Dialect and authography: Some differences between American and British spellers

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Abstract

In two experiments, we asked whether American and British university students make different kinds of spelling errors as a function of the differences between their dialects. The American students spoke a rhotic dialect, pronouncing an /r/ in such words as leper, hermit, horde, and gnarl. The British students, with their nonrhotic dialect, did not include an /r/ in such words. The dialect differences led to different spelling errors in the two groups. For example, the British students sometimes misspelled horde as “haud” because its vowel has the alternative spelling au in their dialect. They sometimes spelled polka as “polker” because its final vowel is often spelled as “er.” The U.S. students were much less likely to make such errors, although they did make other errors that reflected aspects of their dialect. Phonology, far from being superseded by other strategies in the development of spelling, continues to be important for adults.
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According to most views of spelling development, young children spell by attempting to represent the sounds that they hear in words (Ehri, 1986; Frith, 1985; Gentry, 1982; Read, 1986; Treiman, 1993). Early spelling is thus strongly phonological. Young children’s spellings reflect their conceptions of phonological structure and their understanding of the links from sounds to letters. For example, young children from the United States may misspell girl as “grl” because they pronounce this word with three units of sound: an initial /g/, a merged vowel + consonant unit often classified as a syllabic /r/, and a final /l/. The pronunciation of the word does not contain a separate vowel, and so children often fail to include a vowel in their spelling (Read, 1975; Treiman, 1993; Treiman, Berch, Tincoff, & Weatherston, 1993; Treiman, Goswami, Tincoff, & Leevvers, 1997).

As children progress, their spelling is thought to become less influenced by phonology and more influenced by other factors. Theories of spelling development in English have labeled higher levels of spelling skill “orthographic” (Frith, 1985), “transitional” (Gentry, 1982), or “morphemic” (Ehri, 1986). These terms are intended to convey the idea that older children and adults rely on memory for familiar letter patterns (e.g., the –tion of nation) and information about words’ morphological structure (e.g., health is spelled with ea because it is related to heal). Skilled spellers are thought to possess complete and accurate memory records for most words, enabling them to retrieve the words’ spellings from memory. They no longer need to construct spellings from the phonological forms of words, a process that is highly prone to error in the English
language. The idea that phonology is superseded by other strategies in the normal course of spelling (and reading) development has been called the developmental bypass hypothesis (Pennington, Lefly, Van Orden, Bookman, & Smith, 1987).

Other researchers argue that phonology continues to play an important role in adults’ spelling, at least for some kinds of words. Dual-route theories of spelling are based on the idea that adults construct the spellings of regular words (e.g., shunt) from the words’ phonological forms, especially if the words are relatively uncommon. The spellings of irregular words (e.g., colonel) and extremely common words (e.g., cat) are retrieved from memory, bypassing phonology. Dual-route models and supporting evidence have been put forward by Barry (1994), Ellis (1982), and Kreiner (Kreiner & Gough, 1990; Kreiner, 1992, 1996). Some of the evidence is amenable to alternative explanations, however, and so a dual-route model is not universally accepted. For example, Burt and Fury (in press) have argued for a single-route account by which spellers rely on learned word-specific knowledge rather than on-line construction of spellings from phonological information.

Given the disagreement between proponents of single-route and dual-route models, we sought a new way to determine whether phonology plays an important role in adults’ spelling. Our method was to ask whether speakers of different dialects make different kinds of spelling errors. Such differences should exist if phonology is involved in spelling because phonological knowledge is derived from the pronunciations of words. Several studies have found influences of dialect on the spelling of young children (see Read, 1986; Treiman et al., 1997). However, little research has looked for dialect-related misspellings among adults. One of the few studies of which we are aware that included
adults was carried out in the Dutch language (Verhoeven, 1979, cited in Assink & Kattenberg, 1994). The Dutch children in this study made a number of dialect-related spelling errors, such as omitting the final consonant of *vriend* (friend) if this consonant was not pronounced in their dialect. The proportion of errors that could be traced to dialect interference was much smaller in high school and university students than in elementary school children. These results support the developmental bypass hypothesis, for they suggest that phonology is less important in the spelling of adults than in the spelling of children.

The purpose of the present study was to determine whether English-speaking adults make spelling errors that reflect their dialect. To do this, we compared spellings that were produced by college students in the United States (Michigan) and Britain (Wales). One phonological feature on which these dialects differ, and the one on which we focused, is the occurrence of /r/ after a vowel. All dialects of English allow /r/ before a vowel, but not all dialects allow it after a vowel within a syllable (Giegerich, 1992). Dialects that permit postvocalic /r/ are called rhotic; dialects that do not allow postvocalic /r/ are called nonrhotic. Most areas of the United States have a rhotic dialect, meaning that an /r/ is present in words such as *doctor*, *girl*, *card*, and *corn*. In most parts of England and Wales, especially for educated speakers, the dialect is nonrhotic. *Doctor*, as pronounced in isolation by speakers of these dialects, ends with the unstressed vowel schwa. Likewise, words such as *girl*, *card*, and *corn* do not contain an /r/ for speakers of nonrhotic dialects.

Treiman et al. (1997) took advantage of these differences between American and British English to compare the spellings of schoolchildren from the United States
In that study, children were asked to spell words that contained an \( r \) after the vowel as well as words that did not. The participants were in first and second grade or the British equivalents thereof. The children were divided into two groups based on spelling ability. The less advanced spellers had a spelling age of less than 7 ½ years on a standardized spelling test, averaging between 6 years, 7 months and 6 years, 10 months. The more advanced spellers had a spelling age of over 7 ½ years, with a mean between 8.6 and 8.9. The less advanced spellers produced a number of dialect-related spelling errors. For example, the American children in this group tended to misspell \textit{girl} as “grl” whereas the British children more often misspelled it as “gel.” The less advanced British spellers also produced errors such as “docke” for \textit{doctor}, “cud” for \textit{card}, and “con” for \textit{corn}. Such \( r \) omissions were less common among children with higher levels of spelling skill. However, the more advanced British spellers made a number of dialect-related errors on words such as \textit{china}, \textit{bath}, and \textit{dawn}. They sometimes spelled \textit{china} as “chiner,” overgeneralizing the vowel + \( r \) spelling that is commonly used for final schwa in their dialect (e.g., \textit{doctor}, \textit{tiger}). In addition, the British children produced errors such as “barth” for \textit{bath} and “dornn” for \textit{dawn}. These children pronounce the vowels of \textit{bath} and \textit{card} alike, as /\( \text{\textalpha} \)/. Also, the vowels of \textit{dawn} and \textit{corn} are pronounced alike, as /\( \text{\textlambda} \)/. Even the more advanced spellers had apparently not sorted out which /\( \text{\textalpha} \)/s should be spelled with \( \text{\textalpha} \text{r} \) and which should be spelled with \( \text{\textalpha} \). Similarly, the British children were not sure which /\( \text{\textlambda} \)/s should be spelled with \( \text{\textlambda} \text{r} \) and which with \( \text{aw} \) (or its variant, \( \text{au} \)).

The results of Treiman et al. (1997) suggest that certain kinds of dialect-related misspellings are no less common among children with higher levels of spelling skill than
among children with lower levels of spelling skill. These findings raise the possibility that the developmental bypass hypothesis is incorrect and that even adults might make spelling errors that reflect their dialect. In the present study, we tested students from an American and a British university on words that were similar to those used by Treiman et al., but less common. British university students surely know that *china* ends with *a* and that *tiger* ends with *er*, but they may be unsure about the spellings of *polka* and *leper*. If British students produce errors such as “polker” and “lepa” at higher rates than U.S. students, this would suggest that dialect continues to affect spelling into adulthood.

**Experiment 1**

**Method**

**Stimuli.** Four types of words were selected, with 18 words in each category. Type 1 words, such as *leper*, *ether*, and *panther*, were bisyllabic words with an unstressed second syllable. The word’s spelling ended with a vowel (*e* in all but one case) followed by *r*. As pronounced in American English, the words ended with an unstressed syllabic */r/*. In British English, the words ended with the unstressed vowel schwa, with no */r/,

when pronounced in isolation. Type 2 words, such as *polka*, *stamina*, and *tapioca*, contained between two and four syllables. The last syllable, which was unstressed, was spelled with a final *a*. In both American and British English, the *a* corresponded to an unstressed schwa vowel. Type 3 words were monosyllabic or bisyllabic and had stress on the first syllable. The stressed syllable contained a vowel (*e*, *i*, or *u*) followed by *r*, as in *hermit*, *dirge*, and *murky*. The vowel + *r* sequence corresponded to stressed syllabic */r/* in American English. In British English it was pronounced as */ɜ/*, without an */r/*. Finally, Type 4 words were bisyllabic (or in one case trisyllabic) with an unstressed first syllable.
The vowel of this unstressed syllable corresponded to schwa in American English and generally corresponded to schwa in British English as well. The vowel was most often spelled as \textit{a}, as in \textit{canoe} and \textit{lament}. A few Type 4 words had \textit{e}, \textit{i}, or \textit{o} spellings of the critical vowel.

The words in the four categories were equal in length (mean length of 6.0 letters for all four categories). All of the words were low in frequency, ranging from 0 to 13 (Kučera & Francis, 1967). Mean frequencies were similar across the four word types (2.8, 2.7, 3.7, and 2.2 for Types 1, 2, 3, and 4, respectively). The words were randomly intermixed for presentation, and the same random order was used for all participants.

**Procedure.** The participants were tested in small groups. The experimenter for the U.S. group was a native speaker of American English who spoke a rhotic dialect. The experimenter for the British group was an educated Londoner who had a non-rhotic dialect, the so-called Received Pronunciation.

The experimenter pronounced each word and asked the participants to circle the number from 1 to 7 that best captured their feeling of familiarity with the word. In explaining the rating scale, the experimenter asked participants to give a rating of 7 when a word was familiar to them and when they knew its meaning very well. A rating of 4 was to be given when the participant recognized a word but did not know its meaning. A rating of 1 was to be given when a word was completely unknown. Participants were asked to use intermediate numbers for intermediate states of mind. After the participants had rated a word for familiarity, the experimenter said the word in a sentence, said the word in isolation once again, and asked the participants to spell the word.
Participants. The U.S. group consisted of 43 students who were enrolled in psychology classes at Wayne State University in Detroit, Michigan and who were native speakers of American English. A questionnaire administered after the study indicated that almost all of the participants had spent all or most of their lives in the Detroit area. This area, like most of the United States, has a rhotic dialect. The data of three additional students were not included in the analyses. One of these students appeared to misunderstand the familiarity rating scale, the second failed to spell many of the words, and the third produced many illegible spellings.

The British group consisted of 34 psychology students from Cardiff University in Wales, all native speakers of British English. A questionnaire given after the study showed that the majority of the British students were from Wales or Southern England, which generally have a non-rhotic dialect. None of the students had been raised in Scotland or Ireland, two areas with a rhotic dialect. The students were asked to pronounce the word clamber (in isolation) after the experiment. All of them pronounced it without an /r/, confirming that they had a non-rhotic dialect.

Results

Overall numbers of errors. We looked first at the numbers of misspellings made by the two groups of students. The mean percentage of errors, pooling over the four word types, was 28% for the U.S. students and 17% for the British students. Analyses of variance were carried out both by subjects and by items using the factors of nationality (U.S. vs. British) and word type. There was a significant main effect of nationality ($F_{1}(1,75) = 16.78; F_{2}(1,68) = 23.54; p < .001$ for both). No other effects were significant by both subjects and items. The poorer performance of the U.S. students probably
reflects the fact that Wayne State University is less selective in its admissions standards than Cardiff University.

Specific types of errors. Our primary interest is in the types of errors made by the U.S. and British students. Did the two groups of students make different types of spelling errors that reflected their different dialects? For Type 1 words, such as *leper*, the critical error was one that ended with a single vowel rather than the conventional vowel + r. For speakers of non-rhotic British English, spellings without a final r would more closely match the word’s pronunciation. Of the errors produced by the British students, 24% (18 of 76) omitted the final r. For example, *leper* was misspelled as “lepa,” *ether* as “etha,” and *panther* as “pantha.” In these examples, as in all of the British adults’ errors of this type, the misspelling ended with a. Only 1% of the U.S. students’ errors (2 of 179) omitted the final r. As Table 1 shows, the difference between the two nationalities was statistically significant. (For this and subsequent analyses of errors, students who made no errors on a particular type of word were excluded from the subjects analysis and words that elicited no errors in one or both groups of students were excluded from the items analysis.)

For the Type 2 words, such as *polka*, the critical errors were those in which participants added an r at the end of the word. Speakers of a non-rhotic dialect might make such errors if they had learned that final schwa is usually spelled, not with the single vowel letter that would be expected from the pronunciation, but with a vowel letter followed by r. For the British students, 17% of all errors on Type 2 words (22 of 133) involved the addition of r. Examples are “polker” for *polka*, “staminar” for *stamina*, and “antenner” for *antenna*. The vowel, in the majority of these errors, was e. The second
most common vowel was a. Errors that involved the addition of r represented only 2% of all errors (4 of 257) for the U.S. students, as Table 1 shows. The difference between the British and U.S. groups was significant.³

For Type 3 words, such as hermit, the errors of interest were those in which no r was included in the spelling of the critical syllable. Speakers of a non-rhotic dialect might be expected to produce errors such as “hemit” because the word does not contain an /r/ as they pronounce it. However, the British students made few errors of this kind (4% or 4 of 103). The U.S. students also made few such errors (2% or 6 of 270), and there was no significant effect of nationality.

For Type 4 words, such as canoe, we asked how often students added an r to the spelling of the critical syllable, as in “carnoe.” There were very few such errors for either the British group (1% or 1 of 109) or the U.S. group (0% or 0 of 211), and the difference was not significant.

According to the single-route hypothesis, by which spelling relies on learned word-specific information, one might expect to find effects of phonology only for unfamiliar words. For familiar words, phonology is thought to be bypassed and dialect-related spelling errors should not be found. To assess this hypothesis, we repeated the preceding analyses using only words, for each participant, that received a familiarity rating of 5 or higher. The results of these analyses, shown in Table 1, were quite similar to the results of analyses based on all words. This outcome suggests that phonology plays a role even in the spelling of moderately or highly familiar words, at least if these words are relatively low in printed frequency.

Discussion
Our results show that adults who speak British English make certain dialect-related errors when they spell. Speakers of this dialect appear to have learned that final schwa has two primary spellings: vowel + r (as in mother and tiger) and a (as in pizza and sofa). Given words such as leper (Type 1) and polka (Type 2), speakers of British English do not always know which spelling is appropriate. They sometimes select the wrong alternative, producing errors such as “lepa” and “polker.”

A comparison of the results on words like polka (Type 2) and words like canoe (Type 4) shows that British adults’ tendency to misspell schwa with a vowel followed by r is largely confined to word-final position. When the British students encountered a schwa in the first syllable of a word like canoe, they rarely misspelled it this way. This difference probably reflects adults’ use of context-sensitive sound-to-spelling relationships. Initial and medial schwas in British dialect are generally spelled with a vowel. Vowel + r spellings are most common for certain prefixes, such as per, but these were not found among our Type 4 stimuli.

Knowledge of conventional phoneme-grapheme correspondences can also explain why the British students rarely made errors like “hemit” for the Type 3 word hermit. The first vowel of this word as pronounced in British English, /ɛər/, is generally spelled with one or more vowel letters followed by r, as in sir, work, earn, and hurt. Although they do not include an /r/ in their pronunciations of such words, British adults have apparently learned that /ɛər/ typically has a two-letter spelling consisting of a vowel letter followed r.

We may compare our findings with British adults to the results obtained with British children by Treiman et al. (1997). Some of the words that were spelled by the children, such as tiger and doctor, were similar to the Type 1 words of the present study.
The main difference is that the words used in the study with children were more common than the words used here with adults. In the earlier study, the less advanced British spellers (those with spelling levels of 6 to 7 ½ years) made more r omissions than vowel omissions in the second syllables of words such as tiger and doctor. For example, these children produced errors such as “tige” and “docda.” The more advanced spellers (those with spelling levels of between about 7 ½ and 10 years) generally included the r. The present results show that British adults make the same kinds of omission errors observed among the less skilled child spellers when they are presented with relatively uncommon but still known words such as leper and ether.

When British children and adults use a single vowel instead of a vowel + r sequence in words like tiger and leper, which vowel do they choose? As mentioned earlier, the adults studied here invariably used a, as in “lepa” and “etha.” Reanalyses of the Treiman et al. (1997) data show that the more skilled child spellers also preferred a. The less skilled children, in contrast, produced many spellings with e and u (e.g., “kuve” and “cavu” for cover) in addition to those with a (e.g., “cava”). Apparently, the less skilled children had not yet learned that a is by far the most common single-vowel spelling of final schwa (as in pizza and sofa). The more skilled children and the adults knew this, and so produced many errors with final a.

The study of Treiman et al. (1997) also included words that were similar to the Type 2 words of the present study. These were words such as pizza and sofa, whose endings are similar to those of the Type 2 words polka and stamina but which are more common. The British children sometimes produced errors such as “pitser” and “sofer” for pizza and sofa, respectively. These children used a vowel + r sequence to represent
the final schwa, just as the British university students did when they misspelled *polka* as “polker” and *stamina* as “staminar.” In the study with children, such *r* intrusions were actually more common among the more skilled spellers than the less skilled spellers. Apparently, the more advanced children had learned that final schwa is usually spelled with a vowel letter followed by *r* and sometimes applied this pattern too broadly. The beginners, being less familiar with the vowel + *r* spelling pattern, were less likely to overgeneralize it. In conventional English, the vowel letter in these vowel + *r* spellings is most often *e*, as in *tiger* and *cover*. The adults in the present study preferred *e* to other vowels in their erroneous vowel + *r* spellings. The children studied by Treiman et al. (1997) did too, with the preference for *er* stronger among the more advanced spellers than the less advanced spellers.

So far, we have seen some similarities between the spellings of British adults and the spellings of British children. It appears that British adults sometimes make the same kinds of dialect-related spelling errors that young children do, provided that the words are relatively uncommon. When we turn to words with stressed syllabic */r/* in American English, however, we see some differences between adults and children. When the British adults in the present study spelled Type 3 words such as *dirge* and *hermit*, they rarely omitted the *r*. In contrast, the less skilled British spellers studied by Treiman et al. (1997) produced a number of *r* omissions on words of this kind, such as “dit” for *dirt* and “gol” for *girl*. For young children, it appears, spelling is largely governed by the sounds that they hear in words. Hearing no */r/* in their pronunciations of *dirt* and *girl*, young children often use no *r* in their spellings of these words. For adults, spelling is largely governed by knowledge of conventional phoneme-to-grapheme correspondences.
Knowing that the spelling of /ɔ/ generally includes an r, adult speakers of British English rarely misspell *dirge* as “dige” or *hermit* as “hemit.”

**Experiment 2**

We have attributed British adults’ errors such as “lepa” for *leper* and “polker” for *polka* to the fact that final schwa in their dialect has two common spellings: vowel + r and a. An alternative explanation for errors such as “polker” is based on the fact that, when a word with final schwa precedes a word beginning with a vowel in connected speech, an intrusive /r/ may occur in rhotic dialects. For example, an /r/ may be heard in the phrase “polka and waltz.” Perhaps speakers of British English sometimes use an r at the end of *polka* because they sometimes pronounce the word with an /r/ in connected speech.

To test this alternative explanation, Experiment 2 included words such as *caucus*. *Caucus* is never pronounced with an /r/ in British English, as intrusive /r/ is limited to the ends of words. The first syllable of *caucus* is pronounced with /ɔ/ in British English. This vowel has two common spellings in this dialect. One is au (or its variant aw), as in *caucus* and *tawny*. The other is or (or ore), as in as *horde*, *sore*, and *orthography*. Barry and Seymour (1988) found that or and ore spellings occurred in approximately 35% of monosyllabic English words with /ɔ/ and that aw and au spellings occurred in about 35%.

If spelling errors reflect a confusion between common spellings of a phoneme, then speakers of British English may produce errors such as “corkus” for *caucus* as well as errors such as “authography” for *orthography*. “Corkus” errors would suggest that r additions in spelling can occur even without /r/ intrusions in speech.
Experiment 2 also included words such as *casket*. This is another case in which there is more than one common spelling for a phoneme. The first vowel of *casket*, which is /ɑ/ for many British speakers, may be spelled as *ar* (e.g., *gnarl, parka*) or as *a* (e.g., *casket, khaki*). If speakers of this dialect sometimes interchange the two spellings, they may misspell *casket* as “carsket.” The word *casket* is never pronounced with an /r/ in British English, and so a “carsket” misspelling could not reflect the presence of an /r/ in speech.

**Method**

**Stimuli.** Four types of words were selected for Experiment 2, with 18 words in each category. The words were between one and three syllables long. Type 1 words, such as *horde* and *Norse*, contained *o* followed by *r* in the stressed syllable. The *or* sequence was pronounced as /ɔr/ in American English and as /ɔ/ in British English. Type 2 words, such as *caucus* and *tawny*, were spelled with *au* or *aw* in the stressed syllable. This sequence was pronounced as /ɔ/ in both British and American English. For British speakers, then, Type 1 and Type 2 words have the same vowel nucleus.

For Type 3 words, the nucleus of the stressed syllable was spelled with *ar*. It was pronounced as /ɑr/ in American English and as /ɑ/ in Southern British English. Examples of Type 3 words are *gnarl* and *parka*. The stressed syllable of Type 4 words was spelled with *a* and no following *r*, as in *casket* and *khaki*. The vowel was pronounced as /æ/ in American English and as /ɑ/ in most versions of British English. In most parts of Britain, therefore, the stressed syllables of Type 4 words and Type 3 words have the same vowel.
The words in the four categories were equal in length (mean length 6.1 for all four types). Word frequency (Kučera & Francis, 1967) was similar across the four types of words and similar to that in Experiment 1 (mean frequencies of 2.9, 2.2, 2.3, and 2.7 for Types 1, 2, 3, and 4 respectively; range = 0 to 13). The words were randomly intermixed for presentation, and the same random order was used for all participants.

Procedure. The procedure and experimenters were the same as in Experiment 1.

Participants. The U.S. group consisted of 36 students who were enrolled in psychology classes at Wayne State University and who were native speakers of American English. A questionnaire administered after the study revealed that almost all of the participants had spent all or most of their lives in the Detroit area. One additional U.S. student failed to spell a large number of the words, and her data were omitted from the analyses.

The British group consisted of 54 psychology students from Cardiff University, all native speakers of British English. These students were chosen from a larger group by eliminating students who, in a questionnaire administered after the study, indicated that their accent was best described as Northwest or Northeast English. These students were dropped because speakers from the Northern part of England typically pronounce Type 4 words like casket with /æ/ rather than /ɑ/. The questionnaire further asked whether students pronounced bath and path like Cath (pronounced aloud by the experimenter with /æ/) or as laugh (pronounced by the experimenter with /ɑ/). We selected only students who circled laugh. Other questions asked whether pass and brass rhymed with farce or lass in the participant’s own speech. We selected only students who circled farce. We also selected students who responded that plant rhymed with am’t rather than ant and
who responded that *vase* rhymed with *R*'s rather than *A*'s. Given these selection procedures, we can assume that the British participants gave the same pronunciations to the stressed vowels of Type 3 words (e.g., *gnarl*) and Type 4 words (e.g., *casket*): /ə/ in both cases.

Results

**Overall numbers of errors.** The mean percentage of errors, pooling over the four word types, was 29% for the U.S. students and 21% for the British students. Analyses of variance using the factors of nationality and word type showed a main effect of nationality (\(F_1(1,88) = 6.11, p = .015\); \(F_2(1,68) = 10.65, p = .002\)). No other effects were significant both by subjects and by items.

**Specific types of errors.** For Type 1 words, such as *horde* and *Norse*, we focused on misspellings that contained a vowel but no following *r* in the critical syllable. For the British students, 20% of the errors (47 of 241) fit this description. The figure was 7% (17 of 232) for the U.S. students. As Table 2 shows, the difference was significant. For the British students, the majority of errors of this type substituted *au* or *aw* for *or*, as in “haud” for *horde*, “Nauce” for *Norse*, and “pawpuss” for *porpoise*.

For Type 2 words, such as *caucus* and *tawny*, we looked at errors in which the critical syllable contained a vowel letter followed by *r*. For the British students, 52% of all errors (145 of 281) fit this description. Examples are “corkus” for *caucus* and “torny” for *tawny*. For the United States students, only 2% of errors (4 of 197) fell into this category. The difference between the two nationalities was significant. For the British students, almost all errors of this kind used the vowel + *r* sequence *or*, as in “corkus” for
caucus and “torny” for tawny. Or is the single most common spelling of /ɔ/ in British English (Barry & Seymour, 1988).

For Type 3 words, such as gnarl and parka, we tabulated the percentage of errors in which the critical syllable contained a vowel letter but no following r. The percentages were 14% for the British students (21 of 149) and 4% for the U.S. students (7 of 168). The difference was significant by subjects but marginal by items, as Table 2 shows. When the British students made errors of this kind, they almost always used a rather than ar.

For Type 4 words, such as casket and khaki, we focused on errors in which the participant added an r after the vowel of the critical syllable. For the British students, 31% of all errors on Type 4 words (40 of 130) were of this type. The figure was less than 1% for the U.S. students (1 of 145), a reliable difference. When the British students made errors of this kind, they almost always used the vowel + r sequence ar. Examples are “carsket” for casket and “karki” for khaki.

As in Experiment 1, we repeated the analyses using, for each participant, only those words with which the participant was at least moderately familiar (familiarity rating of 5, 6, or 7). The results, shown in Table 2, revealed the same general patterns as in the analyses based on all words. The nationality difference for Type 3 errors, which was marginal in the items analysis based on all words, was reliable in the analysis based on familiar words.

Discussion

The results show that phonemes that have more than one common spelling in a particular dialect are often misspelled. Dialect-related differences in spelling can arise
because the phonemes with ambiguous spellings are not always the same from one
dialect to another. In American English, /ɔ/ not followed by /r/ is generally spelled as au
or its variant aw. In British English, or is a common alternative, as in horde and Norse,
making the spelling of the vowel more ambiguous. With relatively infrequent though still
familiar words, speakers of British English do not always know whether to use au (aw) or
or. Thus, the British students in this study sometimes misspelled horde as “haud” and
caucus as “corkus.”

The phoneme /ɑ/ also has more than one common spelling in British English.
This phoneme may be spelled as ar, as in gnarl, or a, as in casket. With the relatively
infrequent words used here, the British students had not always sorted out which spelling
should be used where. Thus, they produced errors such as “knal” for gnarl and “carsket”
for casket.

Our finding that British adults sometimes used an r when spelling words like
caucus and tawny suggests that additions of r in spelling do not necessarily reflect the
intrusive /r/s that may occur in connected speech. In British dialect, caucus and tawny
are never pronounced with an /r/. The use of r in spelling must reflect a confusion
between alternative spellings of a phoneme rather than the presence of an /r/ in speech.
Similarly, the errors such as “polker” for polka that were observed in Experiment 1
probably reflect confusion between alternative spellings of schwa (er as in mother and a
as in sofa) rather than the intrusive /r/s that sometimes occur in connected speech.

We may compare the spelling errors observed with adults to those observed by
Treiman et al. (1997) with children. In the earlier study, British and American
schoolchildren were asked to spell words that were similar to those used here but more
frequent. For example, the children spelled words such as corn and Paul that were similar in phonological structure and spelling pattern to words such as horde (Type 1) and caucus (Type 2), respectively. The British schoolchildren sometimes omitted the r of a word like corn and sometimes added an r to a word like Paul. In this respect, the children’s errors seem similar to the adults’. A difference is that the great majority of the adults’ errors appeared to reflect knowledge of the alternative vowel spelling, as in “haud” for horde and “corkus” for caucus. For children, a minority of errors fit this description (19% for the less advanced spellers and 39% for the more advanced spellers). For example, children who omitted the r of corn did not necessarily spell the word as “caun” or “cawn.” They often spelled it as “con” instead. The children probably failed to include an r because no /r/ was present in the phonological form of the word, not because they were familiar with the au and aw spellings of /ɔ/.

Treiman et al. (1997) also asked children to spell words like card and bath. These words are similar to the gnarl-type (Type 3) and casket-type (Type 4) words of the present study, but are more frequent. The British children were significantly more likely than the American children to omit the r of a word like card and to add an r to a word like bath. When the British children omitted the r of a word like card, they did not show the priority for a spellings of the vowel that the adults did. Errors with other vowels, such as “cud” for card and “bune” for barn, were common among the less skilled spellers. The children's errors appear to reflect their focus on pronunciation. Because no /r/ was present in their pronunciations of the words, the children often did not include an r in their spellings. The adults' errors appear to reflect a knowledge of the phoneme-
grapheme correspondences for their dialect, in particular the fact that both $a$ and $ar$ map on to the same phoneme.

**General Discussion**

Our results show that dialect-related spelling errors are not confined to young children who are learning to spell. Adults, too, show a number of dialect-related spelling errors. These results speak against the idea that phonology is completely bypassed in the normal development of spelling. Spelling is influenced by dialect in adults as well as in children.

In two experiments, we found some striking differences between the spellings produced by adult speakers of American English and the spellings produced by adult speakers of British English. For adults, dialect-related spelling differences occur because phonemes that have two or more common alternative spellings are difficult to spell (see also Kreiner & Gough, 1990; Kreiner, 1992, 1996) and because the spellings of certain phonemes are more ambiguous in one dialect than another. As one example, the spelling of /ɔ/ is more ambiguous in British English than in American English. British English offers the options of or, au and aw, among others, whereas American English does not have the or option when /ɔ/ is not followed by /r/. Given the additional option that they have to consider, speakers of British English may misspell *caucus* as “corkus.” As another example, the spelling of word-final schwa is more variable in British speech than in American speech. This is because British dialect offers a vowel + r option (as in *mother* and *doctor*), whereas American English does not. Speakers of British English may thus misspell *polka* as “polker” or *stamina* as “staminar.” Dialect-related spelling differences are found on words that are pronounced differently in the two dialects, such
Dialect and authography

as horde and leper. They can also be found on words that are pronounced similarly in the two dialects, such as caucus and stamina.

So far, we have concentrated on spelling errors that are more common among speakers of British English than among speakers of American English. For example, British college students are more susceptible than U.S. college students to errors such as “corkus” for caucus and “staminar” for stamina. However, we do not wish to claim that the English writing system as a whole is better suited to American English pronunciations than to British English pronunciations. In some cases, there is more ambiguity for American English than for British English. One such case is that of flaps. In American English, the middle consonant of a word like loiter is pronounced not as a clear /t/ but with a quick tap of the tongue against the ridge behind the upper teeth, or flap. Audible and pagoda also contain medial flaps. Flaps may be spelled with t (or tt), as in loiter and shatter, or d (or dd), as in audible and pagoda. Flapping does not occur in the dialect of British English investigated here, and so the t and d spellings of loiter and pagoda are more predictable in British English than in American English.

There were 6 words in Experiments 1 and 2 that included flaps spelled as d and 7 words that included flaps spelled as t (or tt). The British students never used the wrong alternative (i.e., t or tt for d or d or dd for t or tt) when spelling these words, despite making a total of 56 errors on words with flaps spelled as d and 76 errors on words with flaps spelled as t (or tt). In contrast, 55% (79 of 143) of the U.S. students’ errors on d flap words used t or tt. Of the U.S. students’ errors on t (or tt) flap words, 32% (33 of 103) used d or dd. The figures were 51% and 26%, respectively, when the analyses were restricted to words that the students rated as 5 or higher in familiarity. For example, the
American students misspelled audible as “autoble,” pagoda as “pagotta,” loiter as “loider,” and shatter as “shadder.” These errors are similar to those previously documented among American children, such as “wodr” for water and “nobutty” for nobody (e.g., Read, 1975; Treiman, 1993; Treiman, Cassar, & Zukowski, 1994). The results support the idea that adults can make similar kinds of dialect-related spelling errors as children, provided that the words are relatively infrequent. The results with flaps further show that certain dialect-related misspellings are more common among speakers of American English than speakers of British English. Neither of these dialects -- in fact, no existing dialect -- is a perfect match to the orthography.

Our results show that phonology continues to play an important role in the spelling of adults. Contrary to the predictions of the phonological bypass hypothesis, phonology is not a strategy that is used by young children and that is replaced by other strategies as spelling skill increases. Our findings speak against theories of spelling development that portray learners as progressing through a series of distinct stages (Ehri, 1986; Frith, 1985; Gentry, 1982). According to these theories, each stage of development is characterized by the use of a particular strategy or type of knowledge. As learners move from one stage to the next, earlier strategies are replaced with more advanced ones. Our results suggest, to the contrary, that new strategies are added to old ones. For example, morphological spelling strategies do not supplant phonological ones but co-exist with them, with each strategy being used for some kinds of words and in some situations. As a result, the spelling errors of adults are sometimes strikingly similar to those of young children. Our conclusion that phonology is not completely bypassed in the development of spelling is compatible with that of Rittle-Johnson and Siegler (1999),
who stressed that children have a variety of spelling strategies available to them from an early age. Development often reflects the increasingly effective execution of strategies and more adaptive choices among strategies in addition to, or instead of, the introduction of new strategies.

Process models of spelling in adults are less well developed than those of reading. Our results are consistent with dual-route models of spelling in which phonology plays an important role at least for words that do not occur at high rates in printed texts (Barry, 1994; Ellis, 1982; Kreiner & Gough, 1990; Kreiner, 1992, 1996). The results are not compatible with a single-route account in which spellings are typically produced from learned word-specific information (Burt & Fury, in press). Adults have not stored the full spellings of many words that they encounter periodically when they read and that they consider to be familiar. They rely on phonology to fill in the gaps in word-specific knowledge. The use of phonology can lead to errors that differ from dialect to dialect. Orthography can thus become “authography” for speakers of British English.
References


Appendix: Words used in experiments

Experiment 1

Type 1: leper, ether, lunar, wager, ulcer, viper, Geiger, grocer, falter, solder, loiter, filter, clobber, panther, shatter, whisper, lobster, clamber

Type 2: polka, vodka, scuba, llama, panda, viola, enigma, asthma, amoeba, plasma, siesta, pagoda, antenna, stamina, tapioca, spatula, vanilla, taffeta

Type 3: hermit, murky, curse, mirth, birch, blurt, dirge, turban, turnip, kernel, gerbil, vermin, serpent, Persian, sirloin, termite, cursive, sherbet

Type 4: canoe, lapel, cigar, Tibet, Benin, cadet, cavort, debris, lament, devout, malign, cajole, cements, fatigue, magenta, commend, bassoon, massage

Experiment 2

Type 1: horde, Norse, fjord, gorge, torso, absorb, accord, morsel, scorch, sordid, portal, scorned, contort, Scorpio, chortle, snorkel, mortal, porpoise

Type 2: caucus, tawny, taunted, vault, gauze, gaunt, fauna, autism, faucet, nausea, audible, applaud, defraud, dawdled, maudlin, auger, spawned, staunch

Type 3: gnarl, parka, karma, snarl, tardy, parch, tartan, parcel, pardon, embark, startle, varnish, discard, tarnish, varmint, garland, harness, harvest

Type 4: casket, khaki, fasten, clasps, ghastly, caste, slant, blasts, prance, staffed, rascal, plaque, lance, casks, plasters, mastery, enchant, stance
Author Note

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Footnotes

1 Two of the words in this category, debris and massage, are commonly pronounced in British English with a stressed rather than an unstressed first syllable. For British participants, therefore, the error analyses for Type 4 words are based on the 16 words in which the first syllable is always unstressed.

2 For several the Type 4 words, the vowel is transcribed as /ɪ/ rather than schwa in current British dictionaries. However, the distinction between /ɪ/ and schwa is no longer widespread. Younger speakers of British English, in particular, often use schwa in such cases (Giegerich, 1992).

3 The speech of African Americans is often described as lacking an /r/ in words such as mother and leper, and 17 of the U.S. participants were African American. However, our experience is that /r/ dropping is not prevalent in the speech of African-American college students from the Detroit area. Errors such as “lepa” for leper and “polker” for polka were infrequent for African-American students as well as for the other U.S. students.
Table 1

Data on Critical Spelling Errors in Experiment 1

<table>
<thead>
<tr>
<th>Word type</th>
<th>Type 1</th>
<th>Type 2</th>
<th>Type 3</th>
<th>Type 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(e.g., “lepa” for leper)</td>
<td>(e.g., “polker” for polka)</td>
<td>(e.g., “hemit” for hermit)</td>
<td>(e.g., “carnoe” for canoe)</td>
</tr>
</tbody>
</table>

Results based on all words

<table>
<thead>
<tr>
<th></th>
<th>Percent errors, British students</th>
<th>Percent errors, U.S. students</th>
<th>t test for difference by subjects</th>
<th>t test for difference by items</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>24 %</td>
<td>17%</td>
<td>p &lt; .001</td>
<td>p = .017</td>
</tr>
<tr>
<td></td>
<td>1 %</td>
<td>2%</td>
<td>n.s.</td>
<td>n.s.</td>
</tr>
<tr>
<td></td>
<td>4%</td>
<td>2%</td>
<td></td>
<td>n.s.</td>
</tr>
<tr>
<td></td>
<td>1%</td>
<td>0%</td>
<td></td>
<td>n.s.</td>
</tr>
</tbody>
</table>

Results based on words with familiarity rating of 5 or more

<table>
<thead>
<tr>
<th></th>
<th>Percent errors, British students</th>
<th>Percent errors, U.S. students</th>
<th>t test for difference by subjects</th>
<th>t test for difference by items</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>22%</td>
<td>16%</td>
<td>p &lt; .001</td>
<td>p &lt; .001</td>
</tr>
<tr>
<td></td>
<td>1%</td>
<td>2%</td>
<td>n.s.</td>
<td>n.s.</td>
</tr>
<tr>
<td></td>
<td>4%</td>
<td>3%</td>
<td></td>
<td>n.s.</td>
</tr>
<tr>
<td></td>
<td>2%</td>
<td>0%</td>
<td></td>
<td>n.s.</td>
</tr>
</tbody>
</table>

Note. p values are one tailed.
Table 2

Data on Critical Spelling Errors in Experiment 2

<table>
<thead>
<tr>
<th>Word type</th>
<th>Type 1</th>
<th>Type 2</th>
<th>Type 3</th>
<th>Type 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(e.g., “haud” for horde)</td>
<td>(e.g., “corcus” for caucus)</td>
<td>(e.g., “knal” for gnarl)</td>
<td>(e.g., “carsket” for casket)</td>
</tr>
</tbody>
</table>

Results based on all words

<table>
<thead>
<tr>
<th></th>
<th>Percent errors, British students</th>
<th>Percent errors, U.S. students</th>
<th>t test for difference by subjects</th>
<th>t test for difference by items</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20%</td>
<td>7%</td>
<td>p = .001</td>
<td>p = .010</td>
</tr>
<tr>
<td></td>
<td>52%</td>
<td>2%</td>
<td>p &lt; .001</td>
<td>p &lt; .001</td>
</tr>
<tr>
<td></td>
<td>14%</td>
<td>4%</td>
<td>p = .003</td>
<td>p = .060</td>
</tr>
<tr>
<td></td>
<td>31%</td>
<td>1%</td>
<td>p &lt; .001</td>
<td>p = .001</td>
</tr>
</tbody>
</table>

Results based on words with familiarity rating of 5 or more

<table>
<thead>
<tr>
<th></th>
<th>Percent errors, British students</th>
<th>Percent errors, U.S. students</th>
<th>t test for difference by subjects</th>
<th>t test for difference by items</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15%</td>
<td>8%</td>
<td>p = .025</td>
<td>p = .031</td>
</tr>
<tr>
<td></td>
<td>38%</td>
<td>2%</td>
<td>p &lt; .001</td>
<td>p = .002</td>
</tr>
<tr>
<td></td>
<td>15%</td>
<td>4%</td>
<td>p = .004</td>
<td>p = .037</td>
</tr>
<tr>
<td></td>
<td>23%</td>
<td>1%</td>
<td>p &lt; .001</td>
<td>p = .008</td>
</tr>
</tbody>
</table>

Note. p values are one tailed.
The words *debris* and *massage* are commonly pronounced in British English with a stressed rather than an unstressed first syllable. The error analyses for Type 4 words for British participants therefore include the 16 words in which the first syllable is always unstressed.

For a few of the Type 4 words, the vowel is transcribed as /ɪ/ rather than schwa in current British dictionaries. However, younger speakers of British English often use schwa in such cases (Giegerich, 1992).