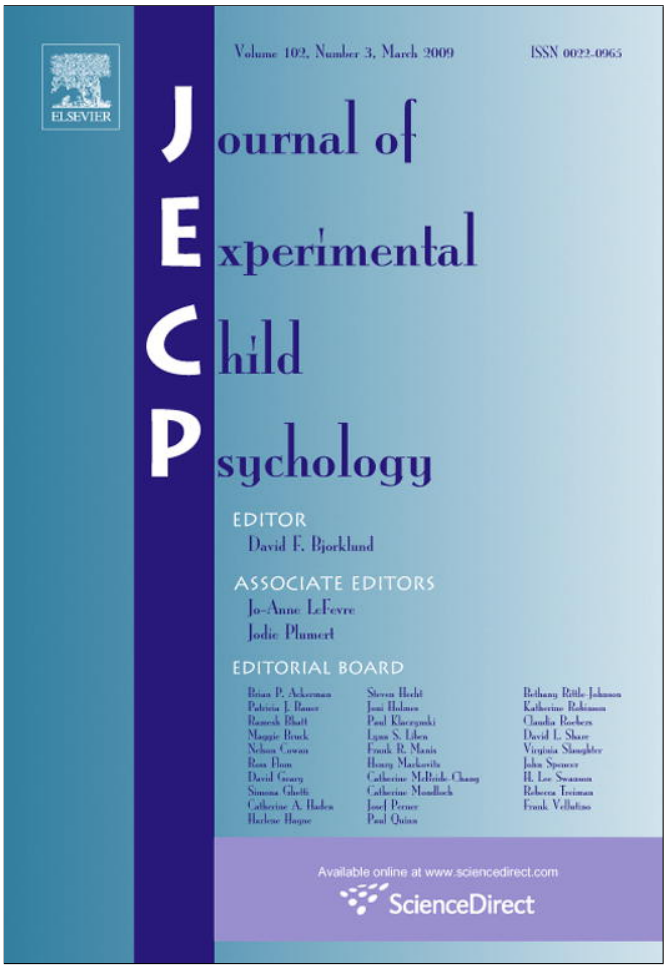

Journal of Experimental Child Psychology 102 (2009) 280–298

Contents lists available at ScienceDirect

Journal of Experimental Child Psychology

journal homepage: www.elsevier.com/locate/jecp

The development of idiom comprehension: An investigation of semantic and contextual processing skills

Kate Cain *, Andrea S. Towse, Rachael S. Knight

Department of Psychology, Lancaster University, Lancaster LA1 4YF, UK

ARTICLE INFO

Article history:
Received 19 December 2007
Revised 26 June 2008
Available online 20 September 2008

Keywords:
Children
Idioms
Inference from context
Semantic analysis

ABSTRACT

Two experiments compared 7- and 8-year-olds' and 9- and 10-year-olds' ability to use semantic analysis and inference from context to understand idioms. We used a multiple-choice task and manipulated whether the idioms were transparent or opaque, familiar or novel, and presented with or without a supportive story context. Performance was compared with that of adults (Experiment 1) and 11- and 12-year-olds (Experiment 2). The results broadly support Cacciari and Levorato's global elaboration model of figurative competence with a notable exception: Even the youngest children were able to use semantic analysis to derive the meanings of transparent idioms as well as being sensitive to meaning in context. The findings show that young children process language at both the small-grain phrase level and the discourse level to establish figurative meaning, and they demonstrate that the language processing skills that aid idiom comprehension, as well as idiom knowledge itself, are still not fully developed in 11- and 12-year-olds.

Introduction

An idiom is a form of figurative language that can (usually) have both a literal and a figurative meaning, depending on the context. For example, the sentence "Chris spilled the beans" might refer to someone tipping out the contents of a jar of beans (literal) or revealing a secret (figurative). Comprehension of figurative language, such as idioms, can cause particular difficulties for young children (Gibbs, 1987; Gibbs, 1991) and children with language difficulties (Kerbel, 1998; Kerbel & Grunwell, 1998). The current research investigated the contribution of two language processing skills to young

* Corresponding author. Fax: +44 1524 593744.
E-mail address: k.cain@lancaster.ac.uk (K. Cain).

0022-0965/$ - see front matter © 2008 Elsevier Inc. All rights reserved.
doi:10.1016/j.jecp.2008.08.001

children's understanding and acquisition of the meanings of idiomatic phrases: semantic analysis and inference from context. Our aim was to determine how these different language processes contribute to developmental differences in idiom comprehension. A unique feature of this work is our use of novel idioms. Previous research has always used idioms that occur in the speakers' language, for which participants may have full or partial knowledge. Our use of novel idioms enabled us to assess idiom processing without the confound of prior knowledge that may obviously be related to age.

Semantic analysis of an idiomatic phrase involves retrieving alternate meanings of key words and computing a nonliteral meaning of the phrase. Transparent idioms (also referred to as decomposable or semantically analyzable) have a clear overlap between the literal and figurative meanings of the phrase. For example, the term "to speak your mind" can be analyzed to derive its meaning: "to express your feelings or opinions frankly." Some idioms cannot be broken down word by word. These idioms are typically referred to as opaque idioms (also nondecomposable or semantically nonanalyzable). Their meanings cannot be derived successfully by semantic analysis. For example, it is not possible to determine that "to bite the dust" means "to cease to exist" by analyzing the component words in the phrase.

Nippold and colleagues highlighted the importance of semantic analysis in her metasemantic hypothesis of figurative language comprehension (Nippold, 1998; Nippold & Taylor, 1995). According to this hypothesis, the ability to analyze the internal semantics of the phrase aids idiom comprehension. Semantic analysis is thought to be particularly useful for comprehending transparent idioms because the literal meaning of a phrase may help to cue its figurative meaning (Caillies & Le Sourn-Bissaoui, 2006; Nippold & Duthie, 2003). Adults and adolescents are sensitive to differences in transparency and can reliably rate the contribution of key words to the meanings of idiomatic expressions (Titone & Connine, 1999). Furthermore, skilled language comprehenders perform some semantic analysis of the phrase when reading an idiom (Titone & Connine, 1994; Titone & Connine, 1999).

There are conflicting findings about the age at which semantic analysis can be used by children to process an idiom's meaning. Several studies indicate that this is an early developing skill. For example, Gibbs (1987), Gibbs (1991) found that 5-year-olds were better at explaining transparent idioms than opaque ones, although performance was fairly poor. Other work suggests that semantic processing may develop later. For example, Nippold and Rudzinski (1993) found a positive correlation between transparency and performance on an idiom explanation task for 14- and 17-year-olds but not for 11-year-olds. Similar findings were obtained by Nippold and Taylor (1995).

The choice of tasks used to measure idiom comprehension may influence the likelihood of detecting effects of transparency (Levorato & Cacciari, 1999). Younger children may be disadvantaged on explanation tasks because their expressive language skills and comprehension skills will be lower than those of older children. Using a multiple-choice task, Levorato and Cacciari (1999) found that 9-year-olds could take advantage of the transparency of an idiom to understand its meaning out of context, but 7-year-olds could not. Gibbs (1991) found a similar difference between third graders (mean age 8 years 9 months) and first graders (mean age 6 years 10 months). Levorato and Cacciari (1999) suggested that although semantic analysis can influence idiom comprehension from an early age, the importance and use of this processing skill increase as children get older. Together with the findings of Nippold and colleagues (Nippold & Rudzinski, 1993; Nippold & Taylor, 1995), this body of work suggests that semantic analysis may enjoy an extended period of development.

The other language process used to derive the meanings of unfamiliar or unknown idioms that we consider in this article is inference from context. The use of context for language comprehension is evident from an early age. Physical, sentential, and discourse environments constrain the possible referents of a new word for young children (Akhtar, 2006). When reading, the text provides the context from which the comprehender can construct meaning (Garton & Pratt, 1998). Attention to the textual context might develop alongside reading. It enables the reader to work out the appropriate meanings of ambiguous words, such as *bank,* and the correct pronunciations of homographs, such as *bow.* Similarly, if the meaning of an idiom is not known, clues from the surrounding text or discourse may be used by the learner to infer an appropriate meaning.

Inference from context may be particularly useful for understanding an opaque idiom, the meaning of which is not cued by the words in the phrase. The use of inference from context is highlighted in an

influential comprehensive model of the development of figurative competence, Cacciari and Levorato's global elaboration model (e.g., Levorato & Cacciari, 1992; Levorato & Cacciari, 1999). The essence of this model is that comprehension of idioms (and other forms of figurative language) is dependent on the same skills and strategies that underpin reading and listening comprehension more generally. As children move from processing language on a piecemeal or local basis to strive for coherence within and across sequences of text, their developing inferential skills enable them to derive the meanings of idioms from the presentation context. In general, children and adolescents find idioms easier to interpret when they are presented in a supportive narrative context than when they are presented with no context (e.g., Gibbs, 1987; Levorato & Cacciari, 1992; Nippold & Martin, 1989). The facilitatory effect of context is apparent at a young age; even 5-year-olds are better able to explain the meanings of idioms when they are presented in context (Gibbs, 1991).

Levorato and Cacciari (1995) proposed that that development of the skills and abilities used to process and acquire figurative language takes place between 7 and 11 years of age. To understand the relative importance of semantic analysis and inference from context at different stages in the development of figurative competence, we need to consider studies that manipulate both the transparency of the idiom and the presentation context in this age range. In Gibbs's (1991) study, children between 5 and 9 years of age found it easier to explain the meanings of normally decomposable (transparent) idioms than nondecomposable (opaque) idioms both in and out of context. All age groups benefited from the presence of context, but only 8- and 9-year-olds were able to use semantic analysis to aid comprehension of (transparent) idioms out of context with a significant degree of success (37% correct for 8-year-olds and 42% correct for 9-year-olds). Levorato and Cacciari (1999) reported a similar pattern of data using a multiple-choice task. In their study, 9-year-olds demonstrated higher levels of comprehension for semantically analyzable (transparent) idioms out of context than did 7-year-olds. The younger children showed greater contextual gains in their comprehension of semantically analyzable idioms relative to opaque ones.

At first glance, these findings might appear to be contradictory because context should be particularly important for opaque idioms, which are not amenable to semantic analysis. However, these findings are not contradictory if we consider examples of real-world language processing such as conversations and reading. These situations involve processing language in context, and it is unlikely that both semantic analysis and inference from context will operate entirely separately. Specifically in relation to idioms, it is possible that context acts as an additional check when deriving the meaning of transparent idioms; any meaning derived from analysis of the phrase can be checked and refined in relation to the meaning suggested by the supporting context (e.g., Levorato & Cacciari, 1999). This explanation fits with a broad definition of metasemantics as a higher order semantic skill that includes awareness of the relations between words and their pragmatic context (Roth, Speece, Cooper, & de la Paz, 1996).

In summary, semantic analysis and inference from context both support idiom comprehension. The pattern of data from previous research broadly supports the proposal that inference from context develops early and semantic analysis develops later; children age 7 years and under benefit from transparency only when idioms are presented in context, whereas 9-year-olds benefit from transparency when idioms are presented out of context as well. However, there are contradictory findings from studies of different age groups and tasks. As noted by Levorato and Cacciari (1999), there is clearly a need for more work investigating the role of semantic analysis skills during the period when figurative language comprehension emerges.

We report two experiments that compared 7- and 8-year-olds' and 9- and 10-year-olds' ability to interpret idiomatic expressions in relation to the semantic analyzability of the idiom (transparent vs. opaque) and the presence of context (absent vs. present). Levorato and Cacciari (1995) suggested that figurative competence develops between 7 and 11 years of age. We chose our two age groups to cover the age range studied in much of Levorato and Cacciari's work and to represent key ages in the development of figurative competence (Cacciari & Levorato, 1989; Levorato & Cacciari, 1992; Levorato & Cacciari, 1995; Levorato & Cacciari, 1999). To determine the relative importance of semantic analysis and inference from context in the *acquisition* of idiomatic meaning, we included novel idioms that were translations of real European idioms for which there are no equivalents in British English (see Cain, Oakhill, & Lemmon, 2005). Previous research on the development of idiom comprehension has used idioms that occur in the speakers' language. Therefore, those studies cannot rule out the possi-

bility that developmental differences were influenced, in part, by older children's greater knowledge and exposure to these expressions. Our use of novel idioms enabled us to investigate the contributions of semantic analysis and inference from context without the confound of prior knowledge.

Our work extends previous research on the development of idiom comprehension by addressing four specific questions. First, are both age groups able to use contextual information to support idiom comprehension for expressions that are not familiar? Second, is semantic analysis of idiomatic expressions an early or later emerging processing skill? Third, are semantic analysis skills specifically related to the understanding of figurative language that is amenable to phrase-level analysis? Fourth, is there evidence for an extended period of development of idiom processing skills?

The first question was addressed by comparing the effects of context for the same children for the same idioms. Many investigations into the influence of context on idiom comprehension have used a between-participants design (Levorato & Cacciari, 1999) or different items in different conditions (Nippold & Martin, 1989). By manipulating these variables within participants, we were able to calculate the facilitatory influence of context for the same children for the same idioms. The second question was investigated by comparing performance of the two age groups on the transparent novel idioms when the context is absent, for which knowledge and context could not influence performance. Clearly, when these expressions are presented in context, there is the likelihood of an additional influence of the interaction between semantic analysis and context because these two sources of information provide clues to the idiom's meaning. The third question was addressed by looking at the relation between performance on an independent measure of semantic analysis skills and performance on the different types of idiom (Experiment 1). This task required children to produce (at least) two different meanings for sentences with ambiguous words and grammatical structures, and it involved many of the same skills needed to interpret an idiomatic expression. To date, there are no published studies comparing idiom comprehension with performance on an independent measure of semantic analysis. We sought to determine whether semantic analysis was critically important in the processing of transparent idioms by relating performance to novel transparent and novel opaque idioms separately. The fourth question was addressed by comparing the two groups' comprehension of novel idioms with that of more skilled language users: adults (Experiment 1) and 11- and 12-year-olds (Experiment 2). The use of novel idioms enabled us to determine how any age differences are related to language skills rather than knowledge of specific idioms.

Experiment 1

The aim of Experiment 1 was to investigate whether younger and older children differ in their use of semantic analysis and inference from context to understand idioms. To do this, we manipulated the transparency of the idiom (transparent vs. opaque) and the presence of context (absent vs. present) and familiarity (familiar[1] vs. novel). To further explore the contribution of semantic analysis skills, an independent measure of semantic analysis of phrases was taken.

Idiom comprehension was assessed with a multiple-choice task. An alternative assessment in which children explain the meaning of each idiom would provide an insight into the source of information used to interpret the idiom by allowing analysis of correct and incorrect responses. However, explanation is a difficult task for young children who may differ from older children in their expressive language skills as well as their comprehension level (Spooner, Gathercole, & Baddeley, 2006). Multiple-choice tasks have been used successfully to assess idiom comprehension (e.g., Levorato & Cacciari, 1995) and have been shown to be sensitive to the effects of transparency and context in children and

[1] We use familiar idioms to refer to those that are common in British English, although this work and other work indicate that these idioms were not fully known to this age group. In our original selection work (reported in detail in Cain et al., 2005), "recognition" scores from our participants indicated that 8-year-olds had not heard the novel transparent or novel opaque idioms before (*M*s = .43 and .14 of 6, respectively). In a subsequent study, we obtained familiarity ratings from 16 native British English-speaking adults for the 24 idioms. No variants for novel idioms were reported. The two sets of real idioms (transparent and opaque) did not differ in their familiarity ratings, and neither did the two sets of novel idioms, *p*s > .10, but all other contrasts were significant. Mean scores were as follows: real transparent = 2.4, real opaque = 2.8, novel transparent = 6.7, and novel opaque = 6.8. Full details are reported in Cain and Towse (in press).

adolescents (e.g., Levorato & Cacciari, 1999; Nippold & Taylor, 1995). This method has fewer language production demands than an explanation task and is likely to be a more sensitive measure for comparing idiom comprehension in different age groups.

Based on previous research, we expected that, in general, the older children would perform better than the younger children, transparent idioms would be easier to interpret than opaque idioms, and the presence of context would facilitate idiom comprehension. The following outcomes relate to the four specific research questions. Children who are able to use inference from context should show a contextual facilitation effect; comprehension of familiar and novel idioms should improve with the presence of context. Children who are able to use semantic analysis should perform above chance in the comprehension of both familiar and novel transparent idioms. Performance on the independent assessment of semantic analysis (the ambiguous sentence task) should relate specifically to the comprehension of transparent idioms when no context is provided. If idiom processing skills have an extended period of development (as suggested by the work of Nippold and colleagues), age differences between adults and children should be apparent in an analysis of performance on novel idioms.

Method

Participants

A total of 40 children (23 girls and 17 boys) participated in this study. Of these children, 20 were in Year 3 (7 or 8 years of age, M = 7 years 10 months, range = 7 years 5 months to 8 years 5 months) and 20 were in Year 5 (9 or 10 years of age, M = 9 years 11 months, range = 9 years 5 months to 10 years 0 months)[2] They attended two village schools in northwest England, serving mixed catchment areas. Children with a statement of special educational needs were excluded from the study. All of the children spoke British English as their first language and had parental permission to participate in this work. In addition, 25 undergraduate students from Lancaster University completed the two idiom tasks. They all received course credit for their participation. The data from 6 adults who did not speak British English as their first language were excluded from the analysis. The data from 19 adults (12 women and 7 men) are reported, and the mean age of the adult sample was 19.4 years.

Materials: Construction and evaluation

A total of 24 idioms were used in this study. Of these idioms, 12 were common British English idioms and 12 were translations of European idioms with no British equivalents and, therefore, considered novel. There were 6 transparent and 6 opaque idioms for each set that had been piloted and used in previous research. Full details of the selection of these idioms and ratings for their transparency can be found in Cain and colleagues (2005; see also Cain & Towse, in press). This previous research demonstrated that the novel opaque idioms could not be interpreted without the context present. A full set of idioms is provided in Appendix.

Experimental tasks and procedure

Children's understanding of each idiom was assessed using a multiple-choice task in which participants needed to choose one of four interpretations of the idiom: a target idiomatic interpretation of the phrase (idiomatic), a nonliteral interpretation that was plausible within the story context (contextually plausible), a nonliteral interpretation that was not plausible within the story context (contextually implausible), or an interpretation that provided a literal interpretation of (part of) the phrase (literal). Examples are provided in Table 1. Pilot work with adults (N = 34) established that, in context, the idiomatic interpretation was the most common selection.

Idioms: *Context absent*. Children in the younger age group were tested individually, and the older children were tested in groups of four or five. Testing was conducted in a quiet room away from the classroom with the children sitting apart from each other. The instructions for the task were printed on the front cover of the test booklet and read aloud to the children: "In this booklet there

[2] In England, school entry and year group is based on age. Children are held back or advanced a year only in extremely exceptional circumstances, and this was not the case for any of the children in this study. Hence, all of the children in Year 3 had their 8th birthdays during that academic school year and had experienced the same number of years in formal education.

Table 1
Example of materials with multiple-choice options

Idiom: to be left out in the cold
Context story: Mr. Evans announced that Karen had been chosen to play the lead in the school play. All of her friends were very jealous because they had wanted the part. At lunchtime Karen's friends went and sat at another table and didn't leave any space for her. Karen had to go and sit at a different table. Karen felt that she had been left out in the cold.

Question and options for idiom context absent and idiom context present conditions:
What does it mean when someone says "to be left out in the cold"?
A. To make friends jealous (contextually plausible).
B: To sit by an open window (literal).
C: to be ignored (idiomatic).
D: To keep friends waiting (contextually implausible).

are a number of short expressions or sayings, for example, 'it's raining cats and dogs.' After each saying there are four possible meanings. Your job is to choose the right one." An example with four multiple-choice options followed, and this was completed by each child in his or her booklet with help from the experimenter and feedback if necessary. An example is provided in Table 1. Children were then told, "Don't worry if you haven't heard some of these sayings before; a few of them have been made up. If you're not sure which one is the right answer, just choose the one that you think it might be." Children then worked through the booklet, and the experimenter read aloud each item and the four multiple-choice options for the younger children. Adults were tested in small groups and completed the task independently. Full instructions were printed on the cover of the response booklet, and the examiner was available to answer any queries.

Idioms: *Context present.* This condition was administered a minimum of 2 weeks after the context absent condition to minimize the effects of memory for the items. Children in the younger age group were tested individually, and the older children were tested in groups of four or five in a quiet room away from the classroom with the children sitting apart from each other. The same 24 idioms were used. Each was embedded in a supportive story. An example is provided in Table 1. The instructions were adapted to note the story context.

The items were presented in the same order for each participant, distributed so that the same type of idiom (familiar transparent, familiar opaque, novel transparent, or novel opaque) did not appear consecutively. A different order was used for the two presentation conditions, context absent and context present, ensuring that each alternative occurred in the same position (first, second, third, or fourth) an equal number of times. The total number of each response option selected was calculated (maximum = 6 for each condition). Adults completed the task as above.

Semantic analysis skills. Only children completed this task. They were tested individually in a quiet room. The Ambiguous Sentences subtest from the Test of Language Competence–Expanded Edition (TLC–Expanded) (Wiig & Secord, 1989) was adapted. A total of 11 items were selected from Level 1 on the basis that they were common in British English. Each item included a short phrase that could have multiple interpretations such as "It is off the hook," which could refer to a fish or a phone off the hook. The phrases were presented visually and read aloud by the experimenter. Each child was asked, "Can you tell me two different things that this sentence could mean?" The child was required to select two of four pictures that matched different meanings of the phrase. For the example given, one picture showed a phone off the hook and one showed a fish off the hook. The other two pictures showed a kite stuck in a tree and a hammer on a shelf. A further 8 items from Level 2 were completed. These items consisted only of phrases. The selected items were common British English words. Items that included key words that had been tested in the first 11 items were excluded. The task for these items was to provide an interpretation of two meanings for each phrase. The items were scored according to the points system specified in the manual. For all items, no points were awarded for no correct interpretations, 1 point was awarded for one correct interpretation, and 3 points were rewarded for two correct interpretations. For the 11 items with pictures, no points were awarded when one or no correct picture responses were made and 1 point was awarded when both of the correct pictures were selected.

Results

The mean sum scores obtained for correct idiomatic choices made when context was absent or present are shown in Table 2. The distribution of each condition was checked and found to be within acceptable limits. Four sets of analyses were carried out to determine the relations among age, use of context, semantic analysis skills, and idiom comprehension. The first set used one-sample *t* tests to compare responding on the idiom comprehension task with chance. The second set used analyses of variance (ANOVAs) to determine whether the magnitude of correct responding differed across ages and in relation to the presence of a supportive story context. The third set investigated the source of errors made on the idiom comprehension task. The final set investigated the relations between correct responding on the idiom comprehension task and semantic analysis skills.

Idiom responses: Comparisons with chance level of responding

Idiom choices: Context absent. A series of one-sample *t* tests for each age group was conducted to determine the likelihood that each group was able to select the correct response by chance. The chance level of selecting the idiomatic response for each condition was 1.5 (6 trials with 4 options each). Because of the number of comparisons to be made (12), the alpha level was set at .004.

For adult participants, the scores obtained for familiar transparent, familiar opaque, and novel transparent idioms were significantly greater than 1.5, indicating either knowledge of the idiom or an ability to derive the meaning of the expression: familiar transparent, $t(18) = 38.19$, familiar opaque, $t(18) = 13.49$, and novel transparent, $t(18) = 38.19$, all $ps < .004$. Scores for the correct interpretation of the novel opaque idioms did not differ significantly from chance, $t(18) = 2.01$, $p > .05$. The two younger age groups showed markedly different patterns of performance. The older children responded above chance level on both types of transparent idiom: familiar, $t(19) = 6.68$, $p < .004$, and novel, $t(19) = 6.94$, $p < .001$. Their performance on both types of opaque idiom did not differ from chance, both $ts < 1.00$. In contrast, the younger children did not select the idiomatic response significantly more often than chance for either type of transparent idiom or for the novel opaque idioms, all $ts < 2.10$. Their performance on the opaque idioms indicated no knowledge of the familiar opaque idioms, for which they selected the idiomatic choice less frequently than chance, $t(19) = 3.90$, $p = .001$.

Idiom choices: Context present. The mean sum scores obtained for correct idiomatic choices are shown in Table 2. All age groups selected a greater number of idiomatic responses when the context was present than when it was absent, indicating that context facilitated performance. A series of one-sample *t* tests for each age group showed that the adults and older children all scored significantly above chance, all $ps < .004$. For the younger children, performance on the transparent idioms was significantly above chance, all $ps < .004$, but the scores obtained for the opaque idioms did not reach our corrected level of significance.

Table 2
Experiment 1: Mean sum scores (and standard deviations) for selection of idiomatic response option by age group and condition

Context	Familiar				Novel			
	Transparent		Opaque		Transparent		Opaque	
	Absent	Present	Absent	Present	Absent	Present	Absent	Present
7- and 8-year-olds	1.15 (0.93)	2.50* (1.10)	0.85 (0.75)	1.65 (1.14)	1.70 (1.29)	2.40* (0.99)	1.10 (0.85)	2.30 (1.22)
9- and 10-year-olds	3.10* (1.07)	3.30* (1.38)	1.30 (0.98)	2.90* (1.29)	3.05* (0.99)	3.50* (1.19)	1.50 (1.10)	2.95* (1.05)
Adults	5.68* (0.48)	5.63* (0.50)	4.74* (1.05)	5.95* (0.23)	5.68* (0.48)	5.68* (0.58)	1.95 (0.97)	5.26* (0.99)

Note. Standard deviations are in parentheses. Maximum score = 6.

* Significantly greater than chance.

Idiom responses: Effects of age and context

Main analysis. The total number of idiomatic choices made when context was absent versus present for each type of idiom was treated as the dependent variable in a four-way ANOVA. The adult participants performed near ceiling for familiar and transparent expressions, and for that reason their data are not included in the main analysis. In the ANOVA, age (young or old) was a between-participants factor, and context (absent or present), familiarity (familiar or novel), and transparency (transparent or opaque) were within-participants factors. Where appropriate, partial eta-squared (η_p^2) is reported as the measure of effect size. This is an estimate of the proportion of total variance accounted for by the independent variable.

There were significant and sizable main effects of age, $F(1, 38) = 41.31$, $p < .001$, $\eta_p^2 = .52$, context, $F(1, 38) = 58.65$, $p < .001$, $\eta_p^2 = .61$, and transparency, $F(1, 38) = 33.52$, $p < .001$, $\eta_p^2 = .47$, and a small effect of familiarity, $F(1, 38) = 3.83$, $p < .05$, $\eta_p^2 = .10$. There were significant two-way interactions between age and transparency, $F(1, 38) = 5.32$, $p < .03$, $\eta_p^2 = .12$, and between context and transparency, $F(1, 38) = 8.21$, $p < .01$, $\eta_p^2 = .18$, which were qualified by a significant three-way interaction among context, transparency, and age, $F(1, 38) = 8.92$, $p < .01$, $\eta_p^2 = .19$. The interaction is depicted in Fig. 1 and was explored by analyzing the performance of the two age groups separately (as recommended by Roberts & Russo, 1999).

For the younger age group, there were main effects of context, $F(1, 19) = 34.83$, $p < .001$, $\eta_p^2 = .65$, and transparency, $F(1, 19) = 6.42$, $p < .05$, $\eta_p^2 = .25$, but the interaction was not significant, $F < 1.00$. As is clear from Fig. 1, the younger children's performance on both types of idiom was boosted by context. For the older age group, there were also main effects of context, $F(1, 19) = 24.75$, $p < .001$, $\eta_p^2 = .57$, and transparency, $F(1, 19) = 31.06$, $p < .001$, $\eta_p^2 = .60$, which were qualified by a significant interaction, $F(1, 19) = 17.54$, $p < .001$, $\eta_p^2 = .48$. The simple main effects demonstrated a significant effect of context for opaque idioms, with higher scores obtained when context was present than when it was absent, $F(1, 19) = 37.23$, $p < .001$, but no effect of context for transparent idioms, $F(1, 19) = 2.21$, $p = .15$. Furthermore, there was a significant effect of idiom type for context absent, with higher scores obtained for transparent idioms than for opaque ones, $F(1, 19) = 62.21$, $p < .001$, but the comparison did not reach significance for context present, $F(1, 19) = 3.21$, $p = .09$.

Analysis of novel idioms. An analysis of all age groups' performance on only the novel items was conducted to determine the relative importance of inference from context and semantic analysis in the acquisition of idiomatic meaning. Adults' data were included in this analysis because adults did not perform at ceiling for novel idioms.

There were significant and substantial main effects of age, $F(2, 56) = 118.58$, $p < .001$, $\eta_p^2 = .81$, transparency, $F(1, 56) = 89.47$, $p < .001$, $\eta_p^2 = .62$, and context, $F(1, 56) = 96.11$, $p < .001$, $\eta_p^2 = .63$. Each

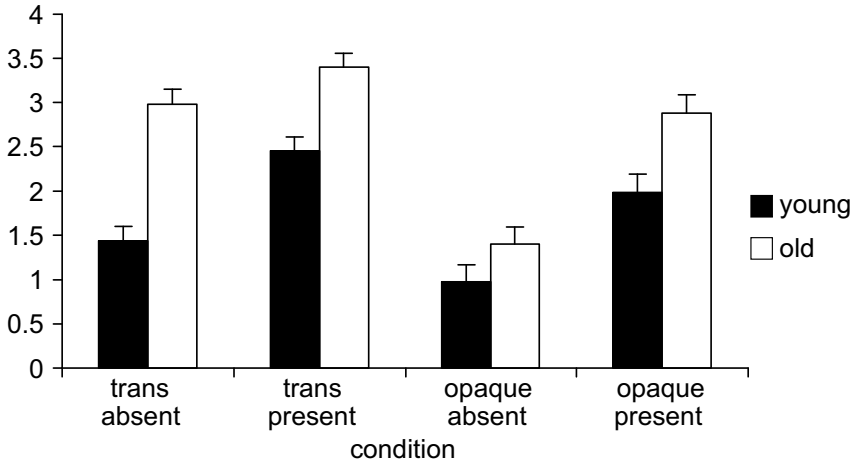

Fig. 1. Experiment 1: Analysis of children's performance on familiar idioms. The graph (with standard error bars) depicts the three-way interaction among age group, transparency, and context for the selection of correct idiomatic responses. The maximum score was 6. trans, transparent idioms; opaque, opaque idioms; absent, context absent; present, context present.

of the two-way interactions was significant: context and age, $F(2, 56) = 3.77$, $p < .05$, $\eta_p^2 = .12$, transparency and age, $F(2, 56) = 16.58$, $p < .001$, $\eta_p^2 = .37$, and context and transparency, $F(1, 56) = 43.61$, $p < .001$, $\eta_p^2 = .44$. These were qualified by a three-way interaction among age, context, and transparency: $F(2, 56) = 12.53$, $p < .001$, $\eta_p^2 = .31$. The mean values are reported in the final four columns of Table 2 and are shown in Fig. 2.

To explore the interaction, the performance of each age group was analyzed separately. For the adults and older children, there were main effects of transparency and context qualified by a significant two-way interaction: adults, $F(1, 18) = 81.56$, $p < .001$, $\eta_p^2 = .82$, and older children, $F(1, 19) = 4.42$, $p < .05$, $\eta_p^2 = .19$. Looking at the simple main effects for the adult data, there was a significant effect of context for opaque idioms, with higher scores obtained when context was present than when it was absent, $F(1, 18) = 308.17$, $p < .001$, but no effect of context for transparent idioms, $F(1, 18) < 1.00$. Furthermore, there was a significant effect of idiom type for context absent, with higher scores obtained for transparent idioms than for opaque ones, $F(1, 18) = 170.14$, $p < .001$, but not for context present, $F(1, 18) < 1.00$. For the 9- and 10-year-olds, simple main effects revealed the same pattern of findings. There was a significant effect of context for opaque idioms, with higher scores obtained when context was present than when it was absent, $F(1, 19) = 37.23$, $p < .001$, but no effect of context for transparent idioms, $F(1, 19) = 2.21$, $p > .15$. Furthermore, there was a significant effect of idiom type for context absent, with higher scores obtained for transparent idioms than for opaque ones, $F(1, 19) = 62.21$, $p < .001$, but not for context present, $F(1, 18) = 3.21$, $p = .09$. For the younger children, only the main effect of context reached significance, $F(1, 19) = 20.23$, $p < .001$, $\eta_p^2 = .52$.

Idiom task: Analysis of errors

Three types of error were possible: selection of the contextually plausible, the contextually implausible, or the literal interpretation of the phrase. Only the children made a significant number of errors both when context was absent and when context was present; the adults performed near ceiling on all types with the exception of the novel opaque idioms presented with context absent. The mean total numbers obtained for each choice, for the two younger age groups, are shown in Table 3.

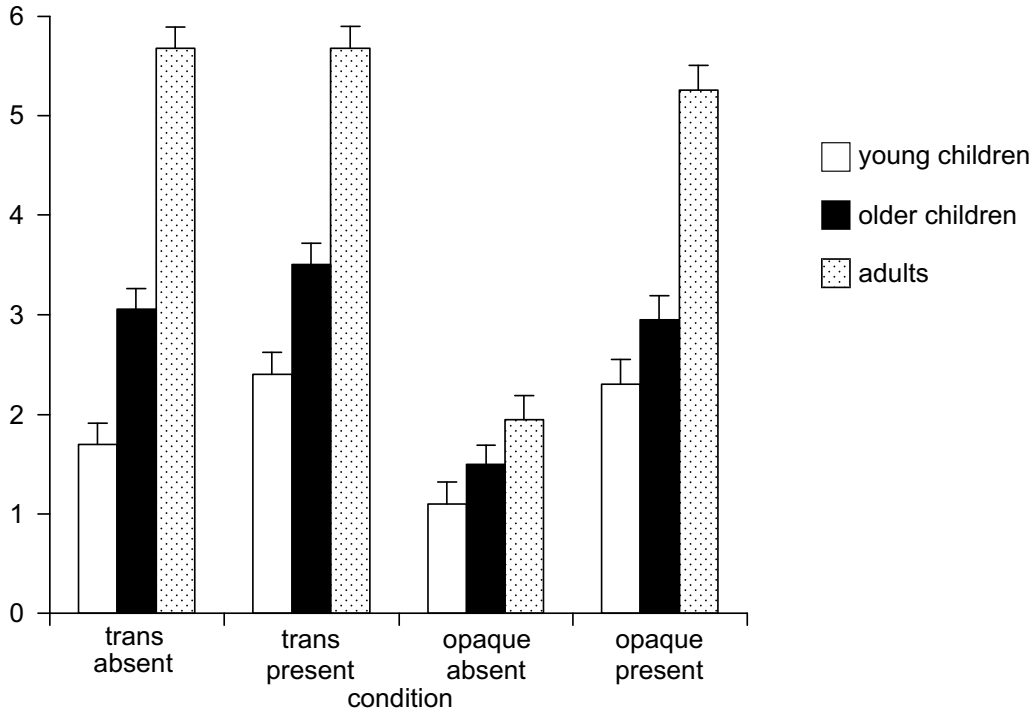

Fig. 2. Experiment 1: Analysis of all three age groups for performance on the novel items. The graph (with standard error bars) depicts the three-way interaction among age, transparency, and context for the selection of idiomatic responses. The maximum score was 6. trans, transparent idioms; opaque, opaque idioms; absent, context absent; present, context present.

Table 3
Experiment 1: Mean sum scores (and expressed as percentages of errors) for selection of incorrect response options for context absent versus present by age group and condition

Context	Familiar				Novel			
	Transparent		Opaque		Transparent		Opaque	
	Absent	Present	Absent	Present	Absent	Present	Absent	Present
Contextually plausible								
7- and 8-year-olds	0.55 (12)	1.55 (44)	1.45 (27)	2.05 (48)	1.20 (28)	2.20 (63)	1.35 (30)	2.20 (56)
9- and 10-year-olds	1.20 (43)	1.45 (60)	1.90 (40)	1.60 (53)	1.40 (49)	1.10 (42)	1.65 (36)	1.75 (60)
Contextually implausible								
7- and 8-year-olds	1.65 (33)	1.50 (45)	1.40 (27)	1.40 (33)	1.30 (30)	0.75 (20)	0.85 (19)	0.40 (12)
9- and 10-year-olds	0.95 (33)	1.10 (35)	1.35 (30)	1.00 (35)	1.00 (33)	1.05 (46)	1.30 (29)	0.95 (30)
Literal								
7- and 8-year-olds	2.65 (55)	0.45 (12)	2.30 (45)	0.90 (19)	1.80 (41)	0.65 (17)	2.70 (52)	1.05 (31)
9- and 10-year-olds	0.75 (24)	0.15 (6)	1.45 (31)	0.50 (13)	0.55 (19)	0.35 (13)	1.55 (35)	0.35 (11)

Note. Percentages are in parentheses and have been rounded up or down to whole numbers.

Idioms: Context absent. To determine whether the younger children showed a literal processing tendency, the proportion of remaining responses that were literal interpretations was entered as the dependent variable in a three-way ANOVA with age, transparency, and familiarity as factors. There were 19 children in the older age group because 1 child did not make any errors in one condition. There was a significant main effect of age group, $F(1, 37) = 12.94$, $p < .001$, $\eta_p^2 = .26$, which arose because this response type was chosen more frequently by younger children than by older children (*M*s = .48 and .28, respectively). No other main effects or interactions were significant.

Idioms: Context present. To examine the children's use of context, the proportion of remaining responses that were contextually plausible response options was entered as the dependent variable in a three-way ANOVA with age, transparency, and familiarity as factors. None of the main effects or interactions reached significance.

Relation between performance on the semantic analysis and idiom tasks

The older children obtained higher mean scores in the ambiguous sentences task than did the younger children: 37.90 (*SD* = 7.51, range = 23–59) and 26.7 (*SD* = 8.91, range = 19–50), respectively. These scores differed significantly, $t(38) = 4.30$, $p < .001$, indicating that the older children were more likely to come up with two alternate meanings for a greater number of items. Correlations were computed to explore the relation between semantic analysis skills and performance on the idiom task with context absent and present. Clearly, there is a confound between age and semantic analysis skills that must be borne in mind when interpreting these data; older children have superior semantic analysis scores.

The correlations revealed specific relations between semantic analysis scores and the correct selection of the idiomatic interpretation for transparent idioms. The correlations represented medium to large effects with context absent: familiar transparent, $r = .55$, $p < .001$, and novel transparent, $r = .40$, $p = .01$, and medium effects with context present: familiar transparent, $r = .32$, and novel transparent, $r = .34$, both *ps* < .05. There was also a significant correlation between semantic analysis skills and familiar opaque idioms with context present, $r = .42$, $p < .01$. None of the other correlations with opaque items reached significance: context absent, familiar opaque, $r = .30$, and novel opaque, $r = .10$; context present, novel opaque, $r = .30$; all *ps* > . 05.

Summary of results

When idioms were presented without a supportive context, developmental differences were apparent. For transparent idioms, the adults' and older children's selection of the idiomatic response was significantly above chance levels of responding, and the younger children's response rate was not.

With context present, the adults and older children performed above chance levels for all idiom types, and the younger children performed above chance only for transparent items. The main ANOVA demonstrated that both groups of children benefited from the presence of context. For the younger children, there was a general effect; for the older children, bigger gains were apparent for opaque idioms. These findings were supported by the analysis of only novel items. In addition, the analysis of novel items demonstrated superior performance by the adults in general. The independent measure of semantic analysis skills was significantly related to comprehension of transparent idioms in both presentation conditions (context present and context absent). In addition, it was related to comprehension of familiar opaque idioms when context was present. Crucially, semantic analysis skills did not significantly correlate with performance on novel opaque idioms.

Discussion

The findings in relation to our four questions can be summarized as follows. First, both groups of children were more likely to select the target interpretation when the idioms were presented in context, indicating that the younger group could use context to work out the meanings of the phrases. This effect was evident for familiar and novel idioms. Second, when novel transparent idioms were presented without a supportive context, the adults and older children selected the idiomatic interpretation above chance levels of performance, and the younger children failed to do so. This finding suggests that the adults and older children were able to use semantic analysis to work out a sensible meaning for the transparent idioms. Third, performance on an independent measure of semantic analysis skills was related specifically to comprehension of transparent idioms in the context absent condition, indicating the importance of semantic analysis in idiom comprehension (Nippold, 1998; Nippold & Taylor, 1995). Fourth, age differences found in the analysis of novel idioms demonstrate that the language processing skills that aid idiom comprehension and acquisition are still not fully developed in 9- and 10-year-olds. We discuss each of the main findings in turn.

Both groups of children benefited from the presence of context. This finding complements and extends the findings of Levorato and Cacciari (1999). We have demonstrated the facilitatory effect of context using a within-participants design. In addition, performance did not approach ceiling on the transparent items in the context absent condition, allowing for a robust test of context effects on transparent idiom comprehension. There was evidence of developmental change in the effective application of inference from context, with the adults showing superior performance to both groups of children when idioms were presented in context.

Other research with this age group reports much higher levels of comprehension for idioms presented in context. In Levorato and Cacciari's (1999) study, 9-year-olds selected the correct response for 91.5% of transparent idioms and 74.7% of opaque idioms; in our study, the corresponding values were 58% for familiar transparent and 48% for familiar opaque. Differences in the items used and the number of response options (four vs. three) are just two plausible reasons for the differences in apparent competence or task difficulty. Importantly, our study suggests that although 7- and 8-year-olds can use inference from context to support the processing of idioms, this skill is still developing in 9- and 10-year-olds. This developing skill may aid the growth in idiom knowledge found beyond the primary school years (Nippold & Rudzinski, 1993; Nippold & Taylor, 1995).

In contrast to inference from context, a different pattern of developmental change was evident in the use of semantic analysis. Older children were able to analyze the component words in the phrases to work out the meanings of idioms, although their performance was not in line with adult levels. There was little evidence that 7- and 8-year-olds could use semantic analysis successfully; younger children did not perform significantly above chance in understanding the novel transparent items. These findings support Levorato and Cacciari's (1999) conclusion that semantic analysis becomes increasingly important during the later stages of development of figurative competence.

An alternative interpretation is that the younger children in our study attempted a componential analysis of the idioms, leading them to select the literal interpretation for some expressions. The error analysis revealed a literal selection bias for idioms without context. It must be noted that the error

analysis is not wholly independent of the analysis of correct responses. However, the analysis of proportionate scores enabled us to determine whether processing and response preferences were evident for either age group in the two presentation conditions. The tendency to select the literal response, rather than the contextually plausible or implausible response, suggests that an analysis of component words took place.

It is clear how a tendency toward a literal response might arise when we consider the construction of the four alternative answers. They were designed to focus on a literal interpretation of one or two key words in each phrase rather than a word-for-word literal interpretation. Examination of our materials (see Table 1 for an example) indicates that a literal response bias is consistent with the use of semantic analysis. For the idiom "to be left out in the cold," the literal response option "to be sat by an open window" is related to a plausible interpretation of the consequences of sitting by an open window. Thus, the inclusion of the literal response option may have resulted in an underestimation of the 7- and 8-year-olds' performance for transparent idioms. The younger age group may have used semantic analysis to derive the meanings for the novel idioms and, in so doing, selected the literal response option.

Other researchers have advised against including a literal option, albeit for different reasons; for example, Nippold and Taylor (1995, p. 38) cautioned, "Literal foils should be avoided because they may inadvertently make a task too simple by allowing students to quickly eliminate obviously inappropriate choices." In contrast, our data indicate that for the younger children at least, the literal option was plausible when no context was present.

Semantic analysis should aid comprehension of transparent idioms to a greater extent than opaque idioms because of the relation between component words and the figurative meanings (e.g., Nippold, 1998; Nippold & Taylor, 1995). In support of this hypothesis, we found that the independent measure of semantic analysis was related to correct idiom selections for both novel and transparent idioms in the context absent condition. The effect sizes were medium to large (Cohen, 1988). Thus, the ability to come up with alternate meanings for phrases containing ambiguous words and grammatical structures is related to the ability to come up with appropriate meanings for transparent idioms. With context present, performance was correlated with correct responding on the familiar opaque items as well. It is clear that the independent measure of semantic analysis skills taps broader language skills. We explore this finding further in the General Discussion.

The 9- and 10-year-olds did not perform at ceiling on any type of idiom with context present; adult participants' scores were substantially higher in this condition. The differences between the groups in performance on the novel idioms suggest that the language processing skills that aid idiom comprehension and acquisition are far from fully developed at 10 years of age. Our data suggest that these skills may develop over a longer period of time than that proposed by Levorato and Cacciari (1995).

Experiment 2 was designed to address two significant issues that arose from these findings. First, we wanted to determine whether the youngest age group's performance would improve without the potentially misleading literal response option. Second, we wanted to study idiom comprehension in an older group of children. Levorato and Cacciari (1995) suggested that the skills used to develop figurative language develop between 7 and 11 years of age. Nippold (1998) and Nippold and Taylor (1995) demonstrated growth in idiom comprehension during adolescence. However, neither body of work used novel idioms, making it hard to disentangle growth in idiom knowledge (which will be influenced by greater experience with language) from growth in processing skills. We included a group of 11- and 12-year-olds to study the range of development in these skills further.

Experiment 2

Experiment 2 was conducted to explore the possibility that 7- and 8-year-olds can use semantic analysis skills to derive nonliteral meanings of idiomatic expressions. For the reasons outlined above, it seems possible that these participants were misled in Experiment 1 by the inclusion of the literal response options. We included a comparison group of children, 11- and 12-year-olds, to provide a more complete picture of the development of idiom processing skills for the reasons presented above.

Table 4
Experiment 2: Mean sum scores (and standard deviations) for selection of idiomatic response option by age group and condition

Context	Familiar				Novel			
	Transparent		Opaque		Transparent		Opaque	
	Absent	Present	Absent	Present	Absent	Present	Absent	Present
7- and 8-year-olds	3.55* (1.57)	3.65* (1.37)	2.35(1.27)	3.25* (1.29)	3.25* (0.91)	3.75* (1.38)	1.90(1.07)	3.95* (1.05)
9- and 10-year-olds	3.35* (1.57)	4.25* (1.45)	2.25(1.02)	3.70* (1.26)	3.40* (1.32)	4.50* (1.34)	2.20(1.28)	3.50* (1.57)
11- and 12-year-olds	4.82* (1.10)	4.59* (1.50)	3.50* (1.34)	4.18* (1.56)	4.18* (1.44)	4.32* (1.55)	2.41(1.18)	3.82* (1.44)

Note. Standard deviations are in parentheses. Maximum score = 6.
* Significantly greater than chance.

Method

Participants

We report the complete data from 62 children: 20 in Year 3 (7 or 8 years of age), 20 in Year 5 (9 or 10 years of age), and 22 in Year 7 (11 or 12 years of age)[3] Children attended two schools in northeast England serving mixed catchment areas. Children with a statement of special educational needs were excluded from the study. All of the children spoke British English as their first language and had parental permission to participate in this work.

Experimental tasks and procedure

The idioms and multiple-choice tasks were the same as those used in Experiment 1 with the exception that the literal foil was not included, making three options for each idiom. Testing for the two younger age groups was conducted in small groups in a quiet room away from the classroom, and the older children were tested in their classroom[4] As before, the items were presented in the same order for each child, distributed so that the same type of idiom did not appear consecutively, and a different order was used for the context absent and context present conditions. The total number of each response option selected was calculated (maximum = 6 for each condition).

Results

The mean sum scores obtained for correct idiomatic choices with context absent versus present are shown in Table 4. Two sets of analyses were carried out. The first set used one-sample *t* tests to compare responding on the idiom comprehension task with chance. The second set used ANOVAs to determine whether the magnitude of correct responding differed across ages and in relation to the presence of a supportive story context.

Idiom responses: Comparisons with chance level of responding

Idiom choices: Context absent. A series of one-sample *t* tests for each age group was conducted to determine the likelihood that each group was able to select the correct response by chance. The chance level of selecting the idiomatic response for each condition was 2 (6 trials with 3 options each). Because of the number of comparisons to be made, the alpha level was set at .004.

For older children, the scores obtained for familiar transparent, familiar opaque, and novel transparent idioms were significantly greater than 1.5, indicating either knowledge of the idiom or an ability to derive the meaning of the expression: familiar transparent, $t(21) = 12.05$, familiar opaque, $t(21) = 5.27$, and novel transparent, $t(21) = 7.13$, all $ps < .004$. Scores for the correct interpretation of the novel opaque

[3] The school did not provide age data for this study, but all children were in the same year group and none had been held back a year.
[4] Some answer booklets were left incomplete and these were not included in the analysis, leaving 22 children in the older.

idioms did not differ significantly from chance, $t(18) = 1.62$, $p > .10$. The two younger age groups showed a different pattern of performance. The 9- and 10-year-olds responded above chance level on both types of transparent idiom: familiar, $t(19) = 3.86$, and novel, $t(19) = 4.77$, both $ps < .004$. Their performance on both types of opaque idiom did not differ from chance, both $ts < 1.10$. The youngest children demonstrated the same pattern of performance. Their scores were above chance for both types of transparent idiom: familiar, $t(19) = 4.41$, and novel, $t(19) = 6.14$, both $ps < .004$, and their performance on both types of opaque idiom did not differ from chance, both $ts < 1.30$.

Idiom choices: Context present. The mean sum scores obtained for correct idiomatic choices are shown in Table 4. Each age group selected a greater number of idiomatic responses when the context was present than when it was absent, indicating that context facilitated performance. A series of one-sample *t* tests showed that all groups obtained scores that were significantly greater than chance, $ps < .004$ for all idioms.

Idiom responses: Effects of age and context

Main analysis. The total number of idiomatic choices made when context was absent versus present for each type of idiom was treated as the dependent variables in a four-way ANOVA. In the ANOVA, age (7 and 8, 9 and 10, or 11 and 12 years) was a between-participants factor, and context (absent or present,), familiarity (familiar or novel), and transparency (transparent or opaque) were within-participants factors. Where appropriate, η_p^2 is reported as the measure of effect size. This value estimates the proportion of total variance accounted for by the independent variable.

There were significant and sizable main effects of context, $F(1, 59) = 49.65$, $p < .001$, $\eta_p^2 = .46$, and transparency, $F(1, 38) = 78.27$, $p < .001$, $\eta_p^2 = .57$. There was a small effect of age, $F(2, 59) = 4.75$, $p < .02$, $\eta_p^2 = .14$. The main effect of familiarity did not reach conventional levels of significance, $F(1, 59) = 3.25$, $p = .08$.

There were three significant two-way interactions. One was between age and familiarity, $F(2, 59) = 3.81$, $p < .03$, $\eta_p^2 = .12$. Simple effects analysis revealed significant differences between familiar and novel idioms for the oldest age group, $F(1, 59) = 11.35$, $p < .01$, but not for the younger age groups, $Fs < 1.00$. There was a significant interaction between context and transparency, $F(1, 59) = 20.22$, $p < .001$, $\eta_p^2 = .26$. Looking at the simple main effects, there was a significant effect of context for transparent idioms, with higher scores obtained when context was present than when it was absent, $F(1, 61) = 7.74$, $p < .01$, and a much stronger difference for opaque idioms when context was present than when it was absent, $F(1, 61) = 55.84$, $p < .001$. Furthermore, there was a significant effect of idiom type for context absent, with higher scores obtained for transparent idioms than for opaque ones, $F(1, 61) = 78.81$, $p < .001$, and also for opaque idioms, $F(1, 61) = 11.62$, $p < .001$.

The final two-way interaction was between context and familiarity, $F(1, 59) = 7.74$, $p < .01$, $\eta_p^2 = .12$. Looking at the simple main effects, there was a significant effect of context for familiar idioms, showing that scores were higher when context was present than when it was absent, $F(1, 61) = 19.36$, $p < .001$, and also for novel idioms, with higher scores obtained in the presence of context, $F(1, 61) = 46.57$, $p < .001$. There was also a significant effect of idiom type for context absent, with higher scores obtained for familiar idioms than for novel ones, $F(1, 61) = 8.49$, $p < .01$, but not for context present, $F(1, 61) < 1.00$.

No other interactions reached significance: context and age, $F(2, 59) = 2.76$, $p = .071$, all other $Fs < 1.85$, $ps > .17$.

Analysis of novel idioms. As before, an analysis of performance on only novel items was conducted. There were significant and substantial main effects of transparency, $F(1, 59) = 45.34$, $p < .001$, $\eta_p^2 = .44$, and context, $F(1, 59) = 54.48$, $p < .001$, $\eta_p^2 = .48$. There was a significant interaction between context and transparency, $F(1, 59) = 18.95$, $p < .001$, $\eta_p^2 = .24$. The three-way interaction among age, context, and transparency did not reach conventional levels of significance, $F(2, 59) = 2.91$, $p = .062$, $\eta_p^2 = .09$. No other main effects or interactions were significant, all $Fs < 1.72$, all $ps > .18$.

Simple main effects analysis was used to explore the interaction between context and transparency, as depicted in Fig. 3. The greatest difference was apparent between idiom types presented with context absent; the difference between transparent and opaque idioms in context was less. Simple

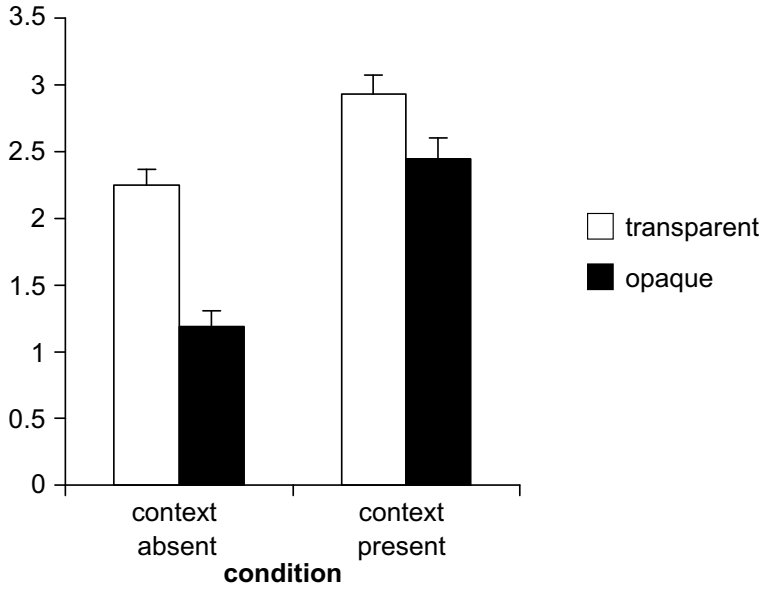

Fig. 3. Experiment 2: Graph (with standard error bars) depicting the two-way interaction between transparency and context for the selection of idiomatic responses. The maximum score was 6.

main effects revealed the same pattern of significant effects as in the main analysis reported above, all *F*s > 5.37, all *p*s < .025.

Summary of results

The oldest age group were significantly more likely than chance to select the idiomatic response for familiar transparent, novel transparent, and familiar opaque items, and the two younger age groups performed above chance only on familiar transparent and novel transparent idioms. All groups performed above chance on all idiom types when presented in context. The ANOVA revealed an interaction between age group and familiarity, indicating that the older children had greater knowledge of the familiar idioms than did the two younger age groups. There was also an interaction between context and transparency that arose because of enhanced performance across age groups for the opaque idioms with context present. Finally, there was a significant interaction between context and familiarity because performance on the novel idioms was generally poor in the absence of context.

Discussion

The findings in relation to the development of inference from context and semantic processing skills can be summarized as follows. All age groups were able to use context to support their comprehension of both familiar and novel idioms. They selected a greater number of correct responses than chance when context was present, and they demonstrated a boost from context in their performance on opaque idioms, in the ANOVA. All age groups were able to use semantic analysis to derive meanings for transparent idioms presented with context absent. We discuss these findings in relation to developmental differences in idiom knowledge, the processes involved in idiom acquisition, and the findings of Experiment 1.

There was little evidence of developmental differences in the processing skills proposed to aid idiom acquisition and comprehension: semantic analysis and inference from context. All age groups performed above chance on novel transparent idioms with context absent and benefited from the presence of context when processing opaque idioms. There was not a significant effect of age in the analysis of novel idioms. This pattern of findings contrasts with that of Experiment 1, where the younger children did not perform above chance for transparent idioms with context absent and there was a sizable effect of age in the main analysis. In Experiment 2, we found support for the hypothesis that all three age groups could use semantic analysis when presented with idioms with context absent. This

suggests that the performance of 7- and 8-year-olds may have been underestimated in Experiment 1. As a result, the facilitatory effect of context was greatest for the novel opaque idioms that could be interpreted successfully only in context.

Developmental differences in knowledge of idioms were evident; only the 11- and 12-year-olds performed above chance on familiar opaque idioms with context absent. Indeed, the pattern of performance of the older children was similar to that of the adults in Experiment 1; they obtained scores that were significantly above chance for both types of transparent idioms and also for familiar opaque items. Unlike the adults in Experiment 1, the 11- and 12-year-olds did not perform at ceiling, indicating that knowledge of idioms continues to develop beyond the primary school years (see also Nippold & Rudzinski, 1993; Nippold & Taylor, 1995).

General discussion

This research investigated developmental change in the processes used to comprehend idioms. There was evidence that children as young as 7 or 8 years of age can use both inference from context and semantic analysis to aid idiom comprehension. Two experiments demonstrated that all age groups benefited from the presence of a supportive story context to interpret idioms. In Experiment 2, children between 7 and 11 years of age selected the target idiomatic interpretation of idioms at above chance level when presented without a supportive story context (context absent). Further support for the contribution of semantic analysis was provided by the relation between an independent measure of semantic analysis and comprehension of familiar and novel transparent idioms in the context absent condition. A developmental change in the ability to use both semantic analysis and inference from context was apparent.

These findings broadly support the global elaboration model of Levorato and Cacciari (1995), who proposed that idioms are learned and understood using the language processing skills that are crucial to make sense of all forms of language: literal and figurative. Levorato and Cacciari (1999) concluded that the use of context is crucial to figurative competence and that learners become increasingly sensitive to the internal semantics of figurative expressions such as idioms. Furthermore, they proposed that these skills develop between 7 and 11 years of age. Our work suggests two important qualifications. First, semantic analysis may contribute to idiom comprehension earlier in the development of figurative competence. We found that both context and semantic analysis were related to idiom selection and that learners became increasingly able to use both skills to support their interpretation of unknown and/or unfamiliar idioms. Second, the development of these processing skills continues beyond 11 years of age.

An early sensitivity to context in language learning and comprehension is well documented (e.g., Akhtar, 2006). Thus, it is not surprising to find that children age 7 years and over understand idioms better when they are embedded in a supportive context. This is in line with previous investigations into idiom comprehension (e.g., Levorato & Cacciari, 1995; Levorato & Cacciari, 1999). There is less evidence that young children can use semantic analysis of the phrase to support idiom comprehension. We provided two strands of evidence to support an early ability to analyze the components of an idiomatic expression: comprehension of transparent idioms when no context was present and the relation between transparent idiom understanding and the semantic analysis task.

The correlations between the semantic analysis task and both types of familiar idiom may have arisen because children who know more than a single meaning of a homonym or can compute different grammatical structures for the same word string are more likely to have greater knowledge of real idioms. There may also be a relation between the familiarity of an idiom and its transparency (e.g., Nippold & Rudzinski, 1993). Thus, the contrast between the novel transparent and novel opaque idioms is of greatest interest here. This suggests that semantic analysis skills, as tapped by our independent measure, do support the processing of transparent idioms. We would not argue that this skill alone is the only factor involved, and of course the findings do not necessarily extend to everyday language processing; young children might not ignore a literal interpretation of an idiom presented in a conversation or story. However, semantic analysis appears to make a contribution to idiom comprehension in line with Nippold's metasemantic hypothesis (Nippold, 1998; Nippold & Taylor, 1995).

Our research not only indicates the capabilities of young children but also demonstrates the extended period of development of these processing skills. The developmental differences in performance on the familiar idioms indicate that knowledge of the meanings of familiar idioms is still being acquired during early adolescence (Nippold & Martin, 1989; Nippold & Rudzinski, 1993; Nippold & Taylor, 1995). Our findings in relation to comprehension of the novel expressions suggest that the language processing skills that aid the acquisition of idiomatic knowledge are not fully developed by 11 or 12 years of age. We found developmental improvements in the use of context; adults were more likely than children to select the idiomatic response for novel opaque idioms presented in context. We also found evidence for developmental improvements in semantic analysis; adults were more likely than children to select the idiomatic response for novel transparent idioms presented without context.

All of the children in our study were young readers whose experience with print may have led to greater attention to context and enhanced metalinguistic skills (Garton & Pratt, 1998). Younger children understand figurative language, but there is a need for investigations of the processing skills that support their comprehension. Children between 4 and 6 years of age demonstrate some knowledge of idioms assessed in forced-choice (Gibbs, 1987) and multiple-choice (Caillies & Le Sourn-Bissaoui, 2006) tasks. Gibbs's (1987) data suggest an early sensitivity to context; even the youngest children were poorer at selecting the correct response option in the context absent condition compared with context present condition. It is less clear whether such young children can use semantic analysis when idioms are presented without a supportive context. The kindergarteners (mean age 5 years 8 months) in Gibbs's work did not demonstrate sensitivity to the difference between the transparent and opaque items. Gibbs used real idioms, so it is possible that the meanings (or partial meanings) may have been known to the children who succeeded on the task. Future work using novel idioms should investigate whether children under 7 years of age can analyze the components of an idiomatic expression to derive an appropriate meaning. Superior performance for transparent idioms, albeit in context, suggests that they may be able to do so (e.g., Caillies & Le Sourn-Bissaoui, 2006; Gibbs, 1987).

We did not investigate whether children made a deliberate choice to use either contextual or semantic analysis. Furthermore, it should be noted that we did not look at the spontaneous use of either processing skill to work out the meanings of idioms or the age at which this will arise. The majority of work investigating idiom comprehension in young children has, like our own work, used off-line tasks to measure performance such as multiple choice (Cacciari & Levorato, 1989; Levorato & Cacciari, 1995; Nippold & Taylor, 1995) or explanation/completion tasks (Gibbs, 1991; Levorato & Cacciari, 1995; Nippold & Rudzinski, 1993). On-line tasks such as reading times and priming paradigms have been used successfully to investigate the time course of idiom meaning activation in adults for familiar idioms (Glucksberg, Newsome, & Goldvarg, 2001; Schweigert, 1986; Titone & Connine, 1994). These procedures may prove to be useful for investigating the time course of figurative language processing in younger populations, for whom idioms may be unfamiliar, to establish whether the figurative meaning is derived or activated when the phrase is first encountered. This method would enable researchers to investigate an alternative explanation of the difference between Experiments 1 and 2: that the availability of the literal response option made it hard for the children in Experiment 1 to inhibit or suppress the literal meaning in favor of a more figurative one.

Comprehension of idioms requires sensitivity to context, but this is not the same as the ability to derive an appropriate inference from context. Harris, Kruithof, Terwogt, and Visser (1981) looked at children's ability to detect inconsistencies in a text. In their study, 11-year-olds were more likely than 8-year-olds to show explicit recognition that a line did not make sense, but both age groups showed implicit awareness of the inconsistency (measured by reading times). The study by Harris and colleagues suggests a refinement in our thinking about the development of children's language processing skills and increasing competence with idioms. All age groups in our research demonstrated awareness that the literal meaning of the phrase did not make sense in relation to the text. However, despite this sensitivity to context, they were best able to derive appropriate meanings of the transparent idioms; performance for opaque idioms, for which context was the sole source of information, was poorer. This suggests that semantic analysis of the phrase may help to refine or reinforce a meaning derived from context. Clearly, there may be an additional interactive effect between inference from context and semantic analysis for idioms presented in context. It may be difficult to fully tease apart

the influence of each in future work because it is not possible to study contextual processing without the involvement of semantic processing, but this is an important issue for researchers to consider.

Finally, our work highlights the need to carefully consider the task used to measure performance. We chose a multiple-choice task to minimize the cognitive demands of the task that might unduly limit younger children's performance. However, this benefit comes with a cost. By using this task, we cannot say for certain whether children were able to *derive* the meaning of phrases from semantic analysis or context; instead, they may have engaged an elimination and matching strategy. This has been a criticism of other previous studies of idiom comprehension. We contend that the multiple-choice task does have its uses, for the reasons outlined in this article, but that converging evidence from other measures, such as explanation, is required. Clearly, the choice of distracter items should be made with care (Nippold and Taylor, 1995). In this study, the literal choice options available to children in Experiment 1 may well have underestimated the performance of the younger children because of the literal response bias.

In summary, we have demonstrated the importance of both inference from context and semantic analysis to idiom processing. Both strategies can be used from a young age, with 7- and 8-year-olds being able to use semantic analysis to process novel and unfamiliar idiomatic expressions when they are amenable to semantic analysis as well as being sensitive to meaning in context. Our work suggests that young children are capable of processing figurative language at both the small-grained phrase level and the discourse level to establish meaning. Future work should address when these factors are used spontaneously in language processing and the factors that influence their development.

Appendix

Idioms used in this study

Familiar	Mean component rating	Transparent novel	Mean component rating
To get away with murder	4.00	To be caught between two fires	3.79
To leave (somebody) out in the cold	3.67	To run around like scalded pigs	3.54
To skate on thin ice	3.63	For good hunger there is no hard bread	3.42
To rock the boat	3.58	To drown in a glass of water	3.08
One's bark is worse than one's bite	3.39	To shoot sparrows with canons	3.08
To cross swords with someone	3.38	To try to make a hole in water	3.04
Opaque familiar		Opaque novel	
To carry a torch	2.79	The turtle is shrouded	2.25
To go to pot	2.66	To eat the leaf	2.13
To throw in the towel	2.54	To pet the horse first	2.11
To be wet behind the ears	2.50	To be at the green	1.83
To beat about the bush	2.42	To have salt in your pumpkin	1.83
To take the biscuit	2.42	To whistle in your thumb	1.63

Note. Mean component ratings were taken from Cain and colleagues (2005), in which undergraduate students rated the extent to which individual words or phrases (e.g., "to skate on," "thin ice") contributed to the figurative meaning (provided) of each idiom on a 5-point scale. Higher scores indicate a higher contribution and greater transparency.

References

Akhtar, N. (2006). Contexts of early word learning. In G. D. Hall & S. R. Waxman (Eds.), *Weaving a lexicon* (pp. 485–507). Cambridge, MA: MIT Press.

Cacciari, C., & Levorato, M. C. (1989). How children understand idioms in discourse. *Journal of Child Language, 16*, 387–405.

Caillies, S., & Le Sourn-Bissaoui, S. (2006). Idiom comprehension in French children: A cock-and-bull story. *European Journal of Developmental Psychology, 3*, 189–206.

Cain, K., Oakhill, J., & Lemmon, K. (2005). The relation between children's reading comprehension level and their comprehension of idioms. *Journal of Experimental Child Psychology, 90*, 65–87.

Cain, K., & Towse, A. (in press). To get the wrong end of the stick: Reasons for poor idiom understanding in children with reading comprehension difficulties. *Journal of Speech, Language, and Hearing Research.*

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.

Garton, A., & Pratt, C. (1998). *Learning to be literate: The development of spoken and written language* (2nd ed.). Oxford, UK: Blackwell.

Gibbs, R. W. (1987). Linguistic factors in children's understanding of idioms. *Journal of Child Language, 14*, 569–586.

Gibbs, R. W. (1991). Semantic analyzability in children's understanding of idioms. *Journal of Speech and Hearing Research, 34*, 613–620.

Glucksberg, S., Newsome, M. R., & Goldvarg, Y. (2001). Inhibition of the literal: Filtering metaphor-irrelevant information during metaphor comprehension. *Metaphor and Symbol, 16*, 277–293.

Harris, P. L., Kruithof, A., Terwogt, M., & Visser, T. (1981). Children's detection and awareness of textual anomaly. *Journal of Experimental Child Psychology, 31*, 212–230.

Kerbel, D. (1998). A study of idiom comprehension in children with semantic–pragmatic difficulties: II. Between-groups results and discussion. *International Journal of Language & Communication Disorders, 33*, 23–44.

Kerbel, D., & Grunwell, P. (1998). A study of idiom comprehension in children with semantic–pragmatic difficulties: I. Task effects on the assessment of idiom comprehension in children. *International Journal of Language & Communication Disorders, 33*, 1–22.

Levorato, M. C., & Cacciari, C. (1992). Children's comprehension and production of idioms: The role of context and familiarity. *Journal of Child Language, 19*, 415–433.

Levorato, M. C., & Cacciari, C. (1995). The effects of different tasks on the comprehension and production of idioms in children. *Journal of Experimental Child Psychology, 60*, 261–283.

Levorato, M. C., & Cacciari, C. (1999). Idiom comprehension in children: Are the effects of semantic analysability and context separable? *European Journal of Cognitive Psychology, 11*, 51–66.

Nippold, M. A. (1998). *Later language development: Ages 9 through 19*. Little, Brown: Boston.

Nippold, M. A., & Duthie, J. K. (2003). Mental imagery and idiom comprehension: A comparison of school-age children and adults. *Journal of Speech, Language, and Hearing Research, 46*, 788–799.

Nippold, M. A., & Martin, S. (1989). Idiom interpretation in isolation versus context: A developmental study with adolescents. *Journal of Speech and Hearing Research, 32*, 58–66.

Nippold, M. A., & Rudzinski, M. (1993). Familiarity and transparency in idiom explanation: A developmental study of children and adolescents. *Journal of Speech and Hearing Research, 36*, 728–737.

Nippold, M. A., & Taylor, C. L. (1995). Idiom understanding in youth: Further examination of familiarity and transparency. *Journal of Speech and Hearing Research, 38*, 426–433.

Roberts, M. J., & Russo, R. (1999). *A student's guide to analysis of variance*. London: Routledge.

Roth, F. P., Speece, D. L., Cooper, D. H., & de la Paz, S. (1996). Unresolved mysteries: How do metalinguistic and narrative skills connect with early reading? *Journal of Special Education, 30*, 257–277.

Schweigert, W. A. (1986). The comprehension of familiar and less familiar idioms. *Journal of Psycholinguistic Research, 15*, 33–45.

Spooner, A. L. R., Gathercole, S. E., & Baddeley, A. D. (2006). Does weak reading comprehension reflect an integration deficit? *Journal of Research in Reading, 29*, 173–193.

Titone, D. A., & Connine, C. M. (1994). Comprehension of idiomatic expressions: Effects of predictability and literality. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 20*, 1126–1138.

Titone, D. A., & Connine, C. M. (1999). On the compositional and noncompositional nature of idiomatic expressions. *Journal of Pragmatics, 31*, 1655–1674.

Wiig, E., & Secord, W. (1989). *Test of Language Competence–Expanded Edition (TLC–Expanded)*. San Antonio, TX: Harcourt Assessment.