (Szagun, 2004a). A coding scheme for pragmatic content of utterances in parental speech was developed. The most important categories are:

Statements and commentaries about ongoing events: A comment is made about objects, persons, events in the immediate, perceivable context.

Questions asking for maximum information, mostly w-questions.

Devices for calling attention, such as the child's name.

Expansions: expanding a child's incomplete or formally incorrect utterance providing the correct form.

Repetition of content: expressing the same semantic content differently.

Routines: Expressions like *good bye, thank you*.

Four hundred parental utterances were coded for pragmatic content per data point. Inter-rater reliability was calculated on the basis of 25 % of the utterances at different data points. It ranged from 82 % to 89 %.

3 Results

3.1 Lexical and Grammatical Development

The different scales of the parental questionnaire and their maximum scores were: Vocabulary = 600, inflectional morphology = 42, sentences complexity = 32.

Figures 1, 2 and 3 show means and standard deviations for vocabulary, inflectional morphology and sentence complexity scores, for the total sample 30 months after implantation, whose implantation age ranged between 6-47 months, and for children grouped according to age at implantation, i.e. 6-12 months, 13-25 months, 25-47 months. The figures show that there is extensive variability on all scales, but especially on the grammar scales.

In order to determine whether there are differences in language scores depending on age at implantation one-way ANOVAs were calculated for each scale. In no case was the main effect of age group significant. Thus, there is no difference in lexical and grammatical knowledge depending on whether children were implanted in their first, second or third and fourth year of life.

Figure 1. Mean number of words (SD) according to questionnaire 30 months after implantation for the total sample (6-47mths), and children grouped according to age at implantation

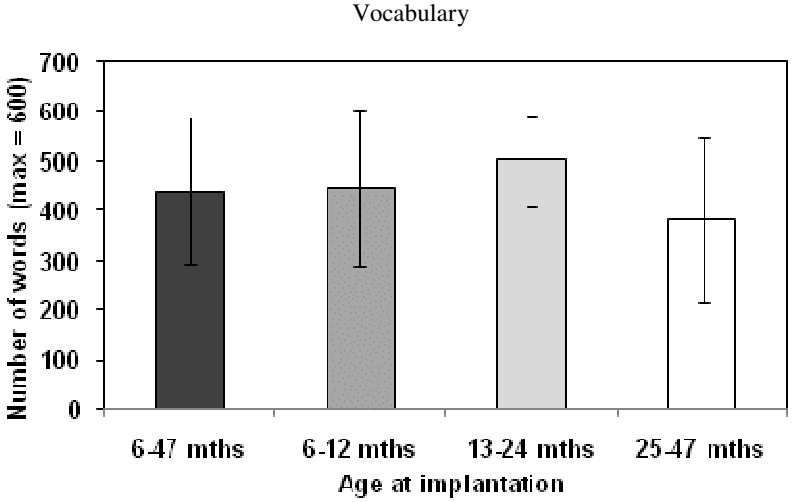


Figure 2. Mean inflectional morpheme score (SD) 30 months after implantation for the total sample (6-47 mths), and children grouped according to age at implantation

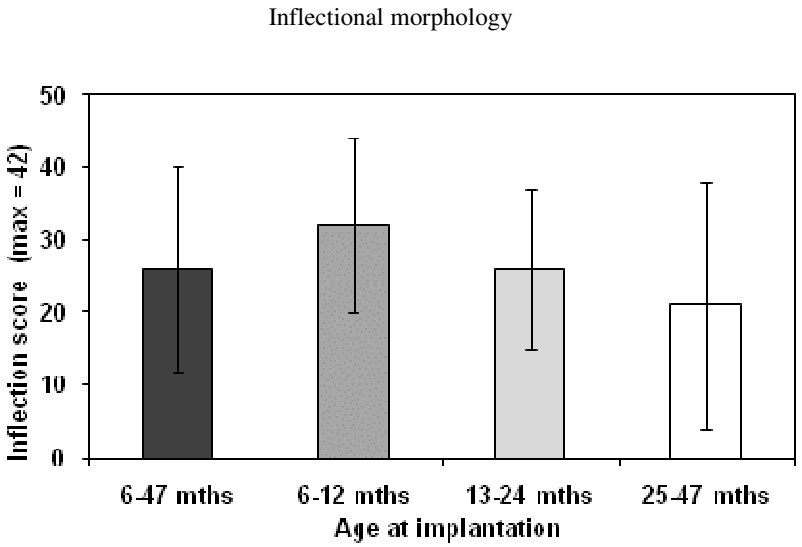
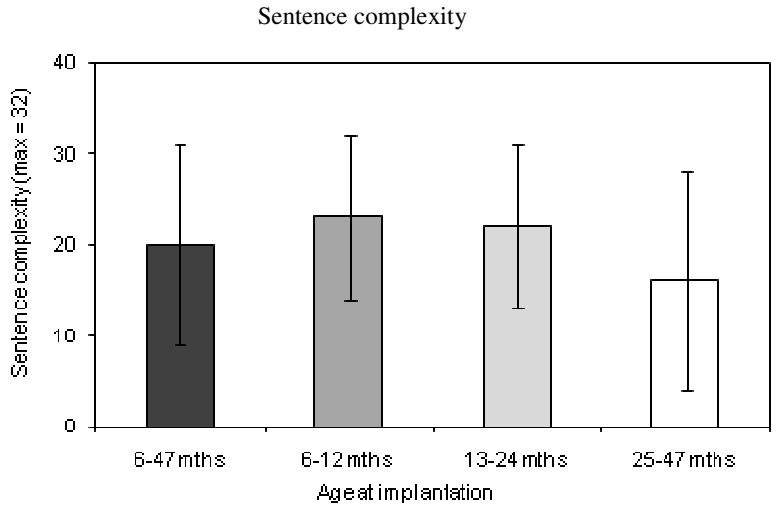


Figure 3. Mean sentence complexity score (SD) 30 months after implantation for the total sample (6-47 mths), and children grouped according to age at implantation



For the longitudinal sample language measures were based on MLU and number of types. Figure 4 shows means and standard deviations for MLU and number of types for the total sample at the 4 different data points, 12, 18, 24 and 30 months after implantation. Standard deviations are large, especially for vocabulary.

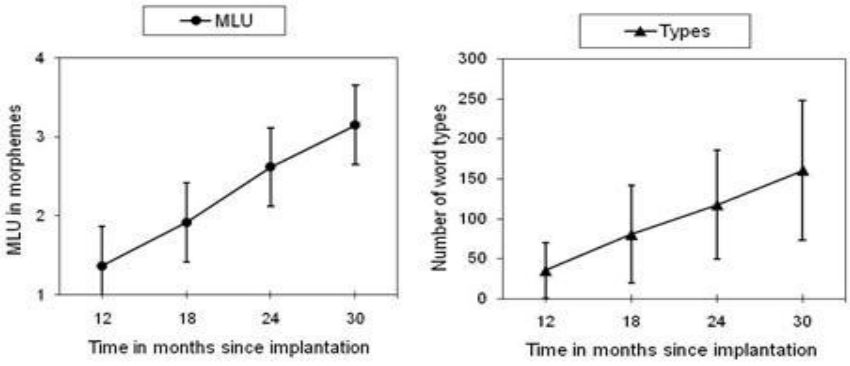


Figure 4: Mean MLU (SD) and mean number of types (SD) for the total longitudinal sample over the data points 12, 18, 24, 30 months after implantation

Figures 5 and 6 show mean MLU and mean number of word types per age group according to age at implantation for the longitudinal sample. Two-way ANOVAs with repeated measures on data point (4) and the between-subjects factor age group at implantation (3) were calculated, respectively. For MLU there was a significant effect of data point, $F(3,69) = 52.99$, $p < .001$, a significant data point x age group interaction, $F(4,43) = 2.93$, $p < .03$ (Greenhouse-Geisser), but no significant effect of group. Pair-wise comparisons between age groups (Scheffe) at each data point were non-significant. For number of word types, there was a significant effect of data point, $F(3,69) = 63.48$, $p < .001$. No other effect or interaction was significant. In the longitudinal sample, too, children implanted in the first, second, or third and fourth year of life do not differ significantly in terms of linguistic progress.

Figure 5. Mean MLUs over time per age group at implantation (longitudinal sample)

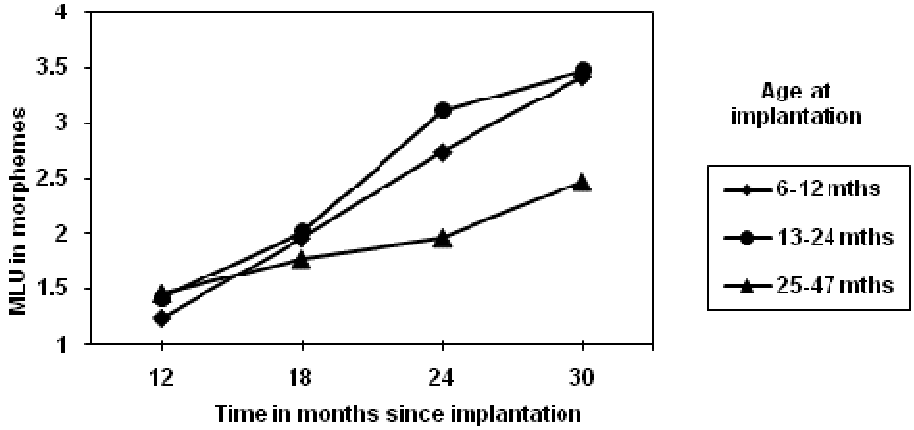
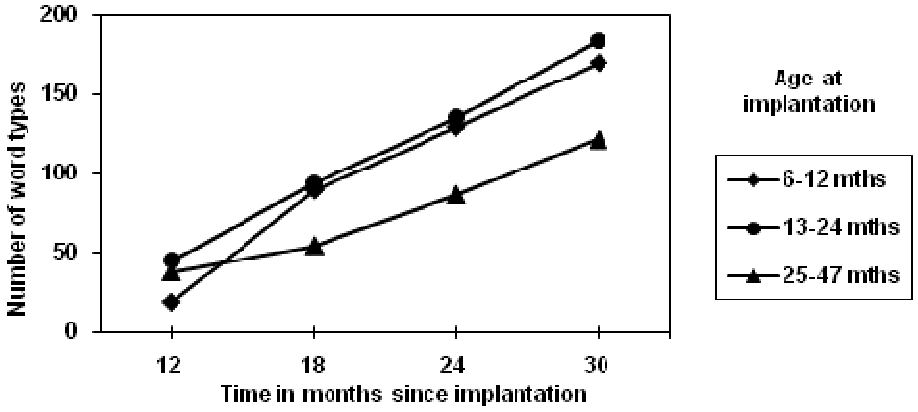


Figure 6. Mean number of word types over time per age group at implantation (longitudinal sample)



3.2 Relation of Age at Implantation and Social Class to Linguistic Progress

A correlational analysis was used to examine the relation between age at implantation, social class and linguistic progress. Table 1 presents bivariate and partial correlation coefficients (Pearson) between age at implantation, social class and language measures at data point 30 months after implantation for both samples. Questionnaire and spontaneous speech measures are used. Social class, as measured by mother's educational level, relates significantly to every measure of children's subsequent linguistic progress, either considered on its own (bivariate coefficients) or when age of implantation is partialled out. Age of implantation relates significantly to linguistic progress only for questionnaire measures of grammar in the cross-sectional sample, and only if it is considered as the only variable (bivariate coefficients). When social class is partialled out, age of implantation does not explain a significant amount of the variability any more although there is a non-significant tendency in the predicted direction (see Table 1).

Table 1. Bivariate and partial correlation coefficients between social class, age at implantation and language measures in both samples at data point 30 months after implantation

	Cross-sectional sample (n=41)				Longitudinal sample (n=26)			
	Social class		Age at implantation		Social class		Age at implantation	
	bivariate	partial	bivariate	partial	bivariate	partial	bivariate	partial
Questionnaire measures								
Vocabulary	.46**	.42**	-.21	-.03	.51*	.52*	-.30	-.16
Inflections	.52**	.46**	-.31*	-.11	.57**	.61**	-.27	-.19
Sentences	.63**	.57***	-.37*	-.12	.71***	.68**	-.30	-.15
Spontaneous speech measures								
MLU					.56**	.52**	-.21	-.09
Word types					.41*	.43*	-.13	-.08

* p < .05, ** p <.01, *** p <.001

3.3 Relation of Adult Input to Linguistic Progress

For the longitudinal sample time-lagged correlations (Pearson) were calculated between mothers' dialogue characteristics at 12 months after implantation, and child language measures at 24 and 30 months after implantation. There were positive correlations ranging from .51 to .80 ($p < .01$) between maternal MLU, expansions, comments about ongoing events and the child variables MLU and type frequency. There were negative correlations ranging from -.42 to -.75 ($p < .05$) between maternal exact repetitions, routines, attention calling devices and the same child variables. Thus, adult language input relates to subsequent linguistic progress by children.

In a regression analysis the combined contribution of those variables which correlated with child linguistic progress was analyzed, using stepwise forward regression. As all dialogue variables correlate with maternal MLU – either positively or negatively - this measure was chosen to represent maternal speech characteristics. As age at implantation did not correlate significantly with linguistic progress in the longitudinal sample, it was not entered as a variable into the regression equation. The results of the regression are presented in Table 2.

When the combined factors are analyzed social class loses its significance, maternal MLU emerges as the only significant predictor of child linguistic progress.

Table 2. Characteristics of maternal speech[a] as predictors of child linguistic progress

Child language measure	Predictors of linguistic progress		R^2
MLU			
24 months after implantation	maternal MLU		.75
30 months after implantation	maternal MLU		.71
Type frequency			
24 months after implantation	maternal MLU	.80	

[a] maternal speech measured 12 months after child's implantation

4 Discussion

The present results show that there is extensive variability in grammatical and lexical development of children with cochlear implants, even when these children receive their implants as young as between 6 and 47 months of age. This finding corroborates previous findings of extensive variability in the language development of young children with cochlear

implants in samples of children with only slightly higher implantation ages (Szagun, 2001, 2004a; Svirsky et al., 2004; Tomblin et al., 2005; Nicholas & Geers, 2007).

In the present study, the observed variability was not sufficiently accounted for by age at implantation. In the two different samples there were no significant differences in grammatical and lexical development in dependence on whether children received their cochlear implant in the first, second, or third and fourth year of life. Unfortunately, we were unable to distinguish between children implanted in their third or fourth year, because of insufficient numbers of children implanted in their fourth year of life.

Correlational analyses of the relation between age at implantation and linguistic progress showed no more than a mild tendency in the direction of a significant inverse relation between age at implantation and linguistic progress, and only when age was considered in isolation. In this case, measures of grammar were significantly inversely related to age at implantation in one of the two samples. However, when the joint influence of age at implantation and social class was analyzed, age of implantation lost its significance in both samples, whereas social class was strongly related to linguistic progress.

Looking at the effect of age more closely, Figures 1, 2, 3, 5 and 6 show a non-significant trend in the direction of the two younger age groups, i.e. children implanted before 24 months, performing at higher levels than the older children. There is no evidence, however, that children implanted in the first year of life outperform children implanted thereafter, as suggested by Lesinsky-Schiedat et al. (2004) On the contrary, there is a slight tendency in the results of the longitudinal study for children implanted in the second year to do better than children implanted in the first year.

The differences with regard to the impact of age between the present and some other studies may result from the use of different language measures and/or different methods of data analysis. Thus, Svirsky et al. (2004) and Lesinsky-Schiedat et al. (2004) used very general tests of language comprehension, focusing mainly on vocabulary. Even when partly similar language measures were used, procedures for data analyses were different. Thus, Tomblin et al. (2005) and Nicholas & Geers (2007) based their analyses on combined language measures and/or average and linear growth curves. Svirsky et al. (2004) used estimated average growth curves. Working with average growth curves would seem counter-productive when analysing individual differences. Equally, assuming linearity of growth may be problematic, as developmental growth curve modelling has shown that linearity may not represent growth adequately (vanGeert, 1994). In fact, individual growth curve modelling of the present longitudinal data confirmed a significant linear trend in less than half the children. For this reason, actual scores and not growth rates were used in the present analyses.

Where the present study differs most is that it considers the joint influence of implantation age and environmental factors. As environmental variables parents' social class, as measured by mothers' education, and parental dialogue characteristics were used. The results show convincingly that environmental factors rather than age at implantation account for much of the variability observed in the linguistic progress of children with CI, even when children implanted in their first year of life are included in the sample. Parents' social class and language input explain a substantial amount of variability in children's language development. In the samples studied here, the effect of age is even weaker than in our previous study which rendered a significant, though weaker effect of age than of quality of pre-operative hearing (Szagun, 2001, 2004a). As most of the children in the present samples had even lower implantation ages than those in the previous study, this challenges the hypothesis of faster linguistic progress with ever-decreasing implantation age.

In the regression analysis social and maternal MLU were entered as separate variables. This choice of variables may be criticized because social class and MLU are not completely independent. Characteristics of language use may be viewed as an aspect of social class. Yet, both variables were entered as separate variables into the regression analysis because social class is viewed as the more comprehensive factor encompassing more than characteristics of language use. As the results show, however, when the combined influence of social class and parental dialogue characteristics is analyzed, social class loses its significance and parental

MLU remains the only factor predicting children's language development. This shows that the more specific linguistic aspects rather than the global factor of social class are the ones that influence children's language most strongly.

What does maternal MLU imply? In the present study longer maternal MLU predicted more rapid language development in children. Long MLU in speech to young children implies the use of moderately long sentences averaging about five words per sentence. In our study longer MLU correlated with more comments about ongoing events, questions to the child and expansions of the child's utterances. In all, such language implies a rich language input. Thus, rich parental language input explains most of the observed variability in the language development of young children with cochlear implants.

The present results are relevant for conceptions of a 'sensitive phase' of language learning. The effect of environmental variables on the linguistic growth of children with cochlear implants and the relative lack of an effect of age at implantation argue against a maturational concept of 'sensitive phase'. Whatever a 'sensitive phase' for language learning implies, it does not seem to imply 'the earlier the better' for children who receive cochlear implants – at least not, as long as implantation takes place by the time children are four years old. This does not argue against a special sensitivity of the nervous system for language learning in young humans. What it does argue against is the sole dependence of this sensitivity on maturation, i.e. age, and a very early termination of such sensitivity. It seems rather that children who are implanted in the first four years of life are within the time span of sensitivity for language learning, but their experience with language interacts with this biological readiness for learning language. In this sense, the current data are compatible with an epigenetic view of 'sensitive phase'.

5 Conclusion

Overall, the present results do not confirm the claim that the younger children receive their cochlear implants the better their linguistic progress (Svirsky et al., 2004; Lesinsky-Schiedat et al., 2004; Tomblin et al., 2005; Nicholas & Geers, 2007). Experiential factors rather than age at implantation account for much of the variability in the language development of even very young children with cochlear implants. Much research focuses on age at implantation as the sole explanatory factor for variability in the language of these children. The present research suggests that this approach may be too narrow. Research should focus on the many factors that may influence language development in children with CI, such as quality of post-operative hearing, working memory, and environmental variables of language input. It seems necessary to study the interaction of these multiple influences, if we want to explain the variability observed in the language development of children with CI.

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Children's Early Acquisition of the Passive: Evidence from Syntactic Priming

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Abstract

We report an experiment that examined 3- and 4-year-old children's representation of the passive structure. Early studies of typically-developing children's acquisition of the passive suggest that this construction is acquired late and – or that its acquisition is semantically constrained: children comprehend actives much earlier than passives and comprehend actional verb passives earlier than non-actional verb passives (Maratsos, Fox, Becker & Chalkley, 1985). Conversely, some production studies have shown the passive is acquired earlier than thought: 3-4 year old children produce passives following training (Brooks & Tomasello, 1999) and priming (Huttenlocher, Vasilyeva & Shimpi, 2004), however, such studies have not examined whether the passive is constrained to actional verbs early on. We report a syntactic priming study that manipulated Prime Structure (active vs. passive) and Verb Type (actional vs. non-actional). We found a strong and reliable effect of Prime Structure for children (27%) and adult controls (19%). There was, however, no effect of Verb Type (Fs < 2). Participants were more likely to produce passive targets following passive primes than active primes, irrespective of the verb. We conclude that children do acquire an abstract syntactic representation for the passive early on (by 3-4 years) that is not constrained by verb type.

1 Introduction

1.2 Studies of Children's Acquisition of the Passive

Previous research into children's comprehension of the passive has repeatedly found that they comprehend actional verb passives (1a) better than non-actional verb passives (1b), the latter not being reliably understood until beyond the age of five years (Maratsos et al., 1985; Sudhalter & Braine, 1985; Borer & Wexler, 1987; Gordon & Chafetz, 1990; Marchman, Bates, Burkardt, & Good, 1991; Fox & Grodzinksy, 1998; Hirsch & Wexler, 2004).

1) a. The boy was *hit* by the girl
   b. The boy was *loved* by the girl

One explanation to account for this oft-replicated result is that the acquisition of the passive is semantically constrained such that children generalize the passive structure to highly transitive verbs first, such as physical action verbs or verbs of result, before generalizing it to less transitive, non-actional verbs such as psychological or experiential verbs at a later age (Maratsos et al. 1985).

An alternative argument is that aspects of the passive construction are acquired late and that children use some other strategy at a younger age which results in them comprehending

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or appearing to comprehend actional but not non-actional verb passives. For example, Borer & Wexler (1987) argue that the ability to form argument chains, required to move a verb's object into subject position in constructions such as the passive, is not acquired before 5 years of age and that before then the strategy children use is to analyse verbal passive sentences as adjectival passives. Their explanation for the discrepancy in results of comprehension tests is that such an analysis may be felicitous with actional verb past participles but not with non-actional verb past participles, hence children's inability to comprehend these passives.

Alternatively, Fox & Grodzinsky (1998) propose that the ability to transmit the passive verb's external thematic role to the oblique noun phrase is acquired late and that the strategy young children use to interpret full passives is to assign an agentive thematic role from the preposition *by*, a strategy that works for actional passives (hence children's comprehension of these) which tend to have an agent subject role but not for non-actional verb passives (hence children's poor performance with these) whose external argument tends to be a theme or experiencer and therefore is not compatible with the role assigned by the preposition *by*.

A wider review of the literature however reveals a great deal of evidence suggesting the passive is not acquired late. For example, the passive appears in children's spontaneous speech from around the age of three (Budwig, 1990) and elicited production studies have also shown that children can produce full passive sentences by four years. Huttenlocher et al. (2004) used passive primes to elicit passive sentence descriptions of pictures from four year olds and Tomasello, Brooks & Stern (1998) found that three and a half year olds who heard the structure modelled in sentences with novel verbs produced more passives with different novel verbs than a control group. Furthermore, such studies using novel verb experiments also show early productive use of the passive structure suggesting that children of this age can generalize the syntactic construction to new items (see also Pinker, Lebeaux & Frost, 1987; Brooks & Tomasello, 1999). Finally, it has also been shown that when placed in a discourse context in which a full passive utterance was appropriate, that is, one where the discourse focus was on the patient but where there was also more than one possible agent present, children as young as three were able to produce full passive utterances (Crain, Thornton & Murasugi, 1987). This language production research suggests that the passive is neither acquired as late as previously suggested nor that children use alternative strategies for producing passive-like utterances before being able to produce full passive sentences.

Though this research shows that alternative experimental methods may show earlier competence with the passive than has been demonstrated in comprehension tests, these studies have, however, only tested children's production of *actional* verb passives and as such the question of whether children's early knowledge of the passive is restricted to highly transitive verbs before non-actional, psychological verbs remains unaddressed by language production research. The present study addresses the question of whether there is a semantic constraint on English-speaking children's early passives using a method, syntactic priming, that has successfully shown that children have a syntactic representation for the passive at a young age.

1.2 Syntactic Priming

The term 'syntactic priming' refers to the tendency amongst speakers to repeat the syntactic structure of an utterance used in previous discourse and has been both observed in conversational contexts (Weiner & Labov, 1983) and used as an experimental method for manipulating participants' speech (Bock, 1986). Through prior processing of a syntactic structure a speaker becomes more likely to repeat that structure in a subsequent utterance, thus a speaker is more likely to produce a passive sentence after hearing a passive sentence prime, such as (2a), than after hearing an active sentence prime such as (2b). This effect of structural repetition has been variously attributed to repetition of the processing mechanisms of language production (Bock, 1986); residual activation of linguistic representations (Branigan,

Pickering, Liversedge, Stewart & Urbach, 1995); and implicit learning (Bock, Dell, Chang & Onishi, 2007).

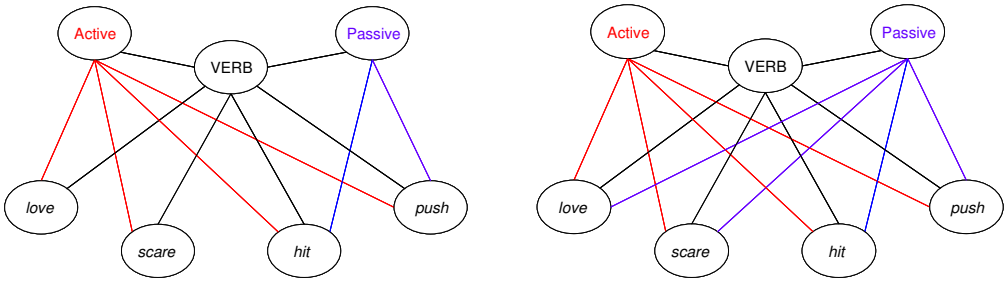
2) a. The pig is being washed by the farmer
   b. The farmer is washing the pig

How can this be related to children's acquisition of the passive? It follows that participants may be primed to reproduce a syntactic structure only if that structure has been acquired already. To date, there have been a few priming experiments that have tested children's acquisition of the passive. These studies have generally shown that young children were more likely to produce passive descriptions following passive primes than following active primes – this structural repetition in the absence of repeated lexical items between prime and target suggests that children have indeed acquired an abstract representation for the passive by four (Huttenlocher et al., 2004; Whitehurst et al., 1974) or even three (Bencini & Valian, 2006), though see also Savage, Lieven, Theakston & Tomasello (2003) for different results and interpretation. However, these studies used actional verbs for both the prime and target items, none of these studies have employed this method to investigate the issue of semantic constraints to children's early passives. The present study therefore investigated priming of passive sentences with children aged three and four years old and specifically looked at whether any priming effect varied according to the verb type of the prime.

We hypothesized that if children's early development of the passive construction was based on a core class of verbs, actional verbs, the children would have an early syntactic representation for the passive that was only linked to verbs from that verb class and would therefore only be primed by same-class verbs also linked to the passive representation (see Figure 1: *hit* and *push* are both action verbs and so are linked to the passive structure node, either should prime the other, however *scare* and *love* are not action verbs and so the passive construction is not yet generalized (linked) to them – they should not therefore prime or be primed by passives). The alternative, null, hypothesis is that children acquire the passive with non-actional verbs as early as action verbs (see Figure 2). In this case we would expect the same priming effect from both actional and non-actional primes.

Figure 1. Schema if the passive is only generalized to actional verbs early on.

Figure 2. Schema if the passive is not semantically constrained early on



1.3 Questions and Predictions

This study addressed the following questions therefore: do children acquire an abstract syntactic representation for the passive before 5 years old? It was predicted that if they do not, then no priming effect would be observed. It was furthermore predicted that if children's early knowledge of the passive construction is restricted to item-based (verb-based) representations (Tomasello, 2000) then no priming would occur since there was no overlap between the lexical items in the primes and targets. The second question addressed in this study was: is children's early acquisition of the passive constrained to actional verbs and only generalized to non-actional verbs at a later age? It was predicted that if children do have a semantically constrained representation for the passive early on (Figure 1) then priming would only be observed in the actional prime condition but if not (Figure 2) then priming would occur in both verb type conditions.

2 Method

2.1 Priming Task

The priming task was a picture description task embedded in a children's card game, 'Snap' (Branigan, McLean & Jones, 2005). In Snap, two players each have a set of picture cards placed face-down in front of them. They take it in turns to turn over their top card and reveal its picture, when both players reveal the same picture on their cards it is the first player to shout 'snap' who wins the cards in play. The game continues until one player has won all the cards.

In the experiment the only variations to the game were that the players described their picture as they turned it over and the game ended when all cards had been turned over once. A game was used to mask the priming and to make the task easy and more appealing to children; they were not under pressure to provide 'correct' answers.

2.2 Participants

The participants were 20 pre-school children (10 girls), ranging in age from 3;1 to 4;11 (mean age 4;2). All children were acquiring English as their first and only language and none were reported to have any language or developmental difficulties. A control group of 20 adult, native speakers of English (15 female), were recruited from the University of Edinburgh student population and paid for their participation.

2.3 Design

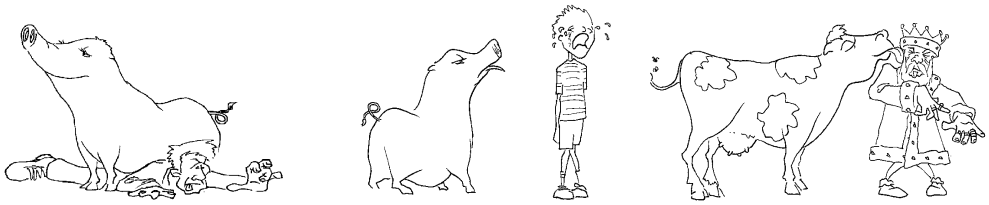
There were two priming conditions: Prime Structure (Active vs. Passive) and Verb Type (Actional vs. Non-Actional) which combined created the four priming conditions. The

experiment was based on a repeated measures design: all participants experienced all levels of all priming conditions and so the experiment measured whether the children alternated their response structure after hearing alternative prime structures with alternative verb types.

2.4 Materials

The materials consisted of a set of Snap picture cards depicting transitive events with human patients and animal agents. Where possible, nouns and verbs were chosen that had been used in previous experiments of children's acquisition of the passive and – or that had a suitable age of acquisition rating for the children participating in the study (Morrison, Chappell & Ellis, 1997). Those required to describe a target item were different to those used in its primes (see Figure 3); the repetition of lexical items between the prime and target was avoided to ensure any priming effect observed was related to abstract structural representations and not attributable to item-based representations (Tomasello, 2000).

Figure 3. Actional verb and non-actional verb primes with actional verb target



a pig is squashing a boy a pig is upsetting a boy a cow is licking a king

Twelve actional verbs (shake, wash, tickle, push, kiss, punch, lick, hug, chase, kick, scratch, pinch) were used twice each to create 24 target items. Each target item had an actional verb and non-actional verb prime, both depicted with the same agent and patient, though a participant only saw either the actional or non-actional prime for a given target picture. There were 24 actional primes made up of six different actional verbs (hit, pat, bite, pull, squash, carry) used four times each and 24 non-actional primes created from six non-actional verbs (frighten, shock, annoy, upset, surprise, scare) used four times each.

Further to the prime and target items, a set of eight filler items formed the Snap items of the game; these items had the same picture so here the same verb was used for the prime and target: four new actional verbs were used once in the passive and once in the active each. Finally a set of four practice items was also created using different verbs and nouns to the experiment and filler items.

2.5 Procedure

The experiment began with a practice session: first the participants were shown individual pictures of each of the characters and were asked to name them. Then a very short game of Snap was played with the practice items. Participants who completed both parts of the practice session then played the full game using the experiment materials.

Pre-arranged playing cards were placed face-down in front of the players (the experimenter and the participating child). The experimenter began each game by turning over her top card and describing it (covertly, according to a priming script). The participant then took their top card and described it. The game continued until all the cards had been turned over and described. The experimenter's descriptions of her cards were, unknown to the participant, primes for the participants' subsequent description of their own card. Each prime and response constituted an individual experiment trial. These were interspersed with the filler items that were the matching 'Snap' items. Priming was therefore measured on a trial by trial

basis depending on whether or not the participant repeated the syntactic structure he heard in the prime in his immediately following description. The experiment game was audio-recorded on a Mini-Disc player; the participants' responses were transcribed after the experiment and were scored according to the criteria outlined below.

3 Results

3.1 Scoring criteria

The participant's first complete target utterance for a given item was scored as either Active, if the utterance contained an agent in subject position, an appropriate verb and a patient in direct object position, or Passive, if the utterance contained a patient in sentence-subject position, a passive auxiliary (either *get* or *be*), an appropriate verb and an agent expressed in a *by*-phrase; minor errors, such as the participant making a morphological error in the verb phrase, were allowed since it was considered that these did not reflect the selection of a different underlying structure. Incomplete utterances, reversed passives (where the participant produced a passive sentence but with the argument roles reversed), truncated passives, (where the participant omitted to produce a *by*-phrase) and any utterances that were syntactically correct but not a transitive sentence were scored as Other and excluded from the analyses.

3.2 Results

Out of the 480 target items, the children produced 312 (65%) responses that could be scored as either Active (236, 49%) or Passive (76, 16%) and 156 (32%) responses that were scored as Other, (12 (3%) trials were eliminated when the child failed to respond or the response was lost due to recording problems or misplaced cards).

The 312 transitive targets (active and passive responses) were evenly distributed across the priming conditions: 25% occurred in the active actional prime condition, 28% occurred in the active non-actional condition, 23% in the passive actional condition and 24% in the passive non-actional condition. Table 1 shows how many actives and passives the children (and adults) produced in each priming condition. It is clear that, numerically, both groups produced more passives following passive primes compared to following active primes (and more actives were produced following active primes compared to following passive primes), although roughly even numbers of passives were produced following actional primes as following non-actional primes.

Table 1. Number of passives produced in each priming condition response

		Children		**Adults**	
Priming	**Condition**	**Active**	**Passive**	**Active**	**Passive**
Active	Actional	73	6	102	9
	Non-Actional	77	10	97	11
Passive	Actional	40	31	78	35
	Non-Actional	46	29	78	27

3.3 Analysis

For the statistical analyses of the priming data, the participants' active and passive scores were converted into proportions of active and passive responses for each priming condition in order to allow for the uneven numbers of transitive responses across conditions. For a given priming condition the number of passive responses for each case was divided by the sum of the passive and active responses for that case (see Table 2 for the mean proportions by condition). The proportions of active responses were also calculated in this manner though the statistical analyses were only performed with the passive scores since these are of primary interest and, due to the way the proportions are calculated, the active and passive scores are in complementary distribution.

Table 2. Mean proportion of passive responses produced in each priming condition

Priming Condition		**Children**	**Adults**
Active	Actional	0.10	0.08
	Non-Actional	0.17	0.10
Passive	Actional	0.44	0.31
	Non-Actional	0.38	0.26

The proportions of passive responses were compared in a repeated measures, 2 (Prime Structure) x 2 (Verb Type) x 2 (Group) ANOVA, treating participants (F1) and items (F2) as random effects. This showed a significant main effect of Prime Structure ($F1(1,38) = 30.27$, $p < .001$, partial $\eta^2 = .443$, $F2(1,46) = 72.99$, $p < .001$, partial $\eta^2 = .613$); more passives were produced following passive primes than active primes, in fact overall there was a 23% priming effect of passive primes. However, the effect of Verb Type was not significant ($Fs < 2$); passive responses were just as likely following actional primes as following non-actional primes. No other interactions were significant (all $Fs < 3$) except for the prime by group interaction which was significant by items only, though the effect size was not large ($F1(1,38) = .99$, $p = .33$, partial $\eta^2 = .025$, $F2(1,46) = 5.05$, $p < .05$, partial $\eta^2 = .099$). The effect of Group approached significance by items ($F1(1,38) = 2.38$, $p = .13$, partial $\eta^2 = .059$, $F2(1,46) = 3.62$, $p = .06$, partial $\eta^2 = .073$) suggesting that neither group produced significantly more passives than the other.

Planned comparisons showed that there was a simple main effect of prime for both children ($F1(1,19) = 21.11$, $p < .001$, partial $\eta^2 = .357$, $F2(1,23) = 548.23$ $p < .001$, partial $\eta^2 = .559$), and adults ($F1(1,19) = 10.15$, $p = .003$, partial $\eta^2 = .211$, $F2(1,23) = 19.82$, $p < .001$, partial $\eta^2 = .301$); and for both verb types, actional ($F1(1,19) = 29.95$, $p< .001$, partial $\eta^2 = .441$, $F2(1,23) = 50.66$, $p< .001$, partial $\eta^2 = .524$), and non-actional ($F1(1,39) = 9.62$, $p= .004$, partial $\eta^2 = .202$, $F2(1,23) = 23.67$, $p< .001$, partial $\eta^2 = .340$) showing that both participant groups were more likely to produce passive targets following passive primes than active primes and that passive responses were more likely following non-actional verb passive primes than non-actional active primes and likewise for actional verb passive primes compared to active primes.

Table 3. Percentage priming effects

	children	**adults**
Actional	34%	23%
non-actional	21%	16%
Overall	27%	19%

The percentage priming effects for each verb type and overall are presented in Table 3: they show the percentage increase in the mean proportion of passives produced after passive primes compared to after active primes, that is, the increase in passives produced when primed compared to when not primed. As can be seen in Table 3, there was a strong priming effect in

both verb type conditions and for both groups. The results from the statistical analyses suggest the participants were influenced by the structure of the prime but not by the verb type of the prime.

4 Discussion

The present study investigated priming of passive sentences with children aged three and four years old and adult controls and specifically compared actional verb primes with non-actional verb primes. Overall we found that the nursery children behaved like the adult control group: they were more likely to produce a passive description after hearing a passive prime than an active prime, irrespective of whether the prime verb was actional or non-actional. We can make a number of conclusions from these results: Firstly they suggest that children have an adult-like syntactic representation for the passive before the age of five. Secondly, we can conclude that at this age, this representation is not restricted to item-based representations – priming occurred in the absence of repeated lexical items between prime and target suggesting that this representation is abstracted away from individual verb-based representations by three to four years of age. Thirdly, the fact that the priming effect was not influenced by the semantic class of the verbs used suggests that three and four year old English-speaking children's early representation of the passive is not limited to actional verbs only.

As such, the results of the experiment reported in this study contradict suggestions that the passive is late acquired (e.g. Borer & Wexler, 1987): 85% (17/20) of the three and four year old children tested produced at least one full passive description. These results therefore add to the literature showing that children younger than five years can produce the passive construction and support previous syntactic priming research that found structural priming of the passive at four years of age (e.g. Huttenlocher et al., 2004). Furthermore, this study extends both the priming literature and previous research on children's production of the passive since, unlike previous studies, it tested young children's production of the passive following both actional and non-actional primes. That there was no boost to the priming effect when the verbs in the prime and target were from the same semantic class (actional) nor drop in priming when they differed (non-actional prime to actional target) suggests that these children had a structural representation for the passive which was not constrained to actional verbs; as such these results also appear to contradict suggestions that the acquisition of the passive is semantically constrained (e.g. Maratsos et al. 1985).

However, the fact that these results showed no effect of Verb Type does leave open the question, why do children perform poorly on non-actional passives in comprehension tests? One potential explanation is methodological: Firstly, the non-actional verb events tested are particularly difficult to depict and so children may perform worse with these simply because the pictures, and not the language that is being tested, are difficult to reliably interpret. Secondly, their performance on these comprehension tests may be related to an underdeveloped ability to perform the required task rather than underdeveloped linguistic skills (Crain & Fodor, 1993). Indeed, it has previously been demonstrated that the task used may impact on the results of these tests: in comprehension tests of the same linguistic structures using different methods, Maratsos et al. (1985) found that performance was poorer when children were asked "who did it?" after hearing transitive sentences than when they were asked to identify the correct picture after hearing the same structures. Conversely, in the priming task used in this study, the participants had fewer non-linguistic tasks to perform and as such their language processing may have been less hindered hence they were able to comprehend the actional and non-actional passive primes and produce their own passive sentence descriptions. This would suggest that syntactic priming is an appropriate, additional method for testing early linguistic competence.

Another possible reason why the results reported here differ to previous findings may be related to the fact that, due to limitations in recruiting nursery-aged children, the age range of our group of children participants was rather large (3;1 – 4;11); it is possible that this group

straddled a critical period of development with regards the questions asked in this study and so it may be prudent to test a separate group of children at each end of the range to see whether this would lead to more distinctive effects with regards the semantic class of the verbs tested.

A final possible answer to the question of why children perform poorly on non-actional passives in comprehension tests but responded to non-actional verb primes, is that the type of non-actional verb tested may be crucial to these results. The present study compared non-actional verbs that have a theme for the underlying subject and an experiencer for the underlying object (3a) whereas the verbs tested in comprehension tests that show poor comprehension of non-actional verb passives were verbs with an experiencer subject and theme object (3b).

3) a. The bear$_{[theme]}$ is frightening the girl $_{[experiencer]}$
   b. The bear$_{[experiencer]}$ is seeing the girl $_{[theme]}$

It may be that the acquisition of the passive is generalized early on to certain verbs, including actional verbs *and* object-experiencer, non-actional verbs but is not generalized to subject-experiencer non-actional verbs until a later age. Maratsos et al. (1985) make a similar suggestion supported by evidence that the input children receive tends to include passives with actional verbs and object-experiencer, rather than subject-experiencer, non-actional verbs. Ferreira (1994) also provides evidence that adults prefer to produce passives with object-experiencer non-actional verbs compared to subject-experiencer non-actional verbs and even actional verbs. If the input children receive is weighted towards object-experiencer and actional verb passives this may explain both their poor performance in comprehension tests of subject-experiencer non-actional verb passives and also our priming results showing no difference between actional and object-experiencer non-actional verb primes. Clearly, further testing is required to compare subject-experiencer non-actional verb primes with the present study's results. If the passive is generalized to subject-experiencer non-actional verbs later than actional and object-experiencer non-actional verbs then we would expect these primes to elicit fewer passives.

5 Conclusion

In this syntactic priming study we found that both children and adults were more likely to produce passive targets following passive primes than active primes, irrespective of whether the prime contained an actional or non-actional verb. We conclude that children do acquire an abstract syntactic representation for the passive early on that is generalized to actional and object-experiencer non-actional verbs.

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Prosodic Phonology and Atypical Spoken Language Acquisition in Children who are Hearing Impaired

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Abstract

The purpose of this paper is to look at the development of early syllable structure and the minimal prosodic word in the spoken language outputs of two children with hearing impairment who present with additional difficulties in the acquisition of spoken language on top of that expected due to their hearing difficulties.

The speech productions of these two children are reviewed using Demuth and Fee's model of syllable structure development (Fee 1997) which was adapted in the light of Kehoe and Stoel-Gammon's (2001) findings.

Child A (male) was aged 9;3 and used a cochlear implant while child B (female) was aged 6;11 and used digital acoustic hearing aids. Aided thresholds were 42 and 45 dBA respectively. Both children were educated in an oral-aural environment although child B's parents were both Deaf and BSL was their primary language.

The model identified the level of each child's development of English syllable structure and showed very clearly that child B has not yet fully cued in to the basic prosodic properties of spoken English. This method of looking at the syllable structure development of children with hearing impairment could prove extremely helpful in guiding professionals and parents in clinical and educational decision processes.

1 Introduction

Digital acoustic hearing aids and cochlear implants (CIs) have allowed children with severe to profound hearing loss perceptual access to the speech spectrum and opportunities for spoken language acquisition not possible with the traditional acoustic analogue amplification of the past. However, in children with CIs it has become apparent that spoken language outcomes may vary quite extremely (Pisoni 2000). This variability in spoken language outcomes can also be observed in children with hearing impairment who use acoustic hearing aids. While demographic factors can help to explain some of this variability e.g., age of diagnosis, age of amplification etc., a proportion of this variability remains difficult to explain (Pisoni 2000). In recent years, Pisoni and his team in Indiana have shown that capacity and speed of processing in short-term memory are significant underlying contributors to this variation for children with CIs.

Other research has found that alongside memory, our understanding of variations in the acquisition of spoken language in children with CIs can be further developed by looking at the influence of the Prosodic Hierarchy (PH) (Titterington, Henry et al. 2006). The PH is an abstract prosodic structure which determines the syllabification, stress placement and intonation of an utterance parsed onto it (Selkirk 1995). It stipulates the phonetic and phonological structure of an utterance and assigns metrical foot structure at the level of the syllable (Selkirk 1995). Titterington, Henry et al. (2006) looked at how children with CIs

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processed weak syllables in the PH that were footed as opposed to unfooted. They found that children with CIs developing spoken language as expected (n=15, mean age = 9;06 (SD = 2;00)) processed both types of weak syllable equally well until memory load increased when they then preferentially processed footed over unfooted weak syllables. A similar but less marked pattern was found for language matched controls indicating that these children with CIs had developed and were using a PH similar to that of their hearing peers with equivalent language levels.

However, a small outlying group of CI users (n= 5, mean age = 10;03 (SD = 2;01)) diagnosed with specific additional difficulties in spoken language acquisition did not process footed or unfooted weak syllables differentially and generally used weak syllables rarely (despite having similar aided hearing thresholds to their CI peers developing spoken language as expected). These children either had not developed or were not using the PH for processing footed or unfooted weak syllables in the same way that their peers with CIs developing spoken language as expected did. This leads to the development of an interesting question about this outlying group of CI users: Can an adapted version of Demuth and Fee's model of early syllable development (Fee 1997) identify where these children are in relation to their development of the syllable and the minimal prosodic word?

Consequently, this study looked at one child representative of the group of CI users not developing spoken language as expected from the Titterington, Henry et al. (2006) study and a young acoustic hearing aid user who was also not developing spoken language as expected (despite reasonable aided hearing thresholds for both children). The overall aim of the study was to investigate early syllable structure and minimal prosodic word development in the spoken language outputs of these two children.

2 Method

2.1 Design of Study

This single case study uses a non-randomized observational cross-sectional design.

2.2 Participants

Table 1. Demographic Details of participants

Demographic details	Child A	Child B
Chronological Age	9;3	6;11
Age of Onset of hearing loss	1;2	0
Age of fitting/switch on of hearing aid device	2;6	0;3
Age of consistent device/hearing aid use	2;6	3;2
Aided thresholds	42 dBA	45 dBA
Receptive language ability (Vocabulary age equivalents)	2;8	1;00
Mean Length of Utterance	2.7	1
First Language	Spoken English	British Sign Language

Two children with severe to profound sensorineural hearing loss participated (see table 1 for demographic details). As a similar pattern in variability of spoken language outcomes found for children with hearing impairment who use CIs can be observed in children who use acoustic hearing aids, one child was a cochlear implant user (Child A (male)) and one an acoustic hearing aid user (Child B (female)). Child A was representative of the group of children who were not developing spoken language as expected from the Titterington, Henry et al. (2006) study and Child B was at an earlier stage of language acquisition and also not developing spoken language as expected. Although Child B was being educated in an oral-

aural environment (at her parents choice), her first language was British Sign Language (BSL) and her ability to tap into the native prosodic structure of spoken English was of particular interest under these special circumstances.

2.3 Procedure

Speech samples were collected from each child.

For Child A a range of target structures based on Brown's (1973) grammatical morphemes and the Language Assessment and Remediation of Syntax Profile (LARSP: Crystal, Fletcher et al. 1989) were elicited using modelled elicitation. Thirty two different multiword utterances were targeted and produced through this method.

Child B (who was at the early first words stage of development) was asked to name a collection of objects and pictures of first words. Sixty-four single word utterances were elicited out of a possible one hundred.

For both children, responses were recorded digitally through an omnidirectional microphone (ECN-MS907) using a Sony minidisc recorder (MZ-R700). The speech data was then downloaded into sound wav files in the Cool Edit Programme or Adobe Audition (version 1.5) of a desk top computer using a sampling rate of 32 kHz with 16-bit amplitude quantization. The speech samples were transcribed live voice and then the recordings reviewed by a Speech and Language Therapist specialised in the transcription of speech by children with hearing impairment. As Child B was particularly unintelligible the transcription of her 64 words was validated by a trained phonetician (Dr Christiane Ulbrich).

3 Results

Demuth and Fee's (Fee 1997) model of syllable structure development was adapted based on Kehoe and Stoel-Gammon's (2001) findings and used to analyse the speech data in this study. This model is based on the concept of the minimal word where children begin using utterances that are subminimal and do not comply with the minimal bimoraic constraints of spoken English. Utterances gradually evolve to meet word minimality requirements until any prosodic form that occurs in English can be used:

Stage 1:
Core syllable CV – subminimal (monomoraic) e.g., /d□/
Stage 2: Minimal Words (all bimoraic)
- Core syllables (C)V(V)CV(V) (optional stage)
- Vowel length distinctions (C)VV
- Closed syllables (C)V(V)C

Stage 3 :
Any prosodic word structure that may be found in English can now be used.

Based on work by Demuth, Culbertson et al. (2006) and Kehoe and Stoel-Gammon (2001) the key questions that were asked of each child's data were:

1. What syllable structures are used most frequently?
2. How are vowels used?
3. How are codas used?
4. Is there an association between vowel length and coda realization?

3.1 Findings for Child A:

3.1.1 What Syllable Structures are used most frequently?

Figure 1. Most Frequent Syllable Structures Targeted

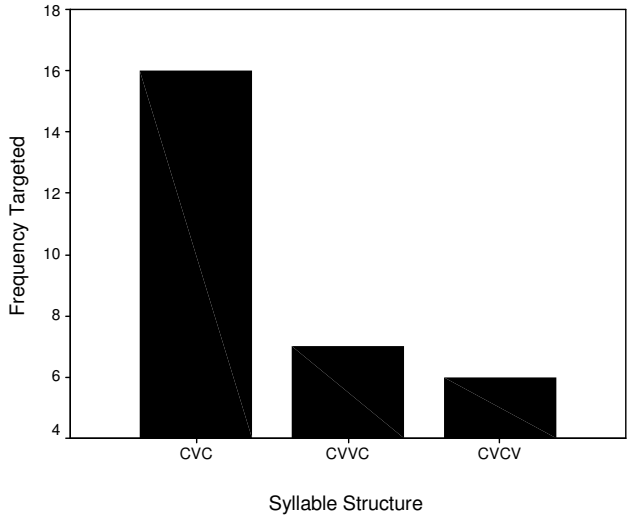
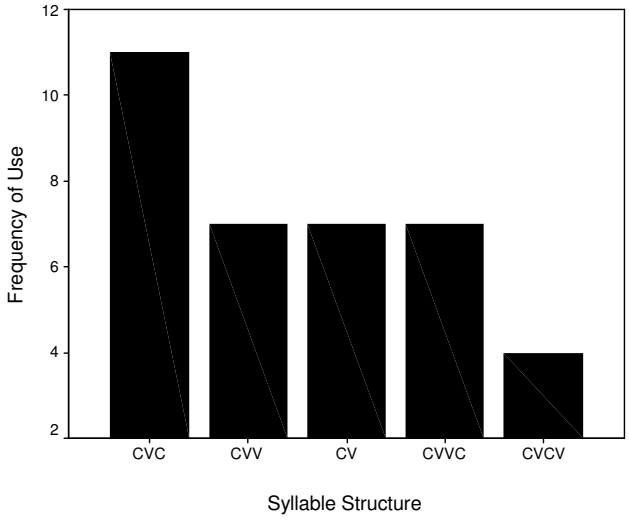


Figure 2. Most Frequent Syllable Structures Used



As can be seen from figure 1 the most frequently targeted syllable structures for Child A were CVC, CVVC and CVCVs. Figure 2 shows that while most of Child A's productions did coincide with the structures most targeted e.g., CVC, he used a range of additional structures to the CVC, CVVC and CVCVs targeted. He used a significant number of open syllabled structures – both with a short (subminimal syllable structure) and long vowel.

3.1.2 How are vowels Used?

As can be seen in figure 3, Child A achieved approximately 75-85% success in his vowel realisations indicating that segmental accuracy of vowels is relatively sound with a clear ability to mark both short and long vowels in his speech productions.

3.1.3 How are Codas Used?

Figure 4 shows that Child A used coda consonants about half the time that they were targeted. He is clearly having some difficulty using coda consonants and rarely realises them accurately.

Figure 3. Vowel Realisations for Mono and Disyllabic Lexical Items
(1 = 1st and 2 = 2nd syllable of the disyllable)

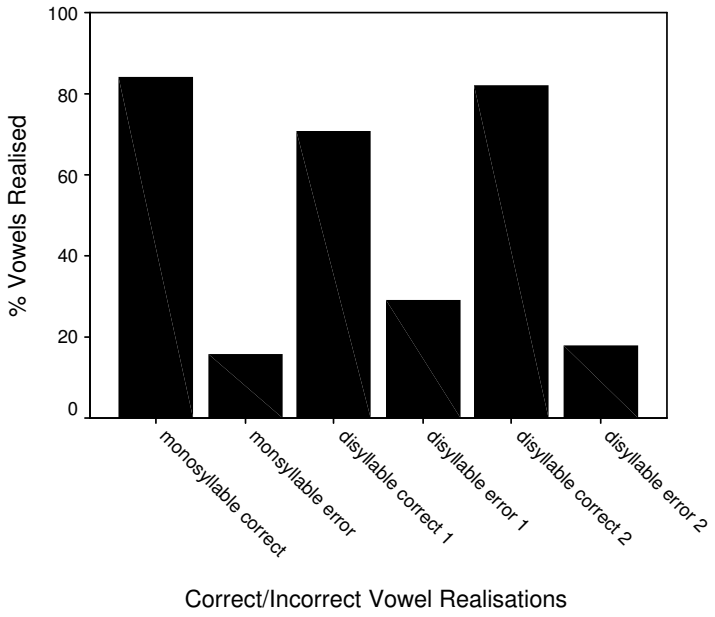
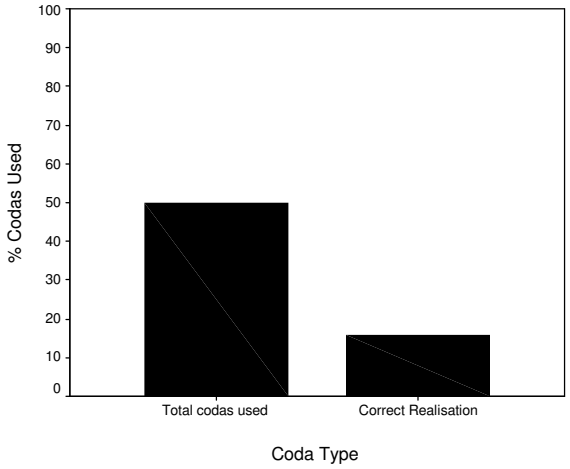


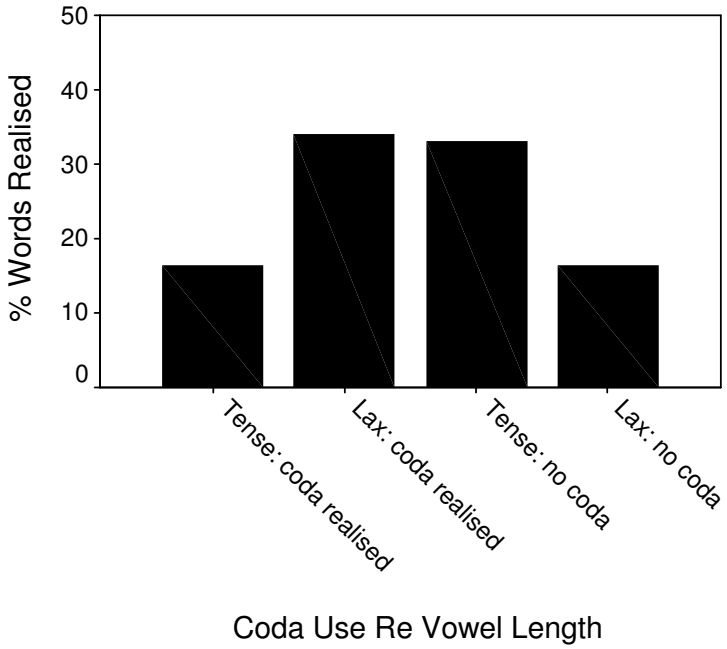
Figure 4. Percentage of Coda Consonants Used



3.1.4 Is there an association between vowel length and coda realisation?

Figure 5 shows that Child A preferred to use coda consonants with lax rather than tense vowels.

Figure 5. Association between vowel length and coda realisation



3.2 Findings for Child B:

3.2.1 What Syllable Structures are used most Frequently?

Figure 6 shows the most frequent syllable structures targeted from the first words list used to elicit the speech production sample from Child B.

Figure 6. Most Frequent Syllable Structures Targeted.

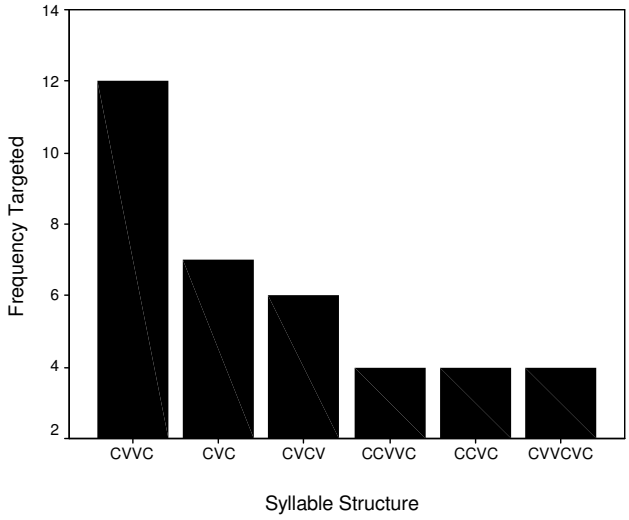
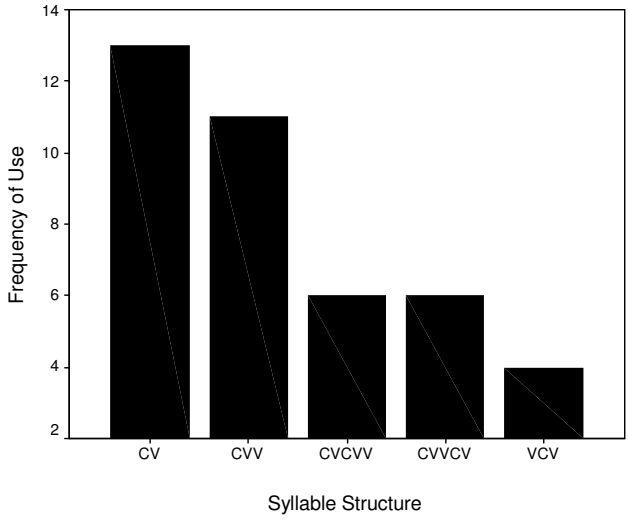


Figure 7. Most Frequent Syllable Structures used



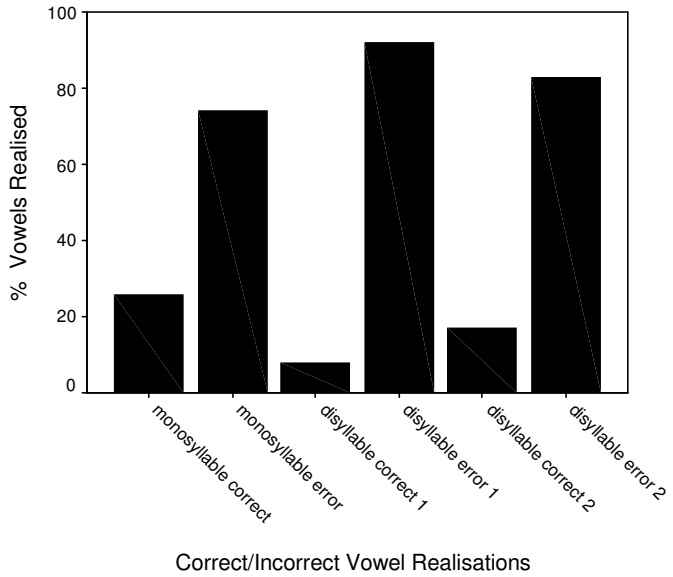
A wide range of structures are targeted but the structures targeted with the highest frequency are the same as those found in the target sample for Child B e.g., CVVC, CVC and CVCVs. Figure 7 shows the most frequent syllable structures used by Child B. Interestingly, Child B did not use any syllable structures that were the same as those targeted. She used a mixture of mono and disyllabic structures – preferring monosyllables overall. Notably, the

syllable structure used most frequently in Child B's speech productions was the subminimal CV structure.

3.2.2 How are Vowels Used?

Figure 8 shows that most of Child B's vowel realisations are errors. Child B used a range of segmental (some of which were non-English) and vowel length errors e.g., *green* > /□œ/, face > /□□/.

Figure 8. Vowel Realisations for Mono and Disyllabic Lexical Items
(1 = 1st and 2 = 2nd syllable of the disyllable)



3.2.3 How are Codas Used?

Figure 9 shows that codas were used rarely. Very few of these productions were accurate realisations of the coda targeted.

3.2.4 Is there an association between vowel length and coda realisation?

Figure 10 shows that Child B is realising and omitting codas similarly with lax vowels. However, she does tend to avoid coda consonant use with tense vowels.

Figure 9. Percentage of Coda Consonants Used

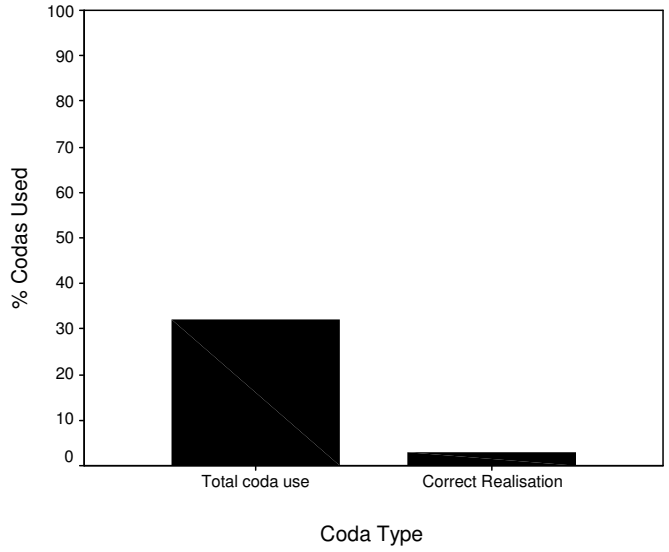
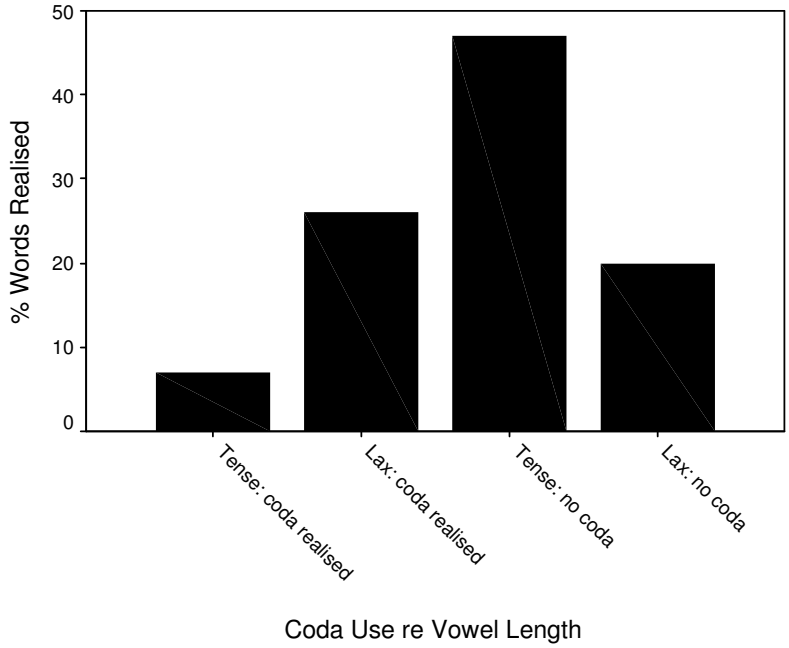


Figure 10. Association between vowel length and coda realisation



4 Discussion

In this preliminary study, the four key questions asked of the data for each participant were as follows:

1. What syllable structures are used most frequently?
2. How are vowels used?
3. How are codas used?
4. Is there an association between vowel length and coda realisation?

Question 1 addresses whether the participants were able to use English syllable structure reflecting the bimoraic nature of spoken English. Question 2 addresses whether the participants could mark vowel length distinctions. Question 3 addresses whether codas are used by the participants, and if they are used, question 4 addresses whether there is a closer association between the use of codas with lax versus tense vowels. In this context, lax vowels may be seen to license coda use – a process that has been identified as an early stage in the acquisition of coda consonants (Demuth, Culbertson et al. 2006). It appears that it is easier to use coda consonants with lax rather than tense vowels in the first instance.

4.1 Can the participants use English syllable structures?

Clearly, Child A can use bimoraic English syllable structures. However, he does dip in and out of stages 1 and 2 in his use of syllable structure with some continued production of subminimal CV structures. Child B, who is in a signing environment at home, is clearly having difficulty fully cueing in to the bimoraic nature of spoken English.

4.2 Can the participants mark vowel length distinctions?

Child A is producing most targeted vowels correctly and is able to mark vowel length distinctions. In contrast, Child B rarely produces vowels accurately making both segmental and length errors.

4.3 Are codas used by the participants?

Neither participant is using coda consonants frequently or accurately although Child A is managing better than Child B in this context.

4.4 Do coda consonants occur more frequently with lax than tense vowels?

Child A appears to optimally use coda consonants when they are licensed by lax vowels. Child B uses coda consonants rarely. It seems that coda consonants following a lax vowel are easier for her to realise than those following a tense vowel. However, as coda consonants are realised and omitted with similar frequency for lax vowels, it may be a stretch to label this as licensing for child B.

5 Conclusion

It appears that the model of syllable structure development used may be useful when investigating children with hearing impairment who have particular difficulties acquiring spoken language.

Forming an accurate prognosis for spoken language acquisition in children who are severely to profoundly hearing impaired with particular difficulties in spoken language development can be a difficult process. This approach to looking at early syllable structure

development may prove to be a helpful part of the future assessment process for such children as the results appear to indicate very clearly if the child has even begun to process spoken language according to its native prosodic properties. In this instance, Child A has begun to tap into the native prosodic qualities of spoken English while Child B is struggling to do so.

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Is One Language Sample Enough in Morphosyntactic Analysis?

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Abstract

Language sampling is a tool frequently used by clinicians in order to gain a clear picture of a child's linguistic and communicative abilities (Hewitt et al. 2005; Nettelbladt & Hansson 2001). Much research has used language samples in order to examine the morphosyntactic capabilities of children; however, it is unclear whether a single language sample is sufficient in providing a clear representation of the child's abilities. It is possible that linguistic behaviour may change within a short time period, making multiple samples, or perhaps longer samples, necessary. The aim of this study is to answer the question of how much if any morphosyntactic variation exists in a normally developing child's language samples between two closely spaced sessions when no independent variable is introduced. Four normally developing children between the ages of 2;8 and 3;9 were recorded twice each within a week and their language was analysed with regard to areas of morphosyntax. Results will be presented and analysed in terms of both theoretical and clinical implications.

1 Introduction

The spontaneous language sample is a common tool of Speech and Language Therapists and specialised teachers (Stalnaker and Creaghead 1982; Cole, Mill and Dale 1989; Evans and Craig 1992; Southwood and Russell 2004; Marinellie 2004). Survey-based research has shown that 85% of SLTs use this tool. Out of those therapists, 92% use them for diagnoses while 77% use them for determining appropriate intervention (Kemp and Klee 1997). 60% of SLTs who use spontaneous samples report using sample lengths from 50 to 100 utterances (Hux et al. 1993) while 28% report using fewer than 50 utterances (Kemp et al. 1997). This paper describes a pilot study which explores the question of how reliable samples of different lengths are when analysing morphosyntax. This is a vital question considering the prevalence of the use of the spontaneous sample along with the fact that it is regularly used to inform diagnosis and therapeutic treatment.

A strength of the spontaneous sample over more formalized testing is the fact that the children's language is likely to be closer to their ordinary use of language than it would be during alternative forms of testing and also more mindful of the communicative context (Kemp and Klee 1997; Marinellie 2004; Evans and Craig 1992; Southwood and Russell 2004; Hewitt et al. 2005).

Drawbacks of the spontaneous sample include the difficulty of obtaining high quality recordings and the amount of time required to transcribe them (Cole, Mill and Dale 1989; Evans and Craig 1992; Hux, Mirris-Friehe and Sanger 1993; Kemp and Klee 1997). Possibly a more serious drawback to the use of language samples is our lack of knowledge regarding what length or what number of samples are necessary in order to be representative of a child's language (Wren 1985; Cole, Mill and Dale 1989; Gregg and Andrews 1995; Scott 1995;

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Gavin and Giles 1997; Marinellie 2004). It is to be expected that different linguistic areas will require different sample lengths or numbers. For example, pragmatics could easily be predicted to require more and/or longer samples than would phonology if asked to provide a reliable picture of an individual's linguistic production.

1.1 The notion of reliability

Reliability is a vital measure that is required if an assessment is to be considered appropriate. It reassures professionals that the tool they are using will give very similar results repeatedly when used in identical conditions. Only if scores are consistent along with performance, are the results useful to the SLT or researcher. Unfortunately, very little has been done in this field in regard to spontaneous language samples. Cole et al (1989) makes the point that "Although reliability information is basic to the interpretation of test results, this measurement characteristic appears to have been generally overlooked in the area of language sample interpretation." Marinellie (2004) takes the same view, stating, "Currently, it is unknown whether an ordinary language sample is adequate to yield most types of spoken syntactic complexity" and calls sample reliability in regard to syntax "a relatively uncharted area" both for typically developing children along with children with SLI.

A further difficulty of the spontaneous sample is the lack of availability of datasets showing the number of particular morphosyntactic structures typical for children at defined ages. Hewitt, Hammer, Yont and Tomblin (2005) have called not only for these datasets to be assembled but also speak of the necessity of doing the same for children with language impairments so that their datasets could be compared. A small database representative of typically developing children's MLU, word useage, and bound morpheme counts has been established for children aged 3-13 based on 100-utterance samples (Leadholm and Miller 1994). However, only one sample length is represented and no test-retest procedure was carried out which could have informed the question of how reliable the samples were.

Considering the desire of researchers to possess datasets for various ages, various aspects of language, and for both children who are typically developing and for those with language impairments (Eisenberg 2001; Hewitt et al. 2005), there are many places where this research could begin. This project focuses on morphosyntax because it is known to be an area of difficulty in language impairment, particularly in Specific Language Impairment (Yoder 1989; Gopnik and Crago 1991; Rice, Wexler and Cleave 1995; Leonard 1998) and has been proposed as a possible key to the diagnosis of SLI (Rice and Wexler 1996; Leonard 1998). The dataset proposed could provide a tool helpful in analysing theories of this sort.

1.2 Reliability studies in the areas of syntax and morphology

A study by Johnson and Tomblin (1975) examined the question of reliability in regard to the Developmental Sentence Scoring assessment (Lee 1974) which recommends that a sample of 50 utterances be collected to test the syntactic and morphological development of children. Their research examined reliability coefficients based on 5 to 250 utterances and their findings suggested that 175 utterances needed to be gathered in order to surpass a coefficient of 0.90.

Gavin and Giles (1997) similarly tested language samples of up to 175 utterances and reported that a coefficient of .90 wasn't reached in any area until 175 utterances were used. However, Muma's study of samples up to 400 utterances (1998) finds that 200-300 sentences are needed to accurately assess the use of most grammatical repertoires.

Marinellie (2004) investigated the use of language samples for syntactic complexity with 15 children with SLI and 15 with typically developing language with a mean age of 10;8. Findings showed that the SLI group produced some examples of most of the structures, but fewer of each kind than the typically developing group, sometimes only producing one example of a structure per sample. Marinellie calls the reliability of the sample size into question and calls for further investigations into the reliability of varied length samples, also

suggesting a test-retest methodology for future studies. Evans and Craig (1992) reiterate this idea, stating that more than one sample may be needed to ensure that the language sampled is representative of the child's naturally occurring language.

Cole, Mills and Dale (1989) used the test-retest procedure in order to gauge the reliability of language samples of 10 children with mild to moderate developmental delay ranging in age from 4;4 to 6;8. Using 2 20-minute long samples, taken within 2 weeks of each other in identical settings, they looked specifically at MLU, question use, and morphological production of the past tense, regular plural and present progressive. Findings showed low correlations for these categories (questions .13, past tense .28, regular plural .50 and present progressive .16). Although samples were measured by time instead of utterances, each sample was over 100 utterances in length. This paper concludes that "additional information about the reliability of measure derived from samples is needed."

The rest of the current paper presents a pilot study which gathered repeated language samples of typically developing children from 2;6 – 3;6 in order to determine the correlation of various morphosyntactic features at sample lengths of 50, 100, 150 and 200 utterances. It is hoped that this information will lay the groundwork for a larger study, provide the beginnings of a dataset of typically developing children and shed light onto the question of how reliable spontaneous language samples of different lengths are.

2 Method

2.1 Participants

Participants for the pilot study consisted of 3 girls and 1 boy ranging in age from 2;8-3;9 (mean 36.5 months) from the local community who were considered as typically developing based on the following criteria: 1) the children had normal hearing levels 2) the children had never been referred to speech and language therapy 3) the children's parents were not aware of any language or communication difficulties of their children 4) parents reported the absence of any neurological disorders. All of the children were from monolingual English backgrounds.

2.2 Procedure

Naturalistic language samples were gathered at a recording studio on two occasions, a maximum of a week apart. This was to minimise the effect of language learning on the samples. The context of the two sessions were kept as near identical as possible so as not to introduce any extraneous variables. Each parent provided informed consent and was escorted with their child into a playroom housing a large selection of toys. The carer and the child played normally for approximately 35 minutes. Each parent was instructed to spend at least five minutes if possible discussing a recent occurrence that had taken place before the session. This was to encourage the child to use a wider range of verb tenses than they might have done otherwise (Crystal 1982, p.14). The playroom was a Flexible Learning Room fitted with five hidden cameras and a host of media systems controlled from the adjacent control gallery. All sessions were transcribed in their totality by a single transcriber. Each utterance was then analysed according to the morphosyntactic structures listed in the Word section of the Language Assessment and Remediation Screening Programme (LARSP) (Crystal, Fletcher and Garman 1976). Each usage of a morpheme from this list was counted for 200 utterances of each child.

Table 1. morphemes from the LARSP

Word	Examples

-ing	Mummy eating/
pl	all the cows/
-ed	I found it/
-en	have you eaten/
3s	my cat sits on a chair/
gen	I see the farmer's cow/
n't	don't/
'cop	it's big/
'aux	I'm counting/
-est	the biggest cup/
-er	bigger one/
-ly	he go quickly/

3 Results

Results are presented here in two brief sections. First, the raw data from each of the four children will be presented, followed by discussion of the correlation. A descriptive view of the data is provided in the following *Discussion* section.

3.1 Raw data

The data from this section is cumulative, meaning that Child E produced four instances of the –ing morpheme in the first 50 utterances analysed and then five more in the next 50 utterances, etc.

Table 2. morpheme production for child E

child E age 2;8	**sample 1**					**sample 2**			
	50	**100**	**150**	**200**		**50**	**100**	**150**	**200**
-ing	4	9	16	18	-ing	2	2	6	7
pl	2	10	15	17	pl	2	1	9	9
-ed	0	0	1	2	-ed	0	0	0	0
-en	0	0	2	2	-en	0	0	0	0
3s	0	0	0	0	3s	0	0	0	0
gen	0	1	1	3	gen	0	0	0	0
n't	0	0	0	1	n't	0	0	0	0
'cop	6	9	16	17	'cop	5	7	11	14
'aux	3	5	11	13	'aux	2	2	6	8

-er	0	0	0	1	-er	0	0	0	0
-est	0	0	0	0	-est	0	0	0	0
-ly	1	1	1	1	-ly	0	0	0	0

Table 3. morpheme production for child F

child F age 2;10	**sample 1**					**sample 2**			
	50	**100**	**150**	**200**		**50**	**100**	**150**	**200**
-ing	3	6	11	12	-ing	6	11	20	28
pl	5	9	10	11	pl	0	3	4	9
-ed	0	0	1	1	-ed	1	2	5	7
-en	1	1	1	1	-en	0	0	0	4
3s	1	2	3	3	3s	5	5	5	6
gen	3	3	4	4	gen	1	1	1	1
n't	3	4	7	15	n't	3	8	8	8
'cop	7	14	19	24	'cop	3	13	15	18
'aux	2	5	8	8	'aux	3	7	11	17
-er	0	0	0	0	-er	0	0	0	0
-est	0	0	0	0	-est	0	0	0	0
-ly	0	0	0	0	-ly	0	0	1	1

Table 4. morpheme production for child J

child J age 2;11	**sample 1**					**sample 2**			
	50	**100**	**150**	**200**		**50**	**100**	**150**	**200**
-ing	2	6	8	10	-ing	3	7	8	10
pl	6	9	10	12	pl	4	6	6	7
-ed	4	8	9	10	-ed	0	0	0	0
-en	2	2	3	5	-en	1	2	3	4
3s	1	2	3	11	3s	1	1	1	3
gen	0	0	0	0	gen	0	0	0	1
n't	1	4	5	9	n't	5	8	14	23
'cop	17	28	38	45	'cop	4	12	21	26
'aux	4	5	9	15	'aux	6	10	11	15
-er	0	0	0	0	-er	0	0	0	0
-est	0	0	0	0	-est	0	0	0	0
-ly	0	0	0	0	-ly	0	0	0	0

Table 5. morpheme production for child M

child M age 3;9	**sample 1**					**sample 2**			
	50	**100**	**150**	**200**		**50**	**100**	**150**	**200**
-ing	2	5	9	11	-ing	5	11	25	29
pl	4	7	10	13	pl	2	2	3	7
-ed	1	3	10	12	-ed	0	0	7	9
-en	2	3	3	3	-en	2	2	2	3
3s	3	3	4	5	3s	5	7	8	8
gen	0	0	3	3	gen	0	2	7	7
n't	7	12	17	21	n't	5	7	10	15
'cop	5	9	10	14	'cop	1	11	14	16
'aux	4	6	9	11	'aux	4	6	22	27

-er	0	0	0	0	-er	0	3	3	3
-est	0	0	0	0	-est	0	0	0	0
-ly	0	0	0	0	-ly	1	2	2	2

3.2 Correlation

Table 6. correlation results for all children

	50	**100**	**150**	**200**
-ing	-.381	-.924	-.477	-.499
pl	.239	.725	.882	.329
-ed	-.440	-.486	.228	.192
-en	.818	.894	.890	.284
3s	.730	.822	.781	.210
gen	1.00**	.000	.488	.150
n't	-.604	.566	.508	.449
'cop	.360	.494	.876	.970**
aux	.663	-.050	-.451	-.359
-er	.	.	.	-.333
-est	.	.	.	.
-ly	-.333	-.333	-.522	-.522

*Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

. Cannot be computed because at least one of the variables is constant.

Table 6 displays the correlation for each morpheme between the first and second samples for the four children. As there are only four children, it is not surprising that the correlations are unstable. The morpheme -en displays high correlations for 50, 100 and 150 utterances, suggesting that this may be a reliable measure of linguistic development. However, the correlation falls from above 0.8 down to just 0.284 with 200 utterances. Inspection of tables A to D, shows this is due to child F producing 4 –en morphemes in the last 50 utterances of sample 2 despite only producing one such morpheme in the previous 350 utterances.

Out of the morphemes examined, only the contracted copular has a correlation that moves consistently higher with longer samples. This is likely to be due to the fact that it was produced a relatively large number of times (174) in comparison to other morphemes were produced relatively few times and had much less consistent correlations.

Table 6 shows two of the correlations of morphemes to have reached statistical significance with the result for the genitive being doubtful as three of the children gave zero responses for both samples. The contracted copular is more promising, however, as it is based on much greater use. It is expected that correlation studies in an upcoming project with 25 children will be more informative.

4 Discussion

This pilot study draws attention to information that is useful for those using spontaneous language samples. Most striking is the uneven distribution of given morphemes throughout an individual sample. This is exemplified by child J's use of the third person singular which she uses once in each of the first three groupings of 50 utterances. She then goes on to use it eight times in the last group.

The unevenness of the spread of a given morpheme throughout a sample repeatedly leads to the situation where if one shorter sample of 50 or 100 utterances had been analysed on its

own, the morpheme may have been completely absent despite the fact that a longer sample of 200 utterances showed it to be present. This deserves special attention considering that the presence versus the absence of morphemes is likely to draw more attention to a possible sign of difficulty than a perceived underuse of a morpheme, particularly when diagnostic and therapeutic decisions are being made. The table below shows the frequency of this phenomenon. In the case of child E, this happens for six out of the twelve morphemes at the 50 utterance size and for three out of twelve when considering 100 utterances. Unsurprisingly, the errors reduce in line with the expansion of the sample size considered.

Table 7. Errors regarding the presence vs absence of a morpheme

	Errors at 50	Errors at 100
child E	6	3
child F	5	2
child J	1	0
child M	3	1

5 Conclusion

The analysis of spontaneous language samples is very popular among language researchers and practitioners due to the freedom of production that it affords the child. However, almost no research has been carried out into the reliability of the language sample in the field of morphosyntactic analysis. Given the fact that language samples are often used to diagnose language difficulties and to plan therapy, research into the degree of reliability provided by these samples is vital.

The main finding from this pilot study is the unevenness of the distribution of most morphemes throughout a 200 utterance language sample. Samples of 50 and 100 utterances were often shown to be inaccurate regarding the presence or absence of a particular morpheme in an individual's productive repertoire.

This pilot project is currently being expanded into a larger one analysing 25 typically developing children and a larger set of morphemes. Besides analysing the reliability of morphosyntactic production, a database of norms for different sized language samples will also be developed. It is intended that both aspects of this study will be of assistance to future researchers and practitioners comparing the linguistic production of typically developing children with those who are language impaired.

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Interpretation of Animal Metaphors: Evidence from Chinese and English Children and Adults

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Abstract

This research aims to investigate the differences and similarities in the understanding of animal metaphors in English and Chinese children and adults. 95 Chinese children and adults and 54 English children and adults participated in the experiment. The child participants are aged from eight to eleven and adults are aged from eighteen to forty. They were presented with stimulus sentence relating to fourteen animal words under four pragmatic conditions. It was found that adults gave a relatively larger number of psychological interpretations than children. Children gave more perceptual interpretations than adults. English children gave more perceptual interpretations than Chinese children. Behavioural interpretations were also found prominent in this research.

1 Introduction

Animal metaphors are used ubiquitously across languages to refer to human behaviour. Cowards are represented as chickens, lions denote the brave and crowd-followers are sheep and, although connotations and labels may vary quite significantly, the general conceptual metaphor of 'humans as animals' exists across cultures (Kovecses, 1997).

Conceptual metaphor theory (Lakoff and Johnson, 1980) has been extremely influential in cognitive science and other fields, and has cross-cultural implications. Of particular interest to this study are the conceptual metaphors HUMANS ARE ANIMALS, and OBJECTIONAL HUMAN BEHAVIOUR IS ANIMAL BEHAVIOUR (Kovecses, 2002). Kovecses (2003) also put forward that although these conceptual metaphors may be universal cross-culturally – meaning that animal metaphors may be used to describe people in all cultures – their expression in terms of the source domains used (e.g. the particular animal) may vary as a function of the linguistic and cultural background in question.

Some researchers have suggested that culture and age have significant effects on people's interpretation and production of animal metaphors. For example, Dowker (2003) pointed out that a British person would use the term fox to mean 'sly and cunning person', while a Canadian might use the same term to mean 'attractive woman'. The ways in which animal metaphors are used are certainly influenced by cultural conventions. Talebinejad and Dastjerdi (2005) compared 44 animal metaphors in English and Persian, and found that although animal metaphors in English and Persian are similar to a certain extent; many aspects of them are culture-specific. There are some differences in the frequency and predominant types of metaphors in the two languages. For example, shark is a 'dishonest person, a swindler' in English, but a 'man with no or very little beard growing on him' in Persian.

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Wierzbicka (1985, 1996) proposes the following themes are significant in people's concepts of animals: 'habitat', 'size', 'appearance', 'behaviour', and 'relation to people'. Leach (1964) discussed 'the folk classification of animals in British English which is based on such criteria as edibility and taboo, in turn related to the matters of killing and verbal abuse.' In Chinese culture, pig has a very close relation to people's life as pork is the main meat for the Han nationality. Therefore Chinese people have created many proverbs, idioms, and poems with pig, in which pig invokes an image of being dirty, smelly, fat and stupid, such as 'to live a life even worse than a pig' (to live a very poor and bad life), 'as stupid as a pig', or with regard to someone's home 'as filthy as a pigpen'. However, some tropical animals are unknown to Chinese people except possibly with regard to their appearances. For instance, zebras are rarely seen by Chinese people, so they seldom appear in Chinese idioms or proverbs. Chinese people only know that the stripes of a zebra are white and black. Therefore, they can only understand metaphoric expressions concerning a zebra if these relate to its appearance.

In this research, animal metaphors were chosen for comparison in the two different languages: Chinese and English. Although there has been extensive research on metaphor across cultures, very little empirical research has been done on animal metaphors, and little of this has been cross-linguistic, although there have been some studies within the domain of anthropology or in literary investigations (Leach, 1964; Wierzbicka, 1985, 1996).

The simple paraphrase task is the most natural task and prevents the experimenter from over-interpreting children's responses as well as from narrowing their scope. When children do not grasp the meaning of a stimulus sentence relating to metaphor as intended by the experimenter, very often their interpretation is labelled as a simple association or, as a magical, fanciful and bizarre response. An analysis of the sentences used by children to express what they think a metaphor means, the paraphrase task, could greatly improve our knowledge of the particular grounds on which children's construction of the meaning of metaphors rests. For this reason a paraphrase task was used in this experiment.

The current experiment aims to investigate the differences and similarities in the understanding of animal metaphors in English and Chinese children and adults. It was predicted on the basis of the earlier findings (Wang and Dowker, in press) that adults would give more psychological interpretations than children, and that children would give more perceptual interpretations than adults. Animal metaphors were expected to be interpreted differently by Chinese and English people, and especially by Chinese and English adults.

2 Method

2.1 Participants

149 participants took part in this experiment. They were equally divided according to gender at each age level: eight- to eleven-year-old children and eighteen- to forty-year-old adults (see Table 1). They were equally divided between males and females The English child participants were studying at St. Barnabas Primary School in Oxford. The English adult participants were all students at the University of Oxford. All the English participants were native English speakers. The Chinese children were selected at random from the Affiliated Primary School of Taiyuan University of Technology, P. R. China. The Chinese adults were students at Sun Yat-sen University, P. R. China, and had never been to English speaking countries. All the child participants were selected at random from their classrooms and the adults were all unpaid volunteers in universities. None had participated in any earlier studies of figurative language comprehension.

Table 1. Numbers of Participants

Cultural Group	Age Group	Number
Chinese	Adults	65
	Children	30
	Total	95
English	Adults	34
	Children	20
	Total	54
Total	Adults	99
	Children	50
	Total	149

2.2 Materials

The participants were presented with brief vignettes about the use of animal metaphors based on the studies by Caramelli and Montanari (1995). In these vignettes: the topic of the predicative metaphor was either the proper name of a child, e.g. Paul, John etc., or teacher's surname preceded by Mr., according to four pragmatic conditions.

The stimulus sentence relating to metaphor's vehicles were fourteen animal words, of which: elephant, fox, lion, sheep, snail and wolf give rise to a frozen metaphor in Italian (Caramelli and Montanari, 1995); and of which: cod, crow, grasshopper, kangaroo, ladybird and zebra gave rise to a novel metaphor in Italian (Caramelli and Montanari, 1995). Pig and dog were added by the researcher as both of them are very extensively used in Chinese. The same materials were given in English and Chinese versions.

The pragmatic conditions were: (1) a child addressing another child; (2) a child addressing a teacher; (3) a teacher addressing a child; (4) a teacher addressing another teacher.

A short story was created for each pragmatic condition as follows:

1. Child addressing another child:

'There was a boy called Paul. He lived next door to a boy called David. They used to play together. One day David said: 'Paul is a … (elephant, fox, lion, sheep, snail, wolf, cod, crow, grasshopper, kangaroo, ladybird, zebra, pig and dog)'

2. Child addressing a teacher:

'There was a boy called Mark. Mark went to school and his teacher was called Mr. Smith. One day Mark said: 'Mr. Smith is a … (elephant, fox, lion, sheep, snail, wolf, cod, crow, grasshopper, kangaroo, ladybird, zebra, pig and dog)'

3. Teacher addressing a child:

'In St. Paul school there was a teacher called Mr. White and one of his pupils was called Robert. One day Mr. White said: 'Robert is a … (elephant, fox, lion, sheep, snail, wolf, cod, crow, grasshopper, kangaroo, ladybird, zebra, pig and dog)'

4. Teacher addressing another teacher:

'In St. Andrews school there was a teacher called Mr. Jenkins. Another teacher was called Mr. Parker. They used to spend break-time together. One day Mr. Jenkins said: 'Mr. Parker is a … (elephant, fox, lion, sheep, snail, wolf, cod, crow, grasshopper, kangaroo, ladybird, zebra, pig and dog)'.

Thus, overall there were four stories followed by fourteen stimulus sentences relating to metaphors. This means that there were fifty-six items, incorporating a pragmatic condition and a metaphor.

2.3 Procedure

The materials were presented to each participant in four sessions (fourteen stories were presented in each session). In each session all four pragmatic conditions were presented. The researcher read the first story to the participant and then asked: 'What did X (David / Mark / Mr. White / Mr. Jenkins) mean? Writing down the participants' response, the researcher asked: 'Do you think that X (David / Mark / Mr. White / Mr. Jenkins) likes Y (= people addressed by the metaphor)' and transcribed the participant's response. The other stories were then presented in the same way.

2.4 Scoring

Participants' interpretations were classified as perceptual, psychological, behavioural, functional, no-response, evaluative, descriptive, cross-sensory or associative. Their interpretation could either be one type or a mixture of several types. Whenever the researcher was not sure about a particular response, she would have a discussion with other judges until agreement was reached. A sample stimulus sentence together with an example of each type of response and the definitions or guidelines by which they were scored is presented in Table 2.

Table 2. Responses to a sample stimulus sentence: *Tom is an elephant*.

Name	Example	Definitions or guidelines for scoring
Perceptual	Tom is big and fat. Or: Tom is noisy.	Based on, or involving perception.
Psychological	Tom never forgets.	Relating to, or arising from the mind or emotions.
Behavioural	Tom moves clumsily.	Based on or involving action or behaviour
Functional	Tom is a gardener, who waters plants the way an elephant splashes with its trunk.	Relating to a function.
No response	Do not understand.	The participants give no response.
Evaluative	It is nice. Or: He is bad.	Simple evaluation, no exact meaning
Descriptive	Tom's surname is elephant.	Involving or characterized by description; serving to describe. Or concerned with classification or description.
Cross-sensory	(Not in this example, but in: *The smell of my mother's perfume was bright sunshine.*) My mother's odour is very warm.	Different senses were used across. In this example, odour is smelt, but warm is what people feel.
Associative	(Not in this example, but in *Paul is a dog.*) Paul was born in the year of the dog.	Of, characterized by, resulting from, or causing association.

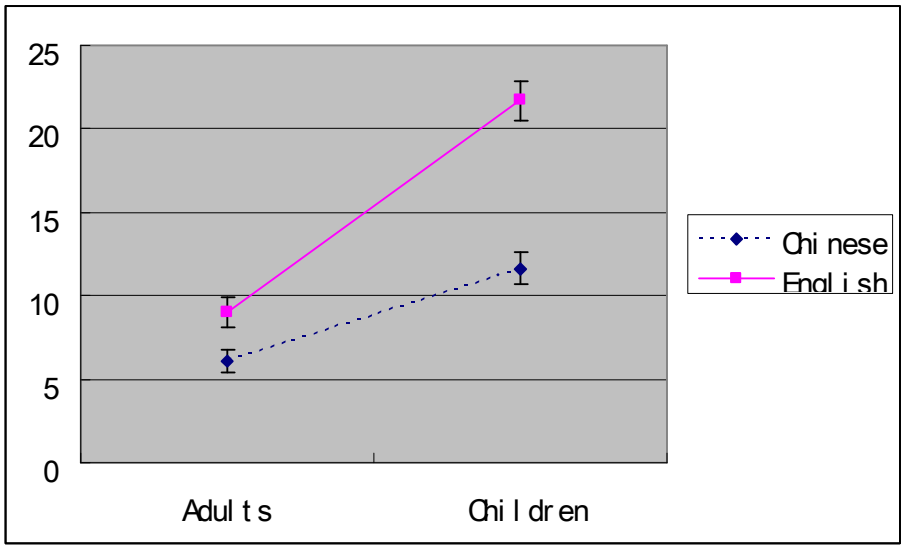
3 Results

For each participant the number of items in each task using each type of explanation was calculated and two-way Analyses of Variance were carried out with age and culture as the factors.

Figure 1 shows the significant cultural and age differences in perceptual interpretations. Children gave more perceptual interpretations than adults ($F(1,145) = 94.827$, $MS = 2592.868$, $p < .0001$), English people gave more perceptual interpretations than Chinese people ($F(1,145) = 48.380$, $MS = 1322.866$, $p < .0001$), and there was a significant culture × age interaction ($F(1,145) = 14.446$, $MS = 395.002$, $p < .0001$).

This interaction was because both English and Chinese children gave more perceptual interpretations than English and Chinese adults. Chinese adults gave comparatively very few perceptual interpretations.

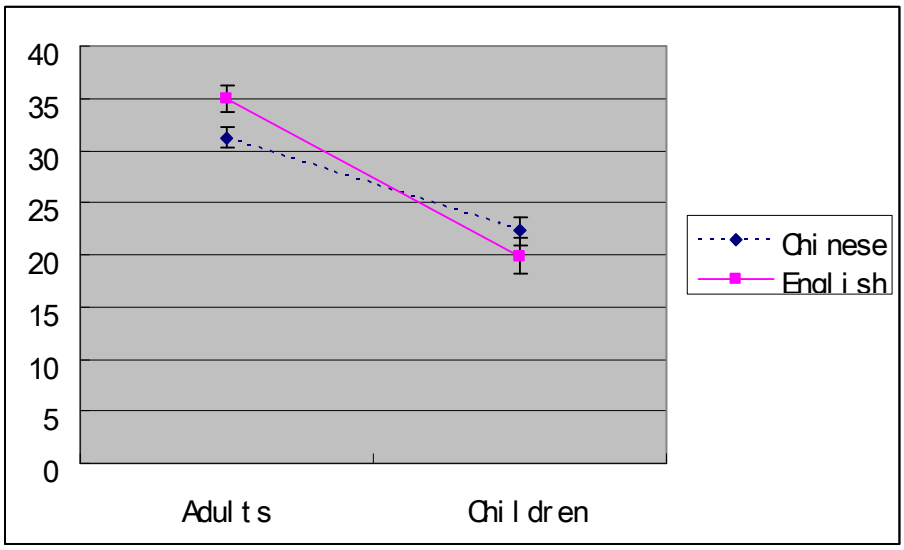
Figure 1. Marginal Means for Perceptual Explanations used by Chinese and English Children and Adults



Note: Error bars display the standard error of the mean

Figure 2 illustrates that adults gave more psychological interpretations than children ($F(1,145) = 77.871$, $MS = 4486.408$, $p < .0001$), but the cultural differences were not significant ($F(1,145) = 0.234$, $MS = 13.482$, $p = 0.629$). There was a significant culture × age interaction ($F(1,145) = 4.955$, $MS = 285.447$, $p = 0.028$).

Figure 2. Marginal Means for psychological Explanations used by Chinese and English Children and Adults

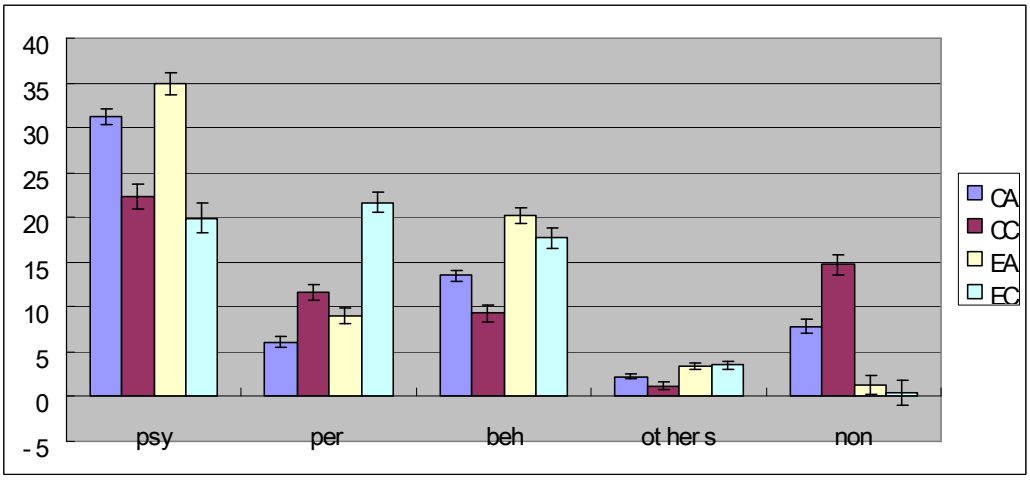


Note: Error bars represent the standard error of the mean

Unlike the earlier studies (Wang and Dowker, in press), behavioural interpretations were also found to be frequent in this study as well as perceptual and psychological interpretations.

Figure 3 shows the means of all the explanations by four groups of people: Chinese adults and children, English adults and children. It was demonstrated that psychological, perceptual and behavioural interpretations are the main interpretations. Non-response was only prominent among the Chinese participants.

Figure 3. Marginal Means of All the Explanations



Note: Error bars denote the standard error of the mean

Figure 4 illustrates that Chinese adults gave many behavioural interpretations, together with psychological and perceptual interpretation. Figure 5, 6 and 7 indicate respectively that Chinese children, English adults and English children all gave many behavioural interpretations, as well as the psychological and perceptual interpretations that were discussed previously.

Figure 4. Mean Totals of Metaphor Categories used by

Figure 5. Mean Totals of Metaphor Categories used by

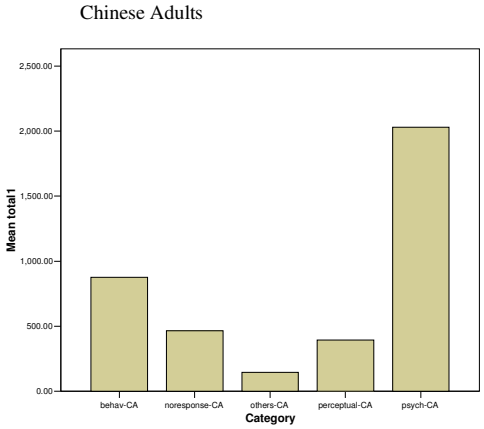


Figure 6. Mean Totals of Metaphor Categories used by English Adults

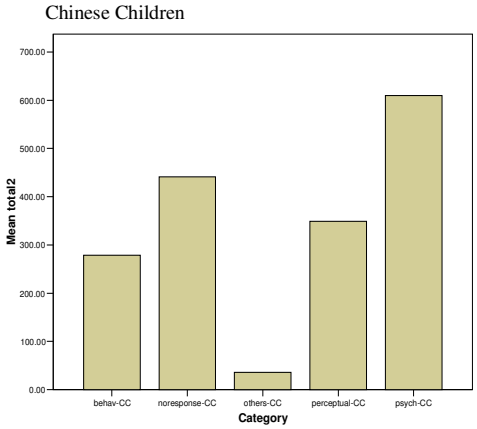
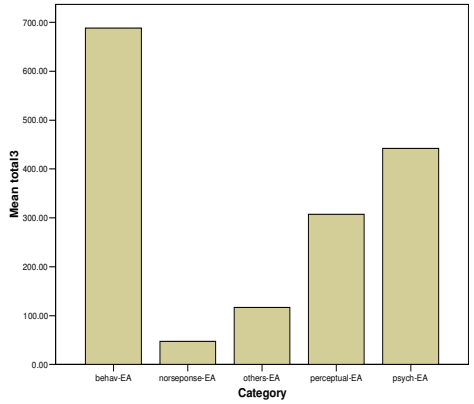


Figure 7. Mean Totals of Metaphor Categories used by English Children



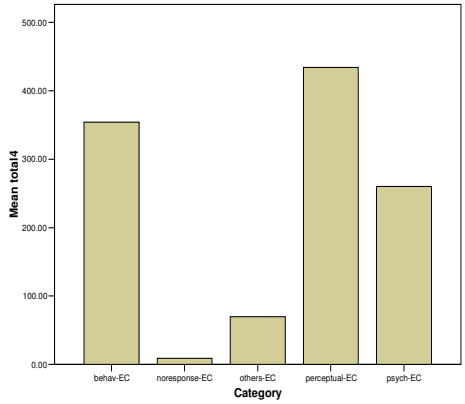
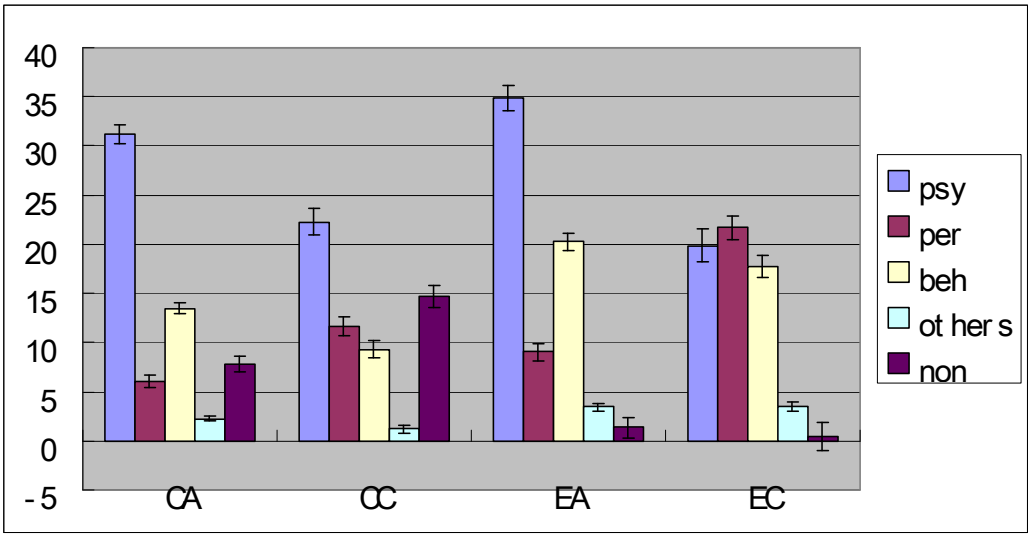


Figure 8 shows the means of different groups of participants for their explanations. Chinese and English adults gave more psychological interpretations than perceptual and behavioural interpretations. Non-responses were only frequent in Chinese participants and especially in Chinese children. English children used equally frequently psychological, perceptual and behavioural interpretations.

Figure 8. Marginal Means of Different Groups of Participants



Note: Error bars denote the standard error of the mean

In addition, non-responses were much commoner in Chinese people than English people, and non-responses were especially frequent in Chinese children. After investigating the data for all the animals in four different pragmatic conditions, it appeared that almost all the non-responses given by Chinese people appeared in the stimulus sentences relating to 'cod'. This was true in all four pragmatic conditions. In the United Kingdom cod is one of the commonest kinds of fish, e.g. commonly eaten as the fish in 'fish and chips'. The cod lives in the North Atlantic Ocean, and separate stocks are found in the waters of North America, Greenland, Iceland, and the Faeroe Islands, in the Irish Sea, to the west of Scotland, in the North Sea, the Barents Sea, the Skagerrak and the Baltic Sea. However, Chinese people are not familiar with this genus of fish. The cod metaphors are novel metaphors for Chinese, and/or they just assumed cod to be a common fish which has a slick facies.

4 Discussion

The results revealed that adults gave a larger number of psychological interpretations to animal metaphors than children probably in part because they were more familiar with conventional psychological explanations. For example, in 'Paul is a sheep', adults would respond that 'Paul is docile, faithful and gentle.' or 'He is pathetic and never thinks of anything for himself.' while children would say that 'He is short and small.' or 'Paul is fluffy and white.'

There was no significant cultural difference in psychological interpretations; however, differences in psychological interpretations between English children and adults were slightly greater than those between Chinese children and adults. This supports earlier suggestions that both Chinese children and adults have closer familiarity with psychological metaphorical expressions than English children and adults.

The results also showed that children tended to give more perceptual interpretations than adults. It may be that adults tended to give fewer perceptual interpretations simply because they gave more psychological interpretations. For instance, children said that '*Robert is a dog*' meant that '*Robert is loud / big / hairy / ugly.*' but adults responded, '*Robert is stupid / rude/ rascal / loyal / vicious.*' When interpreting '*Mr. Smith is a zebra*', a child would say '*Mr.*

Smith is stripy /black and white / has long face.' while adults usually responded that '*He is exotic and interesting / annoying / stubborn.*'

English people were found to give more perceptual interpretations than Chinese people. English children gave predominantly perceptual interpretations and the frequency of perceptual interpretations was also high in Chinese children. A typical example was shown in '*Paul / Mr. Smith / Robert / Mr. Parker is a kangaroo.*' Chinese adults said that '*he is cute and lovely / kind and caring.*' However, Chinese children gave more perceptual interpretations as '*he is fat / good-looking / has a big pocket in chest.*' and English children responded that '*he is tall / big / brown / has big feet / lots of pockets.*'

5 Conclusion

These findings supported the predictions based on prior research on metaphor (Gardner, Winner, Bechhofer and Wolf, 1978; Dowker, 1986; Gentner, Falkenhainer and Skorstad, 1988) and the earlier studies (Wang and Dowker, in press) that adults would give a relatively larger number of psychological interpretations than children. Children gave more perceptual interpretations than adults. English children gave more perceptual interpretations than Chinese children. Unlike earlier studies, behavioural interpretations were also found prominent in this research.

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