Commentary

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The importance of correctly characterising the English spelling system when devising and evaluating methods of reading instruction: Comment on Taylor, Davis, and Rastle (2017)

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Abstract

Taylor, Davis, and Rastle employed an artificial language learning paradigm to compare phonics and meaning-based approaches to reading instruction. Adults were taught consonant, vowel, and consonant (CVC) words composed of novel letters when the mappings between letters and sounds were completely systematic and the mappings between letters and meaning were completely arbitrary. At test, performance on naming tasks was better following training that emphasised the phonological rather than the semantic mappings, whereas performance on semantic tasks was similar in the two conditions. The authors concluded that these findings support phonics for early reading instruction in English. However, in our view, these conclusions are not justified given that the artificial language mischaracterised both the phonological and semantic mappings in English. Furthermore, the way participants studied the arbitrary letter-meaning correspondences bears little relation to meaning-based strategies used in schools. To compare phonics with meaning-based instruction it must be determined whether phonics is better than alternative forms of instruction that fully exploit the regularities within the semantic route. This is rarely assessed because of a widespread and mistaken assumption that underpins so much basic and applied research, namely, that the main function of spellings is to represent sounds.

Keywords

Phonics; whole language; morphology; reading instruction; structured word inquiry

The importance of correctly characterising the English spelling system when devising and evaluating methods of reading instruction. Comment on Taylor, Davis, and Rastle (2017).

Taylor et al. (2017) reported a behavioural experiment that they took to support a specific form of reading instruction called phonics, and an fMRI study that was claimed to provide some insight into how phonics improves performance. Here, we focus on the behavioural data, and show that the findings do not support their conclusion. The fundamental problem is the authors mischaracterised the English writing system in a way that biased the results and constrained the hypotheses they entertained and tested. Although our critique focuses on this study, it is important to note that the mischaracterisation of the English writing system is widespread in the psychology and education literatures.

The study was designed to compare the efficacy of two general approaches to literacy instruction, namely, phonics that emphasises the importance of first learning letter-to-sound correspondences within a phonological route for reading, and meaning-based approaches that emphasise the importance of learning letter-to-meaning

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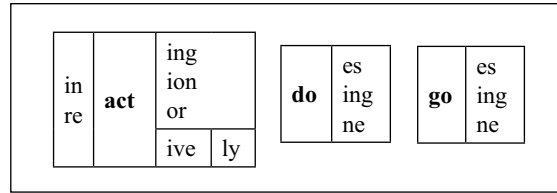Email: j.bowers@bristol.ac.uk

Figure 1. These morphological matrices highlight that the spelling of the base <act>, <do>, and <go> are consistent across all members of their morphological families despite the frequent pronunciation shift of this base in some family members (e.g., <action>, <does>, and <gone>). Note, suffixes do often cause a change in the spelling of the base (dropping final, single, silent <e>s; doubling final, single consonants; and <y> / <i> changes), but the rules are completely consistent. This highlights the consistent mapping of English spellings to meanings. For more detail, see Bowers and Bowers (2017).

mappings in a semantic route from the start. Although Taylor et al. did not describe that latter approach in any detail, the most common are "whole language" and "balanced literacy" methods that assume that children learn best if they are exposed to and engage with words in meaningful texts. Critically, on these two (related) versions of meaning-based instruction, there is little or no systematic instruction into how to map letters to phonemes (Moats, 2000).

To contrast phonics with meaning-based approaches, the authors used an artificial language approach in which they taught participants novel monosyllabic and monomorphemic consonant, vowel, and consonant (CVC) words composed of novel letters. Critically, the mappings between letters and sounds were completely systematic, whereas the mappings between letters and meaning were completely arbitrary. Participants learned the words over multiple days, with phonological training emphasised for some words, and semantic training emphasised for others. At test, performance on naming tasks was better following training that emphasised the phonological rather than the semantic mappings, whereas performance on semantic tasks was similar in the two conditions. Based on these results, the authors concluded that

> . . .early literacy education should focus on the systematicities present in print-to-sound relationships in alphabetic languages, rather than teaching meaning-based strategies, in order to enhance both reading aloud and comprehension of written words. (p. 826)

The conceptual flaw in the experiment

The problem with Taylor et al.'s experiment is that the artificial language mischaracterised both the phonological and semantic routes in ways that that made it easier to learn words in the phonological condition. In addition, the use of arbitrary letter-meaning mappings restricted the types of meaning-based training that could be considered. In our view, this undermines the conclusions that the authors draw.

With regards to the phonological route, the letter-sound mappings in the artificial vocabulary were completely systematic, whereas approximately 16% of the monosyllabic

words included in *The Children's Printed Word Database* (Masterson, Stuart, Dixon, & Lovejoy, 2010) are "irregular" in the sense that they have unexpected pronunciations according to phonics (as calculated by Max Coltheart and Steven Saunders using DRC 2.0.0-beta.3511's vocabulary and GPC rules). Furthermore, irregular words tend to be the most frequent (of the 100 most frequent words in *The Children's Printed Word Database*, 49% are irregular; Masterson et al., 2010), and additional sources of variability in grapheme-phoneme correspondence arise in multisyllabic and multimorphemic words that constitute most of words in children's text (e.g., Anglin, 1993). Accordingly, a high percentage of the words in children's books cannot be read correctly using phonics. Importantly, these irregularities have an impact on word learning: Learning to pronounce words and nonwords is more difficult in English compared to other languages with more consistent grapheme-phoneme correspondences (e.g., Seymour, Aro, & Erskine, 2003). This demonstrates that the inclusion of consistent grapheme-phoneme mappings in the artificial language is not only unrepresentative of English, it likely biased the results in favour of the phonological condition.

With regard to the semantic route, the arbitrary letter-to-meaning mappings in the artificial language is a more fundamental misrepresentation of English. English is a morphophonemic system in which spellings have evolved to represent sound (phonemes), meaning (morphemes), and history (etymology) in an orderly way. As Venezky (1999) put it,

> English orthography is not a failed phonetic transcription system, invented out of madness or perversity. Instead, it is a more complex system that preserves bits of history (i.e., etymology), facilitates understanding, and also translates into sound. (p. 4)

Indeed, English spelling favours the consistent spelling of morphemes over the consistent spelling of phonemes. To illustrate, consider the morphological families associated with the bases <act>, <do>, and <go> in Figure 1. The spellings of the bases are consistent across all members of the morphological families despite pronunciation shifts (e.g., *acting* vs. *action; do* vs. *does; go* vs. *gone*). Or consider the consistent spelling of the <-ed> suffix in <jumped>, <played>,

and <painted> despite the fact that <-ed> is associated with the pronunciations /t/, /d/, and /ɪd/, respectively. Note, the letter sequence <ed> within a base (e.g., <bed>, <red>, <Ted>, <wed>) has yet another pronunciation, /ɛd /, that never occurs for the <-ed> suffix.

These are not idiosyncratic examples: The consistent spelling of morphemes over phonemes is a fundamental organising principle of the English spelling system. Importantly, to spell morphemes in a consistent manner, it is *necessary* to have inconsistent (or perhaps a better term is "flexible") grapheme-phoneme correspondences. Although Taylor et al. briefly note that English spellings are constrained by morphology, these semantic regularities were absent in Taylor et al.'s artificial CVC language. This made learning more difficult in the semantic condition, again biasing the results in support of phonics. (For a more detailed review of the logic of the English spelling system, see Bowers & Bowers, 2017).

In addition to mischaracterising the semantic route, Taylor et al. have mischaracterised the various meaning-based forms of instruction practised in the classroom. In the artificial learning study, participants were repeatedly presented with random orders of the novel written words and asked to perform various semantic tasks (define them, match them to a picture, and categorise them). This is very different from "whole language" and "balanced literacy" forms of instruction that this study was designed to test. Although these meaning-based approaches are quite variable in their implementations, they do claim that children learn best when words are embedded in meaningful text designed to be enjoyable. As a consequence, the Taylor et al. study provides no basis for rejecting these meaning-based methods.

In the same way, the training in the artificial learning experiment mischaracterised meaning-based forms of instruction that focus on the morphological organisation of word spellings (for review, see, Goodwin & Ahn, 2013), or how the English spelling system makes sense once the morphological, etymological, and phonological constraints on spelling are understood (Bowers, Kirby, & Deacon, 2010; Devonshire, Morris, & Fluck, 2013; Kirby & Bowers, 2017). Of course, artificial language learning studies cannot capture all aspects of learning the target language, but the use of novel CVC words that mischaracterised the orthographic-semantic mappings in English, and the use of a training regime that mischaracterised meaning-based reading instruction as practised in the classroom, mean that these findings should not be used to make claims regarding the effectiveness of various meaning-based forms of instruction.

The widespread mischaracterisation of the English spelling system has biased research on literacy

The more general point we want to emphasise, however, is that most researchers claim that the function of letters is to represent sounds (the "alphabetic principle"), and little consideration is given to the fact that English is in fact a morphophonemic system in which morphemes are spelled more consistently than phonemes. This failure to consider the morphological organisation of English spellings has had a profound impact on reading research over the past decades. To illustrate, consider the National Reading Panel (2000) that was set up to assess how to best teach reading. In 449 pages, the word "morpheme" only occurs once (in a table), whereas "phoneme" occurs 294 times (derivations of "morpheme" were mentioned a total of 4 times). In more recent meta-analyses that are taken to support phonics (Galuschka et al., 2014; McArthur et al., 2012; Rose, 2006, 2009) and a recent meta-analysis that fails to find any long-term benefits of phonics (Suggate, 2016), there are no occurrences of the word "morpheme." Just as with Taylor et al. (2017), it is not appropriate to conclude that phonics is better than meaning-based instructions when the systematic spelling-meaning correspondences in English are ignored in the research literature.

To conclude, we agree with the following claim by Taylor et al.:

> Overall, for both learning to read aloud and comprehend written words, reading instruction should focus on the systematicities that are present in a writing system.

But we disagree with their next sentence, namely:

> For alphabetic scripts, this means teaching the systematicities that exist in print-to-sound mappings for both consistent and inconsistent words, not teaching arbitrary print-to-meaning mappings, which will be difficult to learn for all words.

It is the latter claim that motivated Taylor et al.'s use of artificial CVC words that had arbitrary letter-to-meaning mappings, and why Taylor et al. are incorrect to reject meaning-based forms of instruction based on their findings. This latter view also precluded the authors from considering the hypothesis that children should be taught how their writing system works. See Bowers and Bowers (2017) for how this might be done. Before meaning-based strategies are rejected, more interventions that exploit the systematicities that exist in print-to-meaning mappings need to be carried out and evaluated.

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