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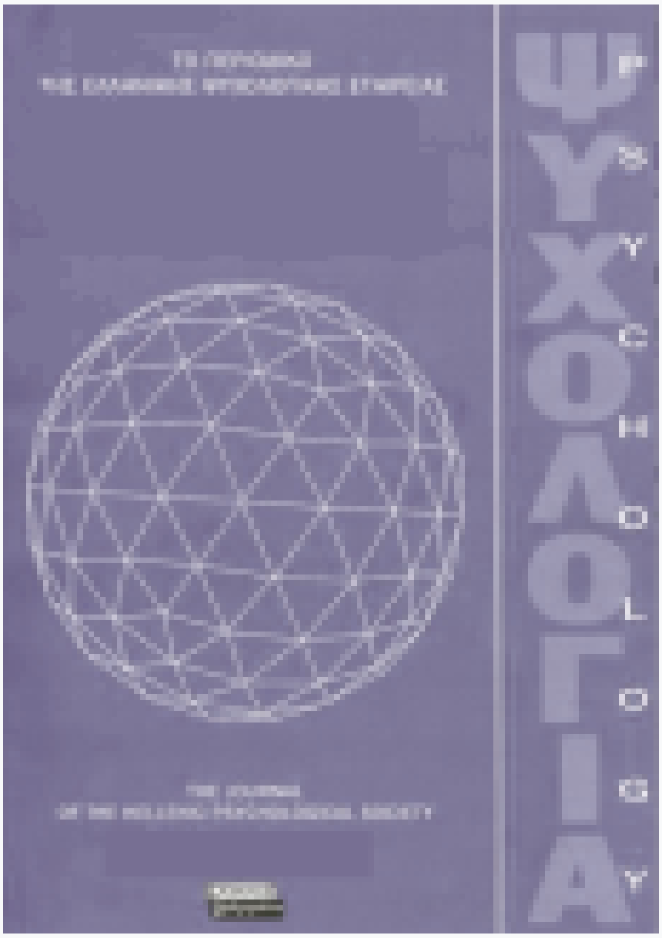

Multiple measures of assessing vocabulary acquisition: Implications for understanding lexical development

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Multiple measures of assessing vocabulary acquisition: Implications for understanding lexical development

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ABSTRACT To investigate the effects of linguistic context on lexical acquisition, 192 children aged between 3 years 6 months and 6 years 6 months were introduced to 2 novel nouns in different stories. The story format provided a natural framework to vary the linguistic context in which the novel terms were introduced. Four different linguistic contexts were used: analogy, lexical contrast, implicit inferential information, and a definition. Baseline assessments were made of the children's receptive vocabulary and working memory. Children's lexical knowledge was assessed on measures of production, comprehension and semantic representations at two time points following the initial story exposure. Both children's existing vocabulary and working memory contributed to their subsequent performance at the two times of testing. In addition, the linguistic context influenced performance across the tasks, with lexical contrast resulting in the most accurate performance. In general the children found the assessment tasks where they needed to generate a contrast or provide an analogy the most difficult. However, performance was mediated by the initial exposure they experienced. The current study highlights the ways in which children's initial level of linguistic competence and lexical exposures support the development of differentiated lexical representations.

Key words: Lexical acquisition, Semantic representation, Vocabulary measures.

Introduction

Vocabulary acquisition is, arguably, the cornerstone of language acquisition. It serves as the starting point for the development of meaning in oral language. Vocabulary knowledge is a strong predictor of academic success; it plays a central role in cognitive development and is a predictor of later literacy and academic achievements (Cunningham & Stanovich, 1997; Stanovich & Cunningham, 1993). Considerable advances have been made in the understanding of the cognitive and contextual factors that support early lexical acquisition (Clark, 2003; Hoff & Naigles, 2002). Yet much less is known about the factors that influence lexical learning as the child approaches the initial phases of formal education.

Studies of young children attest to their apparently remarkable feats of acquisition in structured experimental tasks (Bloom, 2000). Many of these studies rely on a simple mapping process, where all that is needed is the selection of the referent from an array of other stimuli (Ralli, 1999). Such mappings provide initial information about a term's meaning but little is known about the details of the semantic representations that are established and the ways in which different exposures influence the children's ensuing representations (Dockrell & Messer, in press).

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While these «experimental word learning» tasks mimic single word exposure for young children, they are rarely modelled on the range of different naturalistic contexts that children encounter new words (Nelson, 1988, 1990) nor do they resemble the more extensive oral language exposures that older children receive when they encounter novel words (Graves, 1986, 1987; Nagy & Herman, 1987; Nelson, 1988). In these extended exposures the accompanying language may support inferences about different types of meanings (Brabham & Lynch-Brown, 2002). However, it is equally possible that more extended interactions and exposures reduce the salience of novel lexical items and allow the child to infer a wider understanding of the situation or text without having to decipher the novel term (Braisby, Dockrell, & Best, 2001). Incidental word learning for older children is therefore not inevitable (Swanborn & De Glopper, 1999). This study aims to address these concerns by examining the ways in which children exposed to orally presented stories acquire novel words embedded in different linguistic frames.

Lexical acquisition relies on a number of cognitive prerequisites prior to the establishment of a full semantic representation. When a child hears a new word, the sound must be identified in the speech stream, a phonological representation must be encoded, a mapping between the word and world established and ultimately a detailed semantic representation for the new term will be developed together with some type of indication of the morphosyntactic properties of the word. The initial phonological and semantic representation for comprehension provides the child with a database to generate the new term.

Experimental results have identified a central role for phonological factors in the rate of acquisition. One consistent finding has been that during early and middle childhood, at least, there is a close link between children's abilities to retain new phonological information for very short period of times and their vocabulary knowledge (Gathercole & Baddeley, 1989; Gathercole & Baddeley, 1990; Gathercole & Adams, 1993, 1994; Michas & Henry, 1994). Thus, any exposure to a novel term must allow for the establishment of a phonological representation but whether this is sufficient to establish a more detailed representation is currently unclear (McKague, Pratt, & Johnston, 2001). Having established an initial phonological representation, the subsequent semantic representation relies on three different sets of influences: the child's prior level of vocabulary knowledge, the non-linguistic information present, and the nature of the linguistic input. Children with larger vocabularies acquire new terms more quickly than children with smaller vocabularies (Elley, 1989; Leung & Pikulski, 1990). Children with larger vocabularies have more differentiated semantic representations that new lexical items can be related to (Anglin, 1993; Clark, 2003; Dockrell & Campbell, 1986). The context in which children encounter the new term also serves to guide the ensuing development of the word's representations (Baldwin, 1991).

Oral language input that supports lexical acquisition can occur either explicitly or incidentally from particular types of exposures or contexts. Providing a definition for a word could serve as a foundation for meaning however input that includes a definition rarely occurs in typical exchanges (Graves, 1986, 1987; Nagy & Herman, 1987). Whether such explicit information, were it to be provided, would enhance word learning in preliterate children is questionable. Indeed, there is some indication that information provided in an implicit format (see Werner & Kaplan, 1952) serves as a better foundation for developing semantic representations.

There are two implicit forms of semantic information that offer powerful cues to word meaning: lexical contrast and analogy. Lexical contrast occurs when a novel term is contrasted with a known term typically drawn from the same semantic domain. Novel terms that introduced in this way are acquired rapidly and more accurately than those that do not involve a contrastive exposure (Carey & Bartlett, 1978; Heibeck &

Markman, 1987; Gottfried & Tonks, 1996; Au, 1990). Contrast has the potential to both prevent the child from interpreting a new word as synonymous with a known word and provides an indication of the relevant semantic domain to which the new term relates. Thus, it is assumed that children take the contrast as an indicator that the contrasted words, while having different meanings, are related in some way.

Analogies can also provide a child with the basis to develop and differentiate word meanings. Analogy is also a powerful cognitive mechanism (Gentner & Holoyoak, 1997). An analogy is the ability to map knowledge from one domain to another. Accordingly, children could use the information about a known lexical item to draw inferences about a new (previously unknown) lexical item. The ability to use relational similarity of this kind as a support for vocabulary acquisition has not been compared with other linguistic inputs as a support to lexical learning. Children's language exposures may often contain information about the ways in which an item is like another.

Thus, the oral language to which children are exposed offers a range of clues that can enhance lexical learning. Older children appear to benefit more from this information than younger children. Yet, the relative effectiveness of the different linguistic exposures and their subsequent impact on the child's ensuing representations overtime is not well specified (Dockrell & Messer, in press). To develop a comprehensive model of lexical learning, sensitive measures of the child's lexical knowledge are required.

Evidence of the child's lexical knowledge will depend on the type of response required and information available to the learner at the time of testing (Anglin, 1993). Calibrating the relationship between comprehension and production is an initial step in this process. Comprehension is needed for the recognition of words and to provide templates for production. Production, on the other hand, depends on representations derived from comprehension. The prototypical measure of word knowledge is a multiple choice format, in which the child selects a picture for a target word from among several pictures (for younger children) or written words (for older children). Such formats are limited since they are open to simply guessing or using non-linguistic strategies to identify items. This is particularly problematic when the foil items are not selected by clearly operationalized criteria (Anglin, 1993; Dockrell, Messer, & George, 2001). Children's choices in such situations do not necessarily inform us about the nature of their lexical representations. To succeed in a multiple choice test children need only possess a limited level of knowledge about the lexical item, or in some cases no knowledge whatsoever if they know the names of the alternative targets. Forced choice comprehension tasks can make vocabulary knowledge appear «flat» as if all the words are either known to the same level or unknown leading some to argue that «such multiple choice vocabulary tasks are useless at best and dangerous at worst» (Kameenui, Dixon, & Carnine 1987, p. 138). However, «access to word knowledge cannot be compared to an on/off toggle switch» (Drum & Konopak, 1987, p. 79).

There have been several attempts to create assessment techniques that tap different aspects of vocabulary knowledge. A synthesis of these various approaches can be seen as elaborating the view that word knowledge falls along a continuum, and it is necessary to consider where along the continuum a particular lexical item lies. Semantic representations can include knowledge of relevant antonyms, synonyms, hyponyms (Carey & Bartlett, 1978; Heibeck & Markman, 1987) and semantic attributes (Richard & Hanner, 1985). Another group of vocabulary measures are those that assess children's inferences about categorical dimensions of the new lexical items (Dockrell & Campbell, 1986; Keil, 1983). Although there has been some work on varying approaches to assessing vocabulary knowledge, the use of alternative assessment measures has been limited to small-scale tests of their effectiveness in experimental learning studies (e.g., Jenkins et al., 1984; McKeown, 1985; Nagy et al., 1985). Thus, an important step in understanding the development of lexical representations is to consider the ways in which different assessments are related and the ways in which lexical exposures influence the children's performance. If different dimensions of lexical knowledge are considered, a multifaceted picture of vocabulary size can emerge (Graves, 1986).

Stories provide a plausible means of introducing children to new words in a systematic fashion. Crais (1987) argues that to use stories to introduce new words can illuminate what and how a child learns from a specific linguistic context (Au, 1990; Goodman, McDonough, & Brown, 1998; Katz et al., 1974). Previous investigations of lexical acquisition from stories have used published stories to introduce novel items (Elley, 1989; Jenkins et al., 1984; Leung & Pikulski, 1990; Nagy et al., 1985, 1987) while providing important information about the role of lexical learning from stories they were not able to control the amount and nature of the exposure to new items. The use of specifically constructed stories to examine acquisition patterns provides a typical context that permits the systematic manipulation of variables affecting the mapping process.

Purpose of the present study

Current studies of early lexical acquisition indicate that children are quick and efficient at establishing initial world-word mappings in structured experimental settings. The ways in which older children use such exposures, in naturalistic contexts, to develop wider semantic representations is not well understood. The current study aims to address this gap by considering the development of semantic representations in preschool and school aged children who experience different linguistic exposures embedded within a story task. These different exposures are designed to reflect linguistic contexts that provide different levels of information about the novel term. Performance is considered across a range of tasks: direct and indirect. The direct measures refer to the measures that ask the child about the word knowledge explicitly, e.g. by definition or multiple choice task. Indirect measures refer to those measures where the child's knowledge of the new term is investigated by a way in which the term is used, e.g. drawing associations or generating new stories with the target term. Learning is examined across time for both preschool children and children in their first year of formal education.

Methods

Participants

Two hundred and thirty children between the ages of four and six were screened in the first phase of the study. All children had English as their first language and had no identified learning difficulties. One hundred and ninety two children met the entry requirements for the study. The children were divided in three groups of 64 (balanced for gender) reflecting three different age bands: Group 1 M = 4.0, range 3.6-4.6, Group 2 M = 5.0, range 4.5-5.6, Group 3 M = 6.0, range 5.7-6.6.

Design

A mixed between and within subjects design was used. There were four between subject factors: linguistic conditions (analogy, inference, definition, lexical contrast), age group (three age bands), phonological memory level (high/low) and vocabulary knowledge level (average/below average). The experimental assessments were repeated over two test points.

Materials and measurements

The stories

To allow for controlled manipulation of linguistic conditions, eight stories were designed for the study (two for each linguistic condition). Each storybook contained one unfamiliar object-word per story. The target words always appeared twice, once at the beginning of the story and once in the middle of the story. Sentence length was balanced across target words. Each story was about 7-9 sentences long.

Each condition introduced the new word in a different linguistic context. In the Inference condition the new word was introduced implicitly with information about how a certain item is used. In the Analogy condition implicit information about the novel word was given by providing children with an analogy, drawing a relation between an aspect of the target word with another already known word. In the Lexical contrast condition the new word was contrasted with two already known words, such as «He was not playing a piano or a guitar, but an abez». In the Definition condition an explicit definition of the novel item was included in the story. Examples of the stories used are presented in Appendix 1. These definitions were taken from the Collins Cobuild English Language Dictionary (1993).

The lexical stimuli

Target items were identified according to the following certain criteria: low word frequency according to different indexes (Burroughs, 1957; Carroll, Davies, & Richman, 1971), the same level of conceptual difficulty and the same grammatical category (they were concrete words-nouns). The novel words were created using the following criteria: same word length (two syllables) and characterised by morphological transparency.

The target words chosen were two concrete nouns «oboe» and «tepee» and the targets were replaced in the stories with non-words (abez and feber). In this way, learning could be attributed to the exposure of the children to the experimental situation.

Pre-test measurements

In order to be included in the study the children had to fail the multiple choice pre-test for the target («oboe» and «tepee») and the control words («beret» and «hatchet»). Children who already knew the target words were excluded from the study. The control words allowed a comparison between the children's performance that resulted from exposure to the stories in contrast to change in performance influenced from testing or strategy changes.

Post-test measurements

Children's word knowledge was assessed through seven lexical tasks. Assessment took place twice, after the exposure (Immediate post-test) and one week later (Delayed post-test). The order of the post-test assessment tasks was preset in the order that follows. So, the measurements were:

1. Naming task	«What is this?»
2. Inference task	«What do we do with this?»
3. Analogy task	«Do you know anything else like this? Tell me».
4. Contrast task	«Do you know anything else different from this one? Tell me».
5. Multiple choice task	«Show me the x».
6. Definition task	«What do you think an x is?»
7. Sentence generation task	«Why do you think they go together?» (a prompt question was used.) «Which of these two other pictures goes best with this one (target item)?»

Procedure

General testing procedure

All the tasks were introduced to the children as «games», where there were no right or wrong answers. Children were tested in three separate sessions, one week apart. The first session included three pre-test measurements: the British Picture Vocabulary scale (Dunn, Dunn, Whetton, & Pintile, 1982) which measures children's receptive vocabulary; the target and control vocabulary pre-test (screening test) which were described in the pre-test measurements previously; and the non-word memory test (Gathercole & Baddeley, 1990) which is a test measuring the short term phonological memory. Following the pre-test, the children from each age group were assigned randomly to one of four experimental conditions (Inference, Analogy, Lexical contrast, Definition). Groups were balanced for age and gender.

The second week, the children were invited by a puppet to listen to two stories. Each child was told to listen carefully while the puppet was telling the story. The experimenter using the puppet was telling each of the stories (presented in Appendix 1) to the children. Each story introduced a new term in an illustrated storybook context. The stories varied in the way in which linguistic information was used to introduce the new terms. After hearing the story, children's word knowledge was assessed in seven different lexical tasks (Immediate post-test). Further examination of their word knowledge occurred one week later (Delayed post-test).

Results

Baseline measures established that the children did not know the target items. Children's performance on the control and target words was compared using the multiple choice test. All children failed multiple choice task for target and control words and there were no significant differences between children's performance in the different baseline measures. In contrast, children performed significantly better on the target than the control words both during the Immediate (Wilcoxon: $Z = 11.9, p < .0001$) and the Delayed post-test (Wilcoxon: $Z = 11.2, p < .0001$). Thus, there was evidence of learning for the target words only. In the subsequent three sections we consider the factors that influenced the rate and nature of the children's lexical learning.

The first section considers the role of the child's previous skills (phonological and lexical competence) and developmental level on acquisition. The second section considers results across the different assessment measures and the final section examines the children's performance across tasks by linguistic condition

Age and Prior knowledge

To investigate developmental patterns in the children's performance, differences across the three age groups were analysed. Table 1 presents children's performance on the post-test measurements by age during the Immediate post-test. Significant differences were found on all measures except contrast, a task that all children found difficult. For all the other measures there was a stepwise progression, with the older children performing better than the younger ones. To identify patterns of development, a series of Mann-Whitney tests were carried out for all the measures. Group 3 were statistically significant more accurate on all measures than Group 2 (Naming task: $Z = 3.3, p < .005$, Multiple choice: $Z = 2.4, p < .05$, Definition task: $Z = 4.4, p < .0001$, Sentence generation task: $Z = 4.04, p < .001$) and Group 1 (Naming task: $Z = 4.8, p < .001$, Multiple choice task: $Z = 2.8, p < .005$, Inference task: $Z = 3.3, p < .005$, Definition task: $Z = 6.8, p < .001$, Analogy task: $Z = 4.2, p < .001$, Sentence generation task: $Z = 6.4, p < .001$). Group 2 were also statistically significant more accurate than Group 1 for all measures (Multiple choice task: $Z = 2.4, p < .05$, Definition task: $Z = 2.5, p < .05$, Analogy task: $Z = 3.3, p < .005$, Sentence generation task: $Z = 3.2, p < .005$).

Table 2 presents children's performance across tasks by age in the Delayed post-test. As Table 2 shows during the Delayed post-test significant differences were found on all measures except naming and multiple choice tasks. Performance was uniformly high on the multiple choice tasks and low on the naming task. For all the other measures there was a stepwise

Table 1
Children's performance across tasks by age in the Immediate post-test

Tasks	Age Group						Statistics		
	3.6-4.6		4.6-5.6		5.6-6.6		Kruskal-Wallis 1-Way ANOVA		
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	X^2	*df*	*p* <
Naming	.67	(.62)	.86	(.77)	1.33	(.76)	24.3	2	.001
Multiple choice	1.80	(.44)	1.95	(.21)	1.97	(.18)	11.7	2	.005
Inference	1.59	(.58)	1.37	(.70)	1.56	(.59)	10. 9	2	.005
Definition	1.00	(.84)	1.27	(.72)	1.03	(.87)	47.9	2	.001
Analogy	.20	(.51)	.64	(.80)	.62	(.90)	18.5	2	.0005
Contrast	.31	(.66)	.38	(.75)	.48	(.84)	1.1	2	ns
Sentence generation	1.23	(.85)	1.08	(.82)	1.33	(.82)	44.2	2	.001

progression, with the older children performing better than the younger ones as in the Immediate post-test. To identify patterns of development, a series of Mann-Whitney tests were carried out for all the measures. Group 3 were statistically significant more accurate than Group 2 for the Definition task (Z = 2.9, p < .005) and the Sentence generation task (Z = 2.4, p < .05), and Group 1 for four measures (Inference task: Z = 3.2, p < .005, Definition task: Z = 6.09, p < .001, Analogy task: Z = 4.7, p < .001, Contrast task: Z = 2.3, p < .05, Sentence generation task: Z = 5.9, p < .001). Group 2 were statistically significant more accurate than Group 1 on four measures (Inference task: Z = 2.1, p < .05, Definition task: Z = 3.9, p < .0005, Analogy task: Z = 3.2, p < .005, Sentence generation task: Z = 3.7, p < .0005). Thus, in general older children performed better on tasks that required greater lexical knowledge and use of language, although the extent of this advantage decreased over time. There are two factors that might confound a simple age interpretation. These are the children's existing vocabulary level and their phonological memory performance. Children's baseline measures for phonological memory and vocabulary are presented in Table 3.

Children's scores on the BPVS (existing

Table 2
Children's performance across tasks by age in the Delayed post-test

Tasks	Age Group						Statistics		
	3.6-4.6		4.6-5.6		5.6-6.6		Kruskal-Wallis 1-Way ANOVA		
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	X^2	*df*	*p* <
Naming	.36	(.57)	.44	(.69)	.56	(.71)	2.8	2	ns
Multiple choice	1.61	(.70)	1.55	(.75)	1.77	(.61)	4.3	2	ns
Inference	1.59	(.61)	1.61	(.58)	1.56	(.66)	11.2	2	.005
Definition	1.09	(.85)	1.20	(.82)	1.14	(.89)	40.3	2	.001
Analogy	.19	(.47)	.52	(.73)	.59	(.79)	23.01	2	.001
Contrast	.08	(.32)	.16	(.51)	.31	(.66)	6.6	2	.05
Sentence generation	1.33	(.84)	1.28	(.86)	1.39	(.81)	37.4	2	.001

Table 3
Children's performance (*means* and *SDs*) on the Baseline measures in standard scores

Conditions		BPVS		Phon.	Memory
		Mean	*SD*	*Mean*	*SD*
Inference	3.6-4.6	91.8	(12)	127.6	(10.6)
	4.6-5.6	88.5	(12.2)	119.3	(20.5)
	5.6-6.6	79.3	(12.6)	120	(17.6)
Analogy	3.6-4.6	88.6	(10.4)	123.6	(13.5)
	4.6-5.6	86.1	(14)	124.6	(14.9)
	5.6-6.6	83.4	(16.7)	128.7	(8.7)
Lexical contrast	3.6-4.6	91.2	(15.6)	117	(20.8)
	4.6-5.6	86.3	(7.4)	128	(12)
	5.6-6.6	88.6	(16.9)	123.8	(12.3)
Definition	3.6-4.6	84.8	(10.7)	119.9	(16.4)
	4.6-5.6	85.2	(15.9)	124.1	(20)
	5.6-6.6	90	(14.9)	125.1	(12)

vocabulary) were divided into two categories: low and high existing vocabulary according to a stem and leaf chart. A child was placed in the low existing vocabulary if it scored less than 84 (standardised score) and the high existing vocabulary was given if a child scored more than 85 (standardised score). The cut-off point was 1 standard deviation below the mean. Ninety one children (47%) were categorised as low existing vocabulary and 101 children (53%) as high existing vocabulary.

A similar procedure was used to categorise the children into low and high phonological memory. However, given that in general the children's performance was extremely good on this measure, a cut-off point of above 2 SDs from

Table 4
Children's performance across tasks by existing vocabulary and phonological memory in the Immediate post-test

Tasks	CHI	LD	BAS	ED			FAC	TORS				
	Exist	Voc					Phon	Memo				
	Low		High		Mann-Whitney		Low		High		Mann-Whitney	
	Mean	*SD*	*Mean*	*SD*	*Z*	*p* <	*Mean*	*SD*	*Mean*	*SD*	*Z*	*p* <
Naming	.88	(.74)	1.02	(.79)	1.25	ns	.80	(.76)	1.10	(.75)	2.73	.05
Multiple choice	1.87	(.37)	1.94	(.24)	1.50	ns	1.90	(.34)	1.92	(.28)	.27	ns
Inference	1.43	(.65)	1.58	(.60)	1.77	ns	1.45	(.65)	1.57	(.61)	1.44	ns
Definition	1.16	(.82)	1.04	(.81)	1.08	ns	.97	(.81)	1.23	(.80)	2.22	.05
Analogy	.52	(.79)	.47	(.77)	.47	ns	.48	(.79)	.50	(.77)	.40	ns
Contrast	.40	(.73)	.39	(.77)	.48	ns	.33	(.69)	.45	(.81)	.84	ns
Sentence generation	1.14	(.84)	1.28	(.83)	1.15	ns	1.06	(.82)	1.36	(.82)	2.65	.05

Table 5
Children's performance across tasks by existing vocabulary and phonological memory in the Delayed post-test

Tasks	CHI	LD	BAS	ED			FAC	TORS				
	Exist	Voc					Phon	Memo				
	Low		High		Mann-Whitney		Low		High		Mann-Whitne	
	Mean	*SD*	*Mean*	*SD*	*Z*	*p* <	*Mean*	*SD*	*Mean*	*SD*	*Z*	*p* <
Naming	.43	(.62)	.48	(.70)	.18	ns	.42	(.68)	.49	(.65)	1.09	ns
Multiple choice	1.62	(.70)	1.66	(.70)	.75	ns	1.54	(.77)	1.74	(.60)	1.93	.05
Inference	1.44	(.67)	1.72	(.53)	3.28	.005	1.49	(.65)	1.69	(.57)	2.38	.05
Definition	1.05	(.87)	1.23	(.82)	1.36	ns	1.04	(.83)	1.25	(.86)	1.78	ns
Analogy	.42	(.68)	.45	(.71)	.20	ns	.35	(.60)	.51	(.78)	1.06	ns
Contrast	.11	(.41)	.25	(.61)	1.76	ns	.11	(.38)	.25	(.63)	1.24	ns
Sentence generation	1.29	(.86)	1.38	(.81)	.67	ns	1.17	(.85)	1.50	(.78)	2.91	.00

the mean was used. Low phonological memory was defined by score of less than 127 (standardised score), while high phonological memory was given if a child scored more than 130 (standardised score). Eighty six children (45%) were categorised as low phonological memory and one hundred and six children (55%) as high phonological memory.

As the Table 4 shows, the children with high existing vocabulary performed better across all the measurements during the Immediate post-test than the children with low existing vocabulary. However, the differences were not statistically significant. Children with high phonological memory performed better across all the measurements during the Immediate post-test than the children with low phonological memory, but this difference was only statistically significant for the naming, definition and sentence generation tasks. Table 5 presents children's performance across tasks by their existing vocabulary level and phonological memory during the Delayed post-test. Thus, the relative advantage provided by superior phonological memory skills was only evident on the more demanding assessment tasks.

As the Table 5 shows, the children with high existing vocabulary performed better across all the measurements than the children with low existing vocabulary for the Delayed post-test. Significant differences were found for the inference task only. Children with high phonological memory performed better across measurements than the children with low phonological memory, and this difference was statistically significant for multiple choice, inference and sentence generation tasks. In the Delayed assessment children's superior phonological memory skills provided an added advantage on measure in which children were most successful (inference and multiple choice). The different demands of the measurement tasks are considered in the next section.

Type of measurement

Figure 1 presents children's performance across the seven post-test measurements. The children's performance on the multiple choice and inference tasks was the most accurate and this relative advantage for these measures held across times of testing. In contrast, the analogy task and contrast task produced the lowest levels of accuracy in both sessions. Performance on

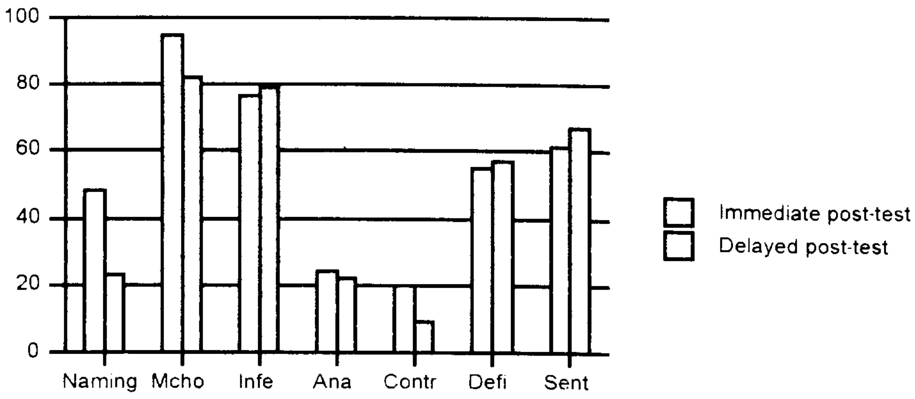

Figure 1
Percentages of correct responses across tasks across testing.

naming task decreased across the sessions. A series of Friedman Two Way ANOVAs were conducted across the measures to further examine these patterns of performance.

Children's performance differed statistically significantly across the measures at the Immediate post-test (X^2 = 333.8, *df* = 6, $p <$ .001). Differences between individual measures were examined and revealed a stepwise progression with the multiple choice task producing the statistically significant better performance than all other measures (Inference task: Z = 6.1, $p <$ .001, Analogy task: Z = 10.8, p < .001, Contrast task: Z = 9.6, $p <$ .001, Definition task: Z = 8.7, $p <$ .001, Sentence generation task: Z = 8.04, $p <$ .001). This was followed by the Inference task (Differing from definition task: Z = 5.6, $p <$ .001, Sentence generation task: Z = 4.5, $p <$ .001, Naming task: Z = 6.6, $p <$ .001, Analogy task: Z = 10.8, $p <$ .001, and Contrast task: Z = 9.6, $p <$ .001), the definition and sentence generation task, where children were equally successful but differed from the remaining measures (Naming task: Z= 3.8, $p <$ .001, Analogy task: Z = 7.3, $p <$ .001, and Contrast task: Z = 7.5, $p <$ .001), the naming task (Analogy task: Z = 5.6, $p <$ .001, and Contrast task: Z = 6.4, p < .001) and finally the analogy and contrast tasks. Success on the analogy and contrast tasks did not differ statistically significantly.

Differences among the Delayed post-test measurements were also statistically significant (X^2 = 406.5, *df* = 6, $p <$ .001). A similar stepwise progression was evident. Children performed best on the multiple choice task, but this did not differ from performance on the inference task (Naming task: Z = 10.3, $p <$ .001, Analogy task: Z = 9.7, $p <$ .001, Contrast task: Z = 10.7, $p <$ .001, Definition task: Z = 4.9, $p <$ .001, and Sentence generation task: Z = 3.5, $p <$ .001). Performance on the inference tasks was similarly better than all other measures (Naming task: Z = 10.1, $p <$ .001, Analogy task: Z = 10.4, $p <$ .001, Contrast task: Z = 10.9, $p <$ .001, Definition task, Z = 6.2, $p <$ .001, and the Sentence generation task, Z = 4.4, $p <$ .001). As in the Immediate post-test, this was followed by a similar level of success on the definition and sentence generation tasks. Performance on post tasks was superior to performance on the remaining measures (Naming task: Z = 7.2, $p <$ .001, Analogy task: Z = 8.11, $p <$ .001, and the Contrast task Z = 9.1, $p <$ .001). As in the Immediate post-test, this was followed by success on the naming

Table 6
Children's performance across tasks by linguistic condition in the Immediate post-test

Tasks	LIN	GUIS	TIC	CON	DITI	ON	S		ST	AT	S
	Infer		Defin		Anal		Lexical contrast		Kruskal-Wallis	1-Way ANOVA	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	X^2	*df*	*p* <
Naming	1.04	(.80)	.88	(.79)	.81	(.73)	1.08	(.74)	4.1	3	ns
Multiple choice	1.92	(.35)	1.87	(.33)	1.92	(.28)	1.92	(.28)	1.13	ns	
Inference	1.77	(.42)	1.35	(.70)	1.35	(.67)	1.56	(.62)	13.9	3	.005
Definition	1.17	(.83)	1.17	(.81)	1.21	(.71)	.85	(.87)	5.4	3	ns
Analogy	.25	(.56)	.23	(.52)	1.27	(.87)	.21	(.54)	59.8	3	.001
Contrast	.02	(.14)	.06	(.24)	.04	(.20)	1.44	(.82)	120.8	3	.001
Sentence generation	1.42	(.79)	1.23	(.81)	.96	(.85)	1.25	(.84)	7.6	3	ns

task but, in contrast to the Immediate post-test, there was no difference between naming and analogy tasks. Both measures were better than performance on the contrast tasks (Naming and Contrast tasks: $Z = 4.1$, $p < .001$; Analogy and Contrast tasks: $Z = 4.04$, $p < .001$).

The tasks presented a similar level of difficulty for the children across the two test sessions. The changes that occurred in the Delayed post-test were not in the order of difficulty but rather the differential success rates for two different tests. Multiple choice and inference no longer differed, and analogy and naming no longer differed. The next section considers the extent to which children's performance on the tasks was moderated by their linguistic exposure to the novel items.

Linguistic condition

Table 6 presents children's performance across tasks by linguistic condition in the immediate post-test. As Table 6 shows, significant differences on children's performance by linguistic condition were found for the inference, analogy and contrast tasks. No significant differences were found on the naming, multiple choice, definition and sentence generation tasks. A series of Mann-Whitney tests were carried out to identify patterns of performance. The results showed that the children performed better in those tasks were input and assessment matched. Thus, the children in the Inference condition performed significantly better on the inference task than the children in the *Definition condition* ($Z = 3.1$, $p < .005$) and children in the *Analogy condition* ($Z = 3.3$, $p < .005$). Whereas children in the *Analogy condition* performed significantly better on the analogy task than children in the *Inference condition* ($Z = 5.6$, $p < .001$), *Definition* ($Z = 5.7$, $p < .001$) and *Lexical contrast conditions* ($Z = 5.8$, $p < .001$). Children in the *Lexical contrast condition* performed significantly better on the contrast task than the children in the *Inference condition* ($Z = 7.6$, $p < .001$), *Definition condition* ($Z = 7.3$, $p < .001$) and *Analogy condition* ($Z = 7.4$, $p < .001$). However, the *Definition condition* did not enhance performance on the definition task.

Table 7 presents children's performance across the different measurement tasks by linguistic condition in the Delayed post-test. Statistically significant differences were found for the analogy and contrast tasks but no other

Table 7
Children's performance across tasks by linguistic condition in the Delayed post-test

Tasks	LIN	GUIS	TIC	CON	DITI	ON	S		ST	AT	S
	Infer		Defin		Anal		Lexical contrast		Kruskal-Wallis	1-Way ANOVA	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	X^2	*df*	*p<*
Naming	.52	(.68)	.37	(.61)	.48	(.71)	.44	(.65)	1.21	3	ns
Multiple choice	1.69	(.66)	1.58	(.74)	1.75	(.60)	1.54	(.77)	2.73	3	ns
Inference	1.73	(.49)	1.52	(.68)	1.60	(.57)	1.50	(.68)	3.33	3	ns
Definition	1.25	(.84)	1.19	(.79)	1.15	(.90)	1.00	(.88)	2.16	3	ns
Analogy	.21	(.50)	.25	(.56)	1.00	(.83)	.27	(.54)	41.39	3	.001
Contrast	.04	(.29)	.04	(.20)	.02	(.14)	.63	(.84)	46.83	3	.001
Sentence generation	1.48	(.77)	1.35	(.84)	1.23	(.88)	1.27	(.84)	2.45	3	ns

measures. The results again showed that the children performed significantly better on those tasks were input and assessment matched. Thus, children in the *Analogy condition* performed significantly better on the analogy task than children in the *Inference condition* ($Z = 5.03$, $p < .001$), *Definition condition* ($Z = 4.7$, $p < .001$) and *Lexical contrast condition* ($Z = 4.5$, $p < .001$). Children in the *Lexical contrast condition* performed significantly better on the contrast task than the children in the *Inference condition* ($Z = 4.4$, $p < .001$), *Definition condition* ($Z = 4.2$, $p < .001$) and *Analogy condition* ($Z = 4.5$, $p < .001$). As in the Immediate post-test, the *Definition condition* did not enhance performance on the definition task.

Discussion

The purpose of the present study was to examine the ways in which children exposed to orally presented stories acquire novel words embedded in different linguistic frames. The ways in which the child's age, existing vocabulary knowledge level and phonological memory impacted on performance was also addressed to provide an overall profile of the young child as a word learner. Children's performance was considered across a range of tasks that tap direct and indirect measures of the child's representations, in order to detect the multifaceted nature of the word-learning task.

Age was found to influence children's performance across almost all the measurements during both post-tests. There was a step-wise progression, with the older children performing better than the younger ones in all tasks except lexical contrast. These results confirm other studies highlighting the role of development (Crais, 1987; Heibeck & Markman, 1987). All children found the contrast task difficult. Given the key role of providing contrasts in supporting lexical learning this apparent inability to generate a contrast is surprising. Older children have more experience with the world, which helps them organise better and acquire more easily and efficiently the incoming new information (see Mervis, 1987; Neisser, 1987). Older children may also use different comprehension strategies allowing the development of richer representations that support lexical performance across a range of tasks. Developmental factors were moderated by the child's phonological memory skills but not, in this study, for the majority of measures by their prior vocabulary competence.

The lack of significant findings for vocabulary level contrasts with other studies in the literature (Elley, 1989; Robbins & Ehri, 1994). A number of reasons may explain this difference. Firstly, although the trend was in the predicted direction, children in the higher vocabulary group demonstrated a wide range of competence. The ways in which the groups were defined may have minimised the influence of vocabulary. This influence was thus only evident in the Delayed post-test, where children with the higher levels of vocabulary knowledge performed significantly better on the inference tasks. A rich elaborated knowledge of words appears to assist the child's ability to draw inferences about intended meanings of unfamiliar words, allowing effective use of context. These cues boost incidental learning and, thereby, support lexical acquisition. In contrast, the phonological memory contributed significantly to performance across a range of tasks and the advantages provided by strong phonological skills had differential effects overtime.

Children with high phonological memory performed better than the children with low phonological memory on a number of measures. The above results are consistent and extend previous experimental findings (Gathercole & Baddeley, 1989, 1990; Gathercole, Hitch, Service, & Martin, 1997; Michas & Henry, 1994). At Immediate post-test strong phonological skills supported performance on the more difficult tasks. Naming, the provision of accurate definitions and sentence generation were better in the group of children with better phonological skills. During the Delayed post-test sentence generation retained a relative advantage but performance on the naming and definitions not longer differed between the groups. The relative advantage was evident in the multiple choice task and the inference task. In the first instance, the ability to retain the phonological form of the new word provided the child with more information processing resources to deal with the more complex tasks. While over time stronger phonological skills provided the children with more durable phonological representations. Thus, children with good skills at maintaining new words in the phonological loop are able to establish accurate long term representations of the words more readily than children with poor phonological loop capacity (Baddeley et al., 1998). Strengths in phonological memory in these tasks also appear to free up processing resources to deal with more complex linguistic tasks.

The current study extends previous work by examining the ways in which children comprehend, produce and use a new term across a variety of tasks. The synthesis of various approaches (direct and indirect measures) demonstrated that word knowledge and the child's ability to utilise this new knowledge falls along a continuum. As predicted, performance on the multiple choice tasks was more accurate than the other measures. While performance on such a task may provide evidence of an initial lexical representation, it is also subject to guessing and other response strategies. In contrast, tasks that required more detailed knowledge of the new term (definition and sentence generation) while resulting in reduced performance demonstrated that the children had acquired detailed knowledge of the term and that they were able to use this knowledge productively. This is an important prerequisite for success in school. Successful naming is, perhaps, the ultimate test of a child's knowledge and the data presented here indicates that tasks that place additional metacognitive demands on the child are more demanding than naming. This was true of both the analogy and contrast tasks. Both the analogy and contrast tasks tap on children's wider understanding knowledge base and demand that the child makes links within and across semantic categories. Alternatively, these tasks may presuppose more detailed semantic representations than the child has been able to establish in this short period. Further research would need to differentiate between these alternative hypotheses.

The results obtained support and extend previous studies (Leung & Pikulski, 1990; Eller et al., 1988; Elley, 1989; Robbins & Ehri, 1994; Senechal & Cornell, 1993) that children can learn novel words from listening to stories. Importantly, it was found that children's success on the particular tasks (analogy, contrast, definition) reflected the input received from the linguistic context. The role of the linguistic context to infer the meanings of unknown words has also been documented by other studies (Carey & Bartlett, 1978; Dockrell & Campbell, 1986; Gottfried & Tonks, 1996) although the mappings between input and use have not been evaluated. It is of particular importance that this match between input and assessment holds over time. Extending the range of exposures children receive, on this basis, should extend and develop the representations that are formed.

The current results challenge conclusions drawn from tasks where no attempt is made to modify the different forms of input the child receives and the ways in which their developing knowledge is assessed. Word learning is a multifaceted and extended process, where the interplay between the child's knowledge and skills and the context is critical. The findings may be pertinent for intervention programmes designed to foster language development from listening to storybooks and indicate that new words need to be encountered in a range of linguistic contexts if rich representations are to be developed.

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Appendix 1

Stories used in the study

Inference condition *«Something to blow»*

Bob liked blowing whenever he had the chance. He was blowing up balloons, blowing bubbles or blowing out candles. So, his mother decided to buy him an «abez». The same afternoon, Bob went to private teacher to teach him how to play music with his new «abez». He thought it would be nice to be member of his school's band. Unfortunately, the next day he got cold and cough; he was feeling weak and he couldn't even move his hands. So he missed his music lesson. He stayed at home, lying in bed and dreaming about magic music lesson. However, after some days he returned to his music class and enjoyed the lesson.

Definition condition *«What is an abez?»*

Last Sunday, George and his daddy went to concert. They enjoyed the music they listened to. But George didn't know one of the musical instruments, the «abez», and asked his daddy to tell him about it. So, his daddy told him that the «abez» is wooden orchestral instrument that is shaped like tube and played by blowing through reed at it's top. George stayed the rest of the day listening to the music. He had really nice time.

Analogy condition *«Abez is like...?»*

Robert and his mother went to a party last Saturday. There were children playing around and a child that was singing. The child with the orange shirt was playing an «abez». Robert really liked the music that was coming from it. He asked his mother to tell him more about it. His mother told him that we make sounds with the «abez» like we make siunds with the flute, by blowing. From that moment Robert knew how someone could make such nice sound, and he spent the whole night listening to that music.

Lexical contrast condition *«Abez is different from...»*

Every week in the school the children had music lesson where each child played different kind of musical instrument. Most of the children liked listening to the piano and to the guitar. But today a new child came in the group who was playing neither a piano nor a guitar. He was playing an «abez». This was making sound in a different way. It was also a kind of sound that they never heard before. So, all the children stopped listening to the piano and to the guitar and they concentrated on the «abez».