Early meta-linguistic awareness of derivational morphology: Some observations from a comparison of English and French

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Running Head: Awareness of derivational morphology in English and French

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ABSTRACT

This cross-linguistic comparison of meta-linguistic development in French and English examines early ability to manipulate derivational suffixes in oral language games as a function of chronological age, receptive vocabulary and year of schooling. Data from judgment and production tasks are presented for children aged between 5 and 8 years in their first, second or third school year in the UK and France. The results suggest that meta-morphological development is accelerated in French relative to English. The French advantage encompasses knowledge of a broader range of suffixes and a markedly greater facility for generalizing morphological knowledge to novel contexts. These findings are interpreted in relation to the word formation systems of English and French, and the educational context in each country.

KEYWORDS: derivational morphology; implicit learning; meta-linguistic awareness; English; French; cross-linguistic
INTRODUCTION

Studies of morphological development are gradually assembling a picture of how and when children become sensitive to affixes in spoken and written language. However, to date, relatively few studies have compared the course of development of derivational skills in different languages. Therefore, in this article, we present some observations about the issues inherent in comparing knowledge about derivational morphology in two European languages, French and English, together with a cross-linguistic study of growth in awareness of derivational suffixes.

The Systems of Derivational Morphology in French and English

Derivational morphology refers to a linguistic system for forming a new word from an existing word or word root. The major mechanism in the derivational process is the addition of an affix to the existing word, either through prefixation or suffixation, with the result that languages can contain sets of related word forms which have been derived from the same base (English (grace): gracious, disgrace; French (grâce): gracieux, disgrâce). Word formation can also be accomplished via the process of compounding whereby two or more lexemes are joined together (e.g. English: windscreen; French: pare-brise), although this process is more typical of Germanic than Romance languages (Bauer, 2003).

With over 80% of the French vocabulary originating from Latin, word forms obtained by derivation are far more numerous than those obtained by compounding. Approximately 170 suffixes exist in French, although there is a wide variation in their productivity with many being confined to scientific or technical terminology. Derivation is less prevalent and less productive in English due to the language’s Germanic roots. Nevertheless, English has also been greatly influenced by French and Latin and, as a result, has acquired a large number of affixes.
However, no more than 50 suffixes could be said to be in common use as many suffixes of Latin or Greek origin are characteristic only of the literate lexicon (Crystal, 2003).

Lexical stress further differentiates the word formation systems in the two languages. Syllables that are stressed are thought to have a greater perceptual salience which may be exploited during spoken word recognition (Cutler & Clifton, 1984; Pitt & Samuel, 1990; Vihman, Nakai, DePaolis & Halle, 2004). Therefore, the fixed pattern of final stress in French words may serve to enhance the salience of derivational suffixes, whereas, the stress pattern of English may act to de-emphasize suffixes since final stress is comparatively rare in English (Delattre, 1965). In addition, many common English suffixes that have been imported from French or Latin, impose a phonological change in the lexical stress of the base word that renders the derivation phonologically “opaque” (e.g. captive versus captivity). The vowel reduction that occurs in unstressed syllables in English (but not in French) heightens the opacity of such pairs (Dauer, 1983).

Thus, the French and English derivational systems differ on some of the key aspects that have been identified as guiding the development of knowledge about derivational morphology across languages, namely, phonological transparency and productivity (Clark, 1993; Carlisle, Stone & Katz, 2001; Casalis, Colé & Sopo, 2004). However, in spite of these differences, studies of adult processing document sensitivity to morphemes in both languages. For example, evidence from studies using the Word Order Competition technique, which induces speech errors by requiring intermittent reordering during reading aloud, supports a morphological account of the treatment of affixes as units in this task rather than competing explanations framed in terms of semantic or phonological overlap (Pillon, 1998; Melinger, 2003). Other evidence from visual masked priming in lexical decision appears consistent with a morphological decomposition
process which occurs early in visual word recognition and which is independent of semantic factors (Longtin, Seguí & Halle, 2003; Rastle, Davis & New, 2004). While a full review of the debate concerning the involvement of morphemes in adult speech production and visual word recognition is beyond the scope of the present study, this work at least, which has been conducted in parallel in English and French, is consistent with models in which a morphological level of structure has developed in the representation of complex words (e.g. Dell, 1986; Taft, 1994).

The Development of Meta-Linguistic Knowledge

In developmental work, the acquisition of knowledge about derivational morphology has been investigated through observational studies of early language use and empirical investigations of morphological knowledge in oral language and reading tasks. This body of evidence, which is more extensive in English than in French, suggests that morphological knowledge develops over a lengthy time span showing a marked growth between school grades 1 and 6 but continuing to improve throughout adolescence and into adulthood (Derwing & Baker, 1979; Anglin, 1993; Mahony, Singson & Mann, 2000; Singson, Mahony & Mann, 2000). A developmental trend for greater explicitness in knowledge about derivations was also noted by Anglin (1993, p.144), which ties in with the increasing element of meta-cognitive “awareness” that has been observed more generally in relation to language development (Clark, 1978; Valtin, 1984; Karmiloff-Smith, 1986, 1992; Gombert, 1992).

A limiting aspect of implicit knowledge about language according to the Representational Redescription (RR) model proposed by Karmiloff-Smith (1986, 1992), is that it consists of independently-stored representations of particular forms which are sufficient to produce accurate behavioral performance within the sphere in which they have been acquired, but which lack the
flexibility to generalize to other situations because the relationships embedded within this implicit system are not themselves represented. A four-phase process of redescription is thus envisaged by Karmiloff-Smith to capture such relationships and to gradually make the information available both for generalization and ultimately for conscious manipulation and report. Broadly, the beginning and end points in this process appear akin to the procedural-declarative distinction referred to in other spheres (Browne, 1997; Karmiloff-Smith, 1997), with the idea that by producing knowledge in a declarative or explicit format this knowledge will become more accessible to higher-level cognitive processes. This would tie in with Anglin’s (1993) observations about the contribution that morphological problem-solving strategies make to vocabulary growth in later childhood.

While Karmiloff-Smith (1992) proposes that meta-linguistic development is primarily endogenously driven, Gombert (1992), in his reworking of the RR model, has argued for a stronger influence of exogenous factors in determining change. Gombert regards the implicit phases as obligatory in normal language development but sees transition to the next phase of meta-linguistic control as optional, and critically dependent upon the presence of a demand for this type of conscious control in the external environment. Learning to read is thought to be the likely catalyst for the emergence of meta-linguistic knowledge about many different aspects of language. This feature of Gombert’s (1992) model has proved to be explanatory in relation to phonological awareness as clear dissociations in the level of explicit awareness of rhyming and phonemic sounds have been observed during the first year of schooling according to whether children were exposed to reading instruction that emphasized phonemes or rhyme (Duncan, Seymour & Hill, 1997, 2000; Goswami & East, 2000).
Although the theories of Karmiloff-Smith and Gombert both draw upon ideas originally put forward by Piaget, the changes which take place during meta-linguistic development are not stage-like alterations across domains but rather recurrent phase changes which are thought to work on different aspects (e.g. semantic, phonological, morphological) of the system independently. Consequently, a child may be at an implicit level of knowledge with respect to one component of language but at an explicit level of knowledge for another. Anglin’s (1993) observations from English suggest that explicit knowledge about derivational morphology might emerge between Grades 3 and 5, rather later than explicit knowledge about phonology which has been observed as early as Grade 1 (Duncan et al, 1997). However, the evidence is restricted to a slightly increased incidence of explicit strategies in defining derived words amongst older children. In the next section, work which has addressed the question of meta-morphological development experimentally will be reviewed and related to other evidence about the development of sensitivity to derivational suffixes in English and French. Of particular interest is the question of whether meta-morphological development might progress at different rates in French and English due to the differences in the systems of derivational morphology reviewed earlier.

*Developmental Studies of Meta-linguistic Knowledge about Derivational Morphology*

Carlisle (Carlisle & Nomanbhoy, 1993; Carlisle, 1995) is one of the few authors to have considered morphological awareness within the framework of meta-linguistic development provided by Karmiloff-Smith (1986, 1992) and Gombert (1992). Drawing upon these models, Carlisle constructed experimental tasks to distinguish different levels of meta-linguistic knowledge about derivational morphology. She used a judgment task to assess more implicit (epi-linguistic) skills since the minimal demand in judging the relatedness of spoken words
appears close to a functional knowledge of language (e.g. “Are these words related:…teach-teacher?). Carlisle suggested that such tasks can be contrasted with tasks which contain a requirement for more explicit (meta-linguistic) manipulation, and hence, the crucial element of conscious control over the derivational process, claiming that experimental production tasks (e.g. “Teach. My uncle is a ________ (teacher)”) fulfill this more explicit criterion. Her view is that the requirement to produce a derivation “to order” differs qualitatively from the spontaneous productions that have been observed in preschool language. As a result of administering contrasting tests of this kind, Carlisle (1995) proposed that the transition from implicit to explicit awareness of derivational morphology takes place during the kindergarten and first grade years because her findings indicated that children already had excellent implicit skills at this point and were demonstrating a growing ability to perform explicit tasks.

In reviewing the experimental findings, the work of Carlisle and her colleagues will be discussed in conjunction with similar studies in the literature for comparative purposes. Several of these studies have examined morphological awareness solely in relation to the English suffix –er and those using the more implicit judgment task have reported high accuracy rates (88%) amongst 6-year-olds (Carlisle & Nomanbhoy, 1993; Carlisle, 1995). Accuracy in the more explicit production task have also been found to be very good (agentive: 91%; instrumental: 72%) in this age group (Clark & Hecht, 1982), although lower accuracy (agentive: 63%; instrumental: 35%) has been observed with non-lexical stimuli (Derwing & Baker, 1979). However, other studies that have tested a wider range of suffixes imply that meta-morphological development may be a more lengthy process. This work, which has tended to focus on older children, indicates that accuracy at oral relatedness judgments is still comparatively high at around 70% amongst 8-year-olds (Mahony et al, 2000), but production accuracy rates show a
marked decrease as a result of widening the stimulus base, with accuracy around only 40% for 6-year olds (Carlisle, 1995), and lower if non-lexical stimuli are used: approximately 4% for pre-school children and 30% for 6-8-year-olds (Derwing & Baker, 1979).

Although few published experimental studies exist in the French language, those that have appeared have assessed a wide range of derivational suffixes. In a relatedness judgment task, Colé, Royer, Leuwers and Casalis (2004) found near ceiling performance (83%) amongst their group of 6-year olds. Casalis and Louis-Alexandre (2000) administered a production task, similar to that used by Carlisle (1995), to the same age group and showed that performance levels were lower, and better with words (51%) than with nonwords (33%). However, these two studies are difficult to compare because Casalis and Louis-Alexandre used prefixes as well as suffixes and evidence suggests that the two types of affix differ in nature in French (Giraudo & Grainger, 2003). Later studies focused only on suffixes in the same type of production task and found a production accuracy rate for words of 76% for 7-year-olds (Casalis et al, 2004) and a rate of approximately 50% for mixed word and nonword stimuli amongst 5-year-olds (Casalis & Colé, in press).

The picture that emerges from this short overview of the literature is that production performance tends to lag behind judgment performance in early schooling in both French and English. This is consistent with the suggestion that the retrieval element of production requires a greater degree of meta-linguistic skill than recognition or comprehension (Windsor, 1994; Carlisle, 1995). Production accuracy rates also appear to fall especially in English with the introduction of a range of suffixes, making it appear that the transition to meta-linguistic awareness may be a more gradual and suffix-specific process than previously proposed.
In her seminal study, Berko (1958) maintained that the explicitness of any awareness task can be manipulated through the use of non-lexical stimuli, as this increases the demand for conscious control by testing knowledge of generalizable rules about morphology. Berko used oral descriptions of pictures to elicit suffix use, and so, to elicit a diminutive suffix, the following example was used: “This is a wug…This is a very tiny wug…What would you call a very tiny wug?” This technique was later adopted by Derwing (1976) who proposed that it was the learning of morphological rules which enabled a child to use suffixes “productively in the creation of new derived words of the same type (including overgeneralizations…” (p.40). In agreement with this position, it was noted in the review presented above that production accuracy decreased when non-lexical stimuli were introduced which would be consistent with the presence of an increased explicit demand through this manipulation. Thus, it appears possible that this technique could be a useful tool in assessing knowledge about derivational morphology as it may offer the possibility of distinguishing the learning of specific instances of derived words from more sophisticated rule-based knowledge.

Cross-linguistic Comparison of Awareness of Derivational Morphology

Although judgment and production skills are clearly emerging in both French- and English-speaking children during early schooling, cross-linguistic comparison of the rate of progress is difficult because of methodological differences between the English and French studies. For example, it is only in studies of older children (Grade 3 onwards) that a broad range of suffixes tends to be examined in English, whereas in French a wide range of suffixes is typical, even in studies of pre-school children. One question to be resolved is whether these methodological differences are simply coincidental or whether instead these differences reflect a response to
differing rates of development for awareness of derivational morphology in the French and English languages.

Our attempt to gather evidence about this issue has been hampered by the lack of cross-linguistic data in the field. Comparison of meta-linguistic development across languages provides an excellent opportunity to investigate the influence of native language on development but while this technique has been used in studies of meta-phonological development (e.g. Duncan, Colé, Seymour & Magnan, 2006), it has never to our knowledge been applied to the study of derivational morphology. The nearest approximation that we can find to cross-linguistic experimental work is to compare two separate single-language studies which investigated awareness of equivalent suffixes in French and English using the same type of production task. The first study, by Clark and Hecht (1982), examined the production of the –er suffix in English (e.g. “I’ve got a picture here of someone who burns things. What could we call someone who burns things? Someone who burns things is a ______?”(burner)); and the second, by Seidler (1988³), investigated the –eur suffix in French (e.g. “Comment pourrait-on appeler un homme qui cache de l’argent?” (cacheur) which can be translated as “What could you call a man who hides money?” (hider)). Each suffix performs a similar function in derivation, takes both agentive and instrumental forms and is highly productive relative to other suffixes in the language. Clark and Hecht reported English production rates for two age ranges 4;6 to 5;2 and 5;3 to 6;0 which, when averaged, give an 84% accuracy rate for novel agentive nouns and 71% for novel instrumental nouns⁴. The accuracy rates amongst a comparable French group aged 4;7 to 5;11 in Seidler’s study were slightly higher, at 90% and 84%, respectively, in spite of the lack of picture support. Furthermore, the proportion of English-speakers who showed consistent use
of –er for both agents and instruments (58%) was smaller than the proportion of French children showing consistent use of –eur (75%).

While the results show evidence of explicit morphological processing by both groups, a slight cross-linguistic difference in favor of the French-speaking children is also apparent. Nevertheless, the differences are small in magnitude making it difficult to draw any strong conclusions from these data. Another reason for caution is that both studies restricted their focus to just one, extremely productive, suffix, which may be acquired atypically early in English (Derwing, 1976; Clark, 1993).

The Present Study

Our aim in this cross-linguistic study is to begin to relate data on the development of morphological awareness to native language context and by so doing to gain insight into the linguistic factors which drive the acquisition of derivational knowledge in English and French. The first objective is to explore the evidence that a transition from implicit to explicit knowledge about derivational morphology takes place during the first year of schooling. Carlisle (1995) provided evidence in support of this position but our review of the literature suggests that this may be a more limited effect than first thought. One point of interest is whether the transition in morphological awareness may be largely restricted to the highly productive suffix which is most often studied in English, namely –er. In the experimental work to follow, we widen the range of derivational suffixes examined in tasks based on those originally used by Carlisle, and we also explore the effect of heightening the explicit demands of the production task through the inclusion of non-lexical stimuli. The expectation is that the development of explicit morphological knowledge may be more advanced for the highly productive–er suffix (and for the equivalent –eur suffix in French) than for other derivational suffixes, for which meta-
morphological development may extend throughout the school years and may be partly dependent on reading acquisition (Mahony et al, 2000).

Although differing methodologies confuse the picture, existing single language studies suggest that French children may be slightly more advanced than their English-speaking peers in their knowledge about derivational suffixes which would tie in with the greater productivity of derivation in French word formation. Therefore, our second objective is to begin to examine cross-linguistic differences in school-aged children’s knowledge about derivational morphology through relating performance rates and error pattern in matched judgment and production tasks to native language. A difference in the educational system between France and the UK complicates this endeavor as children begin school a year later in France (age 6 years) than in the UK (age 5 years). Therefore, we will make the cross-linguistic comparison in two ways by investigating meta-morphological development in relation to (a) educational level in Experiment 1 (where chronological age necessarily differs between language groups); and (b) maturational level in Experiment 2 (where year of schooling necessarily differs between language groups).

EXPERIMENT 1

In this exploration of morphological development in relation to educational level, a cross-sectional analysis will be conducted in the first and third year of schooling in the UK and France. The introductory review identifies this period of early schooling as one of considerable interest in relation to the emergence of knowledge about derivational morphology (Anglin, 1993; Carlisle, 1995; Casalis & Louis-Alexandre, 2000). By assessing children in their first year of schooling, it is hoped to gain insight into the morphological skills that have developed largely during language acquisition in the pre-school period and that are available to children early in
their school careers. Examination of the older group of Grade 3 children is designed to explore the additional effects of longer-term exposure to school-based language and reading instruction.

A recent meta-analysis of data from 827 children reported that morphological awareness shows a moderate correlation with vocabulary and reading between Kindergarten and Grade 9 for alphabetic orthographies, including both French and English (Sénéchal & Kearnan, 2007). Such associations emphasize the need to match the language groups on vocabulary and reading progress and also point to the importance of considering the nature of the French and English derivational systems not only with respect to oral language but also in relation to the written form of each language. While the French and English orthographies both have a morpho-phonological structure, there is a higher degree of opacity in the grapheme-phoneme correspondences underlying derivational relations in English (e.g. heal-health). Although some evidence suggests that morphological awareness can predict early reading skills in English (Carlisle & Nomanbhoy, 1993; Carlisle, 1995), these findings may have been mediated by vocabulary skills since other studies which have controlled for vocabulary and phonological awareness imply that awareness of derivational morphology makes a much later contribution to word decoding from Grade 5 onwards (Carlisle, 2000; Mahony et al, 2000; Singson et al, 2000; Nagy, Berninger & Abbott, 2006). Extension of this work led Mann and Singson (2003) to propose that children in this older age range parse morphologically complex words into base and suffix in order to apply morpho-phonological rules to increase decoding accuracy in the irregular English orthography (see also Nagy et al, 2006).

In the more transparent French orthography, a rich set of connections between early morphological knowledge and *early* reading have been found. Kindergarten derivational skills have been shown to predict text reading and vocabulary skills in Grade 1 (Colé et al, 2004).
These links have been shown to survive controls for vocabulary skill in a study by Casalis and Louis-Alexandre (2000), in which kindergarten derivational skills predicted word decoding in Grade 2 and Grade 2 derivational knowledge was a concurrent predictor of both word decoding and reading comprehension.

Thus, in the experimental work to follow, the available evidence suggests that meta-linguistic awareness of derivational morphology is likely to develop earlier and to be more influenced by early schooling in French than in English.

METHODOLOGY

Participants

The participants were drawn from schools in Scotland and France with a similar middle-income socio-economic intake. Informed consent was obtained for children in the first (Grade 1) and third (Grade 3) year of schooling in each country and after testing on standardized tests of word recognition and receptive vocabulary (see Materials and Procedure for details), language groups were formed which were well matched on these background measures. There were only 15 children in each group and the small-sample size needs to be borne in mind in interpreting our later analyses due to low statistical power. The French children were native French-speakers and the Scottish children were native English-speakers. The average ages of the English-speaking groups were 6 years 1 month in Grade 1 (range: 5;8-6;8) and 8 years in Grade 3 (range: 7;8-8;5). On average, the French language groups were aged 6 years 8 months in Grade 1 (range: 6;5-7;3) and 8 years 8 months in Grade 3 (range: 8;1-9;7). At each grade level, a t-test showed that the French-speaking children were significantly older than the English-speaking children due to the different ages of formal schooling in each country (Grade 1: t(28) = 5.59, p < .001; Grade 3: t(28)= 4.59, p < .001).
Materials and Procedure

Background Measures. Receptive vocabulary was measured using the British Picture Vocabulary Scale in the UK (Dunn, Dunn, Whetton, & Pintillie, 1982) and the Échelle de Vocabulaire en Images Peabody in France (Dunn, Thériault-Whalen, & Dunn, 1993). A receptive vocabulary test was used to obtain a base measure of the children’s word knowledge without adding the extra dimension of explicit verbal analysis of the word’s meaning that would be entailed in a test of expressive vocabulary. To assess word recognition, the British Abilities Scales Word Reading subtest (Elliot, Murray, & Pearson, 1983) was used in the UK and the Alouette test (Lefavrais, 1963) in France. The background measures were always completed before the experimental tasks (Lexical Judgment, Lexical Production, Non-Lexical Production), which were presented in a pseudo-randomized order to ensure that the Lexical version of the Production task was always presented before the Non-Lexical version.

Lexical Judgment Task. This oral task (adapted from Mahony et al (2000)), asks children to decide whether two words belong to the same morphological family (e.g. heat-heater) or not (e.g. ham-hammer). In English, the children were told “In this game, I’m going to give you two words that are a little bit like each other. You have to tell me each time whether the words that I say are from the same family or not. Let’s practise a little bit: kind and kindness, are they from the same family? Teach and teacher? Rob and robin?” The children were given corrective feedback about the answers for the practice items. At no point did the children see the words in written form. The format of the instructions and procedure was the same in French.

Words in both target and foil pairs were phonologically similar. The experimental items contained 10 target pairs and 10 foil pairs in each language and these were randomized for presentation to each child (see Appendix (a) for stimuli).
Lexical Production Task. In this oral task (adapted from Berko (1958)), children produce a derivation in order to close a sentence spoken by the experimenter. Both the root and the derivation were real words (e.g. Someone who runs is a ……? (runner)) and the phonological relationship between root and derivation was always transparent. The instructions given to the children were as follows: “You have to complete the sentences with a word from the same family as the one that I use. Someone who cleans is a…? (cleaner). When you move you make a…? (movement). At no point did the children see the sentences in written form. Corrective feedback was given for the practice items and the instructions given to the children followed exactly the same format in each language.

The 10 sentence frames in each language were designed to elicit diminutive, agentive, instrumental and collective/abstract derived forms in French and diminutive, agentive, locative, and collective/abstract forms in English (see Appendix (b) for materials). These sentence frames were randomized for presentation to each child. Using the databases MANULEX (Lété, Sprenger-Charolles, & Colé, 2004) and CPWD (Stuart, Dixon, Masterson, & Gray, 2003), the mean frequency per million was calculated for all of the roots and derivations as they appear in the sentence frames (see Appendix (b)). There was no significant difference in the frequency of French and English roots, $t(18) = 0.92, p > .05$, or derivations, $t(18) = 0.82, p > .05$. In each language, roots were more frequent than derivations, significantly so in the case of English, $t(9) = 2.61, p < .05$, but not in French, $t(9) = 1.87, p > .05$.

Non-lexical Production Task. This Non-lexical version of the oral Production task was designed to assess more explicit knowledge of derivational morphology by asking children to derive novel forms to order. The children were asked to construct novel (non-lexical) derivations from either a word root (e.g. Someone who needs is a…? (needer)) or a nonword root (e.g. Someone who lums
is a…? (lummer)). All of the items were designed to elicit non-existent but plausible derivatives. Although the same sentence frames were used in both the Lexical and Non-lexical version of the Production task, responses were not so highly constrained in the Non-lexical version because the children could select any appropriate suffix in producing the derivation. For example, with a diminutive sentence frame like “A little feep is a…?”, any of the diminutive suffixes (-y/-ie, -let) could have been used to form the non-lexical derivation (e.g. feepie, feeplet).

The Non-lexical version of the Production task was always administered after the Lexical version and the order of the Word and Nonword root conditions was counterbalanced. Within each condition the ten sentence frames were randomised for presentation to each child. The instructions given to the children in the Word Root condition were: “You are going to do the same thing with the sentences that I give you but this time you have to make up new words which are like real ones. For example, if you had to make up a new word what would you call someone who wants something? Someone who wants something is a…? When you park you make a…?” For the Nonword Root condition the instructions were: “We’re going to do the same thing but this time with made-up words. Even though the words aren’t real you can still try to give them the right ending. Someone who groons is a…? When you laip you make a…?” At no point did the children see the sentences in written form. Corrective feedback was given using the nonsense derivations “wanter”, “parkment”, “grooner” and “laipment” but any morphologically appropriate derivation made up by the child would be accepted as correct. The format of the instructions and procedure was the same in French.

The word and nonword roots used in this task are listed in Appendix (c). The word roots were matched for frequency per million between the languages, \( t(18) = 0.49, p > .05 \), and did not
differ significantly in frequency from the roots used in the Lexical Production task in either French, \( t(9) = 0.33, p > .05 \), or English \( t(9) = 0.48, p > .05 \).

**Coding of responses:** A correct response in the Lexical Production task corresponded to a specific vocabulary item. Responses in the Non-lexical Production task, however, were less constrained because a child could generate an appropriate novel derivation using any one of a number of suffixes all of which perform the same function in word formation. This potential for variation was incorporated into the scoring scheme by marking as correct any novel derivation that respected the semantic and syntactic constraints of the sentence frame. In practice, the variation in response turned out to be small in both French and English and any alternative suffix usage was verified using guidance from the *Oxford English Dictionary* or the *Trésor de la Langue Française* in French.

The remaining responses in the Production task were considered to be errors and were assigned to one of the categories in the following classification scheme. Actual error responses to the English item “A little mouse is a …?” (correct response: mouselet or mousie) are used to illustrate the scheme: 1) **Real Word** – a non-derived word that is semantically and syntactically appropriate (e.g. “vole”); 2) **Wrong Suffix** – derivation of the root using a suffix that is inappropriate in the context (e.g. “mouser”); 3) **Wrong Root** – derivation that uses an inappropriate root with either a correct or incorrect suffix (e.g. “tinser”); 4) **Compound** – a compound form which involves the root from the sentence frame (e.g. “mini-mouse”); 5) **Repeat Root** (e.g. “mouse”) and 6) **Refusal**. All of the remaining errors that were not classifiable according to this scheme were categorized as 7) **Other.** This category consisted mainly of one-off error responses (e.g. “little”) and a small but noticeable number of phonological substitutions (e.g. “touse”).
The reliability of the coding schemes was obtained from two coders (native-speakers) in each country who independently coded 20% of the data from their own language group. Inter-rater agreement rates were 94% in French and 96% in English. The remaining discrepancies were resolved by consensus.

RESULTS
Means and standard deviations for the background measures and experimental tasks can be inspected in Table 1.

--- Table 1 about here ---

Background Measures
Average performance in the word recognition and receptive vocabulary tests was found to be average or slightly above average for chronological age at each grade level in each country according to the age-normed scores (see Table 1). As the French children were older than the UK children at each grade level, the important language group comparison is not between absolute test ages but between test ages relative to chronological age. At Grade 1, analyses showed that reading and receptive vocabulary were ahead of age by a similar amount in each language group (Reading: Mann-Whitney U = 107, p > .05; Receptive Vocabulary: Mann-Whitney U = 86.5, p > .05). Receptive vocabulary and reading age tended to be above chronological age in both language groups at Grade 3. However, the English-speakers appeared to have better reading skills for chronological age than the French-speakers (Mann Whitney U = 62.5, p < .05), whereas, the French children appeared to have a more advanced receptive vocabulary for age than the English-speakers (Mann Whitney U = 63, p < .05).
**Lexical Judgment Task**

Means and standard deviations are shown in Table 1. One-sample t-tests indicated that the performance of each group was significantly above chance (English Grade 1: \( t(14) = 5.34, p < .001 \); English Grade 3: \( t(14) = 6.27, p < .001 \); French Grade 1: \( t(14) = 7.31, p < .001 \); French Grade 3: \( t(14) = 11.30, p < .001 \)). A two-way between-participants ANOVA with factors, Language (English, French) and School Year (Grade 1, Grade 3), showed significant main effects of Language, \( F(1,56) = 7.21, p < .05, \) \( \eta_p^2 = .11 \), and School Year, \( F(1,56) = 6.98, p < .05, \) \( \eta_p^2 = .11 \). The interaction of these factors was not significant, \( F < 1 \). The French children, who were a year older than their UK counterparts in each grade, consistently performed at a higher level but, importantly, both groups showed a similar degree of improvement with schooling.

**Lexical Production Task**

Table 1 contains means and standard deviations for each group. A two-way between-participants ANOVA with factors, Language (English, French) and School Year (Grade 1, Grade 3), revealed significant main effects of Language, \( F(1,56) = 174.49, p < .001, \) \( \eta_p^2 = .76 \), and School Year, \( F(1,56) = 18.26, p < .001, \) \( \eta_p^2 = .25 \), but no interaction, Language by School Year, \( F(1,56) = 1.85, p > .05 \). The French children performed most accurately and each language group showed a similar improvement between the first and third year of schooling\(^8\).

**Error Analysis:**

For the two school years in each country, the mean number of error responses for each error category was calculated by items in all three conditions of the Production task (see Table 2). Inspection of the results reveals considerable variation between error categories in both groups and zero cells within the French dataset. The zero cells may reflect the greater accuracy of the French group resulting in a narrower range of errors. Strategic factors may also be at play as the
older French children, for example, made no Real Word responses in either of the non-lexical conditions.

--- Table 2 about here ---

In order to be able to analyze the French data, separate analyses were conducted for each condition using only those error categories without zero cells. For Lexical Production, a two-way ANOVA with within-items factors School Year (Grade 1, Grade 3) and Error Type (Real Words, Wrong Suffix, Wrong Root, Repeat Root, Refusals) found no significant effects (School Year: $F(1, 9) = 4.00, p > .05$; Error Type: $F(4, 36) = 1.72, p > .05$; School Year by Error Type: $F < 1$).

It was possible to include all error categories in the English error analysis for the Lexical Production task. The two-way ANOVA showed a significant main effect of School Year indicating that more errors were produced in Grade 1 than in Grade 3, $F(1, 9) = 10.68, p = .01, \eta^2_p = .54$. The Greenhouse-Geisser correction was necessary for the other effects (Error Type: $F(3, 27) = 4.12, p < .05, \eta^2_p = .31$; School Year by Error Type: $F(2, 20) = 2.08, p > .05$). A post-hoc Tukey test ($\alpha = .05$ throughout) was used to examine the significant effect of Error Type but variation appeared to prevent any differentiation between the error categories.

**Non-lexical Production Task**

Performance levels were lower in this version of the production task although the French children scores still appeared higher than those of the English-speakers (see Table 1). A three-way mixed ANOVA was conducted on the data with between-participants factors, Language (English, French) and School Year (Grade 1, Grade 3), and within-participants factor, Condition (Word Root, Nonword Root). There were significant main effects of Condition, $F(1,56) = 20.16, p < .001, \eta^2_p = .27$, Language, $F(1,56) = 56.55, p < .001, \eta^2_p = .50$, and School Year, $F(1,56) =$
17.23, \(p < .001, \eta_p^2 = .24\). The interactions Condition by School Year, Language by School Year
and Condition by Language by School Year were not significant (\(F < 1, F(1,56) = 1.60, p > .05\)
and \(F < 1\), respectively), indicating that the language groups showed a similar improvement in
production with schooling. However, the interaction, Condition by Language, \(F(1, 56) = 13.36, p < .005, \eta_p^2 = .19\), was significant with simple effects revealing no difference between the Word
and Nonword Root conditions for the English-speaking children, \(F < 1\), but a significant
advantage for Word over Nonword Roots, \(F(1,56) = 33.18, p < .001\), amongst the French children.

**Error Analysis:** A two-way ANOVA was conducted on the French data from the Word Root
condition of the Non-lexical Production task by restricting the error types to Wrong Suffix,
Wrong Root, Compound, Refusals and Other. There was no effect of School Year, \(F < 1\) and use
of the Greenhouse-Geisser correction was necessary for the other two effects (Error Type, \(F(3, 23) = 26.28, p < .001, \eta_p^2 = .75\); School Year by Error Type, \(F(2, 17) = 5.38, p < .05, \eta_p^2 = .37\)).
Simple effects indicated a significant differentiation between errors in each grade (Grade1: \(F(2, 17) = 7.48, p < .01\); Grade 3: \(F(2, 17) = 23.60, p < .001\)), which was followed up using Tukey
tests. The pattern was one of increasing prominence of Wrong Suffix errors. In Grade 1, Wrong
Suffix errors were equally as common as Refusals and Other errors but could be differentiated
from the least common categories Wrong root and Compound errors, whereas, by Grade 3,
Wrong Suffix errors were more frequent than any other error type. In the Nonword Root
condition, only Wrong Suffix and Other errors occurred at Grade 3 so the analysis was restricted
to these types. The two-way ANOVA showed significant effects of School Year, \(F(1, 9) = 6.62, p < .05, \eta_p^2 = .42\), and School Year by Error Type, \(F(1, 9) = 43.00, p < .001, \eta_p^2 = .83\), but no
main effect of Error Type, \(F < 1\). Simple effects revealed that Other errors were more common
than Wrong Suffix errors at Grade 1, $F(1, 9) = 13.94, p < .01$, but this pattern was reversed at Grade 3, $F(1, 9) = 30.69, p < .001$.

English errors (all categories) in the Non-lexical Production task were analyzed using a three-way mixed ANOVA with between-items factor, Condition (Word Root, Nonword Root), and within-items conditions, School Year and Error Type. The effect of Condition did not feature in any significant effects showing that error responses were similar for both word and nonword roots. Once again more errors were made in Grade 1 than in Grade 3, $F(1, 18) = 16.46, p < .01$, $\eta_p^2 = .48$. The Greenhouse-Geisser correction was necessary for the effects of Error Type, $F(3, 57) = 6.18, p < .01$, $\eta_p^2 = .26$, and School Year by Error Type, $F(4, 64) = 7.62, p < .001$, $\eta_p^2 = .30$. According to simple effects, the errors were differentiated in Grade 1, $F(3, 64) = 15.55, p < .001$, and in Grade 3, $F(3, 64) = 12.62, p < .001$. Tukey tests indicated that in Grade 1, the Real Word and Repeat Root errors were more common than Wrong Suffix, Wrong Root and Compound errors, and Refusals were more common than Wrong Root errors. By Grade 3, the prominence of Wrong Suffix errors had increased to the level of Real Word errors and the incidence of Repeat Root errors had decreased markedly.

--- Figure 1 about here ---

Overview of Production Performance

In spite of the differences in the nature of the lexical and non-lexical versions of the Production task, an exploratory three-way mixed ANOVA was conducted to compare performance across the lexical and non-lexical conditions of the Production task (see Figure 1). This analysis revealed a significant Condition by Language by School Year interaction, $F(2, 112) = 3.50, p < .05$, $\eta_p^2 = .06$. Investigation of simple effects for the French groups showed that Condition was significant, $F(2, 112) = 137.06, p < .001$, but the interaction, Condition by School Year, was not,
The French children exhibited a consistent pattern of response in each school grade: real words > word root > nonword root (shown using Tukey tests). Amongst the English-speaking group, Condition by School Year was significant in an analysis of simple effects, $F(2, 112) = 3.70, p < .05$, showing that the pattern of performance changed between Grade 1 and Grade 3 in English. The effect of condition was not significant in Grade 1, $F(2, 112) = 2.00, p > .05$, indicating that performance was equally poor in all three conditions. Nonetheless, performance was clearly above floor-level. No child scored zero in all three conditions since the two items in each condition containing the suffix –er tended to elicit at least one correct response. In contrast, the Grade 3 children showed a significant distinction between the conditions, $F(2, 112) = 13.79, p < .001$, and a post-hoc Tukey test revealed the following pattern of response: real words > word root = nonword root.

To provide a qualitative insight into the cross-linguistic differences revealed in the statistical analysis, graphs were drawn to illustrate the spread of correct responses across the range of suffixes tested in each language (see Figure 2). Although French accuracy can be seen to decline as the task becomes increasingly non-lexical, the French children’s ability to manipulate suffixes does not appear to narrow substantially in range. By Grade 3, the French group demonstrate a good capacity to perform even the most explicit level of manipulation with three different suffixes (-ette, -eur and –age), whereas this level of performance was only observed for the –er suffix in English.
DISCUSSION

The results indicate that the ability to perform the Lexical Judgment task is well advanced by the outset of schooling and that this ability shows a consistent growth with grade level in each language. In contrast, the pattern of performance in the Production task is suggestive of qualitative differences between the language groups, especially in relation to derivations based on word roots. Production skills were generally poor amongst the Grade 1 English-speakers except for responses to stimuli using the –er suffix which were generally extremely good. Of the three production conditions, Lexical Production showed the most improvement between Grades 1 and 3 in English. Non-lexical skills, however, did not improve significantly during this period and appeared available only for the –er suffix. French children, on the other hand, seem to begin schooling with a well-developed production capacity which is broader in scope. Steady progress was also observed in each condition between the first and third grades in France and, at each grade level, production accuracy fell systematically as the task became increasingly non-lexical in nature.

Errors in the Production task were less numerous amongst the French groups and fell within a narrower range of error categories. Neither language group showed much differentiation between error categories in the Lexical Production task, although the French children made no Compound errors in Grade 1 and no unclassifiable (Other) errors in Grade 3. With Non-lexical Production, Wrong Suffix errors were amongst the most frequent errors made by the French children from Grade 1 onwards and Real Word and Repeat Root errors had completely disappeared from their responses by Grade 3. The English-speakers were much more prone to give Real Word or Repeat Root responses and these, together with Refusals, were the most
common error categories in Grade 1. By Grade 3, however, *Real Word* and *Wrong Suffix* errors were most common.

**EXPERIMENT 2**

Accuracy was higher in French than in English in each task and at each grade level in Experiment 1. This was a likely outcome given the age differences in school entry that existed between the language groups. Thus, to complete our cross-linguistic comparison, it was important to conduct a second experiment to match the UK and French groups on chronological age and receptive vocabulary in order to compare awareness of derivational morphology at a similar phase of maturation and language development in each country. The children who took part in Experiment 2 were aged eight years and, due to the differences in the educational systems, the English-speakers may have had an advantage as they had received one more year of schooling than the French children. The expectation is that the age-match will reduce the quantitative differences between the language groups which were observed in Experiment 1, but that the qualitative differences between the groups may prove more resistant if these are linked to cross-linguistic differences between the English and French languages.

**METHODOLOGY**

**Participants**

Participants were selected in the same manner and from the same schools that were used in Experiment 1. The 15 children in each language group were similar in chronological age (English: 8 years (range: 7;8-8;5); French: 7 years 11 months (range: 7;6-8;3); \( t(28) = 1.65, p > .05 \)). Each child was assessed individually over three or four sessions lasting approximately 20 minutes each.
Materials and Procedure

These were identical to Experiment 1.

--- Table 3 about here ---

RESULTS

Background Measures

The English-speaking children had received one more year of schooling than the French children. As can be seen from the age-normed scores in Table 3, reading progress was normal for chronological age in each group (English: 8 years 10 months (SD=0;9); French: 8 years 1 month (SD=0;11)), but in real terms this meant that the UK group had received one more year of reading instruction than the French group. It can also be seen that there was a tendency for the English-speakers to have stronger reading than receptive vocabulary skills for age, whereas the converse pattern was observed amongst the French-speakers. Nevertheless, the important point for the present analysis is that receptive vocabulary age did not differ significantly between the groups (English: 8 years 2 months (SD=0;10); French: 8 years 10 months (SD=1;8); Mann-Whitney U = 91.50, p > .05).

Lexical Judgment Task

The mean percentage accuracy scores for the English and French language groups were 75.19% and 83.67%, respectively (see Table 3). Examination of the data using one-sample t-tests indicated that both groups performed significantly above chance in this lexical judgment task (French: t(14) = 13.41, p < .001; English: t(14) = 6.27, p < .001). Although the French children tended to outperform the English-speaking children, an independent-samples t-test showed this difference to be non-significant, t(28) = 1.79, p = .08.
**Lexical Production Task**

Inspection of Table 3 indicates that mean performance levels for producing real derivations were noticeably higher in French (73.33%) than in English (39.33%) and this difference was significant in an independent-samples t-test, \( t(28) = 6.24, p < .001 \).

--- Table 4 about here ---

**Error Analysis:** For each language, the mean number of error responses made for each error category was calculated by items in each condition of the Production task (see Table 4). A two-way mixed ANOVA was conducted on the errors from the Lexical Production task with between-items factor, Language (English, French), and within-items factor, Error Type (Real Word, Wrong Suffix, Wrong Root, Compound, Repeat Root, Refusal, Other). It was necessary to use the Greenhouse-Geisser correction for the effect of Error Type, \( F(3, 54) = 2.73, p = .05, \eta^2_p = .13 \). A Tukey test failed to differentiate the error types possibly because of the marginal nature of the result. The main effect of Language was also significant with more errors being made in English, \( F(1, 18) = 5.96, p < .05, \eta^2_p = .25 \), but there was no interaction between Error Type and Language, \( F < 1 \).

**Non-lexical Production Task**

A two-way mixed ANOVA was conducted with between-participants factor, Language (English, French), and within-participants factor, Condition (Word Root, Nonword Root). Both main effects were significant (Language: \( F(1, 28) = 7.74, p < .05, \eta^2_p = .22 \); Condition: \( F(1, 28) = 9.89, p < .01, \eta^2_p = .26 \)), as was the interaction Condition by Language, \( F(1, 28) = 12.51, p < .01, \eta^2_p = .31 \). Simple effects showed that the French children performed at a higher level than the English-speakers on word root items, \( F(1, 28) = 30.90, p < .001 \), however, the groups performed at a similar level on nonword root items, \( F < 1 \).
Error Analysis: As the French children made no Refusals in the Word Root condition and no Real Word errors in the Nonword Root condition (see Table 4), these error types were omitted from the analysis of the Non-lexical Production errors. The three-way mixed ANOVA with between-items factors Language (English, French) and Condition (Word Root, Nonword Root) and within-items factor, Error Type (Wrong Suffix, Wrong Root, Compound, Repeat Root, Other). The Greenhouse-Geisser correction was used for the effect of Error Type. The only significant effects were Error Type, $F(2, 58) = 34.22, \ p < .001, \ \eta^2_p = .49$, and Error Type by Language, $F(2, 58) = 3.64, \ p < .05, \ \eta^2_p = .09$. An analysis of simple effects revealed that the French data contained significantly more errors involving the use of the Wrong Suffix than the English dataset, $F(1, 58) = 6.01, \ p < .05$, but no other differences achieved significance ($Fs < 1$).

--- Figure 3 about here ---

Overview of Production Performance

As in Experiment 1, an exploratory two-way mixed ANOVA was conducted to compare performance across the three conditions (see Figure 3). This analysis revealed a significant Condition by Language interaction, $F(2, 56) = 13.12, \ p < .001, \ \eta^2_p = .32$. Both language groups showed significant simple effects of condition (English: $F(2, 56) = 9.09, \ p < .001$; French: $F(2, 56) = 54.77, \ p < .001$) which were followed up using Tukey tests. These indicated different relationships amongst the three conditions in the two language groups (English: real words > word root = nonword root; French: real words > word root > nonword root).

--- Figure 4 about here ---

The distribution of correct responses across suffixes for each language in each condition is displayed in Figure 4. Examination of the French pattern shows that accurate productions spread
across a wider range of suffixes than in English. Although French knowledge is observably more extensive in the Real Word and Word Root conditions, French and English performance is more similar in the Nonword Root condition where both groups appear most secure in the explicit manipulation of the –er/-eur suffix.

DISCUSSION

Only marginal cross-linguistic differences emerged in the Lexical Judgment task as performance levels in both groups were high (>70%) and well above chance. This contrasted with results of the Lexical Production task where a clear advantage for the French children emerged. Although links have been drawn between derivational knowledge and vocabulary development (Freyd & Baron, 1982; Anglin 1993), production of real derivations was worse in English than in French in spite of equivalent receptive vocabulary skills for age in both groups, and in spite of both roots and derivations being matched in frequency between languages.

Production accuracy fell in both groups as the task became more non-lexical suggesting that the demands for morphological processing became more explicit. The English-speakers appeared most affected by this manipulation and showed lower production accuracy than the French children in the word root conditions, although both groups were equally poor at producing derivations based on nonword roots. For the UK children, the production of non-lexical derivations was largely restricted to the –er suffix, whereas the French children were able to manipulate a greater range of suffixes in the context of a real word root but their performance range also narrowed in the Nonword Root condition to the -eur suffix (the French equivalent of the English suffix –er). The errors made by the two language groups were similar in the Lexical
Production task but the French children differed from the English-speakers in Non-lexical Production in that they made no *Real word* errors and significantly more *Wrong Suffix* errors.

To summarize, a high degree of similarity was evident between languages in the eight-year-olds’ ability to make judgments about morphological relations. However, differences emerged in production ability and, in spite of having received one year less of schooling than their UK peers, the French children displayed superior morphological knowledge in this task and a greater ability to generalize that knowledge to novel contexts.

**GENERAL DISCUSSION**

In Experiment 1, the two language groups were matched on exposure to formal schooling and, as a result, differed in age, whereas, in Experiment 2, a chronological age match was used to equate the groups on their level of cognitive and linguistic maturation. Each manipulation produced a contrasting pattern of cross-linguistic performance on judgment and production measures of morphological awareness which will be explored below.

*Lexical judgment task*

The eight-year-olds in each country exhibited comparable sensitivity to morphological relatedness. The children scored well above chance with the language groups differing only marginally in their accuracy at distinguishing word roots and their derivations (e.g. heat-heater) from other word pairs related only phonologically (e.g. ham-hammer). Furthermore, development between the first and third years of schooling appeared to progress at a similar rate in the French and English samples.

Tyler and Nagy (1989) referred to the ability to “see morphological relations between two words that share a common base morpheme” (p.649) as *relational* knowledge and proposed that this constituted the basis for developing an understanding of both the syntactic properties of
suffixes and the distributional constraints on their use. Relational knowledge may additionally contribute to vocabulary development as the drawing of semantic inferences between root morphemes and the whole form is held to be central to deciphering the meaning of derived words (Freyd & Baron, 1982; Anglin, 1993). Our results suggest that French and UK children have similar relational capabilities by the age of eight years. It is around this age that there is known to be a sharp rise in the number of derivations in English-speaking children’s vocabulary (Anglin, 1993), and it is of interest to know whether French children undergo a similar pattern of vocabulary acquisition or whether derivations begin to be assimilated into vocabulary at an earlier point in French.

Carlisle and Nomanbhoy (1993) were careful to highlight the dependence of morphological learning on phonological, semantic and syntactic knowledge during language acquisition (see Clark (1993) for a review). Testing the relative contributions of these factors to morphological awareness remains a challenge not least because one view is that morphological knowledge is the result of a synergistic convergence of the phonological, orthographic and semantic aspects of words (e.g. Seidenberg & Gonnerman, 2000; Gonnerman, Seidenberg & Andersen, 2007). However, when Carlisle and Nomanbhoy examined the contribution of phonological awareness to performance in their morphological judgment test they found no significant association. This null effect seems likely to have been due to the control for phonological similarity that is embedded within their task which, as in the present study, compared items which were equally phonologically similar but differed in terms of morphological relatedness (e.g. heat-heater versus ham-hammer). An interesting question for future research is whether the judgment task requires any specifically morphological knowledge
about the relation between the “morphologically-related” pairs (e.g. heat-heater) or simply sensitivity to the greater *semantic* relatedness of these items.

*Production Task*

Comparison of levels of performance in the lexical judgment and production tasks is complicated by format differences (yes-no decision vs. response production), however, the evidence is consistent with judgments about morphological relatedness being somewhat easier than the production of derivations. The advantage for judgment over production was only about 3-10% for the French groups, whereas in English the advantage was larger at 35-45%. There did not appear to be a necessary relationship between judgment and production skill as was evident in Experiment 2 where the two language groups had very similar levels of judgment (approximately 80%) but discrepant levels of production. One possible explanation for this pattern of results is that the production task is tapping a more explicit level of awareness than is required in the judgment task. According to Gombert (1992), more implicit forms of awareness are considered necessary for further meta-linguistic development but are not regarded as a sufficient condition for meta-awareness to emerge. Thus, it would be possible for two groups to have similar implicit skills but for only one of those groups to have moved beyond this point towards more explicit processing.

Nevertheless, another possible contributing factor to the differing levels of judgment and production performance is that a purely semantic strategy can be used to successfully discriminate examples like “heat-heater” from “ham-hammer” in the lexical judgment task, whereas in lexical *production* such a strategy is likely to increase the incidence of semantically-based *Real Word* errors (e.g. “A little mouse is a…vole”), as was observed particularly amongst the (younger) English groups. Therefore, it is difficult to say with any certainty that the
difference between task performance levels is best described as a difference solely in terms of the meta-linguistic demands of the lexical judgment and production tasks, as concluded by Carlisle (1995), rather than as a difference in the morphological specificity of the task requirements. This is an important empirical question that will require further research. For the present, our study attempted to strengthen the explicit demands of the production task itself by adding two non-lexical conditions involving the construction of a novel derivation from a word or nonword root. This type of non-lexical production was observed to be significantly more difficult than lexical production in both our experiments, suggesting that this manipulation increases the demand for explicit control over morphological knowledge (Berko, 1958; Manza & Reber, 1997). Interestingly, however, the most explicit version of the production task, in which both root and derivation are nonsense words, proved to be equally challenging for the eight-year-olds in each country. Therefore, it seems that although the French children were advancing more quickly along the path of meta-morphological development than the English-speakers, they still have some way to develop before full explicit control over the use of derivational suffixes is achieved.

Error patterns were consistent with the differing pace of meta-morphological development in each country. The UK children made many real word substitutions that were plausible according to the semantic and syntactic constraints of the task. This error was not typical of the French groups who, as early as Grade 1, made a large proportion of errors that indicated an attempt to form a derivation but which were unsuccessful because of the use of the wrong suffix. By Grade 3 this category dominated the French error responses but was only beginning to emerge as an important error category amongst the English-speaking group.
The transition from implicit to explicit knowledge about derivational morphology

Carlisle’s (1995) proposal that the transition to explicit morphological awareness takes place during the first year at school receives most support from the French dataset. As early as Grade 1, the French children displayed a good knowledge of real word derivations and could generalize this knowledge to produce novel derivations from word roots. This contrasted markedly with the performance of the English-speakers whose knowledge of derivational suffixes was poor in Grade 1 and whose ability to generate novel derivations improved only slowly during the first three years of schooling. Our findings for English, therefore, argue against the proposal that a general transition to explicit processing of derivational morphology occurs before the end of Grade 1.

The reason for the inconsistency with some of the earlier findings for English seems likely to lie in our use of a larger set of derivational suffixes and our heightening of the explicit demands of the Production task. Both of these manipulations appear to have exposed limitations in the explicit skills of the English-speakers. When we restrict the focus to the –er suffix, a precocious ability to manipulate this particular suffix is evident from Grade 1. Therefore, it is not that young English-speakers lack the capacity to explicitly manipulate derivational suffixes but rather that their ability to do so is very restricted in range relative to their French peers (see Figures 2 and 4).

In studies of phonology, those phonological units that children are explicitly aware of appear to be favored as decoding units (Duncan et al, 1997, 2000). If this is also true of morphology, French children may be in a position to use a greater range of derivational suffixes than English-speakers in their early reading, and also in writing, which is more opaque than reading in French. Published evidence from studies of spelling is supportive of a relationship
with literacy. Pacton, Fayol and Perruchet (2005) observed that French children use morphological regularities in spelling as early as Grade 2 for the suffix –ette and Grade 3 for –eau, which is consistent with the early explicit sensitivity to derivational morphology shown by French children in the present study. Similarly, Deacon and Bryant’s (2005) finding that 6- to 8-year-old English-speakers did not use morphological knowledge in spelling is in keeping with our observations of poor explicit manipulation of suffixes by this age group.

In a recent comparison of different orthographies, Jaffré (2006) argued that orthographies encompass two basic principles: the first is phonographic, and refers to the correspondence between the written form and the sounds of the spoken language; and the second is semiographic, and concerns the encoding of meaning in the orthography. According to Jaffré, one characteristic feature of the French orthography is that morphology is systematically encoded in French spelling even though it is frequently not heard in speech. This is especially true of inflectional morphology but it also applies to derivational morphology, where silent letters often establish a visual link between words from the same morphological family. For example, the "t" morphogram at the end of the French word “lait” (milk) is not pronounced in spoken French but it is also to be found (and heard) in the derived words “laitier” (milkman), “laitage” (dairy product), laiteux (milky), etc. Therefore, although such morphograms may introduce grapho-phonological inconsistencies, at a grapho-semantic or morphological level, they represent consistencies which may prove useful for young readers and spellers.

Although English is the deeper orthography with high levels of inconsistency in the correspondence between spelling and sound in both the reading and writing directions, English is also characterized by a significant degree of morphographic regularity. In contrast to French, however, most morphemic elements are pronounced rather than silent and so the separation
between phonographic and semiographic correspondences in the orthography may not be so marked. Several authors have claimed that the capacity for morphological analysis is likely also to prove beneficial for literacy development in English. Mann and Singson (2003) proposed that older children parse morphologically complex words into base and suffix in order to apply morpho-phonological rules to increase decoding accuracy (see also Nagy et al, 2006). Furthermore, Rastle and Coltheart (2000) have argued that derivational affixes could provide important cues about lexical stress assignment and vowel reduction, issues relevant for learning to read English but not French, and an algorithm developed by these authors that incorporated morphological regularities did indeed show a good correspondence with skilled decoding in English.

What factors govern the emergence of explicit knowledge about derivational morphology?

In this final section, we examine factors that might constrain the process of meta-morphological development in order to gain insight into why this acquisition process seems to be accelerated in French relative to English.

Clark (1993) has argued that derivations take time to assimilate. Derivations are complex in form and the meaning of the bound morphemes that they contain is difficult to capture, with the result that knowledge about particular affixes is acquired gradually in a sequence determined by type frequency and productivity (Derwing & Baker, 1979; Clark & Cohen, 1984; Clark, 1993; Windsor, 1994; Lewis & Windsor, 1996). Invoking a process reminiscent of Karmiloff-Smith’s (1986) concept of representational re-description, Clark (1993) went on to suggest that, as individual suffixes are acquired, levels of organization emerge within the lexicon containing groups of derivations which are related in form and meaning. Although Gombert (1992) has argued that progression to the explicit phase requires the presence of an external demand for
meta-linguistic control, our findings in relation to Grade 1 performance in French and to the processing of the –er suffix in English suggest that certain aspects of meta-morphological development may be subject to demands present in the preschool phase (see Duncan et al (2006) for a similar finding in relation to explicit awareness of syllables).

One important question for future research is whether learning about derivational morphology reflects the gradual setting up of statistical regularities within the language system as demonstrated in connectionist models (Seidenberg & Gonnerman, 2000; Gonnerman et al, 2007) such that knowledge about derivational morphology is graded and is computed from phonological, semantic and orthographic information. A slightly different view is encapsulated within the Declarative/Procedural model (Ullman, 2001, 2004), where a mental lexicon of words and a mental grammar of rules are ascribed to the separate memory systems referred to in the name of the model. The model proposes that although both systems can underlie morphological pattern learning, the declarative system specializes in associative mapping, whereas the procedural system is dedicated to the learning and use of rules, more specifically those rules which are global in nature. Interestingly, Ullman (2004) advocates an interaction between these systems during learning, arguing that “in some cases explicit knowledge of the rules themselves may help guide processing, perhaps enhancing the procedural rule acquisition” (p. 247).

The variation in response to the suffixes tested in our study deserves comment here. The English-speakers show a narrow range of performance especially in the Non-lexical conditions. Nevertheless, their level of response to the one suffix that they appear to know (-er) was observed to be quite constant across production conditions. While the absence of a performance decrement in transfer to novel contexts is consistent with rule-based knowledge (e.g. Manza & Reber, 1997; Pacton et al, 2005), it is also possible that statistical learning in a context where few
constraints exist on the use of the –er suffix may produce a similar effect. Nevertheless, in the French data, only the eight-year-olds exhibited anything resembling this type of pattern (see French performance on the -eur suffix in Figure 4). Instead, the French groups tended to show a breadth of knowledge about suffixes that decreased gradually and generally as the task became more non-lexical (see Figure 2). This type of pattern appears more consistent with statistical learning of the regularities underlying derivational morphology (Pacton et al, 2005) or with incomplete rule-based learning (but see Pacton, Perruchet, Fayol and Cleeremans (2001) for a critique of this latter view). Further research is necessary to determine the correct interpretation of these differing response patterns.

In general, cross-linguistic variation in the acquisition sequence appears most likely to emanate from the preschool language environment and/or from the system of formal education adopted by each country. On the basis of our findings, preschool language is implicated because explicit morphological skills were already divergent between the language groups in the first year of schooling, and formal education may also be involved since the pattern of development between the first and third year of schooling was different in each country. Each of these factors will be considered in turn.

**Preschool language.** As noted in the Introduction, derivation is more productive in French than in English and evidence from diary studies suggests that preschool spontaneous speech in French correspondingly contains a wider range of derivational suffixes than is observed in English (Clark, 1993). Compounding, on the other hand, is more prevalent and more productive in English than in French (Bauer, 2003), and cross-linguistic disparities in the early use of compounding for lexical innovation have previously been attributed to this difference (Clark, 1993). The findings from the present study suggest that the complementary incidence of
compounding and derivation in English and French may also be traceable in awareness of derivational morphology, confirming previous indications from diary studies (Clark, 1993).

Recent cross-linguistic evidence from Zhang, Anderson, Packard, Wu and Tang (in preparation) lends support to this type of relationship between the productivity of a word formation system and meta-linguistic development amongst native speakers. Their comparison of English and Chinese is of considerable relevance to the present study because derivational morphology is more common and compounding less common in English than in Chinese. In other words, English stands in a similar relationship to Chinese as French does to English in terms of the relative prevalence of compounding versus derivation in word formation. The authors observed that English-speakers tended to be less sensitive to compound structures than Chinese children, although it should be emphasized that the assessment task used differed from the oral tasks used in the present study because it contained a substantial reading component.

Returning to the present study, a lower prevalence of derivations in English relative to French is consistent with the slower rate of meta-morphological development that we observed amongst our English-speakers. Establishing the spoken frequencies of individual derivational suffixes in the preschool and early school years will be an important focus for future research. An inter-related issue concerns the productivity of individual derivational suffixes as Clark (1993) identifies this as an important principle in the process of coining new words to fill lexical gaps, a process which may prove relevant to the early development of morphological awareness.

The reinforcement of derivational relationships may be further complicated in English by lexical stress, which is contrastive in English and, hence, important for successful word identification. Lexical stress is not contrastive in French and so would not be expected to influence suffix learning to the same extent. In contrast, the predominant patterns of English
lexical stress are likely to de-emphasize suffixes because final syllable stress is rare and hence, the perceptual salience of the suffix would be expected to be low (Cutler & Clifton, 1984; Pitt & Samuel, 1990). Furthermore, the similarity between roots and their derivations is rendered opaque for a whole class of English suffixes which alter the stress pattern of the root in the formation of the derivation (e.g. ‘dedicate’→‘dedication’). Studies confirm that English-speaking children take longer to acquire these stress-shifting suffixes compared to suffixes that are stress-neutral (Carlisle, 1995, 2000; Mahony et al, 2000; Jarmulowicz, 2006).

**Formal education.** Another factor in the explanation of the French advantage in explicit morphological skills may be that the pace of introduction of information about derivational morphology in the school curriculum is simply faster in France than in the UK, and a preliminary review does indeed point to some differences in instructional approach. The recommendations from the French Ministry of Education make express mention of derivational morphology from the first year of schooling in relation to the development of oral vocabulary and the building of a sight vocabulary. Teachers highlight derivational relations (e.g. “sable, sableux, sablonneux, sablière, sablage” which can be translated as “sand, sandy, sand-covered, sand quarry, sanding”) and also employ a process in which derivations are produced and then checked for lexicality (e.g. “coiffure” vs. “peignure” which can be translated as “hairdressing” vs. “haircombing”). In the UK, information about derivational morphology is introduced more gradually but teachers begin informally to highlight frequent suffixes like –er from the end of Grade 1 onwards. However, it is interesting to note that in the present study, the UK children already possessed an advanced ability to manipulate this suffix before this point. More intensive teaching about derivational morphology is introduced later in Grade 3 or 4 in the context of spelling instruction when children explore how words change with the addition of affixes. By the sixth or seventh year of
schooling, children should know the rules governing the relations between a range of roots and derivations as well as the terms “prefix” and “suffix” (Learning and Teaching Scotland, personal communication).

A further aspect of children’s exposure to derivational suffixes in the education system concerns the influence of reading acquisition. Seeing words in print can help to consolidate understanding of the relationship between meaning and the morphemic units within words (Moats, 2000). Less productive and technical suffixes, as well as those suffixes that produce a phonological change to the base, may need to be reinforced by orthographic cues and, at least in English, the written frequency of derivational suffixes appears predictive of progress in this respect (Jarmulowicz, 2002). To explore this matter further, we have undertaken a preliminary inspection of two databases which survey wordforms from children’s early reading materials in English (CPWD, Stuart et al (2003)), and in French (MANULEX, Lété et al (2004)). This has allowed us to compare the incidence of individual suffixes in Grade 1 reading materials in each language. The results confirm that French children encounter a much larger variety of suffixes often with high type frequencies from the outset of schooling. In France, 32 suffixes with type frequencies of two or above occurred in Grade 1 reading materials whereas only 5 suffixes occurred with this level of written frequency in English (-y (Adjective), -er (Noun - agentive), -y (Noun - diminutive), -er (Noun - instrumental), and –ly (Adverb); see also Derwing (1976)). Thus, suffix frequency appears at least to be consistent with production performance since English production ability is largely restricted to the –er suffix, whereas, French children show a facility with the wider range of suffixes that recur in their early reading materials. The extent to which such written frequencies overlap with or are subsumed by underlying oral language frequencies of derivations or their components is a topic for future research⁹.
A final consideration relates to issues raised by Jaffré (2006) in relation to the French orthography. He proposes that the need to distinguish between many similarly pronounced but morphologically distinct pairs such as “chanter” (“to sing”) and “chanté” (“sung”) promotes a greater understanding of the internal functioning of the French language. Thus, mastery of the morphological structure of the French orthography may require a greater degree of meta-linguistic control than is entailed in English. While it remains unclear whether this argument, which is largely based upon the nature of the system of inflectional morphology in French, also extends to the acquisition of derivational knowledge, the more advanced ability of the French children to explicitly manipulate derivational suffixes in the present study is at least consistent with this interpretation.

Conclusions

This is the first study to directly compare children’s awareness of derivational morphology in French and English. The aim was to establish whether the course of acquisition of derivational knowledge might vary in these languages of differing (Romance versus Germanic) origin. The central finding is that the rate of growth in meta-morphological development appears to be slightly accelerated in French relative to English, which parallels the differences in the productivity of the derivational process in the two languages and hence, appears to support the importance of this factor in the early acquisition of morphological knowledge. The emphasis placed on morphology in the oral and written language curricula of the two educational systems also proved to be consistent with the French advantage in manipulating derivational suffixes. The disentanglement of these sources of influence is a challenge for future research.
ACKNOWLEDGEMENTS

The authors would like to express their gratitude to the pupils and staff in the participating schools. We also thank Sheila Baillie and Hannah Bownass for their assistance with data collection. This research was supported by funds from The British Council’s Alliance Franco-British Partnership Programme (PN 03.014) in the UK and the Programme d’Actions Intégrées Franco-Britannique Alliance (05682 XG) administered by the Ministères des Affaires Etrangères et de l’Education Nationale in France.
NOTES

1 Each language is estimated to have contributed 28% of English vocabulary with an additional 5% or words originating from Greek (Finkenstaedt & Wolff, 1973).

2 A similar point has been made by Manza and Reber (1997) in relation to assessment of the implicit learning of artificial grammars.

3 As described by Clark (1993).

4 Actual data are 76% and 91% (agentive) and 70% and 72% (instrumental) for the younger and older group, respectively.

5 As the French (Alouette) reading test does not provide standardized scores, age-equivalent scores are used throughout for ease of comparison of group performance on the background measures. It should be borne in mind, however, that the interpretation and statistical manipulation of age-equivalent scores is problematic (see Bishop (1997) for a discussion of this issue).

6 Note that the English roots are significantly more frequent than their derivations, whereas the French roots show only a tendency in that direction. One anonymous reviewer raised the concern that this difference in relative frequency may have affected the experimental outcome in the Lexical Production task despite the cross-language match in both root frequency and derivation frequency.

7 Although the data presented in the Tables and Figures are in percentage form for ease of comparison, the statistical analyses of the experimental tasks were conducted on the children’s raw scores.
An anonymous reviewer pointed out that in matching the format of the French and English sentence frames in the Production task, the English items contained more instances in which suffix stripping from the root was required prior to forming the derivation (e.g. Someone who works is a…? versus Celui qui travaille est un…?). It is important to bear this in mind while evaluating the results although it does not appear to provide an explanation for the greater inaccuracy of the English-speakers as they achieved most success on items of this type.

See Hay and Baayen (2005) for a related discussion of frequency and the gradience of morphological structure which bears upon the issue of morphological development.
REFERENCES


Appendix

a) Stimuli for the Lexical Judgement Task

<table>
<thead>
<tr>
<th>French Targets</th>
<th>Foils</th>
<th>English Targets</th>
<th>Foils</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glisser- Glissade</td>
<td>Bague- Bagage</td>
<td>Pass- Passage</td>
<td>Mess- Message</td>
</tr>
<tr>
<td>Grille- Grillage</td>
<td>Cour*- Courage</td>
<td>Heat- Heater</td>
<td>Ham- Hammer</td>
</tr>
<tr>
<td>Ville- Village</td>
<td>Gaz- Gazon</td>
<td>Swim- Swimmer</td>
<td>Sum*- Summer</td>
</tr>
<tr>
<td>Bagarrre- Bagarreur</td>
<td>Châle- Chaleur</td>
<td>Act- Actor</td>
<td>Rock- Rocket</td>
</tr>
<tr>
<td>Boxe- Boxeur</td>
<td>Heure- Heureux</td>
<td>Beg- Beggar</td>
<td>Lad- Ladder</td>
</tr>
<tr>
<td>Balle*- Ballon</td>
<td>Pomme- Pommade</td>
<td>Sail*- Sailor</td>
<td>Tail*- Tailor</td>
</tr>
<tr>
<td>Amour- Amoureux</td>
<td>Chat- Château</td>
<td>Gold- Golden</td>
<td>Kit- Kitten</td>
</tr>
<tr>
<td>Salade- Saladier</td>
<td>Sang*- Sanglier</td>
<td>Art- Artist</td>
<td>Van- Vandal</td>
</tr>
<tr>
<td>Bercer- Berceau</td>
<td>Couler- Couleur</td>
<td>Tour- Tourist</td>
<td>Pet- Petal</td>
</tr>
<tr>
<td>Cloche- Clochette</td>
<td>Casser- Cassette</td>
<td>Pack- Package</td>
<td>Cab- Cabbage</td>
</tr>
</tbody>
</table>

* These words are homophones (court, bal, cent, some, sale, tale).
b) Stimuli for the Lexical Production Task

<table>
<thead>
<tr>
<th>French</th>
<th>Lexical</th>
<th>Frequency</th>
<th>English</th>
<th>Lexical</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sentence frame containing the lexical root</td>
<td></td>
<td></td>
<td>Sentence frame containing the lexical root</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>1.</strong> Une petite <strong>fille</strong> est une</td>
<td>fillette</td>
<td>472 60</td>
<td><strong>A little</strong> <strong>book</strong> is a</td>
<td>booklet</td>
<td>541 5</td>
</tr>
<tr>
<td><strong>2.</strong> Une petite <strong>jupe</strong> est une</td>
<td>jupette</td>
<td>29 0</td>
<td><strong>A little</strong> <strong>pig</strong> is a</td>
<td>piglet</td>
<td>151 8</td>
</tr>
<tr>
<td><strong>3.</strong> Celui qui <strong>travaille</strong> est un</td>
<td>travailleur</td>
<td>57 2</td>
<td>Someone who <strong>works</strong> is a</td>
<td>worker</td>
<td>68 3</td>
</tr>
<tr>
<td><strong>4.</strong> Celui qui <strong>ment</strong> est un</td>
<td>menteur</td>
<td>6 9</td>
<td>Someone who <strong>runs</strong> is a</td>
<td>runner</td>
<td>22 0</td>
</tr>
<tr>
<td><strong>5.</strong> Celui qui fait la <strong>guerre</strong> est un</td>
<td>guerrier</td>
<td>77 3</td>
<td>A <strong>baker</strong> works in a</td>
<td>bakery</td>
<td>59 5</td>
</tr>
<tr>
<td><strong>6.</strong> Celui qui s’occupe de la <strong>ferme</strong>, c’est le</td>
<td>fermier</td>
<td>155 40</td>
<td>A <strong>robber</strong> carries out a</td>
<td>robbery</td>
<td>133 8</td>
</tr>
<tr>
<td><strong>7.</strong> <strong>On rase</strong> avec un</td>
<td>rasoir</td>
<td>2 8</td>
<td>When someone <strong>fails</strong> they are a</td>
<td>failure</td>
<td>0 3</td>
</tr>
<tr>
<td><strong>8.</strong> <strong>On arrose</strong> avec un</td>
<td>arrosoir</td>
<td>8 9</td>
<td>When you <strong>mix</strong> things you make a</td>
<td>mixture</td>
<td>78 38</td>
</tr>
<tr>
<td><strong>9.</strong> Quand on <strong>bricole</strong>, on fait du</td>
<td>bricolage</td>
<td>1 3</td>
<td>A <strong>bag</strong> is part of your</td>
<td>baggage</td>
<td>392 3</td>
</tr>
<tr>
<td><strong>10.</strong> Quand on <strong>colle</strong>, on fait du</td>
<td>collage</td>
<td>70 1</td>
<td>When you <strong>post</strong> something you pay for the</td>
<td>postage</td>
<td>87 3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mean</th>
<th>88 14</th>
<th>Mean</th>
<th>153 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD</td>
<td>143 20</td>
<td>SD</td>
<td>175 11</td>
</tr>
</tbody>
</table>
### Stimuli for the Non-Lexical Production Task*

<table>
<thead>
<tr>
<th>French</th>
<th>English</th>
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</thead>
<tbody>
<tr>
<td><strong>Word Root</strong></td>
<td><strong>Nonword Root</strong></td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td><strong>Word Root</strong></td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td><strong>Frequency</strong></td>
</tr>
<tr>
<td></td>
<td>(1-10)</td>
</tr>
<tr>
<td>1. tâche 11 trine</td>
<td>bead 3 feep</td>
</tr>
<tr>
<td>2. poire 29 gleur</td>
<td>mouse 782 tob</td>
</tr>
<tr>
<td>3. gifle 0 panfe</td>
<td>phones 0 lums</td>
</tr>
<tr>
<td>4. bouge 43 furpe</td>
<td>needs 103 ploams</td>
</tr>
<tr>
<td>5. piscine 91 pludes</td>
<td>cobbler 0 pover</td>
</tr>
<tr>
<td>6. balles 12 roupes</td>
<td>boxer 16 ludder</td>
</tr>
<tr>
<td>7. pleure 52 geale</td>
<td>bursts 3 hools</td>
</tr>
<tr>
<td>8. rince 0 larpe</td>
<td>melt 22 nax</td>
</tr>
<tr>
<td>9. grimpe 27 voule</td>
<td>game 160 dep</td>
</tr>
<tr>
<td>10. regarde 407 carbole</td>
<td>fixes 0 baft</td>
</tr>
</tbody>
</table>

**Mean** 67  Mean 109

**SD** 123  **SD** 243

*The sentence frames (1-10) from the Lexical Production task were used in this task with occasional minor adjustments that did not alter syntax.*
Experiment 1: Means and standard deviations for Chronological Age, Receptive Vocabulary Age, Word Recognition Age and percentage accuracy in the Judgment and Production tasks for each language group according to year of schooling

<table>
<thead>
<tr>
<th></th>
<th>English</th>
<th></th>
<th>French</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grade 1</td>
<td>Grade 3</td>
<td>Grade 1</td>
<td>Grade 3</td>
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<tr>
<td></td>
<td>(n=15)</td>
<td>(n=15)</td>
<td>(n=15)</td>
<td>(n=15)</td>
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<tr>
<td>Chronological Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(years;months)</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Grade 1</td>
<td>6:1</td>
<td>0:3</td>
<td>8:0</td>
<td>0:3</td>
</tr>
<tr>
<td>Grade 3</td>
<td>8:0</td>
<td>0:3</td>
<td>8:8</td>
<td>0:6</td>
</tr>
<tr>
<td>Receptive Vocabulary Age</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>(years;months)</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Grade 1</td>
<td>7:1</td>
<td>1:1</td>
<td>8:2</td>
<td>0:10</td>
</tr>
<tr>
<td>Grade 3</td>
<td>8:2</td>
<td>0:10</td>
<td>8:5</td>
<td>1:11</td>
</tr>
<tr>
<td>Word Recognition Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(years;months)</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Grade 1</td>
<td>6:6</td>
<td>0:6</td>
<td>8:10</td>
<td>0:9</td>
</tr>
<tr>
<td>Grade 3</td>
<td>8:10</td>
<td>0:9</td>
<td>7:1</td>
<td>0:6</td>
</tr>
<tr>
<td>Lexical Judgment (%)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Grade 1</td>
<td>65.18</td>
<td>11.01</td>
<td>75.19</td>
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</tr>
<tr>
<td>Grade 3</td>
<td>75.33</td>
<td>13.43</td>
<td>83.00</td>
<td>11.31</td>
</tr>
<tr>
<td>Lexical Production (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Grade 1</td>
<td>20.00</td>
<td>13.63</td>
<td>70.00</td>
<td>15.12</td>
</tr>
<tr>
<td>Grade 3</td>
<td>70.00</td>
<td>15.12</td>
<td>80.00</td>
<td>13.63</td>
</tr>
<tr>
<td>Non-lexical Production</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Word Root)</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Grade 1</td>
<td>16.67</td>
<td>7.24</td>
<td>38.67</td>
<td>13.02</td>
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<tr>
<td>Grade 3</td>
<td>22.00</td>
<td>16.56</td>
<td>53.33</td>
<td>13.97</td>
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<td>Nonword Root</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Grade 1</td>
<td>12.67</td>
<td>7.99</td>
<td>23.33</td>
<td>13.45</td>
</tr>
<tr>
<td>Grade 3</td>
<td>25.33</td>
<td>7.43</td>
<td>40.67</td>
<td>15.34</td>
</tr>
</tbody>
</table>
Table 2.

Experiment 1: Mean Number of Error Responses (/10) in the Production Task Classified by Grade Level and Error Category for (a) English and (b) French Items

(a) ENGLISH

<table>
<thead>
<tr>
<th></th>
<th>Real Words</th>
<th>Word Root</th>
<th>Nonword Root</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grade 1</td>
<td>Grade 3</td>
<td>Grade 1</td>
</tr>
<tr>
<td></td>
<td>M  SD</td>
<td>M SD</td>
<td>M  SD</td>
</tr>
<tr>
<td>Real Word</td>
<td>3.8 4.6</td>
<td>2.0 2.3</td>
<td>4.5 4.6</td>
</tr>
<tr>
<td>Wrong Suffix</td>
<td>0.1 0.3</td>
<td>1.9 3.3</td>
<td>1.0 1.3</td>
</tr>
<tr>
<td>Wrong Root</td>
<td>1.2 2.1</td>
<td>0.6 0.7</td>
<td>0.2 0.4</td>
</tr>
<tr>
<td>Compound</td>
<td>1.5 2.5</td>
<td>1.1 1.9</td>
<td>0.6 1.6</td>
</tr>
<tr>
<td>Repeat Root</td>
<td>0.9 1.1</td>
<td>0.7 1.6</td>
<td>3.0 2.7</td>
</tr>
<tr>
<td>Refusal</td>
<td>4.4 3.1</td>
<td>2.5 2.3</td>
<td>1.9 1.4</td>
</tr>
<tr>
<td>Other</td>
<td>0.1 0.3</td>
<td>0.3 0.7</td>
<td>1.3 1.6</td>
</tr>
</tbody>
</table>

(b) FRENCH

<table>
<thead>
<tr>
<th></th>
<th>Real Words</th>
<th>Word Root</th>
<th>Nonword Root</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grade 1</td>
<td>Grade 3</td>
<td>Grade 1</td>
</tr>
<tr>
<td></td>
<td>M  SD</td>
<td>M SD</td>
<td>M  SD</td>
</tr>
<tr>
<td>Real Word</td>
<td>1.5 1.3</td>
<td>0.8 1.6</td>
<td>1.5 2.2</td>
</tr>
<tr>
<td>Wrong Suffix</td>
<td>0.7 1.1</td>
<td>0.5 1.0</td>
<td>2.5 1.8</td>
</tr>
<tr>
<td>Wrong Root</td>
<td>0.3 0.5</td>
<td>0.1 0.3</td>
<td>0.5 0.8</td>
</tr>
<tr>
<td>Compound</td>
<td>0 0</td>
<td>0.5 1.6</td>
<td>0.4 0.7</td>
</tr>
<tr>
<td>Repeat Root</td>
<td>1.2 1.8</td>
<td>1.0 1.8</td>
<td>1.3 1.7</td>
</tr>
<tr>
<td>Refusal</td>
<td>0.8 0.9</td>
<td>0.1 0.3</td>
<td>0.9 0.7</td>
</tr>
<tr>
<td>Other</td>
<td>0.3 0.5</td>
<td>0 0</td>
<td>2.1 1.2</td>
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</tbody>
</table>
Table 3.

Experiment 2: Means and standard deviations for Chronological Age, Receptive Vocabulary Age, Word Recognition Age and accuracy in the Judgment and Production tasks for each language group

<table>
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<tr>
<th></th>
<th>English (n=15)</th>
<th>French (n=15)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Chronological Age (years;months)</td>
<td>8;0 0;3</td>
<td>7;11 0;3</td>
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<tr>
<td>Receptive Vocabulary Age (years;months)</td>
<td>8;2 0;10</td>
<td>8;10 1;8</td>
<td></td>
</tr>
<tr>
<td>Word Recognition Age (years;months)</td>
<td>8;10 0;9</td>
<td>8;1 0;11</td>
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</tr>
<tr>
<td>Lexical Judgment (%)</td>
<td>75.19 15.55</td>
<td>83.67 9.72</td>
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<tr>
<td>Lexical Production (%)</td>
<td>39.33 10.33</td>
<td>73.33 18.39</td>
<td>***</td>
</tr>
<tr>
<td>Non-Lexical Production (%)</td>
<td>Word Root</td>
<td>22.00 16.56</td>
<td>48.67</td>
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<tr>
<td>Nonword Root</td>
<td>23.33 13.45</td>
<td>26.00 16.39</td>
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</tbody>
</table>

***  p < .001
Table 4.

*Experiment 2: Mean Number of Error Responses (/10) in the Production Task Classified by Error Category for English and French Items*

<table>
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<tr>
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<th>French Items</th>
<th>English Items</th>
<th>French Items</th>
<th>English Items</th>
<th>French Items</th>
<th>English Items</th>
<th>French Items</th>
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</thead>
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<td>M  SD</td>
<td>M  SD</td>
<td>M  SD</td>
<td>M  SD</td>
<td>M  SD</td>
<td>M  SD</td>
<td>M  SD</td>
</tr>
<tr>
<td>Real Word</td>
<td>2.0 2.3</td>
<td>0.9 0.7</td>
<td>3.7 2.3</td>
<td>1.0 1.8</td>
<td>1.6 2.2</td>
<td>0 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wrong Suffix</td>
<td>1.9 3.3</td>
<td>0.4 0.7</td>
<td>3.1 3.0</td>
<td>4.9 2.8</td>
<td>3.5 4.2</td>
<td>6.3 3.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wrong Root</td>
<td>0.6 0.7</td>
<td>0.1 0.3</td>
<td>0.4 0.5</td>
<td>0.2 0.6</td>
<td>0.7 0.9</td>
<td>0.1 0.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compound</td>
<td>1.1 1.9</td>
<td>0.5 0.5</td>
<td>0.5 0.7</td>
<td>0.2 0.4</td>
<td>0.4 1.0</td>
<td>0.1 0.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeat Root</td>
<td>0.7 1.6</td>
<td>0.6 1.1</td>
<td>0.8 1.9</td>
<td>0.2 0.6</td>
<td>0.7 1.5</td>
<td>0.8 0.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refusal</td>
<td>2.5 2.3</td>
<td>1.1 1.1</td>
<td>2.1 2.4</td>
<td>0 0</td>
<td>1.7 1.6</td>
<td>0.1 0.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0.3 0.7</td>
<td>0.4 1.0</td>
<td>1.1 1.7</td>
<td>1.2 0.9</td>
<td>1.8 1.2</td>
<td>1.9 2.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure Legends

**Figure 1.** Mean percentage accuracy in each condition of the Production task in Experiment 1 for English- and French-speaking first and third graders. Error bars represent ±1 SEM.

**Figure 2.** Number of correct responses for each suffix tested in each condition of the Production task in Experiment 1 for English- and French-speaking first and third graders. The maximum possible score is 30.

**Figure 3.** Mean percentage accuracy in each condition of the Production task in Experiment 2 for English- and French-speaking 8-year-olds. Error bars represent ±1 SEM.

**Figure 4.** Number of correct responses for each suffix tested in each condition of the Production task in Experiment 2 for English- and French-speaking 8-year olds. The maximum possible score is 30.
Figures

Figure 1.
Figure 2.

(a) ENGLISH

(i) Real Words

Correct responses (N)

Grade 1
Grade 3

(ii) Word Roots

Correct responses (N)

Grade 1
Grade 3

(iii) Nonword Roots

Correct responses (N)

Grade 1
Grade 3

(b) FRENCH

(i) Real Words

Correct responses (N)

Grade 1
Grade 3

(ii) Word Roots

Correct responses (N)

Grade 1
Grade 3

(iii) Nonword Roots

Correct responses (N)

Grade 1
Grade 3
Figure 3.
Figure 4.

(a) Real Words

(b) Word Roots

(c) Nonword Roots