

Spelling and reading development: The effect of teaching children multiple levels of representation in their orthography

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ABSTRACT

A novel intervention was developed to teach reading and spelling literacy to 5 to 7 year-old students using explicit instruction of morphology, etymology, phonology, and form rules. We examined the effects of the intervention compared to a phonics-based condition using a cross-over design with a baseline measure. One hundred and twenty children attending an English state funded primary school were randomly allocated either to a traditional phonics condition followed by the novel intervention, or to the novel intervention followed by the phonics condition. The novel intervention significantly improved the literacy skills of the children including both word reading and spelling compared with the phonics condition. We conclude that early teaching of English literacy should include instruction in morphology, etymology and rules about form in addition to traditional phonics. We suggest that the results of the study could inform future policy on the teaching of English literacy skills.

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1. Introduction

The purpose of the current study is to investigate the efficacy of two different approaches to the teaching of literacy skills (i.e. word reading, and spelling skills in English). The most frequently used method in many countries is phonics. The essence of the phonics approach is to teach letter (grapheme) sound (phoneme) matching that emphasises the phonological aspect of language. A pupil is taught to identify a sound such as the /c/ in <cat> and relate it to the letter <c>. However, the use of phonics may be less suitable for English than for other languages as English has a deep orthography (writing system) where the relationship between letters and sounds is inconsistent. However, supplementary approaches to teaching English that focus on structure and etymology have been neglected in England. One reason for the neglect may be that there are few studies that have examined the ability of appropriate age children to use non phonics based approaches to acquiring literacy skills. We investigate whether children taught to use etymological and structural aspects of language have superior literacy skills to children relying solely on phonics.

1.1. Transparency of language and literacy acquisition

The transparency of a language refers to the mapping of letters and sounds (phonology). In highly transparent languages such as Finnish, Italian and Spanish, there is an almost one-to-one mapping between letters and sounds, and such languages are said to have a shallow orthography. In contrast, English has a deep or opaque orthography since only 56% of its words can be predicted by phonological rules (Crystal, 2000). Therefore it is claimed that literacy acquisition may be easier with transparent languages because these languages only require children to learn one-to-one correspondences between spoken and written units (Wyse & Goswami, 2008). There is much evidence to support this view. Finnish children read with 90% accuracy after a very short period of formal instruction (approximately 10 weeks) whereas English children take four or five years to achieve the same level of accuracy (Goswami, 2005). Seymour, Aro, and Erskine (2003) compared reading development across 14 European languages. Their findings revealed striking differences between languages. At the end of grade one English-speaking children performed poorly (34% correct word reading). In contrast, children learning to read in transparent orthographies (Greek, Finnish, German, Italian, and Spanish), were close to ceiling performance. Furthermore, a recent study of Italian children by Desimoni, Scalisi and Orsolini (2012) also provides further evidence 'that the consistency of an orthography affects the characteristics of reading and spelling acquisition' (p12).

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However, differences in performance in literacy acquisition are not necessarily attributable to the nature of the language itself. There is a potential confound between the nature of the language (i.e. transparent vs. opaque languages) and the teaching of the language and other contextual factors affecting the acquisition of literacy. For example Finnish is a highly transparent language but Finland is also noted for its outstanding education system (Sahlberg, 2007). One study exists that eliminates any possible confound between the language itself and the education system. Ellis and Hooper (2001) conducted a study that compared literacy acquisition in children in Wales who attended either a Welsh speaking school (Welsh [unlike English], has a transparent orthography, which is highly consistent phonologically) or an English speaking school. The same method of literacy teaching was used in both schools. Furthermore, other possible confounding variables were carefully controlled including: demography, geography, curriculum and management of the schools. It was found that pupils in the Welsh speaking school had superior word reading compared to their counterparts in the English speaking school. The results of this study have been interpreted as providing strong evidence that the intrinsic properties of a language do have an impact on the acquisition of literacy skills.

1.2. The structure of different languages and teaching literacy

In the UK and US teaching practice reflects stage-models of literacy development (see Frith, 1985; Gentry, 2005). In broad terms stage models suggest children pass through stages in a specific sequence. These stages begin with a logographic stage (identifying marks on paper represent letters and words), followed by an alphabetic stage (mapping phonemes and graphemes as in phonics). The final stage is orthographic (incorporating morphology). Teaching literacy in the US and UK begins with phonics and much later might incorporate morphological skills.

We have argued that it is easier to acquire literacy skills in some languages than others. In transparent languages where there is a close mapping of letters and sounds an approach known as phonics would seem highly appropriate. Two different approaches (although extremely closely related) to the use of phonics have emerged. These two types of phonics instruction differ in the following way: synthetic phonics, builds words by 'synthesising' (blending) phonemes sequentially together, whereas analytic phonics takes a whole word and each phoneme is identified (analyzed) to produce the sound of that word. The consensus amongst policy makers in England is that the synthetic approach is superior 'Having considered a wide range of evidence, the review has concluded that the case for systematic phonic work is overwhelming and much strengthened by a synthetic approach' (Rose, 2006 p. 20). However, there is still a vigorous debate in the research literature about the respective merits of the two approaches to phonics (National Institute of Child Health and Human Development, 2000; Wyse & Styles, 2007).

In transparent languages phonics would seem the logical approach to teaching basic literacy skills. However, in non transparent languages, such as English, the approach may be less appropriate. It should be remembered that about 50% of the words in English are exceptions to the rules of phonics. Therefore it would be helpful to explore the structure of the English writing system to investigate other aspects of this language that may be more appropriate for learning and teaching literacy.

Written English is described as morphophonemic as it represents both morphemes (the smallest unit of meaning in a word) and phonemes. It is more regular at the level of the morpheme rather than the phoneme, however, because there are more phonemes (44) than there are letters in the alphabet (26). Consequently,

combinations of letters as well as single letters are used to represent phonemes. In contrast to Italian, which has 25 phonemes and only 33 spellings to represent them, English has 1120 different spellings to represent its 44 phonemes (Paulesu et al., 2001). In addition to morphology and phonology, English spelling also retains etymological information, which often determines the spelling of a word. For example, the words *science*, *conscience*, and *conscious* all contain the same etymological root <sci> (from the Latin, meaning to know) which requires different pronunciations in those words. Another layer of complexity in English comes from spelling conventions related to form. For example, double letters never occur at the beginning of words but they can occur at the end or in the middle of a word. Similarly, certain letter combinations are only permissible in certain positions in a word, thus <ck> is not found at the beginning of the word and <v> is not found at the end of a word.

Given these different levels of representation and complexity, it is perhaps understandable that researchers and educators have focussed on teaching one level at a time. Initially learning about written language only at the level of the phoneme (as is current practice, DfES, 2003) may lead children, and their teachers, to construe spelling as primarily the representation of speech sounds, which it is not (Pinker, 1994; Venezky, 1970). Phonic-only instruction may make it difficult for children to generate hypotheses about written language that go beyond sound-letter mappings; instead they may treat words that do not conform to predictable phonic rules as exceptions that need to be learned in isolation.

Writing systems can be described in terms of levels of representation (or organisation), such as the word, morpheme, syllable, onset, rime, phoneme and phone. In alphabetic writing systems like English, at word level, the phoneme is the basic level of representation and the morpheme is the highest level (Byrne, 1998). However, Byrne's (1998) research indicates that English-speaking children and adults are not aware of the levels of representation in their orthography even when they are learning to read and spell. Byrne concludes therefore that it is beneficial to 'tell' learners about these levels, and that the effect should be faster and better learning; 'if we want children to know something, we would be advised to teach it explicitly' (p. 144). Byrne argues that the most important level of representation in English is the phoneme, and agreement with this view is echoed in current teaching policy and practice in the UK and US (see DfES, 2007; Strauss, 2005). He argues that children who are taught about phonic structure are better at decoding (i.e., reading, although not necessarily comprehending) words than children who have not received this type of instruction.

It is only relatively recently that intervention studies have addressed literacy in relation to morphemes. Nunes and Bryant (2006) document evidence that teaching children above the age of seven about written language at the level of the morpheme is beneficial to English spelling and reading. It is still the case that few intervention studies have examined the effects of morphemic instruction and most of those focus on children aged seven years and older. Indeed, Bowers, Kirby and Deacon's (2010) meta-analysis identified only 22 morphological intervention studies, not all of which were conducted in the English Language. They concluded that morphological instruction is beneficial to literacy learners in many languages including English. Importantly they note that there is still a dearth of intervention studies that concern morphology. Carlisle (2010, pp. 464–487) also conducted a meta-analysis of morphological intervention studies and concluded, 'I was further struck by how little has been done since the 1970s to investigate the nature and value of instruction in morphological awareness' p. 481.

English orthography is complex, but it is impossible to know, even though it may seem unlikely, whether young children are capable of learning its complexities without appropriate empirical research. Existing studies generally test the effects of specific

instruction either at the level of the morpheme or the phoneme, but to the present authors' knowledge, none examine the effect of simultaneous instruction involving all levels of representation.

1.3. How children acquire literacy

Integral to many theories of reading and spelling development is the idea that children develop literacy skills in a stage like progression (e.g. Frith, 1985; Larkin & Snowling, 2008). It has been noted (Nunes & Bryant, 2004) that stage theories appear to embody elements of Piaget's constructivist perspective (Piaget, 1970). For example, Piaget believed that children start with an inadequate schema which they apply to everything (e.g. simple phoneme-grapheme correspondence rules). Then as they encounter exceptions to this rule they adapt or extend the schema, which leads to new experiences that eventually lead to the abandonment of that way of thinking (e.g. realisation that phoneme-grapheme correspondences are not straightforward). This subsequently leads to the development of a more sophisticated theory (e.g. taking account of morphology and etymology when spelling words that cannot be reduced to phonology alone).

The Piagetian framework is evident both in the way children are taught, and in the developmental sequences they are assumed to follow. In English-speaking countries such as the US and UK, instruction generally begins with phonics (the alphabetic stage) so it is therefore not surprising that an 'alphabetic stage' precedes the 'orthographic stage'. There is a tendency for stage-models to imply that children's development is endogenously driven, that is that development occurs wholly within the child. Models of development, however, must account for the impact of the child's environment. Piaget's model implies a predetermined path of intellectual development but arguably one of his most important contributions was to show that children's interaction with their environment was central to the process of development. Even when research attempts to explain development in a more comprehensive and detailed way, the impact of instruction is often ignored. For example, Critten, Pine, and Steffler (2007) explored children's spelling development in relation to Karmiloff-Smith's (1992) Representational-Redescription (R–R) model. They discussed how the R–R model accounts for the unexplained cognitive mechanisms that underlie spelling development. They described how the participants' (5–7 year-olds) knowledge of spelling followed a progression from phonological to morphological. However, they did not examine or relate these findings to the instruction that these school children were receiving.

Recent research on teaching literacy skills has focused on the relative merits of synthetic and analytic phonics (Johnston & Watson, 2005) with a relative neglect of other methods of language acquisition. However, the phonics approach may be less compatible with theories of literacy acquisition than some other methods of teaching literacy. It has been argued (Karmiloff-Smith, 1991) that children are 'spontaneous theoreticians' (p. 277), who go about discovering how the world functions (including linguistic worlds) by building theories. In relation to this view of language acquisition, evidence indicates that children can generate hypotheses about written language before they are formally instructed. Interestingly there is evidence that children, prior to any formal literacy instruction, hypothesise that the morpheme, rather than the phoneme, is the basic level of representation in written English (Byrne, 1998). Treiman and Cassar (1997) found that US kindergartners were more likely to judge that double letters were not allowed at the beginning of words than to judge that they were allowed at the middle or end of words. Given children's implicit knowledge about aspects of their writing system and their inclination to form hypotheses (Piaget, 1970), it may be beneficial to

teach early learners multiple levels of representation explicitly. Furthermore, a purely phonic approach only allows the prediction of the spelling of 56% of English words; knowing about all the levels of representation would allow the prediction of the spelling of 97% of words (Crystal, 2000). However, it is also possible that the English writing system may be too complex and confusing for young children to understand. The important point here is that the ability of young children to understand and make use of a range of regularities in the English writing system remains an empirical question.

1.4. The study

The overall aim of the study was to investigate whether teaching children about morphology, phonology, etymology, and rules about form was superior (i.e. led to better reading and spelling performance) to teaching phonics alone. We examined five to seven year olds. Previous research has focused on older children and little is known about the ability of younger age groups to understand and make use of morphology, phonology, etymology, and rules about form (henceforth we use the term 'novel intervention' to refer to the teaching of morphology, phonology, etymology, and rules about form in contrast to a purely phonics approach). A simple cross over design was employed. Half the children were taught using a standard phonics approach and then our novel intervention, for the remainder of the group the order was reversed. Literacy skills were measured prior to the study, after the first intervention and after the second intervention. We formulated two specific hypotheses. Our first hypothesis was that prior to the commencement of the study, children would not use morphological knowledge to help them spell. It was important to investigate this hypothesis as little is known about knowledge of morphology in these age groups and we also wanted a baseline measure of their knowledge in this area. The second hypothesis was that there would be a faster improvement in spelling and reading skills in the novel intervention arm of the trial than the pure phonics arm of the trial. Some authors (e.g. Larkin & Snowling, 2008) suggest that children of these age groups (particularly the five year olds) cannot use morphology. However, based on our practical knowledge as former teachers and the work of Karmiloff-Smith (1991) on children as natural theoreticians we predicted that children could benefit from formal instruction on morphology.

2. Method

2.1. Participants

The school the participants attended was selected because it was a standard state funded primary school that followed the UK National Curriculum and as such was representative of the standard approach to teaching literacy in England. The school served a mixed working and middle-class area in the south of England. All the children in two Year 1 classes and two Year 2 classes participated (including those with special education needs, less than five in each class). Children in the UK are not assessed formally by national tests until seven years of age so there are no precise data on the ability level of the sample.

Sixty boys and 60 girls participated in this six month longitudinal study involving three test sessions. At the end of the project, however, the results were incomplete for 10 of the children because they had been absent for at least one of the three test sessions and thus data are only presented for 54 boys and 56 girls. The first test session (T1) took place in September, the beginning of the school year in the UK. Half of the children were just beginning their second year of schooling (known as Year 1) and half were beginning their

third year of schooling (known as Year 2). The age range of the children in Year 1 was 5 years 1 month–5 years 11 months, while for those in Year 2 it was 6 years 1 month–6 years 11 months. The second test session (T2) took place in early December, and the third test session (T3) took place at the end of March. Thus at T3 the children were six months older than at T1.

At the beginning of this study the children in Year 1 had previously received one year of formal schooling (Reception Year), while those in Year 2 had received two years of formal schooling. The methods of literacy instruction in this school follow the UK National Curriculum. In their first year of school children are taught the initial 'sounds' of the alphabet, for example the /c/ sound as in <cat>, /a/ as in <apple> and so on. They begin to learn the letter names of the alphabet once this first stage is completed. During the first two years children are introduced to consonant digraphs such as /sh/ in <shop> and /ch/ in <chip>. Toward the end of Year 1 children begin to learn vowel digraphs such as /oa/ in <coat> and vowel consonant digraphs such as /ar/ and /er/. In addition, rote learning of specific word spellings is emphasised through the weekly spelling test of specific words. Children in Year 1 begin by learning a list of five consonant-vowel-consonant (CVC) words e.g., <cat>, <mat>, <hop>, <pet>. By Year 2 children have usually progressed to a list of 10 words, including high frequency words such as <the>, <and>, <one>, and words with consonant or vowel digraphs such as <they>. The children also used the Oxford Reading Tree reading scheme (Hunt & Brychta, 2008), a popular scheme in UK schools, progressing through this at their own pace. The Oxford Reading Tree is not a phonic reading scheme; it takes more of a 'whole word' approach and children are encouraged to guess words from context or picture clues. The standard practice at the school was for the children to take a new book home each week and learn to read the sentences by rote. The teacher or teaching assistant would assess whether this was achieved by listening to each child read once a week.

In Reception Year, Year 1, and Year 2, children are not taught anything about morphology, either explicitly or implicitly. In Year 2, at this school, they are alerted to words ending in the same letter strings such as <ing>, but there are no explicit references to suffixes. As the focus is purely on phonics, the children are not taught any spelling rules or etymology. At the beginning of the study, the school was implementing the 'Letters and Sounds' curriculum (DfES, 2007) that lays down all the phonemes and the order in which the children should learn them from Reception Year onwards. 'Letters and Sounds' is a systematic method of teaching phonics comparable to synthetic phonics.

2.2. Design

This study employed a cross-over intervention design. Four complete classes of children participated (two Year 1 and two Year 2 classes). Each class was divided into two sub-groups of mixed ability based on teacher assessments. This produced eight sub-groups overall, each with 15 children. Four of these sub-groups, two from each Year group, were labeled "Group A (Intervention First)", and the remaining four were labeled "Group B (Intervention Second)".

Each child completed three test sessions and six weeks of daily intervention lessons. The study began with all children participating in a test session (T1) spread over two weeks. Both groups received their daily intervention lessons in a class of 15 children, while the remaining 15 children in each class continued with their usual lessons with their class teacher. After the Group A children had received six weeks of intervention lessons all the participants in both conditions repeated the tests in the second test session (T2). Group B then received their six weeks of daily intervention lessons,

whilst the Group A children returned to their usual lessons with their class teacher. Following this all participants took part in the third test session (T3), again spread over a two-week period.

Each test session was the same. It comprised: two spelling tests, one standardised and one specifically designed for the study; a standardised test of reading; and a short individual interview with every child that was designed to assess knowledge of specific structures and rules of the writing system.

This design was necessary for two reasons. Firstly, it was important to have a control group and thus Group B was a control group until after T2. Secondly, it was important that all the children participating in the study received the same treatment due to ethical standards, and thus Group B received the same treatment after T2.

2.3. Materials and procedure

2.3.1. The spelling tests for each of the three test sessions

Over the course of two-weeks the children were given dictated spelling tests. The first of these was the standardised Schonell spelling test (Schonell & Goodacre, 1971) as used in similar research (Devonshire & Fluck, 2010; Nunes & Bryant, 2006). This test comprises a list of words of increasing difficulty, beginning with simple CVC words and high frequency words, and progressing to multi-syllabic, polymorphemic and low-frequency words. Participants were tested on the first 45 words of this test which were presented in batches of approximately 15 words at a time with an interval of about one day between batches. This was to ensure that the task demand was not affected by tiredness in the young participants, and was also in line with the demands usually expected by the children in this school. During this time, they were also given a spelling test of 22 words that was specifically designed to show effects of the intervention lessons (see Appendix 1). This list of words included pairs that were morphologically related, e.g., <love> and <lovely>, <magic> and <magician>, <real> and <really>. Also included were words for which a specific rule was to be taught during the intervention, for example the rule that <uv> never appears in an English word, as in <dove>. For both tests the children were first told the target word and were then read a sentence that made the meaning of the word clear, after which the target word was repeated. For example, the teacher said "cut, I cut the apple with a knife, cut".

2.3.2. Reading test for each of the three test sessions

Children were tested individually on the standardised Schonell Reading Test (Schonell & Goodacre, 1971). This test requires children to read a list of individual words (sentence context is not provided), which become progressively more difficult. It begins with a mixture of simple high frequency words and words with straightforward phoneme grapheme correspondences, e.g., <look>, <tree>, <bun>. Difficulty then increases as the words become less common and phonological skills alone cannot be relied upon, e.g., <knowledge>, <postage>. There is no time limit to the test but testing ceases when a child makes 10 pronunciation errors in succession.

2.3.3. Scoring of tests

For every correctly spelled word, in both the Schonell (Schonell & Goodacre, 1971) and study spelling tests, a score of one was given. This is the standard scoring for the Schonell test. For example the word <cut>, if spelled <cut>, was given one mark. If spelled incorrectly as <*kut> it received no marks. There was no judgment to be made as words were either correct or incorrect. When scoring words for the number of correctly spelled morphemes, one mark was given to each morpheme spelled correctly. For example the

word <helped> has two morphemes <help> and <ed>, therefore if both morphemes were spelled correctly then a score of two would be given. If only one morpheme was spelled correctly as in <*helpt> only one mark was given as the base morpheme <help> was spelled correctly but the suffix morpheme <ed> was spelled incorrectly. The scoring on the Schonell reading test was scored according to the recommended standard procedure (Schonell & Goodacre, 1971).

2.3.4. Individual interviews

Each child was also interviewed for approximately 5–10 min. These interviews were conducted in a quiet area, outside the classroom, where teachers and teaching assistants hear children read individually. All the children were asked a few questions (see Appendix 2) about specific features of the English writing system. They were asked to name the vowel letters and to say what they knew about them. They were asked to look at six words written on individual flashcards (if they were unable to read the words the researcher read the word). In each case they were asked whether they could identify the base-word or suffix in the word. The children were also asked to say what the <s> was for in the pair of words <hat/hats>.

2.3.5. Intervention lessons

For the intervention the children were taught in their sub-groups of 15 for 25 min every day by a qualified and experienced teacher in a classroom within their school. The learning objectives for Year 1 and Year 2 children were the same but there were opportunities for more able children in both Years to undertake extension activities. So, for example, if a child finished a task ahead of the rest of the class, they were able to undertake another task which was an extension of the first, e.g., find more words using the same base-word by adding additional suffixes or prefixes.

The purpose of the intervention lessons was to emphasise the structure, logic and meaning inherent in the English writing system. The children were first introduced to the vowel letters and the fact that every word must contain a vowel. They were also taught the function of the letter <y> as a vowel. The children were also taught how to count the number of syllables in words, and that each syllable should also contain a vowel. They were also taught spelling rules that are almost entirely consistent (the very few exceptions coming from foreign loan words). For example they were taught that <uv> is not an acceptable letter pattern in English, and the reasons why this rule came into existence. Teaching about morphology was central to the intervention lessons. The children were introduced to the terms 'prefix', 'suffix', and 'base word', and taught how to identify these, and about the rules for combining them to make new words. They were also taught basic etymology; for example, the fact that certain silent letters in words are etymological markers, which relate to other words sharing the same root, e.g., the silent <w> in <two> is an etymological marker relating the words <twin>, <twice>, <twelve> and <twenty>.

The first lesson of the intervention introduced the idea that the way we spell words is not just about writing how they sound, but also about rules that we need to know. The children were told that parts of words have meaning and we can use these 'building blocks' (morphemes) to build words. They were shown examples of words on the whiteboard and how they were 'built', starting with a base word and adding affixes. The children were encouraged to identify the base words and what the affixes might be. Examples were given orally; for example, the teacher said 'today I play football, yesterday I play – 'football''. The children were asked to give the correct ending, which was then written on the whiteboard for the whole class to see. The children also had their own individual whiteboards which they used throughout the lessons (as is common practice in the UK- and

was the same for the children who were receiving their phonic lessons in the alternative group). Subsequent lessons recapped the lesson before and then 5–10 min was devoted to work on vowels and syllables (for example the children would say their name, clap the number of syllables, write their name on their whiteboard and identify the vowels in each syllable). There would then be 10 min of morphology. Words would be selected from the list of words covered in the other phonic class, and this would be used as the basis for adding prefixes. So when the phonic class was looking at the phoneme /ay/ (list of phonemes covered, by phonics class followed *Letters and Sounds* (Df ES, 2007) document), base words with this grapheme were selected to use in word sums i.e. the children were shown the word sum <play + ful → playful>. A list of affixes was gradually compiled over the lessons and this remained on the whiteboard. The children were encouraged to use the words in sentences (Year 1 children wrote the word sums on their whiteboards, and said the sentences orally. Year 2 children often had time to also write a short sentence on their whiteboards or on paper). Phonology was also included in this part of the lesson and children were told that phonics can be applied to base-words; for example, they were told "today we are looking at the letters [ay] when they are together when making the sound /ay/". It was also explained that phonics only necessarily applies to base-words. For instance the word <say> follows phonic rules but when the suffix <s> is added the word is pronounced /sez/ (as in the southern British accent). This highlighted the importance of identifying the base word first when attempting to spell. The remaining 10 min of the lesson were used to talk about rules and etymology. An example would be looking at etymological markers, so the children would be given a word such as 'two' and look for meaning-related words that also had similar spellings. A word web (spider diagram) would be produced on the whiteboard with all the different connected words and the etymological marker letter (in this case the <w> in <two> <twin> <twice> and so on) would be highlighted in a different color.

3. Results

The main aim of this study was to see whether it was possible to teach children explicitly about morphology, phonology, etymology, and rules about form simultaneously, and whether this would improve their reading and spelling. The results begin with an exploration of the relationship between the Schonell tests and the novel intervention tests. The results are then organised according to the two hypotheses specified at the end of the introduction.

3.1. General spelling measures

At each of the test phases (T1, T2 and T3) the children were tested on the standardised Schonell spelling test and a second spelling test designed specifically for this study, hereafter known as Study spelling test. There were strong positive correlations between the Schonell spelling test and the study spelling test at T1, $r(110) = .84$, $p < .001$, T2, $r = (110) = .90$, $p < .0001$ and T3, $r(110) = .90$, $p < .0001$. The high positive correlations between the Schonell test and the Study test demonstrate the construct validity and the reliability over time of the Study test. For each of the tests the children were given a score of one for each word spelled correctly. The overall score was the total number of words spelled correctly.

3.2. Spelling at Time 1 (Hypothesis 1: children do not use morphological knowledge to help them spell)

At T1 none of the children had been explicitly introduced to the concept of base-words and suffixes, however, it is possible that they may have implicitly known something about the need to retain the

spelling of a base-word when adding a suffix. It is impossible to tell whether this is the case from the analysis of correct spellings because accurate spelling could simply be the result of word-specific knowledge or the use of analogy. In contrast, an analysis of spelling mistakes is more informative about a child's knowledge of spelling. If children correctly spelled a base-word but misspelled its derived or inflected form, this is evidence they were not drawing on morphological knowledge. The spelling results at T1 were therefore examined to identify instances where a child had correctly spelled the base word but had incorrectly spelled the derived word.

Table 1 shows the number of children who correctly spelled different base words but incorrectly spelled them in the derived words, compared with children who correctly spelled both. It can be seen that several children were not applying morphological knowledge of base-words and suffixes to their spelling of derived words despite spelling the corresponding base-words correctly. For each of the pairs of words the majority of the children did not preserve the base word in the derived word and spelled the derived word incorrectly. As can be seen in Table 1 the observed differences were only significant for two of the word pairs.

To explore this further, children's misspellings of base and derived words were examined. It is possible that even though some children were unable to spell the base-words correctly they could still use a morphological approach and make a spelling connection between a base and its derived or inflected counterpart. Table 2 shows the number of children who misspelled the base-word and whether they preserved their idiosyncratic spelling in the derived word. For example they may have incorrectly spelled <love> as *<luv> but maintained this spelling in the derived word <lovely> by spelling it <luvly>. Again the results show that children were more likely to change their base spelling, than maintain it; therefore, it is unlikely that they had made a connection between the spelling of a base-word and its derived form and were not employing a morphological approach when spelling these words. For each of the pairs of words the majority of the children did not preserve the base word in the derived word and spelled the derived word incorrectly. As can be seen in Table 2 the observed differences were significant for two of the word pairs (see Table 2). It is important to note that children who either failed to spell both words, or at least write four letters for both words (three in the case of the word <love>) were excluded from the analysis.

If the intervention were effective then children who spelled the base word correctly would be more likely to spell the derived form correctly. Evidence for this is presented in a later section, where the number of correctly spelled morphemes is analyzed, which takes (by default) the spelling of base-words and suffixes into account.

Table 1

Number of children who correctly spelled the base-word and either did or did not preserve the spelling in the derived word at T1.

Correctly spelled base-word preserved/not preserved in derived word	Number of children (N = 110)	Z value
Real-correct spelling preserved e.g., real/really	4	.45
Real-correct spelling not preserved e.g., real/rilly	6	
Love-correct spelling preserved e.g., love/lovely	19	2.45*
Love-correct spelling not preserved e.g., love/luvly	33	
Magic-correct spelling preserved e.g., magic/magician	6	2.47*
Magic-correct spelling not preserved e.g., magic/majishon	15	

* denotes a significant difference, $p < .05$.

Table 2

Number of children who misspelled base-word and either did or did not preserve their misspelling in the derived word at T1.

Misspelled base-word preserved/not preserved in derived word	Number of children (N = 110)	Z value
Real-misspelling preserved e.g., riyol/riyoly	5	6.65*
Real-misspelling not preserved e.g., riyol/rilly	36	
Love-misspelling preserved e.g., luve/luvely	8	.65
Love-misspelling not preserved e.g., luve/luvly	11	
Magic-misspelling preserved e.g., majic/majicon	3	8.13*
Magic-misspelling not preserved e.g., majic/majishun	43	

* denotes a significant difference, $p < .05$.

3.3. Hypothesis 2: the novel intervention leads to greater improvement in spelling and reading skills than a phonics instruction control condition

The aim of the intervention was to see whether explicitly teaching children about morphology, etymology, phonology, and rules about form, improved their spelling and reading performance. Four measures of language performance were included: the Schonell spelling test; the Study spelling test; the correct use of morphemes; Schonell reading test. It was predicted that both groups of children would improve between T1 and T3, because of maturation and all the children were receiving some type of instruction. The most important comparison is between groups at T2, when Group A had received intervention and Group B a phonic instruction control condition. It was predicted that Group A would significantly outperform Group B at T2 on all measures of spelling and reading. We further hypothesised that at T3 Group B, having then received intervention, would have 'caught up' with Group A and there would be no difference in performance between the groups at T3.

To investigate the hypothesis, we conducted an initial omnibus 2×3 mixed factorial MANOVA, which included an independent groups factor (Group, A-Intervention first, B-Intervention second) and a within subjects factor, (Time of Testing, T1, T2, T3), on the four primary measures of performance (Schonell spelling scores, Study Test Scores, Correctly spelled morphemes and Schonell reading scores). There was no significant main effect of Group ($p = .06$, n.s.), there was a significant main effect of Time, Wilk's $\lambda = .12$ $F(8, 96) = 84.59$, $p < .0001$, $\eta_p^2 = .88$, and a significant interaction between time and group, Wilk's $\lambda = .47$ $F(8, 96) = 13.66$, $p < .0001$, $\eta_p^2 = .53$. The main effect of time and the interaction both had large effect sizes.

To clarify the nature of the MANOVA results we conducted four 3×2 mixed univariate ANOVAs using the independent variables already specified. As can be seen in Table 3 there was a significant main effect of time for all dependent variables (all results with large effect sizes). The scores for all tests increased as a function of time and post hoc comparisons revealed that all differences between means were significant ($p < .05$ with Bonferroni adjustment).

As the MANOVA main effect for condition was not significant we did not conduct multiple univariate tests using condition as a variable.

The most important results with regard to the evaluation of the efficacy of the intervention are the interaction effects. As can be seen in Table 4 all the interactions were significant all with large effect sizes.

The shape of the interaction effects was the same for all of the four dependent variables (see Figs. 1–4). Performance improved

Table 3
Main effect of time on Schonell and study spelling, morpheme scores and Schonell reading.

Test	$F(df)^*$	p	η_p^2	T1 M (SD)	T2 M (SD)	T3 M (SD)
Schonell Spelling	194.72 (1.87,193.66)	<.0001	.65	19.02 (8.91)	22.95 (8.11)	26.08 (7.68)
Study Spelling	310.72 (1.76,184.59)	<.0001	.75	4.55 (4.94)	9.47 (6.60)	12.57 (5.62)
Morpheme Score	430.71 (1.74,178.98)	<.0001	.81	27.42 (17.16)	40.65 (19.22)	49.64 (16.64)
Schonell Reading	195.65 (1.72,182.22)	<.0001	.65	17.51 (12.46)	24.54 (15.04)	31.00 (14.37)

* = df's Greenhouse-Geisser adjusted.

for both groups as a function of time, however, there appeared to be a sharper increase for Group A from T1 to T2 and a much sharper increase for Group B from T2 to T3.

Simple main effects analysis confirmed this interpretation for all four variables. There were no significant differences between groups at T1 and T3 but there were significant differences at T2. With reference to all four measures, Group A performed significantly better than Group B at T2 (see Table 5).

The results reveal that the intervention did have a large, positive and significant effect on performance on number of vowels known, suffix identification and base identification; significant effects were also observed on the two spelling measures but with smaller effect sizes and there no significant effect on percentage of words spelled with a vowel. The performance of the groups were similar at the outset but significant improvement was found for Group A between T1 and T2 (after their intervention) and then for Group B between T2 and T3 (after their intervention), resulting in no significant difference between groups at T3.

To further investigate the effects of the intervention at T2, when Group B-Intervention second had not yet received any intervention, a one way MANOVA with Group as the independent groups factor was performed on six specific spelling measures recorded at T2. These measures relate to specific English spelling conventions taught to the children: correct spelling of <ov> in words where the pronunciation is [uv]; correct spelling of the word <two>; number of words spelled with a vowel as opposed to without a vowel letter; number of vowels known; correct identification of a suffix within a word; and the correct identification of a base word within a word.

A significant difference between groups (with a large effect size) was observed, Wilks's $\lambda = .11$, $F(6, 103) = 143.61$, $p < .0001$, $\eta_p^2 = .89$. Univariate ANOVAs on the six spelling measures revealed that performance was significantly better in Group A than Group B except for 'words spelled with a vowel' where there was a ceiling effect for both groups (Table 6).

4. Discussion

We investigated whether teaching five to seven year olds about morphology etymology, phonology and form rules, significantly improved their spelling and word reading skills. With regard to our first hypothesis we found that children were not using morphological knowledge to spell words prior to our intervention; children were significantly less likely to preserve the spelling of a base word when spelling its derived or inflected counterpart. With regard to the second hypothesis, we found that performance on the four

measures of literacy competence (general spelling, spelling of morphemes, specific spelling rules and word reading) was improved to a far greater degree by our novel intervention in comparison with a phonics control condition. At T2, the novel intervention group performed significantly better than the control group, indicating that the overall improvement from T1 to T3 was significantly influenced by the intervention rather than simply reflecting the effect of the children's usual phonics teaching and maturation. The results from the specific spelling measures also confirmed that children had learned rules about morphemes, etymology and form. The results show that the children were able to understand the terms *base-word* and *suffix*, and were able to parse words into these constituent parts. It is important to note that some of the effect sizes were large both in terms of the accepted statistical interpretation and in practical terms. For example the improved scores at T3, for both groups, on the Schonell reading and spelling standardised tests relate to an improved reading and spelling age of 14 months and 7 months respectively.

With reference to the first hypothesis the results show clear evidence that most children were not using morphological strategies to spell prior to formal instruction in these techniques. This finding is consistent with the results of previous research (Larkin & Snowling, 2008). However, the failure of the children to make use of morphological strategies may be due to the fact that they had already received formal phonics instruction, and phonics had become their default strategy when attempting to spell. Some researchers have taken the failure of younger children to spontaneously use morphological strategies as evidence that they would be unable to learn and use morphological strategies to spell (e.g. Larkin & Snowling, 2008; Nunes & Bryant, 2009). Nunes and Bryant

Table 4
Interaction effects of time and condition on Schonell and study spelling, morpheme scores and Schonell reading scores.

Test	$F(df)^*$	p	η_p^2
Schonell Spelling	8.41 (1.87,193.66)	<.0001	.07
Study Spelling	29.10 (1.76,184.59)	<.0001	.22
Morpheme Score	29.75 (1.74,178.98)	<.0001	.23
Schonell Reading	10.30 (1.72,182.22)	<.0001	.09

* = df's Greenhouse-Geisser adjusted.

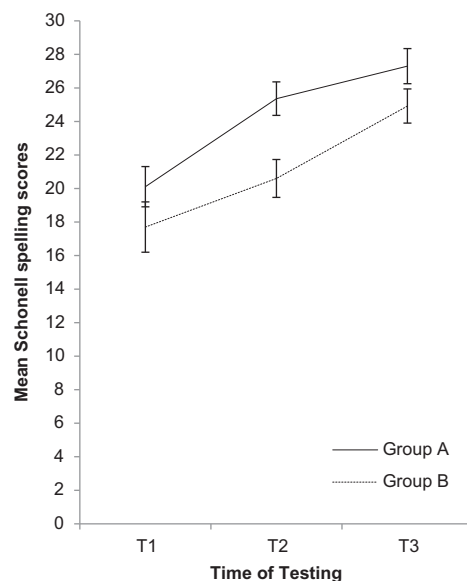


Fig. 1. Mean Schonell spelling scores as a function of group and time of testing error bars indicate standard error.

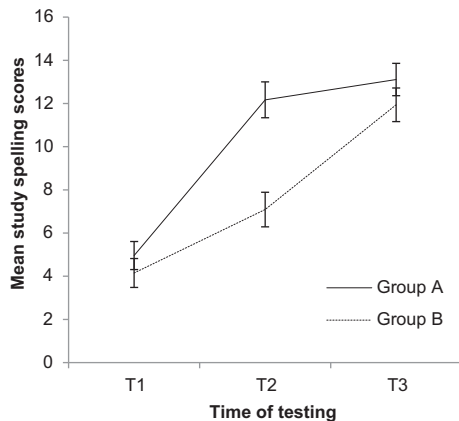


Fig. 2. Mean study spelling scores as a function of group and time of testing; error bars indicate standard error.

(2009) assert, 'there is no point in trying to teach children all the complexities of a very sophisticated system at the same time' (p. 13). They go on to say that 'on the whole, nowadays, teachers begin with the alphabet, showing how individual letters represent sounds and at the same time how words consist of separable sounds' (2009, p. 13). They argue that it is preferable to begin (aged 5 years) with phonic teaching before introducing the other elements of the writing system.

Despite the results that children in the sample did not spontaneously use morphological information, the results regarding Hypothesis 2 demonstrated that they can. The results show clear evidence that children in the age groups used in the study are able to make use of a variety of strategies when learning to spell and read. Furthermore, our results suggest that the use of such strategies lead to meaningful improvements in performance in comparison to using phonics alone. This is consistent with other intervention studies that have demonstrated that children *can* use morphology to aid their spelling (e.g., Bowers et al., 2010; Carlisle, 2010; Devonshire & Fluck, 2010; Hilte and Reitsma (2011)). Unlike these previous studies that focused on morphology, a variety of languages and older children, our study included elements of the complete English orthography and a younger age group.

4.1. Theoretical implications

The results of our study do not lend obvious support to many stage models of reading and spelling development. Many of these

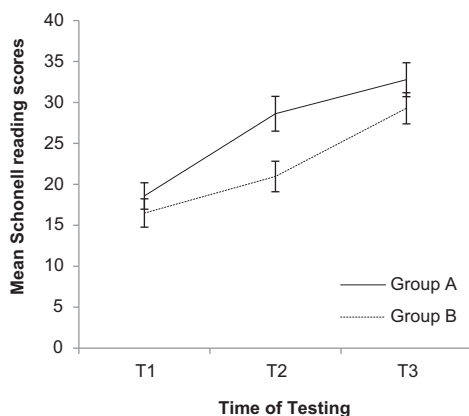


Fig. 3. Mean Schonell reading scores as a function of group and time of testing; error bars indicate standard error.

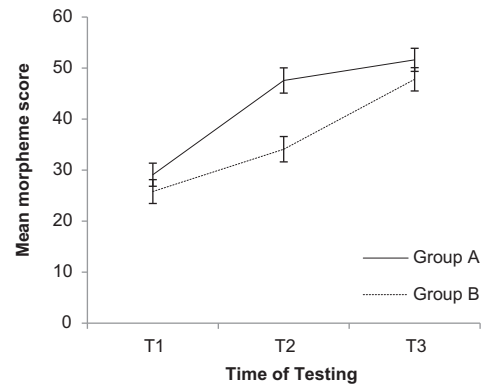


Fig. 4. Mean number of correctly spelled morphemes as a function of group and time of testing; error bars indicate standard error.

models (e.g. Frith, 1985; Gentry, 2005) share a stage model with wider theories of cognitive development. Stage-models of spelling development generally fall into two categories in respect to their predictions about 'appreciation of morphological conventions' (Pacton & Deacon, 2008, p. 13). The first category comprises 'late' models. These models are the most common and many assume that it takes several years for children to be able to appreciate the role of morphology in spelling. It is suggested that it is not until the final stage of spelling development that children can begin to use morphological rules to aid spelling (see Beers & Henderson, 1977; Ehri, 1997; Frith, 1985; Gentry, 2005). The children in our study could be described, after intervention, as being at the orthographic stage because they were demonstrating strategies beyond the alphabetic stage. Reaching the final stage, however, implies mastery of reading and spelling so that it is an automatic process. In reality, both alphabetic knowledge (phonics) and orthographic knowledge will need to be accessed at different times indefinitely.

Stage-models of literacy development which emphasise the 'late' stage reflect teaching practice in the UK. Larkin and Snowling (2008) conclude that because children do not use morphological strategies this supports 'late' stage models and recommend the use of a phonics approach. As their study did not compare different methods of instruction, however, the evidence does not support this conclusion. We suggest Seigler's (2005) overlapping waves model may be more applicable to reading and spelling development than models based on notions of 'stage'. In the overlapping waves model children make use of a variety of strategies to cope with a variety of cognitive tasks rather than moving sequentially from one strategy to another depending on stage.

4.2. Linguistic skills learned from the intervention and educational implications

In both the Year 1 and 2 classes the more able children were able to complete extension exercises such as finding more affixes, and

Table 5
Test scores for Groups A and B at T2.

Test	Group A	Group B	<i>d</i>
Schonell Spelling*	<i>M</i> = 25.36 <i>SD</i> = 7.18	<i>M</i> = 20.44 <i>SD</i> = 8.29	.63
Study Spelling*	<i>M</i> = 12.17 <i>SD</i> = 6.21	<i>M</i> = 7.09 <i>SD</i> = 5.94	.84
Morpheme Score*	<i>M</i> = 47.57 <i>SD</i> = 17.94	<i>M</i> = 34.10 <i>SD</i> = 18.20	.74
Schonell Reading*	<i>M</i> = 28.62 <i>SD</i> = 15.42	<i>M</i> = 20.96 <i>SD</i> = 13.78	.52

* = Difference between groups sig <.05 (Bonferroni adjusted).

Table 6
Mean scores for spelling measures at T2 as a function of group.

Spelling measure	Group A	Group B	F(df)*	p	η_p^2
<ov> spelling	M = 2.32	M = 1.20	33.65 (1108)	P < .0001	.24
Max score = 3	SD = .96	SD = .95			
Spelling of <two>	M = .70	M = .33	16.56 (1108)	P < .0001	.13
Max score = 1	SD = .46	SD = .47			
No. vowels known	M = 6.00	M = .00	271.04 (1108)	P < .0001	.72
Max score = 6	SD = 1.58	SD = 1.95			
Suffix identification	M = 2.50	M = .02	410.15 (1108)	P < .0001	.79
Max score = 3	SD = .91	SD = .13			
Base identification	M = 2.11	M = .08	135.38 (1108)	P < .0001	.56
Max score = 3	SD = .88	SD = .23			
% Words with vowel	M = 99.51	M = 99.42	.066 (1108)	p > .05 n.s.	.001
Max score = 100%	SD = 2.39	SD = 1.34			

writing sentences including the target words. The less able children were able to focus on fewer examples and were able to say sentences orally. The intervention lessons were thus tailored to allow teachers to differentiate work and expectations for mixed ability children. In the present study, analysis of children's spelling at T1 showed that more often than not they did not retain their spelling of a base-word in the derived word. This was evident both when children could and when they could not correctly spell the base word. Thus, the word <love> was correctly spelled by 33 children but those same individuals incorrectly spelled the base in the derived form <lovely>. This suggests that the correct spelling of <love> was due to the frequency of exposure to this common word. The misspellings of the derived word show that these children were making plausible phonological representations, reflecting their exposure to phonic teaching. Although this is consistent with Larkin and Snowling's (2008) finding, the current study shows that children were actually capable of parsing words correctly into their constituent morphemes, and this in turn improved their spelling and reading performance.

In our study the children were taught that the spelling of a base-word can usually be predicted by phonic rules, although sometimes rules about form need to be considered. They were also taught that the spelling of a base word is retained in the spelling of derived and inflected words, even though the pronunciation may change, as in <magic> and <magician>. In addition, they were taught that if a base-word ends in a vowel and a suffix begins with a vowel, such as <love + ing>, they should remove the final vowel from the base-word. It is understandable that educators may believe that these spelling conventions are too complex for such young children to grasp, but our results indicate that children are able to make use of such knowledge. Examples of how children were using this new knowledge were recorded by the researcher during the intervention lessons e.g:

Example 1:

AH (female, 5 yrs): *can you have 'lovelful'?*

Teacher: *That's interesting. I'm not sure. What do you think?*

AH: *yep I think it is ok, um 'cause you can be full of love.*

Teacher: *I agree, but I don't think it is a word that is used much, if it is-we'll have to look it up.*

This 5 year-old was spontaneously created a hypothesis for herself, and was able to explain her reasoning behind her thought. This also demonstrates that the explicit teaching that the child received was now available to her as explicit knowledge that she was able to articulate. Karmiloff-Smith's (1992) Representational-Redescription (RR) model describes how knowledge is represented in the cognitive system and how this knowledge changes with development; developing from implicit to explicit representations. It may be beneficial for future research to address the link between explicit teaching and how

this supports implicit to explicit knowledge in children's spelling development, using the RR model.

Example 2:

JD (male, 6 yrs): *Do all languages have vowels or is it just English?*

AM (female, 6 yrs) in response: *Well, I don't think Chinese has because we learnt it. I went to Locks Heath school. I really liked it I don't know why, I can write Happy New Year but you don't use letters- can I do it on the white board?*

In this example the children were engaging in a conversation about their own language, and demonstrating their interest in the comparisons with other languages.

Example 3:

VS (male, 7 yrs): *Mrs Brown says <y> isn't a vowel but it is isn't it?*

Teacher: *Why do you think it's a vowel?*

VS: *'cause you've got to have one in every word?*

Teacher: *excellent, can you think of an example?*

VS: *well it's not yellow, Mrs. Brown said that but I said <fly> and it's a vowel in <Lucy>.*

Example 3 shows that the children had remembered some rules to do with form and were able to discuss the information learned.

Example 4:

HR (female, 6 yrs): *Look that says heater (pointing at sign above radiator) is <heat> the base word and <er> the suffix?*

Teacher: *well done.*

Example 4 demonstrates that the children understood the terms base-word and suffix and were spontaneously able to identify examples for themselves.

Such examples demonstrate wider meta-linguistic skills being developed, such as thinking about language, being able to discuss the structure of words, and showing a logical understanding of the different ways writing systems work. It is clear from these examples that the children were connecting spelling to meaning, and discussing different levels of representation in written words. Nunes and Bryant (2009) emphasise that research has shown that morphological knowledge is a 'powerful linguistic skill, with consequences for vocabulary learning, reading comprehension, and there are indications that it is also important for second language learning' (p. 215). They also suggest that leaving the task of discovering morphology entirely to children themselves, through implicit learning, is a questionable educational practice. The evidence presented here goes even further than this: it suggests that children should also be taught about etymology, and rules about form, right from the beginning of their education.

4.3. Limitations of the study

There is always a trade-off between laboratory-type research, which can be more tightly controlled, and ecologically valid research such as that taking place in a classroom. Classroom research provides a real-life setting, which is important to investigate as any intervention needs to demonstrate whether it is realistically effective. However, each class is unique. Classroom dynamics, such as children's behavior, available resources and teacher-pupil interaction, may affect results. It also makes it difficult to replicate an intervention exactly. Nonetheless, the results from this study show that children can learn about the complexities of their writing system very early on in their learning. Additional measures of the participants' abilities would have provided further

information, which would have helped to evaluate the effectiveness of the intervention further. Due to time constraints (the study took 18 weeks in school) in the curriculum it was not possible to conduct further testing, however, measures related to children's vocabulary growth and comprehension skills would be valuable.

4.4. Conclusion

The intervention showed that making children aware of the way the English writing system works, in terms of all levels of representation, improved their reading and spelling. These findings have important implications for developmental theories of reading and spelling, and for educational practice. Nunes and Bryant (2009) have set out clearly the advantages for teaching children nine years and older about morphology. However, based on our findings we suggest that in addition to teaching morphology, children should be taught etymology, and rules about form, from the beginning of their formal literacy education, from the age of five years. Future research should examine children's reading and spelling in a longitudinal study which charts the development of children who receive such an intervention from the age of five through to the end of Primary education. This would provide the clearest evidence for the efficacy of teaching more aspects of the English orthography. In conclusion we suggest that our results do provide evidence that morphology, etymology, phonology and form rules can and should be included from the start of formal English literacy instruction.

Appendix 1

List of words for Study spelling test.

Play, real, love, with, playing, helped, lovely, withhold, magic, hope, hopeful, really, magician, dove, display, player, two, have, replay, gain, saying, fly.

Appendix 2

Questionnaire for individual interview

- 1 What are the vowel letters?
- 2 Why are the vowel letters important/what can you tell me about vowels?
- 3 What is the 's' for in the pair of words hat/hats?
- 4 How would you go about spelling the word <two>?
- 5 What is the base word in <says>, <played>, <magician>?
- 6 What is the suffix in <helping>, <player>, <careful>?

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